More than Energy

FINAL

Biosolids Management Plan Update

Prepared by

CH2MHILL

Sustainable Solutions for our Community

WBG091410192118GNV

October 2011

Final

Biosolids Management Plan Update

Prepared for

Gainesville Regional Utilities

October 2011

Prepared by

CH2MHILL

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Contents

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Acronyms and Abbreviations

AACEI	Advancement of Cost Engineering International
AADF	annual average daily flow
AADL	annual average daily load
ANSI	American National Standards Institute
AUP	agricultural use plans
BCR	BCR Environmental, LLC
BFP	belt filter press
Btu	British thermal unit
CFR	Code of Federal Regulations
DMR	daily monitoring report
dry lb/MG	dry pounds per million gallons
EPA	U.S. Environmental Protection Agency
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
ft^2	square feet
GBT	gravity belt thickener
gpm	gallons per minute
GREC	Gainesville Renewable Energy Center, LLC
GRU	Gainesville Regional Utilities
hr	hour
I&C	instrumentation and control
KWRF	Kanapaha Water Reclamation Facility
lb	pounds
lb/day	pounds per day
lb/MG	pounds per million gallons
m	meter
Max West	Max West Environmental Systems, Inc.
mg	milligrams
MG	million gallons
mgd	million gallons per day
min	minutes
MMADF	maximum month average daily flow
MMADL	maximum month average daily load
MSWRF	Main Street Water Reclamation Facility

N	nitrogen
NACWA	National Association of Clean Water Agencies
NMP	Nutrient Management Plan
NRCS	Natural Resources Conservation Service
N-Viro	N-Viro International Corporation
O&M	operations and maintenance
ORB	organics recycle biomodule
ORP	oxidation-reduction potential
P	phosphorus
PFRP	process to further reduce pathogens
PSRP	process to significantly reduce pathogens
PW	present worth
SOUR	specific oxygen uptake rate
SRT	solids residence time
SWE	surface water elevation
TCLP	toxicity characteristic leaching procedure
Unity	Unity Envirotech, LLC
WAS	waste activated sludge
WEF	Water Environment Federation
WPR	Whistling Pines Ranch
WRF	water reclamation facility
WT	wet ton
yd^3	cubic yards

SECTION 1

Introduction

1.1 Background

Gainesville Regional Utilities (GRU) serves the City of Gainesville and other portions of Alachua County, Florida, with electric, water, wastewater, natural gas, and telecommunications services. GRU currently owns and operates the Kanapaha Water Reclamation Facility (KWRF) and the Main Street Water Reclamation Facility (MSWRF), which produce aerobically digested Class B biosolids. These biosolids are currently land applied at Whistling Pines Ranch (WPR), an agricultural site located just west of the town of Archer in Alachua County. The biosolids supplement inorganic fertilizer used in growing various forage and row crops.

The existing Class B land application program has been environmentally sound and cost effective for many years. Because of projected capacity increases at the KWRF and MSWRF, newly proposed restrictive land application rules, and concerns about the long-term viability of the cooperative land application program at the WPR, GRU began exploring other biosolids management alternatives for their facilities in 2005. At GRU's request, CH2M HILL prepared the *Biosolids Management Plan* (finalized in February 2008) in which many sludge treatment technologies, biosolids end uses, and thickening and/or dewatering options were identified. These options—in various combinations—formed several different biosolids management alternatives that were then evaluated based on benefit criteria and a present-worth analysis. Based on this evaluation, GRU selected the alternative with the highest cost benefit score, which was to continue the process of aerobic digestion to produce Class B biosolids, followed by thickening and land application at WPR. The major change moving forward in biosolids management was for GRU to purchase WPR to ensure its long-term availability as a land application site.

In 2007, GRU requested a special exception from Alachua County to continue land application of Class B biosolids after the purchase of WPR. The Alachua County Office of Planning and Development evaluated the request and recommended the exception with a 75-foot setback from the property line to biosolids application points. The Alachua County Planning Commission recommended approval of the special exception with a 75-foot setback. Since that time Alachua County staff have indicated that they may recommend that the proposed setback be increased to 300 feet and include a 75-foot high-density planted buffer. The increased setback and buffer would have reduced the land area usable for biosolids application by approximately 22 percent. The Alachua County Commission was scheduled to vote on the exception in 2010 but instead came to an agreement and consent order with GRU, to cease Class B biosolids land application at WPR by February 21, 2016. To address the biosolids/WAS handling issues going forward, GRU contracted with CH2M HILL to update the previous management plan.

1.2 Purpose

This Biosolids Management Plan Update was prepared to provide the following information to GRU:

- Review status of state and federal regulations and identify changes since 2008
- Update flow, load, and biosolids production projections for KWRF and MSWRF
- Identify new viable biosolids management alternatives
- Evaluate these new alternatives at updated conditions for technological, environmental, and economic benefits

SECTION 2

Update and Review of Biosolids Regulations and Issues

The objective of biosolids regulations is to ensure protection of the environment and public health. The current rules are meant to anticipate adverse effects of certain pollutants or contaminants that may be present in the biosolids. Biosolids may be regulated at all levels – federal, state, and local. The federal rules set the minimum standards, but a state or local community may choose to adopt rules that are more stringent.

The State of Florida has its own set of rules for biosolids management and disposal, in addition to federal regulations. The rules are found in various chapters of the Florida Administrative Code (FAC). The Florida Department of Environmental Protection (FDEP) is responsible for regulating and enforcing state regulations, but has not been delegated responsibility by the U.S. Environmental Protection Agency (EPA) for delegating the federal sludge regulation.

As does the EPA, Florida promotes the beneficial use of biosolids. Chapter 62-640 FAC, Domestic Wastewater Residuals, provides the minimum standards for the treatment of biosolids and septage for land application and distribution and marketing. Chapter 62-640 FAC also establishes land application criteria and defines the requirements for agricultural practices that use biosolids or septage. In general, Chapter 62-640 FAC adopts the pollutant, pathogen, and vector attraction reduction criteria from 40 Code of Federal Regulations (CFR) Part 503 Biosolids Rule under Subparts B and D. In some instances, Florida rules include additional requirements. Federal, state, and local regulations were thoroughly reviewed in the previous *Biosolids Management Plan* (CH2M HILL, 2008).

While federal regulations have not changed, there have been changes to the State of Florida biosolids regulations. FDEP finalized the revised Chapter 62-640 FAC on August 29, 2010. Major revisions and their potential impacts to GRU are described in this section.

2.1 Revisions to Chapter 62-640 FAC

2.1.1 62-640.200 Definitions

FDEP removed the requirement for agricultural use plan (AUP) submittal, and replaced the AUP with a requirement to submit a more detailed Nutrient Management Plan (NMP). An NMP is a site-specific plan establishing the rate at which all biosolids, soil amendments, and nutrient sources can be applied to the land so as to meet crop nutrient needs while minimizing the amount of pollutants and nutrients discharged to waters of the state. This requirement places additional permitting and monitoring burdens on GRU, and could potentially result in lower allowable biosolids loading rates.

2.1.2 62-640.300 General Requirements

Subsection 62-640.300(2) exempts Class AA biosolids from almost all requirements placed on Class B or Class A biosolids. Class AA biosolids do not require a spill response plan, site registration, NMPs, or adherence to land application site criteria. These exemptions encourage the use of treatment technologies that produce Class AA biosolids products, such as composting or heat drying. All existing and new land application sites will have to be registered and an NMP submitted within 30 days of a site being used.

2.1.3 62-640.400 Prohibitions

Article (7) of this subsection stipulates that treatment, management, transportation, use, land application, or disposal of all biosolids, including Class AA, should not cause a violation of the odor prohibition in Rule 62-296.320(2), FAC. This requirement is general and vague and could lead to many complaints and lawsuits for biosolids management operations. This requirement could negatively impact land application operations more so than options that have use other methods of biosolids disposal.

2.1.4 62-640.500 Nutrient Management Plan

This new subsection has the potential for significant impacts on GRU's current land application operations. It is a comprehensive section that requires an NMP be prepared for every site where Class B and Class A biosolids are applied. The most significant requirement of the NMP is that application rates will be based on the most limiting crop nutrient or standards adopted by the Natural Resources Conservation Service (NRCS) for determining rates and timing of land application of biosolids. All nutrient sources for nitrogen (N) and phosphorus (P) must be considered in the NMP. This is a significant change since, to date, FDEP has required agronomic rates only be based on N requirements. This subsection indicates that the Florida P index methodology can be used by a certified planner to establish P loading rates. This index takes into account soil type, site conditions, and proximity and susceptibility of surface waters to receiving P from applied biosolids on a site-specific basis. What is still unclear, however, is how the Florida P index will be used in implementing the new regulations. The process is dependent on site-specific conditions, so implementation will likely vary significantly.

If the Florida P index is allowed, this requirement would probably not have a significant impact on biosolids application at the WPR site. There are no nearby surface waters likely to be impacted by the WPR site, and groundwater modeling to this point has not identified any potential issues; however, strict interpretation of P loadings based on crop needs could greatly limit WPR as a long-term land application site.

2.1.5 62-640.600 Pathogen Reduction and Vector Attraction Reduction

Draft versions of the revised rule included a requirement in Paragraph 62-640.600(1)(b) that a permittee demonstrate a 2-log reduction of fecal coliform in addition to meeting the fecal limit when using the fecal monitoring only option for Class B compliance. This requirement would have impacted GRU's current operation; however, this requirement was not included in the final version. Two changes that were included in this section impact the FDEP references to pathogen reduction requirements in the federal 40 CFR Part 503. FDEP will no longer accept Alternative 4: Sewage Sludge Treated in Unknown Processes, and changed the implementation of Alternative 3: Sewage Sludge Treated in Other Processes. The changes do not currently impact GRU's processes, but may impact future technologies evaluated for Class AA treatment.

2.1.6 62-640.650 Monitoring, Record Keeping, Reporting, and Notification

FDEP has significantly increased the monitoring, record keeping, and reporting requirements for Class A and Class B land application programs. Although these requirements will not prevent the operation of these programs, they will increase operating and supervisory costs associated with Class A or Class B land application.

2.1.7 62-640.700 Criteria for Land Application of Class A and Class B Biosolids at Land Application Sites

FDEP has also increased land application criteria requirements for Class A and Class B land application programs. Key requirements that have been added or increased include restrictions on maximum loading rates to sites, restrictions on the type of equipment that can be used to apply biosolids, requirement to track metals loading for all Class B sites regardless of metals concentrations in biosolids, and increased setback distances. These requirements will not prevent Class B land application, but will increase costs to permit new sites and will increase amount of land required for application sites.

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SECTION 3

Update of Existing Facilities and Loads

Biosolids are a product of the wastewater treatment process. GRU owns and operates two WRFs, the KWRF and MSWRF, where sludge is generated and treated for vector and pathogen reduction prior to land application as biosolids (see **Section 2**). Under the current program, biosolids from both facilities are land applied on a single agricultural site. The following section describes the existing treatment and land application facilities.

3.1 Kanapaha Water Reclamation Facility (KWRF)

The KWRF is located at the intersection of SW 63rd Boulevard and SW 41st Place and operates under FDEP Permit No. FL0112895, and is the larger of the two WRFs serving the City of Gainesville. Although KWRF is currently experiencing annual average daily flows (AADFs) of approximately 10 million gallons per day (mgd) and is rated as a 14.9-mgd AADF advanced wastewater treatment facility, it serves a growing community and is expected to experience flows of up to 14.5-mgd AADF by 2025.GRU is therefore evaluating the expansion of the KWRF to its build-out capacity of 17.5-mgd AADF.

The KWRF treatment process consists of a preliminary treatment with mechanical bar screens and vortex grit removal units, an extended aeration activated sludge process, secondary clarifiers, deep bed filters, and disinfection with sodium hypochlorite. The biosolids treatment process is depicted in **Exhibit 3-1.** The biosolids are stabilized by three aerobic digesters in series followed by gravity belt thickening. The KWRF achieves Class B pathogen reduction by monitoring indicator organisms, as detailed in 40 CFR Part 503, Subpart D, Option 1. The system complies with the vector attraction reduction criteria by providing enough treatment to reduce the specific oxygen uptake rate (SOUR) to equal or less than 1.5 milligrams (mg) of oxygen per gram of biosolids, as per 40 CFR Part 503, Subpart D, Option 4. **Exhibit 3-2** summarizes the existing facilities at KWRF.

3.2 Main Street Water Reclamation Facility (MSWRF)

The MSWRF is located at the intersection of Main Street and SW 16th Avenue in southeast Gainesville, Florida. The facility is rated at its build-out capacity of 7.5-mgd AADF. Though the facility is approaching build-out capacity, the growth in the service area is flat and wastewater flows are not expected to increase significantly in the future.

The wastewater treatment process at MSWRF consists of preliminary treatment with bar screens and grit removal units, an activated sludge process, secondary clarifiers, upflow filters, and disinfection with sodium hypochlorite. The wastewater residuals (biosolids) are aerobically stabilized to meet Class B requirements, thickened by gravity belt thickeners, and subsequently land applied to approved agricultural sites.

Exhibit 3-3 depicts a process flow diagram of the MSWRF biosolids treatment process. The stabilization process consists of two large aerobic digesters in series that qualify as a process to significantly reduce pathogens (PSRP) as detailed in 40 CFR Part 503, Subpart D, Option 2. Thus, the MSWRF achieves Class B pathogen reduction by meeting PSRP requirements.

Symbol	Description
AIT ORP AE	Oxidation Reduction Potential-Element and Transmitter
FIT FE	Flow Measurement-Meter and Transmitter
LIT LE	Level Measurement-Ultrasonic Level Sensor and Transmitter
LSH	Level Switch High
LSL	Level Switch Low

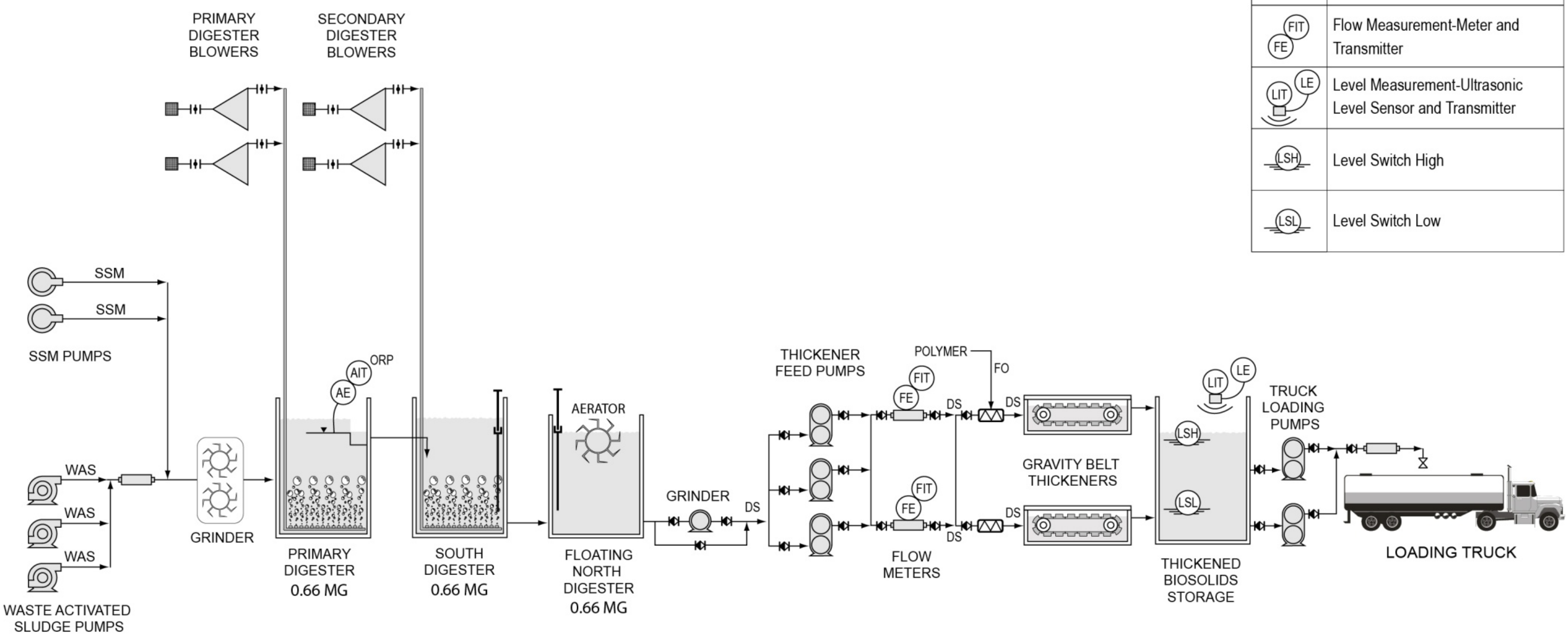

EXHIBIT 3-1
Existing Process Flow Diagram
GRU Kanapaha WRF
CH2MHILL

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EXHIBIT 3-2
Existing Biosolids Treatment Facilities at the KWRF
GRU Biosolids Management Plan

Item	Value
Aerobic Digestion (tanks in series)	
No. of Aerobic Digesters	3
Primary Digester	
Volume, MG	0.66
Diameter, feet	95
SWE, feet	11.75
Type of System	Coarse Bubble Diffusers
No. of Blowers / Blower Rated Capacity, hp	2 / 125
South Digester	
Volume, MG	0.64
Diameter, feet	95
SWE, feet	11.75
Type of System	Coarse Bubble Diffusers
No. of Blowers / Blower Rated Capacity, hp	2 / 100
North Digester	
Volume, MG	0.64
Diameter, feet	95
SWE, feet	11.75 (floating)
Type of System	Surface Aerator
No. of Surface Aerators / Rated Capacity, Hp	1 / 75
Thickener Feed Pump Station	
Grinder / Capacity, gpm	1 / 800
Thickener Feed Pumps / Capacity, gpm	3 / 400
Gravity Belt Thickening	
No. of 2.0-m Thickeners	2
No. of Polymer Feed Pumps / Capacity, gph	3 / 4.5
No. of Filtrate Return Pumps / Capacity, gpm	2 / 650
Truck Loading	
No. of Pumps / Capacity, gpm	2 / 300

gph gallons per hour
gpm gallons per minute
hp horsepower
m meter
MG million gallons
SWE surface water elevation

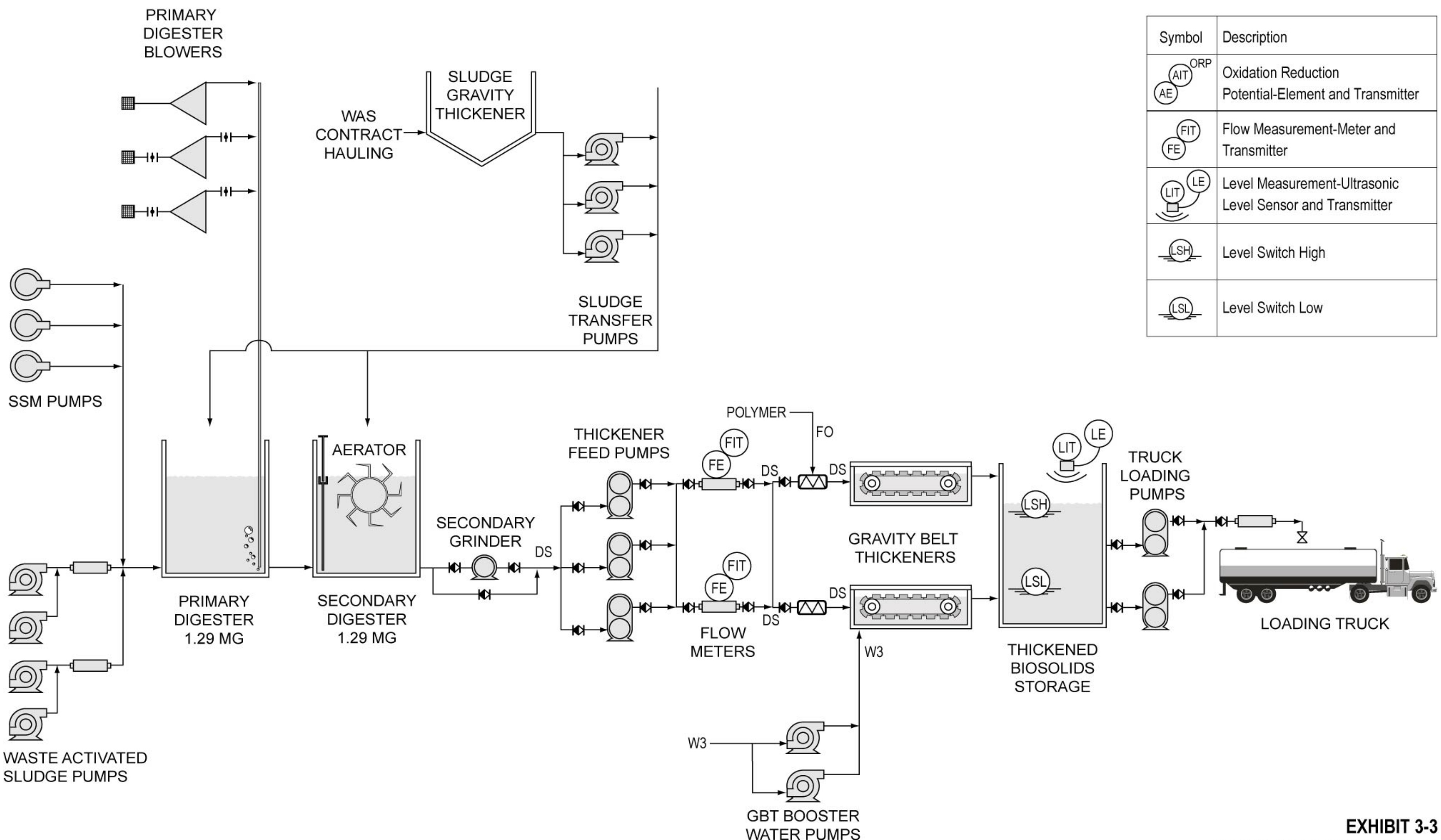

EXHIBIT 3-3
Existing Process Flow Diagram
GRU Main Street WRF

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The MSWRF also achieves vector attraction reduction by meeting SOUR requirements, as specified in 40 CFR Part 503, Subpart D, Option 4, or as backup by injection of biosolids below the soil surface, as specified in 40 CFR Part 503, Subpart D, Option 9. A summary of the existing biosolids treatment facilities at the MSWRF is presented in **Exhibit 3-4**.

EXHIBIT 3-4
Existing Biosolids Treatment Facilities at MSWRF
GRU Biosolids Management Plan

Item	Value
Aerobic Digestion (tanks in series)	
No. of Aerobic Digesters	2
Digester No. 1	-
Volume, MG	1.29
Diameter, feet	112
SWE, feet	16.5
Type of System	Coarse Bubble Diffusers
No. of Blowers / Blower Rated Capacity, hp	3 / 200
Digester No. 2	-
Volume, MG	1.29
Diameter, feet	112
SWE, feet	16.5
Type of System	Surface Aerator
Surface Aerator Rated Capacity, hp	100
Sludge Gravity Thickener	-
Diameter, feet	40
No. of Sludge Transfer Pumps / Capacity, gpm	3 / 200
Thickener Feed Pump Station	
Grinder / Capacity, gpm	1 / 800
Thickener Feed Pumps / Capacity, gpm	3 / 400
Gravity Belt Thickening	
No. of 2.0 m Thickeners	2
No. of Polymer Feed Pumps / Capacity, gph	3 / 4.5
No. of Filtrate Return Pumps / Capacity, gpm	2 / 650
Truck Loading	
No. of Truck Loading Pumps / Capacity, gpm	2 / 300

gph gallons per hour
gpm gallons per minute
hp horsepower
m meter
MG million gallons
SWE surface water elevation

3.3 Current Biosolids Loads at GRU Facilities

In the previous biosolids management plan report, record data were examined to determine the solids production rates for each water reclamation facility (WRF). The generation of waste activated sludge (WAS) was evaluated in terms of dry pounds per million gallons (dry lb/MG) of raw wastewater treated. It was assumed that the rate of WAS production per MG of treated wastewater would remain constant throughout the next 21 years.

For this update, daily monitoring reports (DMRs) dating from 2006 to 2009 were evaluated to update the annual average daily load (AADL) and maximum month average daily load (MMADL), in dry lb/MG, for each facility determined in the previous report. The additional data made little impact, so therefore the same AADL and MMADL values were used for this update. These values are shown in **Exhibit 3-5.**

EXHIBIT 3-5
Historical WAS Rates for 2003-2009[a]
GRU Biosolids Management Plan Update

Facility	Annual Average Daily Load (AADL)[b] (lb/MG)	Maximum Month Average Daily Load (MMADL)[c](lb/MG)
KWRF	1,560	2,000
MSWRF	1,120	1,550

[a] Data from Plant Daily Operations Reports (DMRs)
[b] Average WAS Flow (gallons) x % TSS in WAS x 8.34 lb/gal / Average Plant Flow (mgd)
[c] 92nd percentile of biosolids production rates in 2006-2009

KWRF Kanapaha Water Reclamation Facility
lb/MG pounds per million gallons
MSWRF Main Street Water Reclamation Facility

To evaluate the alternatives over an operating life, the GRU Strategic Planning Department projected the annual average daily wastewater flows at each facility. These flow projections were then used to estimate the amount of WAS produced at each WRF. The WAS projections for the KWRF are listed in **Exhibit 3-6**. Besides treating WAS generated within secondary treatment, the MSWRF also receives WAS from several smaller facilities in the area (University of Florida, City of Waldo, City of High Springs, and the City of Hawthorne). These values are included in the projections shown in **Exhibit 3-7**.

EXHIBIT 3-6
KWRF WAS Projections from 2011 to 2032
GRU Biosolids Management Plan Update

Year	AADF (mgd)	AADF WAS (lb/day)	MMADF WAS (lb/day)
2011	10.27	16,021	20,540
2012	10.47	16,330	20,935
2013	10.66	16,636	21,328
2014	10.86	16,940	21,718
2015	11.05	17,242	22,105
2016	11.27	17,581	22,540
2017	11.49	17,919	22,973

EXHIBIT 3-6
KWRF WAS Projections from 2011 to 2032
GRU Biosolids Management Plan Update

Year	AADF (mgd)	AADF WAS (lb/day)	MMADF WAS (lb/day)
2018	11.70	18,255	23,404
2019	11.92	18,589	23,832
2020	12.13	18,922	24,258
2021	12.34	19,248	24,677
2022	12.55	19,574	25,094
2023	12.75	19,897	25,510
2024	12.96	20,220	25,923
2025	13.17	20,541	26,335
2026	13.37	20,852	26,734
2027	13.57	21,162	27,131
2028	13.76	21,471	27,526
2029	13.96	21,778	27,921
2030	14.16	22,086	28,315
2031	14.35	22,394	28,710
2032	14.55	22,701	29,104

AADF average annual daily flow
KWRF Kanapaha Water Reclamation Facility
lb/day pounds per day
mgd million gallons per day
MMADF maximum month average daily flow
WAS waste activated sludge

EXHIBIT 3-7
MSWRF WAS Projections from 2011 to 2032
GRU Biosolids Management Plan Update

Year	AADF (mgd)	Outside WAS (lb/day)	AADF WAS (lb/day)[a]	MMADF WAS (lb/day)[a]
2011	5.21	2,074	7,906	10,145
2012	5.24	2,106	7,977	10,231
2013	5.28	2,138	8,048	10,316
2014	5.31	2,171	8,119	10,403
2015	5.35	2,204	8,191	10,489
2016	5.38	2,238	8,267	10,582
2017	5.42	2,272	8,344	10,676
2018	5.46	2,307	8,422	10,769
2019	5.50	2,342	8,499	10,863
2020	5.54	2,378	8,578	10,958
2021	5.57	2,415	8,655	11,051

EXHIBIT 3-7
MSWRF WAS Projections from 2011 to 2032
GRU Biosolids Management Plan Update

Year	AADF (mgd)	Outside WAS (lb/day)	AADF WAS (lb/day)[a]	MMADF WAS (lb/day)[a]
2022	5.61	2,452	8,734	11,145
2023	5.65	2,489	8,812	11,240
2024	5.68	2,528	8,891	11,335
2025	5.72	2,566	8,971	11,430
2026	5.75	2,606	9,050	11,524
2027	5.79	2,646	9,129	11,618
2028	5.82	2,686	9,209	11,713
2029	5.86	2,728	9,289	11,808
2030	5.89	2,769	9,370	11,904
2031	5.93	2,812	9,451	12,000
2032	5.96	2,855	9,533	12,097

[a] Includes outside WAS values.

AADF average annual daily flow
KWRF Kanapaha Water Reclamation Facility
lb/day pounds per day
mgd million gallons per day
MMADF maximum month average daily flow
WAS waste activated sludge

3.4 Land Application Program

Based on the results of the *Biosolids Management Plan* (CH2M HILL, 2008) and over 25 years of successful operation, GRU decided to continue land application of aerobically digested Class B biosolids at WPR. To secure long-term availability of the site, GRU entered into an agreement to purchase the site from the current owner.

In 2007, GRU requested a special exception from Alachua County to continue land application of Class B biosolids after the purchase of WPR. The Alachua County Office of Planning and Development evaluated the request and recommended the special exception with a 75-foot setback from the property line to biosolids application points; however, this plan was unpopular with some community members. As a result, Alachua County considered the special exception, with an increased setback to 300 feet, including a 75-foot high-density planted buffer.

To resolve the issue, the County Commission entered into an Agreement and Consent Order with GRU to cease land application of Class B biosolids at WPR by February 21, 2016. The current land application program at WPR is under contract through February 21, 2016.

SECTION 4

Identification of Preliminary Biosolids Management Alternatives

Biosolids management programs include two basic components: treatment and disposal (or "End Use"). The previous *Biosolids Management Plan* (CH2M HILL, 2008) first identified multiple end uses, then various treatment alternatives that could produce a product from the biosolids that would meet the required criteria for the end uses. Using the information garnered in the previous evaluation, the opinions of key stakeholders, and additional knowledge of the regulatory requirements, fifteen biosolids management alternatives were identified that include both treatment and end uses. The following list includes the fifteen alternatives evaluated:

1. New Gasification and Cogeneration at GRU WRF by Third Party Vendor
2. New Gasification and Cogeneration at Remote Facility by Third Party Vendor
3. Gasification and Cogeneration at Existing Facility by Third Party Vendor
4. Alkaline Treatment at Remote Site by Third Party Vendor
5. Landfill
6. Waste-to-Energy Facility
7. Thermal Oxidation and Cogeneration at Deerhaven Generating Station
8. Thermal Oxidation and Cogeneration at Future Biomass Facility
9. Class AA Chemical Treatment, Land Apply at WPR
10. Class AA Chemical Treatment, Market Fertilizer
11. Aerobic Digestion and Drying, Market Fertilizer
12. Implement Solids Reduction Technology Process at WRFs
13. Class AA Exothermic Drying, Market Fertilizer at a Remote Site by Third Party Vendor
14. Class B Aerobic Digestion, Land Apply at WPR with Special Exception Requirements
15. Class B Aerobic Digestion, Land Apply at WPR without Special Exception Requirements (Baseline)

Each alternative is described in the following subsection. Alternatives 14 and 15 are excluded from consideration as potential long-term biosolids solutions but are included to compare the costs of the other alternatives.

4.1 Description of Preliminary Alternatives

4.1.1 New Gasification and Cogeneration at GRU WRF by Third Party Vendor

Max West Environmental Systems, Inc. (Max West) uses a gasification and thermal oxidation process to dispose of biosolids and recover energy. The by-product created using this process is inert ash, which can be disposed of more cost effectively. The main components of the Max West system are shown on **Exhibit 4-1**.

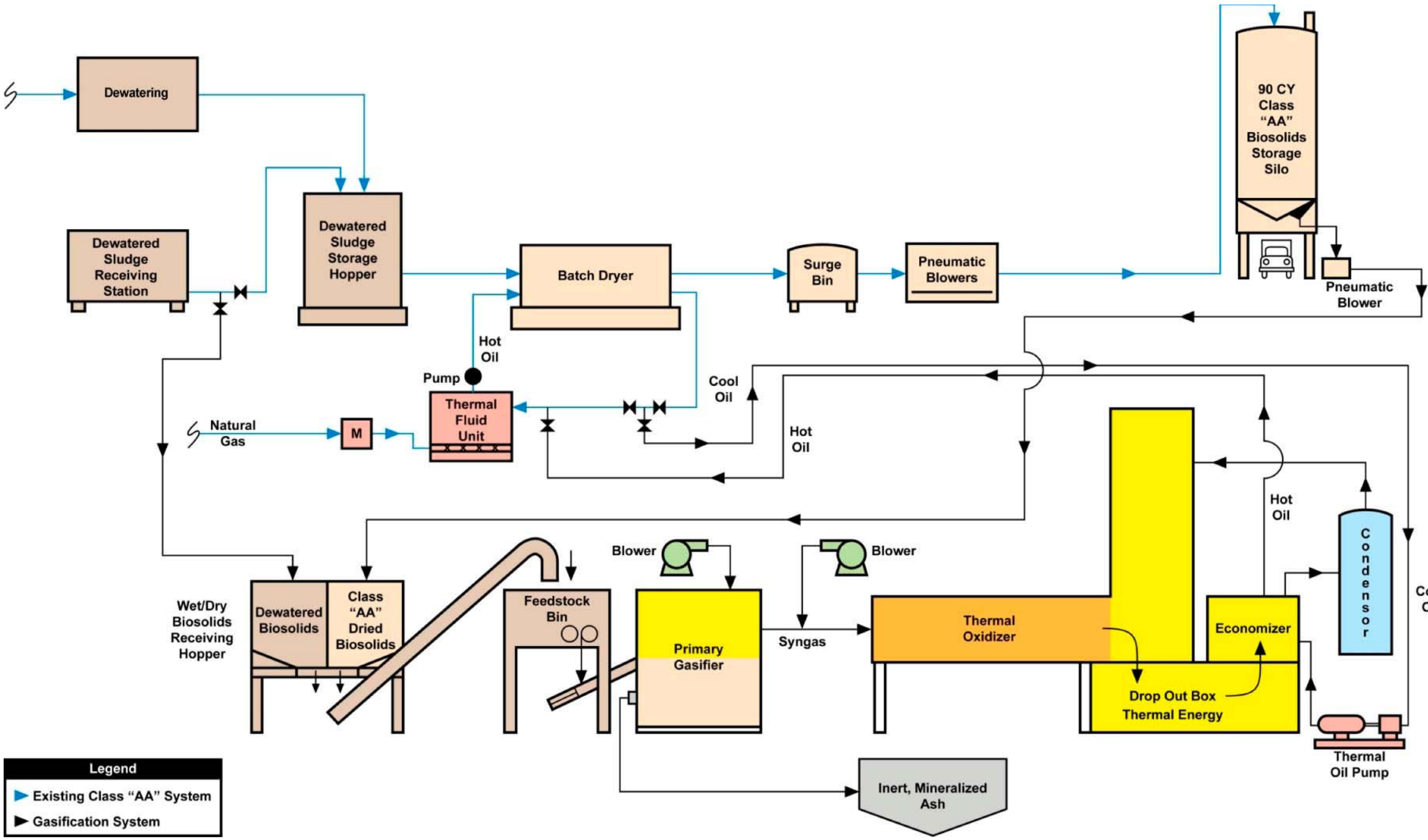

EXHIBIT 4-1
Process Components of a Max West Treatment System
GRU Biosolids Management Plan Update

The biosolids are received by the waste handling feed system and then delivered to the drying system. The dried solids then proceed to the gasifier, which uses an oxygen-starved, ceramic-lined primary gasification chamber. Following gasification, the thermal oxidizer receives the syngases and converts them to useable heat, in addition to eliminating pollutants and odors. The energy recovery system uses the exhaust heat to help dry the incoming solids. One benefit of this process is that the WAS feed does not need to be aerobically digested, saving GRU the cost of operating the aerobic digester blowers.

Max West proposes to design, permit, finance, build, and operate the system and the required facilities to house this process. In this alternative, the facility would operate on the KWRF site.

4.1.2 New Gasification and Cogeneration at Remote Facility by Third Party Vendor

This alternative includes a Max West gasification system similar to the system previously described. The facility would be located offsite and would receive dewatered sludge from GRU and potentially organic wastes from other sources. Previous discussions have been held regarding a Max West facility located in the Alachua/Marion County area that could receive horse or other animal manure, in addition to wastewater treatment plant sludges.

4.1.3 Gasification and Cogeneration at Existing Facility by Third Party Vendor

A WRF, owned and operated by another utility, would serve as the host site for the Max West gasification system included in this alternative. Max West indicated that this alternative had too many uncertainties, however, and a proposal for these conditions could not be provided. This alternative will not be evaluated further.

4.1.4 Alkaline Treatment at Remote Site by Third Party Vendor

The N-Viro International Corporation (N-Viro) operates an alkaline treatment facility in Volusia County, Florida. N-Viro has a patented technology used to stabilize and disinfect organic waste. This process creates a beneficial product for use as a fertilizer or soil amendment.

N-Viro receives dewatered sludge and mixes it with the alkaline admixture at a predetermined ratio. The sludge/admixture combination is then conveyed to heat cells where the temperature and pH of the mixture is increased. These conditions are designed to kill pathogens and reduce odors. This process is regulated under 40 CFR Part 503, Alternatives 2 and 6. Following treatment in the heat cells, the biosolids are dried using a windrowing device. The dried product is then stored onsite, prior to distribution to customers.

N-Viro can also haul the organic waste to its Volusia County facility for a per ton hauling and tipping fee. To use N-Viro for biosolids treatment and disposal, the waste would require dewatering before it is hauled away. One benefit of the alkaline treatment system is that the WAS does not need to be aerobically digested, saving GRU the cost of operating the aerobic digester blowers.

4.1.5 Landfill

Landfill disposal has been used for wastewater treatment plant sludges for decades. Materials delivered to landfills must be dry enough to pass a paint filter test, and a toxicity characteristic leaching procedure (TCLP) test must be performed to prevent disposal of materials with heavy metals or other toxins. With sludge dewatering, most municipal wastewater treatment plants can pass these tests. Landfill disposal is popular for facilities that do not want the capital expenses involved with sludge treatment. Material treatment or stabilization is not required prior to disposal.

Another landfill disposal benefit is fewer regulatory constraints when compared to land application. Landfill disposal of WAS is not considered a beneficial use of sewage sludge or biosolids because it does use the sludge nutrients or energy. This would also require offsite hauling of the dewatered WAS, which can be costly if nearby landfills do not accept WAS. Under this alternative, GRU would give up control of its disposal and have less flexibility in the future if landfill disposal became a less viable option or far more expensive. A long-term contract would be important if landfill were the primary method of disposal.

The Trail Ridge Landfill in Duval County has been identified as a facility that will accept WAS from GRU.

4.1.6 Waste-to-Energy Facility

Disposing WAS in a waste-to-energy facility is similar to landfill disposal. The facility would require a dewatered product that passed the paint filter test, and a per ton tipping fee would be charged. Like a landfill, a waste-to-energy facility would not require any treatment or stabilization; however, unlike a landfill, the WAS and other waste are used to produce energy by digesting the waste anaerobically and collecting biogas. The biogas can then be used to run turbine generators or produce heat or steam.

During the course of this evaluation, Alachua County contacted GRU regarding a novel waste-to-energy facility. Alachua County is proposing to evaluate multiple sites to create an organics recycle biomodule (ORB). Only food and other organic wastes will be accepted into the ORB. Six ORBs will be constructed and operated sequentially. One module will be filled daily and covered with a geomembrane. Following a 1-year fill cycle to fill the ORB, it will be covered and the next module opened for filling. Methane gas collection systems will recover gas from the digesting waste and convert this fuel to power using a turbine generator. After 3 years of digestion and gas capture, the module will be openly aerated for another year. At that time, the digested and aerated material will be removed and used as a compost or soil amendment for a proposed sod farming operation.

The WAS from GRU's facilities would be a benefit to both energy recovery and the production of the soil amendment. Alachua County has presented GRU with three preliminary options for WAS disposal at the future ORB to use for planning purposes.

4.1.7 Thermal Oxidation and Cogeneration at Deerhaven Generating Station

GRU's Deerhaven No. 2 Generating Station is a coal-fired power plant that supplies electricity to customers in Gainesville. The initial version of this biosolids disposal alternative involves hauling the dewatered WAS to Deerhaven. A drying facility constructed on the Deerhaven site would receive the dewatered WAS. The dried product could then be fed into the furnace along with the coal. The dried biosolids have a heating value of approximately 8,000 to 10,000 British thermal units (Btu) per dry pound. Because of the energy required for drying the dewatered sludge, the net energy balance is neutral to slightly positive. For the type of pulverizer and furnace system at Deerhaven, there is little to no experience with co-firing biosolids.

Subalternatives for using the sludge in both liquid and dewatered forms for feed to the furnace or for use as a cooling or transport medium for the ash were also investigated. Preliminary findings showed that neither the liquid biosolids nor the dewatered sludge could be easily used without impacting the plant performance. Neither subalternative was carried forward in the analysis.

4.1.8 Thermal Oxidation and Cogeneration at Future Biomass Facility

GRU has entered into an energy contract with Gainesville Renewable Energy Center, LLC (GREC), an American Renewables project company. In this contract, GREC agrees to build and operate a 100-megawatt wood-fueled biomass power plant in Gainesville, Florida. GRU has agreed to purchase 100 percent of the energy produced in this facility. The biomass facility will use a bubbling bed type furnace, which is an ideal furnace configuration for using wastewater sludge as a fuel.

Based on information from GRU, the biomass facility is being designed and permitted to accept only wood waste as a fuel. The thermal oxidation of WAS is not being considered; therefore, this alternative will not be evaluated further in this update, but can be revisited in a future update.

4.1.9 Class AA Chemical Treatment, Land Apply at WPR

A Florida-based company, BCR Environmental, LLC (BCR), has a patented sludge treatment process called The Neutralizer®. This process meets temperature and pH conditions to qualify as a process to further reduce pathogens (PFRP) equivalency to Class A requirements as defined in 40 CFR Part 503.

The Neutralizer® is a batch process that uses the following four chemicals common in water and wastewater treatment:

- 50 percent sodium hydroxide
- 31 percent sodium chlorite
- 50 percent sulfuric acid
- 40 percent sodium nitrite

The process first receives WAS thickened to 4 percent or less and feeds it into a steel reactor. Chlorine dioxide is generated onsite and added to the WAS for approximately 1 hour (Stage 1). Stage 2 treatment introduces sodium nitrite for approximately 6 hours. The oxidation-reduction potential (ORP) is monitored throughout to ensure the process is meeting all predetermined setpoints for PFRP equivalency. Following Stage 2 treatment, the batch is pumped out of the tank and dewatered.

For this alternative, the dewatered biosolids would be land applied at WPR. Because the biosolids qualify as Class AA, the product qualifies as a fertilizer and reduces the monitoring requirements.

4.1.10 Class AA Chemical Treatment, Market Fertilizer

This alternative uses the same BCR process as the previous alternative, which produces a dewatered cake that meets Class AA requirements; however, the dewatered biosolids would be marketed as a fertilizer in this alternative. GRU could directly market the dewatered biosolids, or GRU could enter into an agreement with a third-party fertilizer company (for example, Sunniland Fertilizer) to take the biosolids and market them through its products.

Although the biosolids from the BCR process meet Class AA standards and could be classified as a fertilizer, the market for a dewatered cake is not as favorable as that of a dried product. Whether self-marketing or using a third party, the long-term viability of marketing this product is unknown. After reviewing this alternative, it was determined that it would not be evaluated further.

4.1.11 Aerobic Digestion and Drying, Market Fertilizer

In this alternative, GRU would contract a third party, GreenEdge, to help produce and market a fertilizer product. GRU would continue to aerobically digest the WAS for stabilization. The biosolids would then be dewatered and dried to produce a pellet. In the final step, GreenEdge would use a process adding chemicals to the dried product to create a slow release fertilizer. The facilities required for this final step would be provided and operated by GreenEdge. GreenEdge would also pay GRU for the final product and take responsibility for marketing and disposal.

4.1.12 Implement Solids Reduction Technology Process at WRFs

Siemens has a patented solids reduction technology called the Cannibal® system. In this system, WAS is sent to a sidestream treatment reactor designed to encourage the destruction of the biological solids. The process is designed to optimize the recycled flow between the activated sludge basins and the sidestream reactor to significantly reduce the amount of biosolids produced at the facility. The Cannibal® system can reduce or eliminate many costs and challenges associated with biosolids treatment and disposal.

When the Cannibal® process was evaluated, potential difficulties with implementation at GRU's facilities were identified. The maximum size WRF required for this process is approximately 16 mgd. The current AADF for KWRF is 15 mgd with expansion planned to 17.5 mgd. Larger installations are possible, but may not be economical because of the size of the sidestream reactor required; therefore, implementation at KWRF is not recommended. Because so few solids leave the process in the Cannibal® system, phosphorus removal is severely hindered. Phosphorus limits will be in place at MSWRF in the future, so this process is not recommended for the MSWRF. Solids reduction technology will not be evaluated further for GRU at this time.

4.1.13 Class AA Exothermic Drying, Market Fertilizer at Remote Site by Third Party Vendor

Unity Envirotech, LLC (Unity) uses waste solids from WRFs in a fertilizer production process originally developed by the Tennessee Valley Authority. The original process created high temperatures with the combination of sulfuric acid and anhydrous ammonia. Cooling water was then added to enable granulation of the product. Unity has taken the original process and replaced the cooling water with biosolids, which are beneficially reused and provide added nutrients and organic material to the fertilizer product.

Unity plans to construct a regional biosolids treatment facility in Polk County, Florida; however, they are still in the process of gathering initial capital to begin the project. Because the Unity Florida facility project is uncertain, this alternative will not be evaluated further at this time.

4.1.14 Class B Aerobic Digestion, Land Apply at WPR with Special Exception Requirements (300 ft Setback and 75 ft Buffer)

In this alternative GRU would continue treating its biosolids to Class B standards using aerobic digestion. GRU would purchase WPR and make improvements to meet the potential special exception requirements of a 300-ft setback with a 75-ft planted buffer. The thickened Class B biosolids would continue to be land applied in the same manner, but additional sampling and monitoring would be required.

4.1.15 Class B Aerobic Digestion, Land Apply at WPR without Special Exception Requirements (Baseline)

The current biosolids treatment and disposal practices by GRU were evaluated in this alternative. The special exception requirements for WPR were not included, but it was assumed that GRU would purchase WPR. This alternative provides a baseline to compare all other alternatives against their current practice.

4.2 Alternatives Identified for Detailed Evaluation

Based on the initial review of the 15 preliminary alternatives, the following 10 alternatives were identified for a more detailed evaluation, which is presented in Section 6:

1. New Gasification and Cogeneration Facility at GRU WRF by Third Party Vendor (Max West, KWRF)
2. New Gasification and Cogeneration Facility at Remote Facility by Third Party Vendor (Max West, Remote)
3. Alkaline Treatment at Remote Site by Third Party Vendor (N-Viro)
4. Landfill
5. Waste-to-Energy Facility (Alachua County ORB)
6. Thermal Oxidation and Cogeneration at Deerhaven Generating Station (Deerhaven)
7. Class AA Chemical Treatment, Land Apply at WPR (BCR)
8. Aerobic Digestion and Drying, Market Fertilizer (GreenEdge)
9. Class B Aerobic Digestion, Land Apply at WPR with Potential Special Exception Requirements of a 300-ft Setback with a 75-ft Vegetative Buffer
10. Class B Aerobic Digestion, Land Apply at WPR without Potential Special Exception Requirements (Baseline)

Alternatives 9 and 10 are excluded from consideration as potential long-term biosolids solutions but are included to compare the costs of the other alternatives.

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SECTION 5

Dewatering Options and Evaluation

5.1 Dewatering Technology Options

Two dewatering technologies were identified in the *Biosolids Management Plan* (CH2M HILL, 2008): belt filter press and centrifuge. These technologies will be evaluated in this update.

5.1.1 Belt Filter Press

Belt filter presses (BFPs) are similar to the existing gravity belt thickeners. They have a gravity section on top of the machines where liquid sludge treated with polymer, travels along a moving belt. The polymer holds the solids together, while the liquid falls through the belts. The thickened sludge then travels to the pressure section of the machine where it travels between two belts through rollers of different diameters. The rollers create the pressure required to squeeze excess water through the permeable belts. The dewatered biosolids remaining within the belts is later scraped off of the belts with a doctor blade and then discharged into a hopper.

Good conditioning (polymer) is important to achieve acceptable cake dryness, and a moderate level of operator attention is needed to maintain optimal performance. BFPs typically achieve 16 to 18 percent solids on WAS and 22 to 30 percent solids on primary sludges. Typical hydraulic loading rates are 100 gallons/minute/meter; the solid loading rate is approximately 600 pounds/hour/meter; the polymer dose is approximately 15 pounds per ton of dry solids. **Exhibit 5-1** presents the advantages and disadvantages of using the BFP as compared to a centrifuge.

EXHIBIT 5-1
Advantages and Disadvantages of Belt Filter Presses (BFP) as Compared to Centrifuges
GRU Biosolids Management Plan

Advantages	Disadvantages
Lower overall disposal volume of biosolids than thickening operations	Odorous operation for unstabilized sludges
Easy to operate and maintain	Lower solids percentage
Lower capital costs	
Lower polymer usage	
Reliable equipment	
Lower energy requirements than centrifuges	

5.1.2 Centrifuge

Centrifuges are devices frequently used for dewatering municipal wastewater sludges. Though there are various types of centrifuges, the solid-bowl conveyer centrifuge is generally used for dewatering wastewater sludge. This centrifuge consists of a rotating cylindrical-conical bowl (reactor) that separates solids from liquid by centripetal force. As this force is applied to dilute wastewater sludge, the difference in density between the solids and water makes each accelerate at a different rate, causing them to separate. A screw conveyer then pushes the solids to one end of the bowl while the water drains by gravity at the opposite end.

The resulting product from centrifuges is typically 20 to 22 percent solids on WAS but pilot testing is recommended to confirm. As with other dewatering equipment, polymer or another conditioning chemical is required to achieve the upper range percent solids. Polymer dosages vary based on the type of sludge being dewatered, but are typically 20 to 30 pounds of active polymer per ton of dry solids. The initial cost, power, and polymer requirements for installing centrifuges are higher than to install either BFPs or gravity belt thickeners (GBTs). Centrifuges require less space and odors are contained within the unit; therefore, they can be housed in a smaller building. **Exhibit 5-2** presents the advantages and disadvantages of using centrifuges.

EXHIBIT 5-2
Advantages and Disadvantages of Centrifuges as Compared to BFPs
GRU Biosolids Management Plan Update

Advantages	Disadvantages
Higher percent solids product than BFP	High capital cost
Lower overall disposal volume of biosolids than BFP operations	High power and polymer costs
Clean appearance	More expensive and difficult to maintain versus a BFP (can be out of service for long periods of time)
Easier to control odor emissions	
Lower footprint requirements	

BFP belt filter press

5.2 Dewatering Facility Layout Options

In addition to selecting which dewatering technology is most applicable for GRU, there are also multiple facility layout options. One option is having separate dewatering facilities at each WRF. Another option is to construct a single dewatering facility at KWRF large enough to handle MSWRF's solids. In this option, MSWRF would continue thickening onsite, and haul the thickened WAS to KWRF for dewatering prior to treatment or disposal.

5.2.1 Separate Dewatering Facility at each WRF

The dewatering facilities for each technology at each WRF are described in this section. All dewatering facilities were sized with redundancy based on the KWRF and MSWRF WAS projections in **Exhibit 3-6** and **Exhibit 3-7**.

KWRF BFP Facility

Exhibit 5-3 lists the items included in the KWRF BFP facility.

EXHIBIT 5-3
KWRF BFP Facility
GRU Biosolids Management Plan Update

Item	Number	Size/Capacity	Note
BFP	3	Two meter	100 gpm/min/m and 600 lb/hr/m
BFP Feed Pump	4	125 gpm	
Polymer Blending Unit	3		
Conveyor	3		
BFP Washdown Pumps	4		
Dewatering Building	1	4,300 ft^2	

BFP belt filter press
ft^2 square feet
gpm gallons per minute
hr hour
lb pounds
m meter
min minutes

KWRF Centrifuge Facility

Exhibit 5-4 lists the items included in the new KWRF centrifuge facility.

EXHIBIT 5-4
KWRF Centrifuge Facility
GRU Biosolids Management Plan Update

Item	Number	Size/Capacity	Note
Centrifuge	3	125 gpm	
Centrifuge Feed Pump	4	125 gpm	
Polymer Blending Unit	3		
Conveyor	3		
Dewatering Building	1	4,100 ft^2	

ft^2 square feet
gpm gallons per minute

MSWRF BFP Facility

The items included in the new BFP facility at MSWRF are listed in **Exhibit 5-5**.

EXHIBIT 5-5
MSWRF BFP Facility
GRU Biosolids Management Plan Update

Item	Number	Size/Capacity	Note
BFP	2	Two meter	100 gpm/min/m and 600 lb/hr/m
BFP Feed Pump	3	100 gpm	
Polymer Blending Unit	2		
Conveyor	2		
BFP Washdown Pumps	3		
Dewatering Building			Renovate existing building

BFP belt filter press
gpm gallons per minute
hr hour
lb pounds
m meter
min minutes

MSWRF Centrifuge Facility

Exhibit 5-6 lists the items for the new MSWRF centrifuge facility.

EXHIBIT 5-6
MSWRF Centrifuge Facility
GRU Biosolids Management Plan Update

Item	Number	Size/Capacity	Note
Centrifuge	2	100 gpm	
Centrifuge Feed Pump	3	100 gpm	
Polymer Blending Unit	2		
Conveyor	3		
Dewatering Building	1	3,300 ft^2	Existing building does not have sufficient overhead clearance for centrifuges

ft^2 square feet
gpm gallons per minute

5.2.2 Combined Dewatering Facility

The combined dewatering facility option has two components: a new dewatering facility at KWRF and improvements to the existing thickening facility at MSWRF.

Combined BFP Facility at KWRF

The combined BFP facility at KWRF includes the items listed in **Exhibit 5-7**.

EXHIBIT 5-7
KWRF BFP Facility
GRU Biosolids Management Plan Update

Item	Number	Size/Capacity	Note
BFP	3	3 meters	100 gpm/min/m and 600 lb/hr/m
BFP Feed Pump	4	125 gpm	
Polymer Blending Unit	3		
Conveyor	3		
BFP Washdown Pumps	3		
Dewatering Building	1	6,600 ft^2	

BFP belt filter press
ft^2 square feet
gpm gallons per minute
hr hour
lb pounds
m meter
min minutes

Combined Centrifuge Facility at KWRF

Exhibit 5-8 lists the items included in the combined centrifuge facility at KWRF.

EXHIBIT 5-8
Combined Centrifuge Facility at KWRF
GRU Biosolids Management Plan Update

Item	Number	Size/Capacity	Note
Centrifuge	3	175 gpm	
Centrifuge Feed Pump	4	175 gpm	
Polymer Blending Unit	3		

EXHIBIT 5-8
Combined Centrifuge Facility at KWRF
GRU Biosolids Management Plan Update

Item	Number	Size/Capacity	Note
Conveyor	3		
Dewatering Building	1	4,400 ft^2	

ft^2 square feet
gpm gallons per minute

Thickening Improvements at MSWRF

In the combined dewatering option, the MSWRF will continue to thicken WAS. The existing thickening facilities need improvements to provide a long-term life comparable to the new KWRF dewatering facilities. The estimated thickening improvements required at MSWRF for the combined options are listed in **Exhibit 5-9**.

EXHIBIT 5-9
Improvement to MSWRF Thickening Facility
GRU Biosolids Management Plan Update

Item	Number	Note
GBT Feed Pumps	3	Demo and replace
Polymer System	3	Demo and replace
GBT	2	Rebuild rollers, bearings, drive, belt, and chicanes
Air Compressors	2	Demo and replace
Exposed Pipes and Valves		Replace and/or paint as needed
Truck loading pumps, piping and valves	2	Demo and replace
Thickening Building	1	Paint and remove insulation as needed
Digester No. 2 Floating Aerator	1	Demo and replace

GBT gravity belt thickener

5.3 Evaluation of Dewatering Options

The four dewatering options were evaluated to determine which option would be used in developing the comparison for the biosolids treatment and disposal alternatives. The analysis of the dewatering options included cost estimates for both capital and operations and maintenance (O&M) costs. The costs were divided into dewatering and thickening costs, and hauling and disposal costs. The cost assumptions used to develop the estimates are included in **Appendix A**.

Exhibit 5-10 shows the capital costs required for the WRF and for hauling equipment for each of the four dewatering options. The separate BFP facilities and combined centrifuge facility have similar capital costs. The combined BFP option is slightly higher at approximately $12 million, and the separate centrifuge option is the highest at $14 million. The projected 20-year present worth O&M costs for the four dewatering options are shown in **Exhibit 5-11**. Both centrifuge options have higher O&M costs due to higher energy and chemical requirements.

EXHIBIT 5-10
Capital Costs for Dewatering Options
GRU Biosolids Management Plan Update

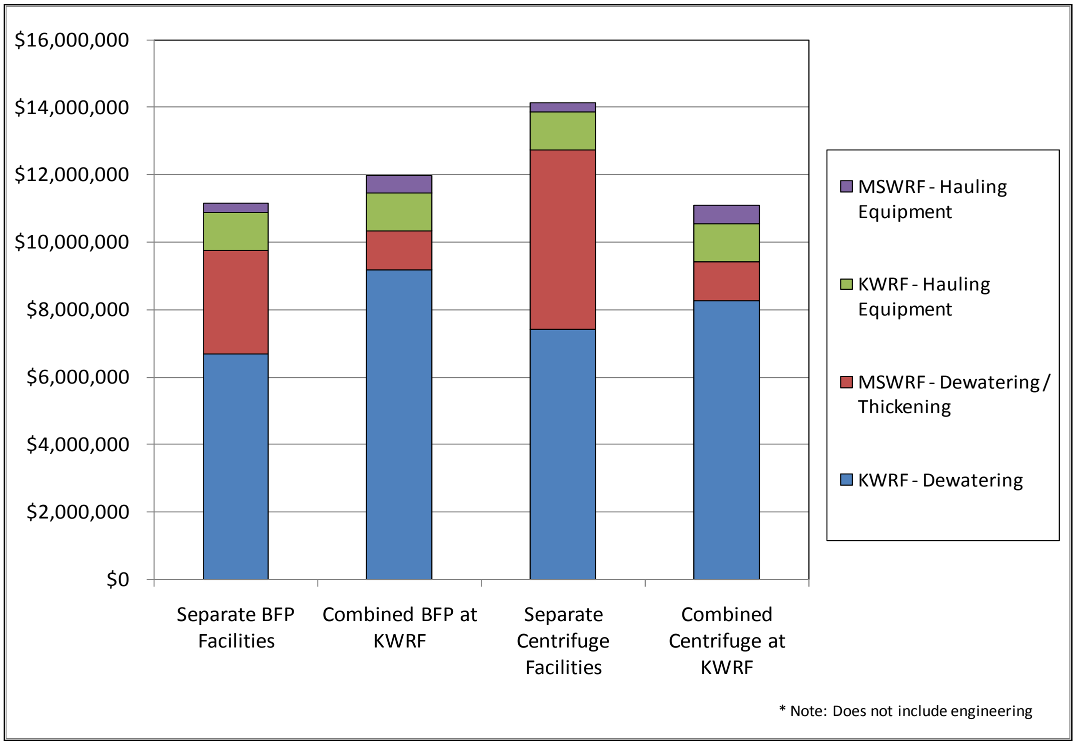
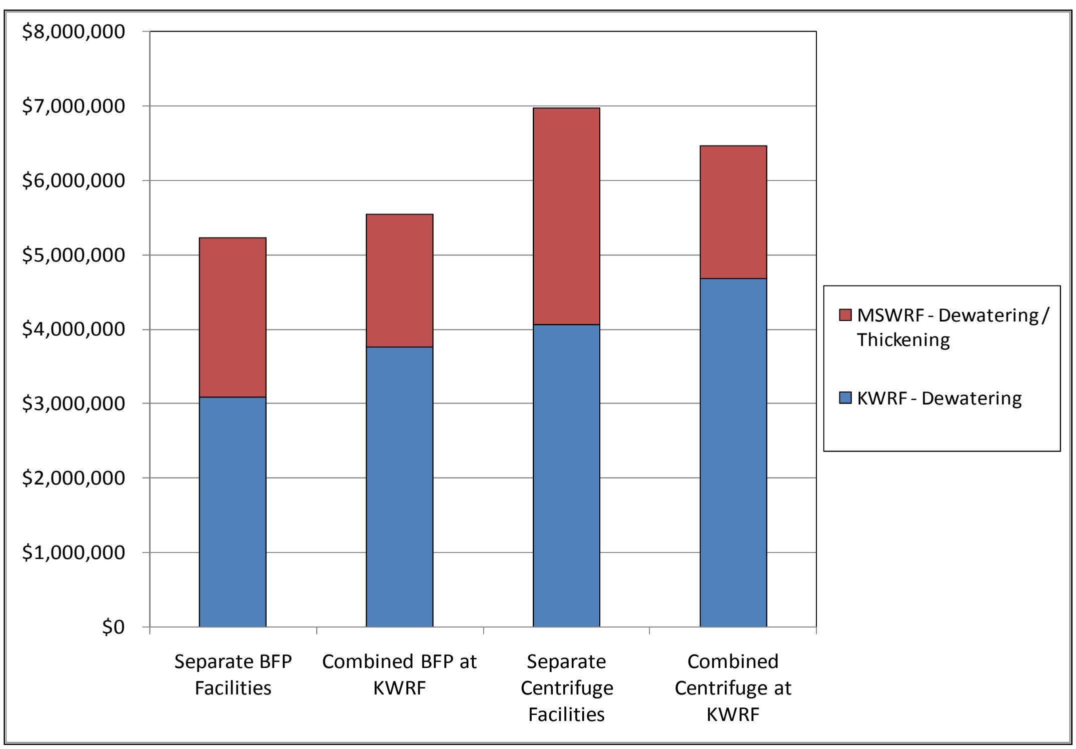


EXHIBIT 5-11
20-year Present Worth O&M Costs of Dewatering Options
GRU Biosolids Management Plan Update



To fully evaluate the dewatering options, all costs associated with biosolids treatment and disposal should be included. Centrifuges reliably produce a dewatered product with a higher solids percentage than compared with BFPs. The increased solids percentage decreases the overall weight per volume. This reduction in weight reduces hauling and disposal costs that are based on tipping fees.

Alternatives identified for the detailed evaluation were selected to compare the dewatering options on a present worth basis. Two alternatives (Deerhaven and GreenEdge) require the higher solids percentage product produced by a centrifuge to efficiently operate a dryer. The batch nature of the BCR process also requires a centrifuge as BFPs are hydraulically limited in comparison; therefore, three of the remaining five alternatives requiring dewatering were selected to use for a comparison between the two technologies and the two layout options.

Exhibit 5-12, **Exhibit 5-13**, and **Exhibit 5-14** illustrate the present worth costs of the four dewatering options for the gasification at KWRF, N-Viro, and landfill alternatives, respectively. The present worth costs are divided by capital and O&M costs for each WRF, hauling costs for each WRF, and combined disposal costs. For each alternative, the combined centrifuge option had the lowest present worth. When a biosolids alternative is selected, the final dewatering option can be further evaluated. For this update, however, all alternatives will be evaluated with a combined centrifuge facility at KWRF and thickening improvements at MSWRF. A process flow diagram and site plan for the combined centrifuge facility at KWRF are included as **Exhibit 5-15** and **5-16**, respectively. A process flow diagram for the thickening improvements at MSWRF is included as **Exhibit 5-17**.

EXHIBIT 5-12
20 Year Present Worth Costs for the Max West KWRF Alternative with Dewatering Options
GRU Biosolids Management Plan Update

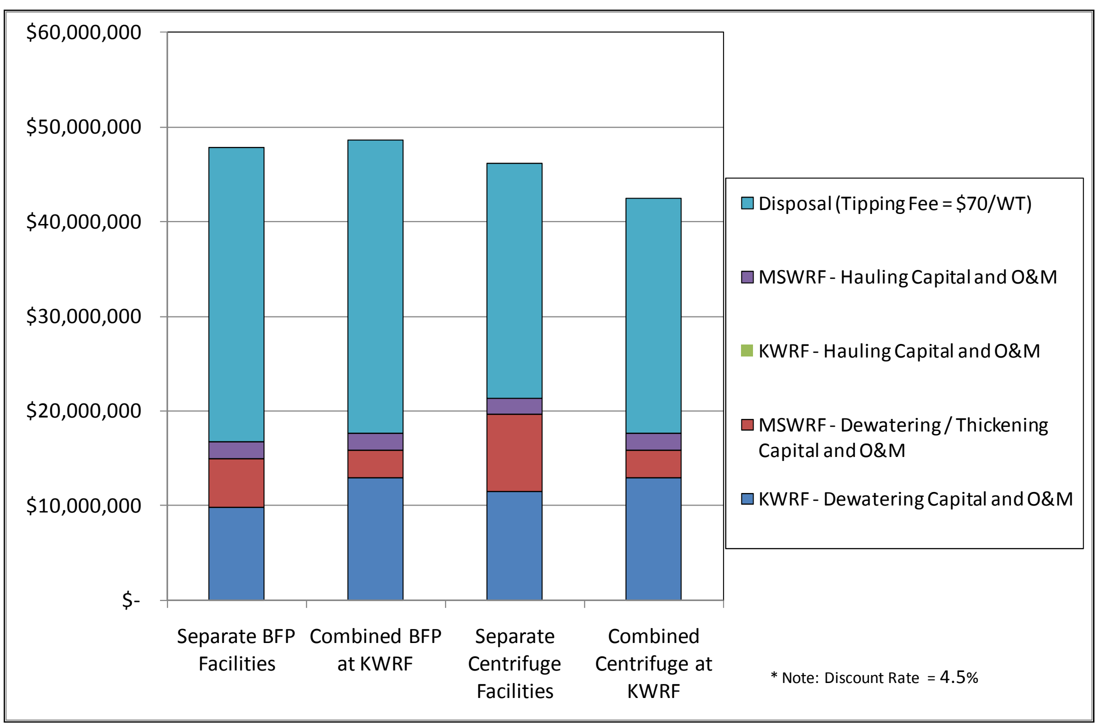


EXHIBIT 5-13
20-year Present Worth Costs for the N-Viro Alternative with Dewatering Options
GRU Biosolids Management Plan Update

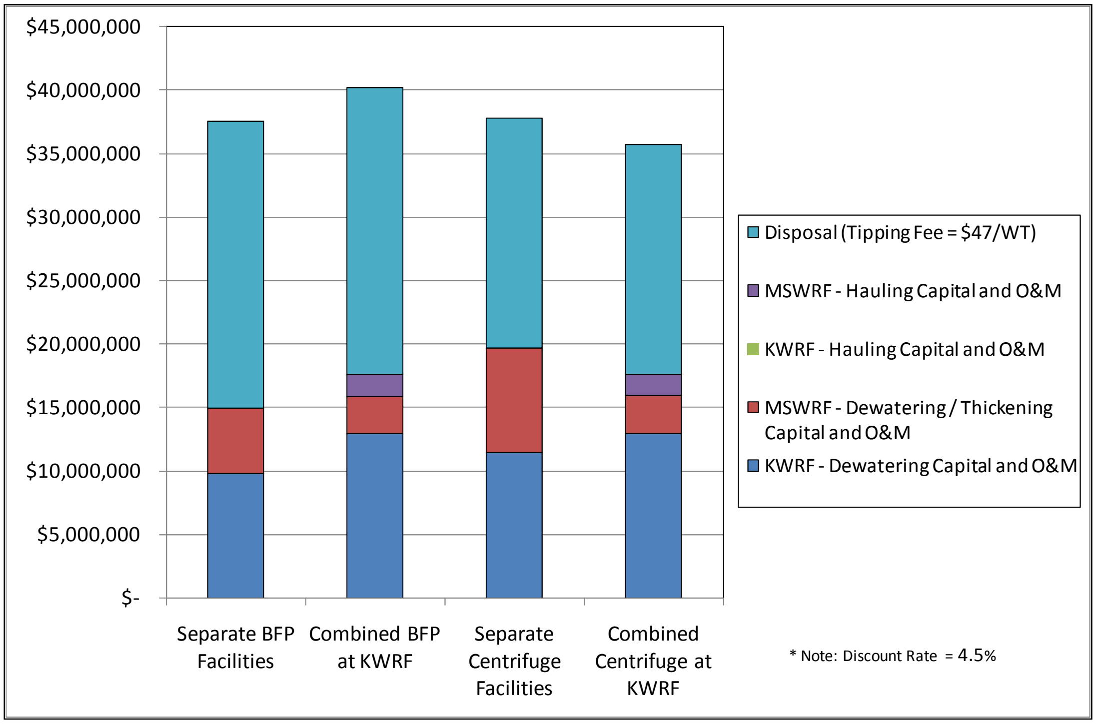
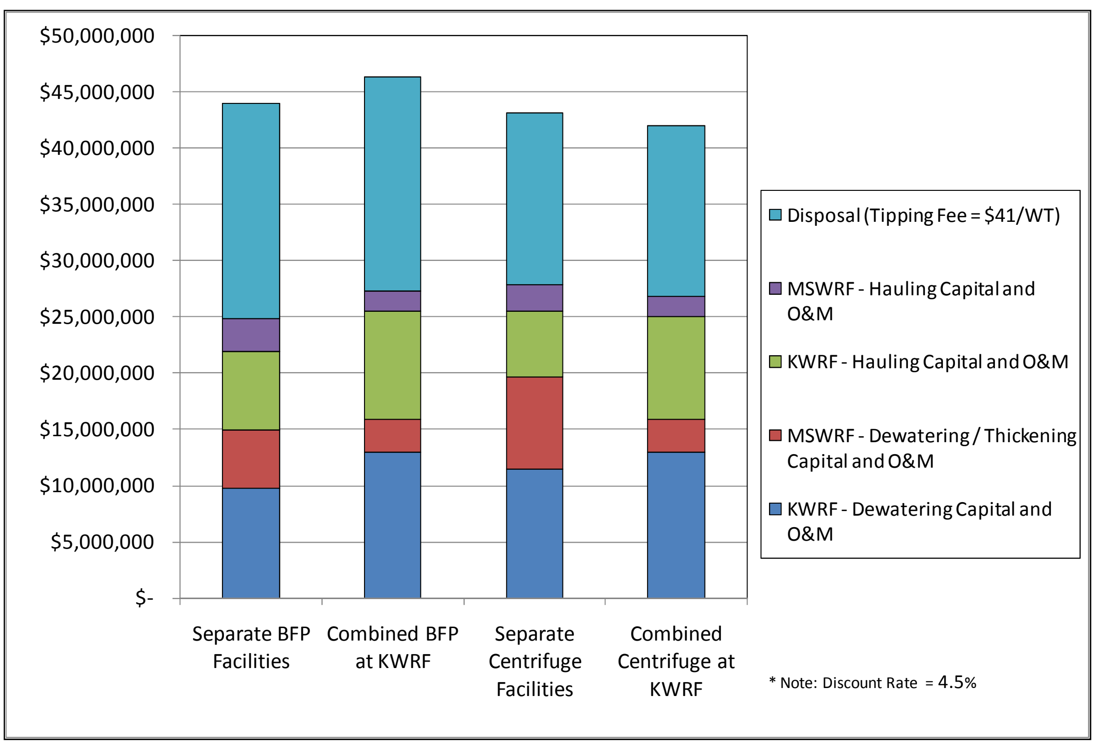
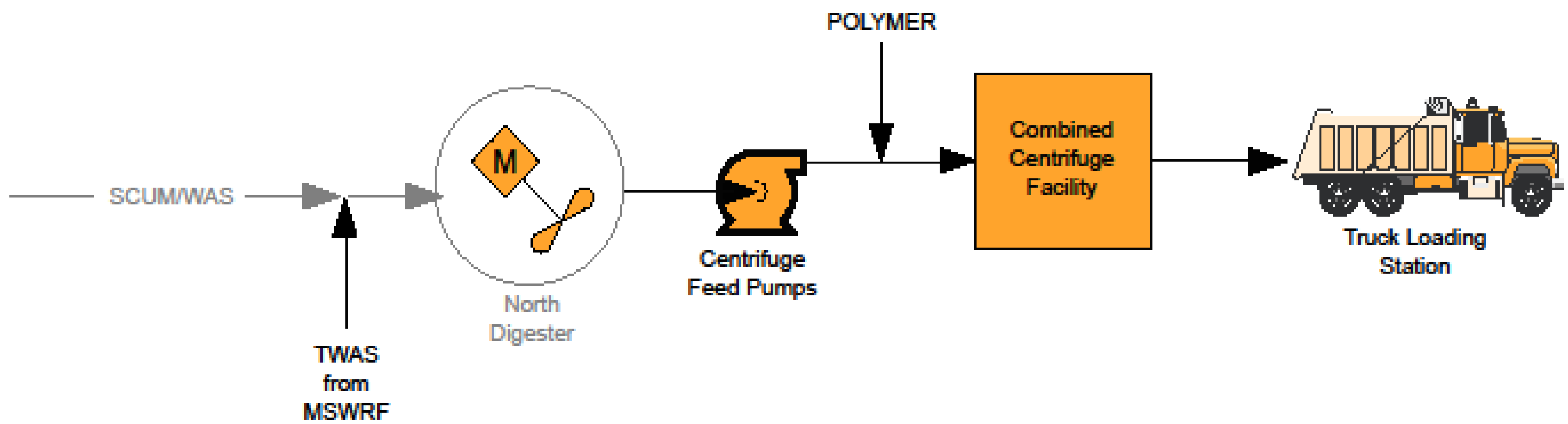


EXHIBIT 5-14
20-year Present Worth Costs for the Landfill Alternative with Dewatering Options
GRU Biosolids Management Plan Update





LEGEND

- Existing Facilities
- Proposed New Facilities

EXHIBIT 5-15
Combined Centrifuge Facility at KWRF
Proposed Process Flow Diagram
GRU Biosolids Management Plan Update

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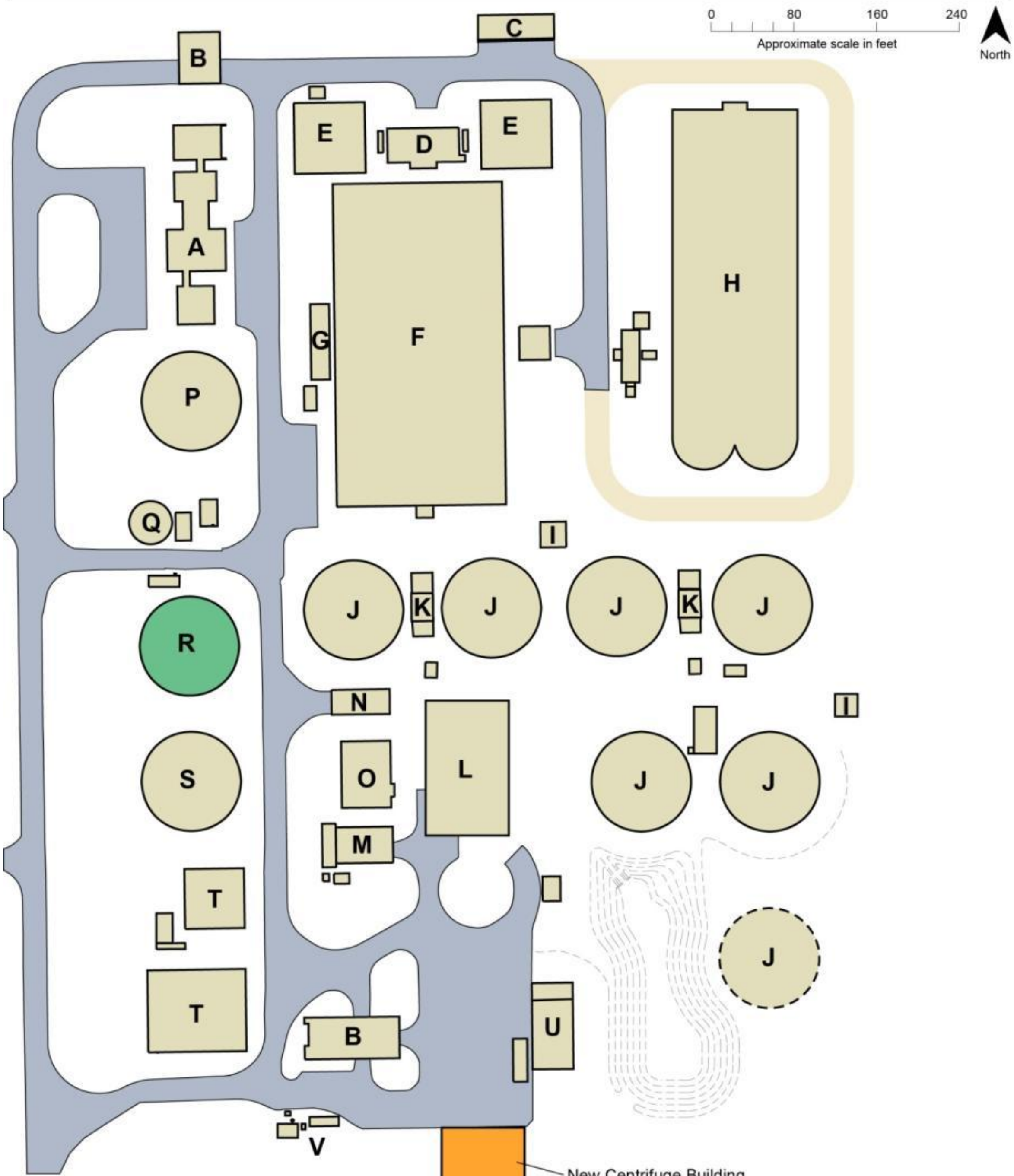

Proposed Modified Biosolids Treatment Facilities

Proposed New Biosolids Treatment Facilities

A	Laboratory	**L**	Effluent Filters
B	Maintenance Shop	**M**	Filter Building
C	Odor Control (Bio-filter)	**N**	Storage Building
D	Preliminary Treatment	**O**	Post Aeration/Filter Backwash Basins
E	Anoxic Basins	**P**	Preliminary Digester
F	Original Oxidation Basins	**Q**	Gravity Thickener
G	Operations Building	**R**	North Digester
H	New Oxidation Basins	**S**	South Digester
I	Mixed Liquor Splitter Box	**T**	Chlorine Contact Basins
J	Secondary Clarifier	**U**	Gravity Belt Thickening Building
K	RAS/WAS Pump Station	**V**	Reuse Water Pump Station

EXHIBIT 5-16
Combined Centrifuge Facility
Proposed Site Plan for KWRF
GRU Biosolids Management Plan Update

WBG090110062159GNV KWRF_Exhibit5-16_Site_Plan_rev0.ai

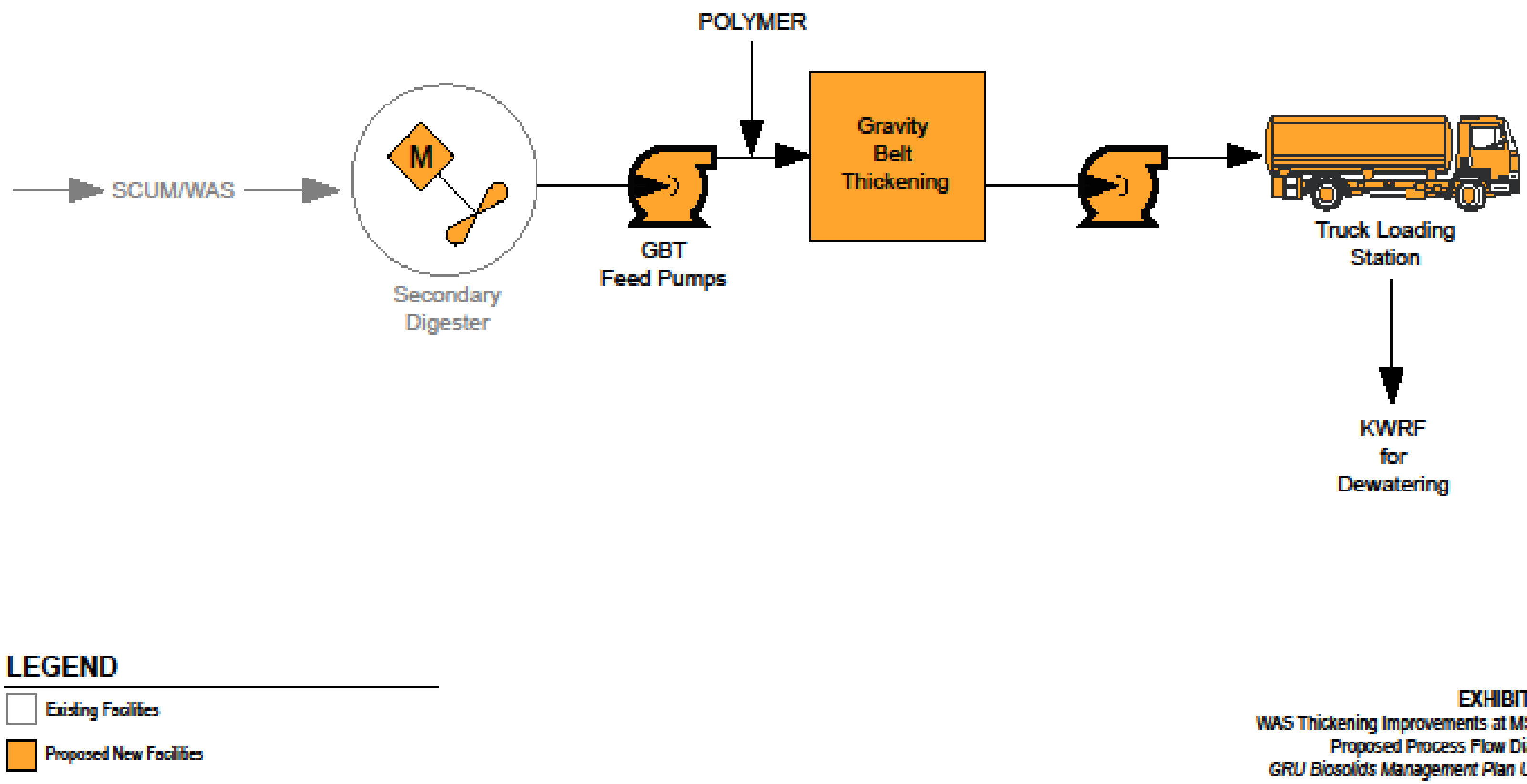

EXHIBIT 5-17
WAS Thickening Improvements at MSWRF
Proposed Process Flow Diagram
GRU Biosolids Management Plan Update

WBG090110062159GNV KWRF_Exhibit5-15_Thickening_Improve.ai

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SECTION 6

Evaluation of Biosolids Management Alternatives

6.1 Alternatives for Evaluation

Ten biosolids management alternatives were deemed viable and selected for evaluation. The treatment facilities and hauling and disposal requirements are described for each alternative in this section.

6.1.1 New Gasification and Cogeneration at GRU WRF by Third Party Vendor (Max West, KWRF)

Required Treatment Facilities

For the Max West KWRF alternative, the WAS requires no additional treatment by the WRFs, only dewatering. A proposed process flow diagram is included as **Exhibit 6-1**. A site plan showing the dewatering and Max West facilities is included as **Exhibit 6-2**. KWRF and MSWRF will each use an existing digester for aerated WAS storage prior to thickening or dewatering. The digester will use a surface aerator to minimize aeration costs.

The dewatering facilities included for this alternative are described in Combined Centrifuge Facility and Thickening Improvements at MSWRF in **Section 5**.

Hauling

Thickened WAS will be hauled 10 miles from MSWRF to KWRF for dewatering and treatment.

No hauling of dewatered WAS is required.

Disposal

The disposal costs will be based on a $70/wet ton (WT) tipping fee. This fee was not inflated over time, as it was assumed that GRU and Max West would enter into a long-term agreement in this alternative. The tipping fee covers all costs for treatment and disposal using the Max West process.

6.1.2 New Gasification and Cogeneration at Remote Facility by Third Party Vendor (Max West, Remote)

Required Treatment Facilities

For the Max West remote gasification and cogeneration facility alternative, the WAS requires no additional treatment by the WRF, only dewatering. KWRF and MSWRF will each use an existing digester for aerated WAS storage prior to thickening or dewatering. A surface aerator will be used to minimize digester aeration costs.

The dewatering facilities included for this alternative are described in Combined Centrifuge Facility and Thickening Improvements at MSWRF in **Section 5**.

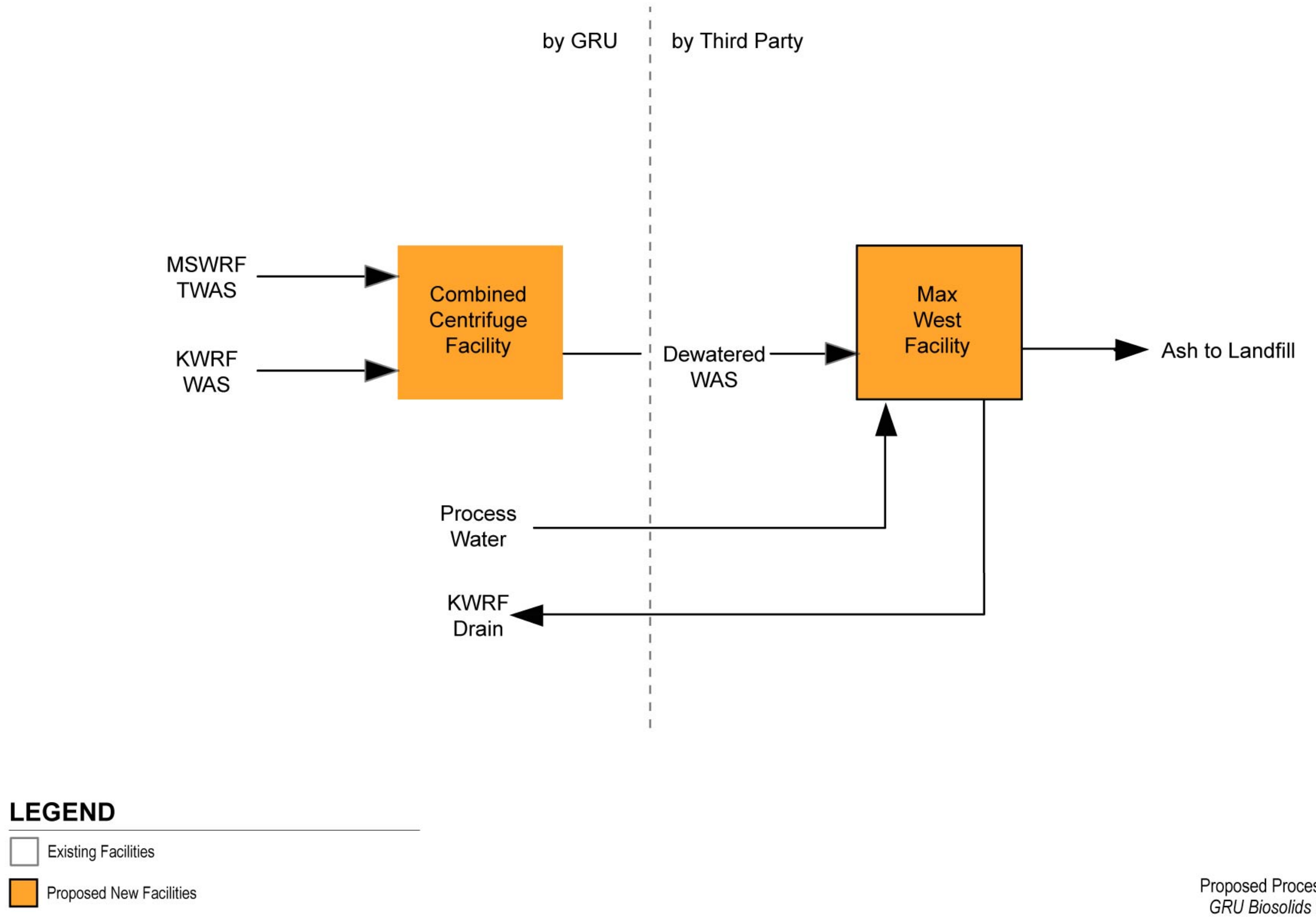
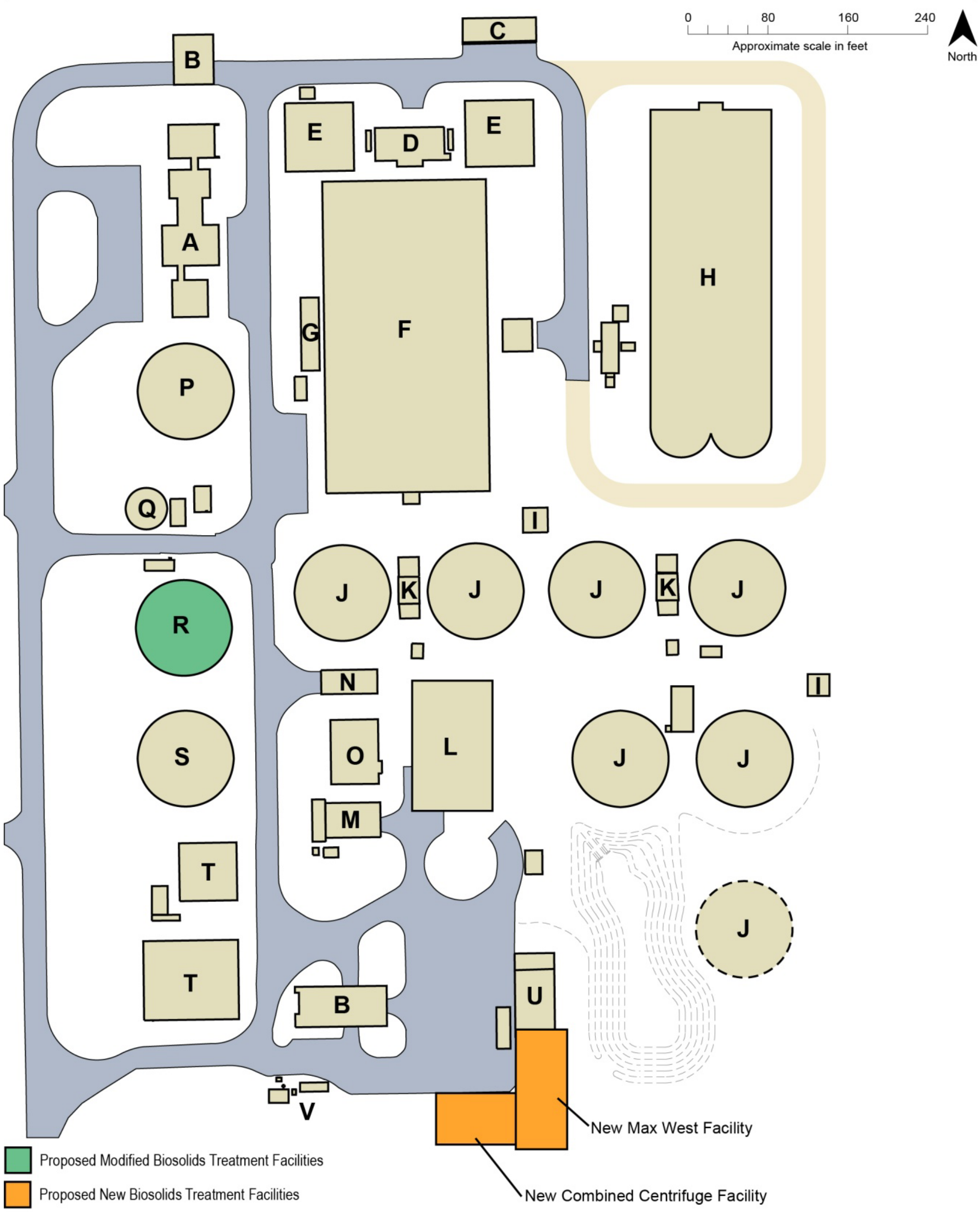


EXHIBIT 6-1
Max West, KWRF
Proposed Process Flow Diagram at KWRF
GRU Biosolids Management Plan Update

WBG090110062159GNV KWRF_Exhibit6-1_Max_West.ai



Proposed Modified Biosolids Treatment Facilities

Proposed New Biosolids Treatment Facilities

A	Laboratory	**L**	Effluent Filters
B	Maintenance Shop	**M**	Filter Building
C	Odor Control (Bio-filter)	**N**	Storage Building
D	Preliminary Treatment	**O**	Post Aeration/Filter Backwash Basins
E	Anoxic Basins	**P**	Preliminary Digester
F	Original Oxidation Basins	**Q**	Gravity Thickener
G	Operations Building	**R**	North Digester
H	New Oxidation Basins	**S**	South Digester
I	Mixed Liquor Splitter Box	**T**	Chlorine Contact Basins
J	Secondary Clarifier	**U**	Gravity Belt Thickening Building
K	RAS/WAS Pump Station	**V**	Reuse Water Pump Station

EXHIBIT 6-2
Max West, KWRF
Proposed Site Plan for KWRF
GRU Biosolids Management Plan Update

CH2MHILL.

WBG090110062159GNV KWRF_Exhibit6-2_Max_West_Site_rev0.ai

Hauling

Thickened WAS will be hauled 10 miles from MSWRF to KWRF for dewatering.

For this update, it was assumed that dewatered WAS will be hauled 50 miles one way by GRU to the remote Max West facility.

Disposal

The disposal costs will be based on a $70/WT tipping fee. This fee was not inflated over time, as it was assumed GRU and Max West would enter into a long-term agreement in this alternative.

6.1.3 Alkaline Treatment at Remote Site by Third Party Vendor (N-Viro)

Required Treatment Facilities

For the N-Viro alternative, the WAS requires no additional treatment, only dewatering. KWRF and MSWRF will each use an existing digester for aerated WAS storage prior to thickening or dewatering. A floating surface aerator will be used at each facility to minimize digester aeration costs, and to adequately aerate with varying levels in the tanks. The existing centrifugal blowers will not be used.

The dewatering facilities included for this alternative are described in Combined Centrifuge Facility and Thickening Improvements at MSWRF in **Section 5**.

Hauling

Thickened WAS will be hauled 10 miles from MSWRF to KWRF for dewatering.

No hauling of dewatered WAS is required; N-Viro will provide hauling and trucks for interim storage as part of the tipping fee.

Disposal

The disposal costs will be based on a $47.26/WT tipping fee from N-Viro. This tipping fee covered the cost to haul dewatered biosolids and process them to Class A; it did not include the cost for dewatering. This fee was inflated at a rate of 1 percent per year to account for increases in diesel fuel costs.

6.1.4 Landfill

Required Treatment Facilities

The landfill alternative requires no additional treatment for the WAS, only dewatering. Each WRF will use an existing digester for aerated WAS storage prior to thickening or dewatering. A floating surface aerator will be used at each facility to minimize digester aeration costs, and to adequately aerate with varying levels in the tanks. The existing centrifugal blowers will not be used.

The dewatering facilities included for this alternative are described in Combined Centrifuge Facility and Thickening Improvements at MSWRF in **Section 5**.

Hauling

Thickened WAS will be hauled 10 miles from MSWRF to KWRF for dewatering.

For this update, it was assumed that dewatered WAS will be hauled 50 miles one way to the Trail Ridge Landfill in Duval County.

Disposal

The disposal costs will be based on a $41/WT tipping fee (cost at Trail Ridge Landfill). This tipping fee was inflated at a rate of 0.5 percent per year.

6.1.5 Waste-to-Energy Facility (Alachua County ORB)

Required Treatment Facilities

The Alachua County ORB alternative requires no additional treatment for the WAS, only dewatering. Each WRF will use an existing digester for aerated WAS storage prior to thickening or dewatering. A floating surface aerator will be used at each facility to minimize digester aeration costs, and to adequately aerate with varying levels in the tanks. The existing centrifugal blowers will not be used.

The dewatering facilities included for this alternative are described in Combined Centrifuge Facility and Thickening Improvements at MSWRF in **Section 5**.

Hauling

Thickened WAS will be hauled 10 miles from MSWRF to KWRF for dewatering.

For this update, it was assumed that dewatered WAS will be hauled 10 miles one way to the Southwest Alachua County Landfill near Archer, Florida.

Disposal

For disposal of dewatered WAS in the Alachua County ORB, the following four preliminary cost scenarios were presented to GRU by Alachua County:

- **Scenario No. 1**: No WAS is disposed of in the ORB and Alachua County operates with municipal solid waste and revenues through gas recovery.
- **Scenario No. 2**: Alachua County pays all capital costs for ORB construction. GRU hauls and disposes of dewatered WAS at ORB at $25/WT. This tipping fee would be inflated at 4 percent annually.
- **Scenario No. 3**: GRU pays all capital costs ($7.7 million) for ORB and pays no tipping fee for 20 years.
- **Scenario No. 4**: GRU pays half of the capital costs ($3.8 million) and no tipping fee for 10 years. GRU pays $25/WT starting in 2021 (inflated 4 percent annually).

At the time of this report, evaluation of the ORB scenarios is on-going with Alachua County. In addition, the ORB costs presented here are not based on historic, market-tested values since the development and operation of the ORB still has many unknowns. Given these two caveats, the level of confidence in the ORB costs is not considered as reliable as the other alternatives. However, the three ORB scenarios will be evaluated on a net present worth basis along with the other alternatives in this report.

6.1.6 Thermal Oxidation and Cogeneration at Deerhaven Generating Station (Deerhaven)

Required Treatment Facilities

The Deerhaven alternative does not require digestion, but does require dewatering and drying. Each WRF will use an existing digester for WAS storage prior to thickening or dewatering.

The dewatering facilities included for this alternative are described in Combined Centrifuge Facility and Thickening Improvements at MSWRF in **Section 5**.

A combined drying facility will be located at the Deerhaven site. Dedicated GRU personnel will operate the dryer. Truckloads of dewatered WAS from KWRF will be unloaded into silos. Odor control will be provided for the silos. From the onsite silos, the dewatered WAS will be pumped to a rotary drum dryer. The dried biosolids will be conveyed to the boilers and mixed with the coal feedstock for energy recovery and disposal.

A process flow diagram for this alternative is included in **Exhibit 6-3**.

Hauling

Thickened WAS will be hauled 10 miles from MSWRF to KWRF for dewatering.

Dewatered WAS will be hauled 18 miles from KWRF to Deerhaven.

Disposal

There are no additional disposal costs associated with this alternative apart from O&M costs related to the facilities at Deerhaven.

6.1.7 Class AA Chemical Treatment, Land Apply at WPR (BCR)

Required Treatment Facilities

No stabilization of the WAS is required prior to the BCR process. Both WRFs will use a digester for WAS storage prior to thickening, with a surface aerator for mixing and aeration. MSWRF will thicken the WAS and haul to KWRF for treatment and dewatering.

BCR Environmental includes the following components as part of their process at build out:

- Four disk thickeners
- Chemical storage and feed facilities for sodium nitrite, sulfuric acid, sodium chlorite, sodium hydroxide, and ferric chloride
- Five 20,000-gallon process tanks

Additional components required to complete the facility include the following:

- Centrifuge dewatering facility (see Section 5)
- 5,750 square feet (ft^2) building for thickening and BCR chemical storage and feed facilities
- 3,450 ft^2 concrete slab for process tanks
- Electrical, plumbing, and other miscellaneous items

Exhibit 6-4 shows a process flow diagram for the BCR process and dewatering. **Exhibit 6-5** shows the facilities required for the BCR process located on the KWRF site.

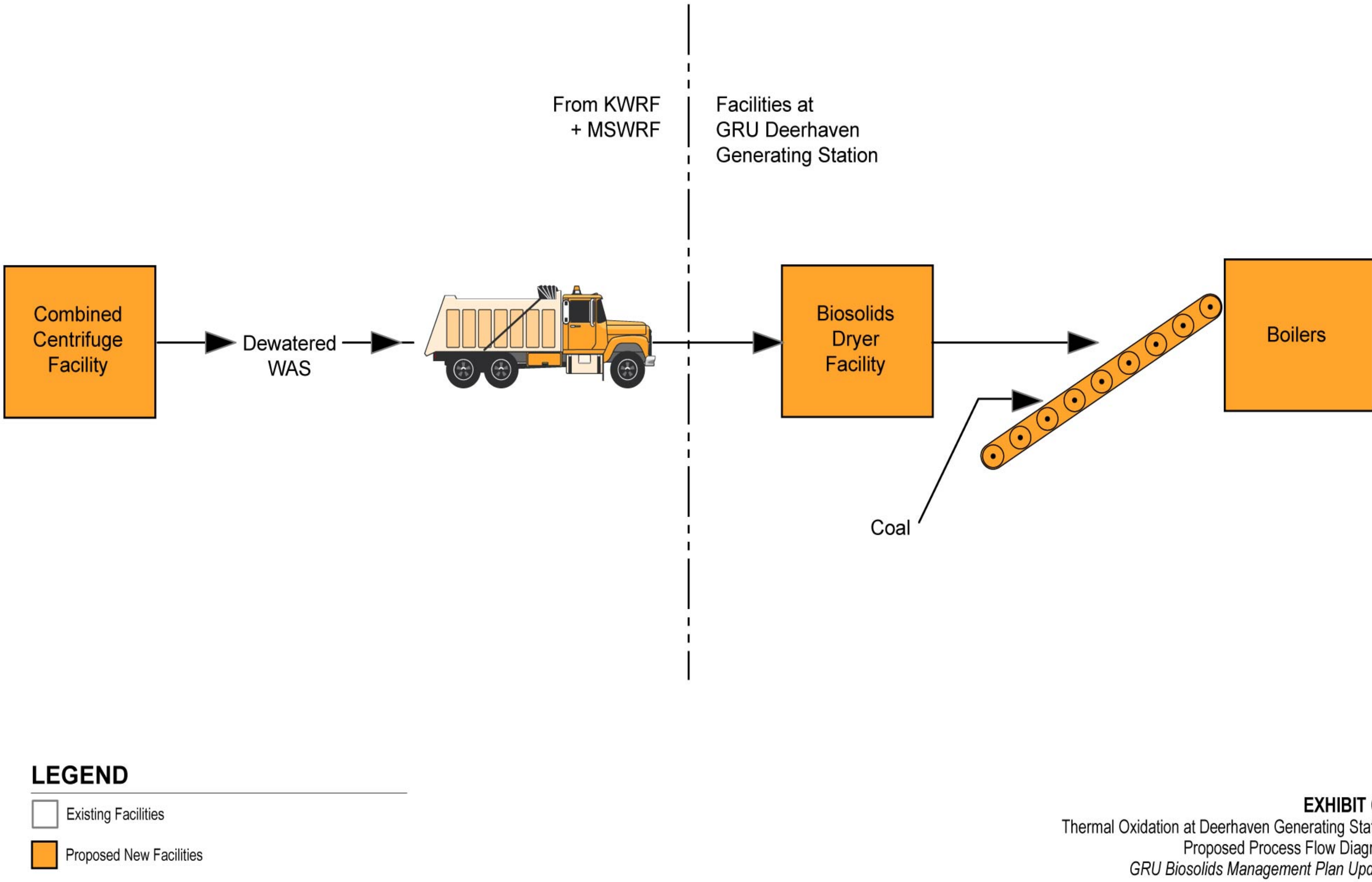


EXHIBIT 6-3
Thermal Oxidation at Deerhaven Generating Station
Proposed Process Flow Diagram
GRU Biosolids Management Plan Update

CH2MHILL.

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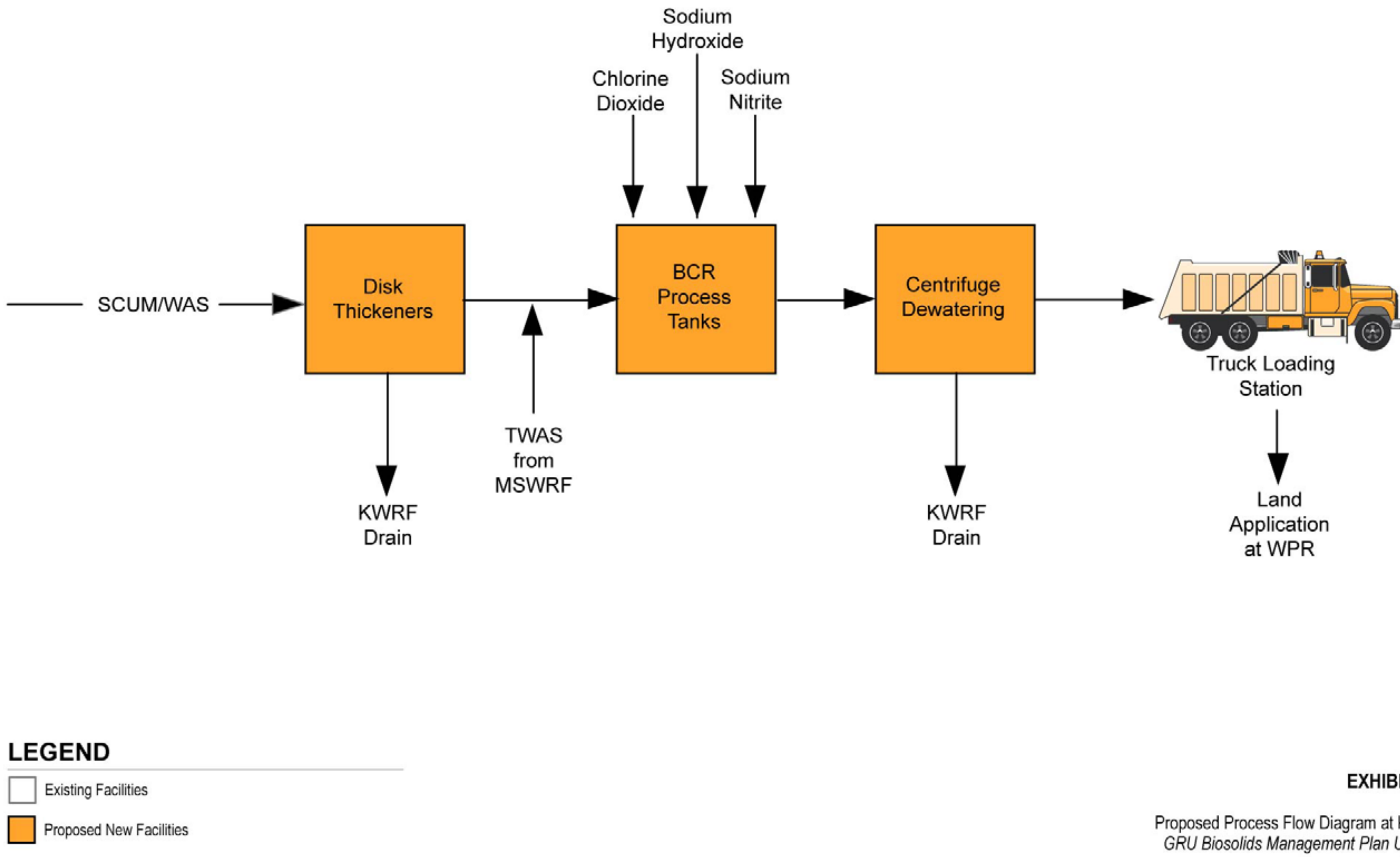
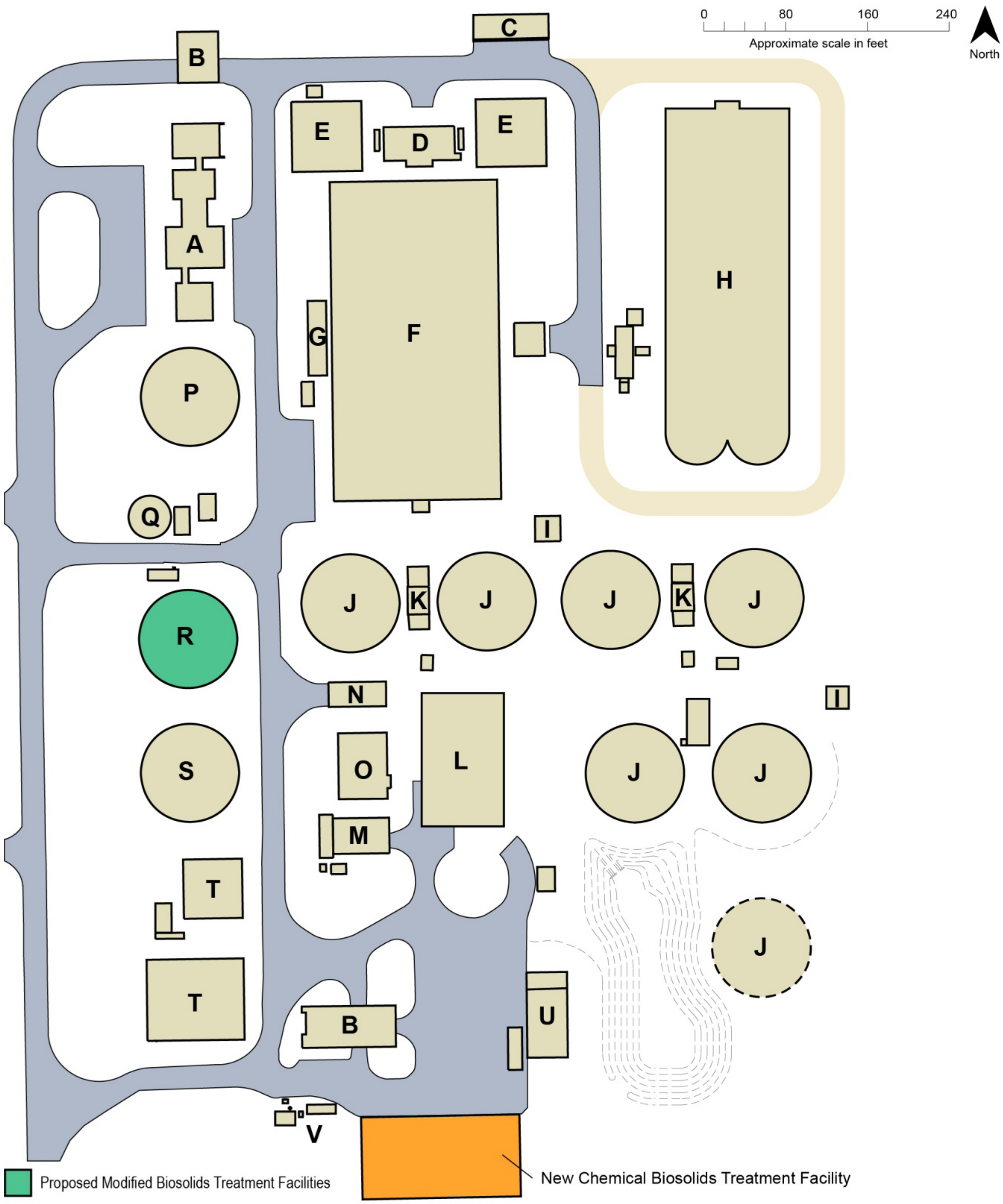


EXHIBIT 6-4
BCR
Proposed Process Flow Diagram at KWRF
GRU Biosolids Management Plan Update

CH2MHILL.

WBG090110062159GNV KWRF_Exhibit6-4_BCR.ai



Proposed Modified Biosolids Treatment Facilities

Proposed New Biosolids Treatment Facilities

A	Laboratory	**L**	Effluent Filters
B	Maintenance Shop	**M**	Filter Building
C	Odor Control (Bio-filter)	**N**	Storage Building
D	Preliminary Treatment	**O**	Post Aeration/Filter Backwash Basins
E	Anoxic Basins	**P**	Preliminary Digester
F	Original Oxidation Basins	**Q**	Gravity Thickener
G	Operations Building	**R**	North Digester
H	New Oxidation Basins	**S**	South Digester
I	Mixed Liquor Splitter Box	**T**	Chlorine Contact Basins
J	Secondary Clarifier	**U**	Gravity Belt Thickening Building
K	RAS/WAS Pump Station	**V**	Reuse Water Pump Station

EXHIBIT 6-5
BCR
Proposed Site Plan for KWRF
GRU Biosolids Management Plan Update
CH2MHILL.

WBG090110062159GNV KWRF_Exhibit6-5_Biosolids_Facility_rev0.ai

Hauling

Thickened WAS will be hauled 10 miles from MSWRF to KWRF for chemical treatment and dewatering.

Dewatered Class AA biosolids will be hauled 10 miles from KWRF to WPR for land application.

Disposal

In this alternative, GRU would purchase WPR and continue to operate the land application of Class B biosolids.

6.1.8 Aerobic Digestion and Drying, Market Fertilizer (Green Edge)

Required Treatment Facilities

Aerobic digestion will continue to be used at both WRFs in this alternative to create a low odor fertilizer product. Additional digestion facilities to maintain a sufficient solids residence time (SRT) will not be added however, as the aerobic digestion process is not required to meet Class B standards prior to the dewatering and drying processes.

The dewatering facilities included for this alternative are described in Combined Centrifuge Facility and Thickening Improvements at MSWRF in **Section 5**.

The dewatered solids will be fed into a rotary drum dryer located at KWRF. The dried product will then be chemically treated by Green Edge to produce a slow release fertilizer. The chemical facilities will be constructed and operated by Green Edge; therefore, these facilities were not included in the cost estimates.

A process flow diagram for the Green Edge alternative is shown in **Exhibit 6-6**. A site plan with the required facilities is included as **Exhibit 6-7**.

Hauling

Thickened WAS will be hauled 10 miles from MSWRF to KWRF for dewatering, drying and processing from Green Edge.

Green Edge will be responsible for hauling dried product away from KWRF.

Disposal

Green Edge will pay GRU $60,000 a year to process and market their dried biosolids. The Green Edge fee was assumed to escalate at 3 percent a year.

6.1.9 Class B Aerobic Digestion, Land Apply at WPR with Potential Special Exception Requirements of a 300-ft Setback and a 75-ft Vegetated Buffer

Required Treatment Facilities

In this alternative, both WRFs will continue to use aerobic digestion to treat the biosolids to Class B standards. MSWRF has adequate digester capacity for the future, but will require aeration upgrades to the secondary digester including two centrifugal blowers and submerged diffusers. KWRF will require two additional digesters to meet future WAS projections. Three new centrifugal blowers will serve the two new digesters.

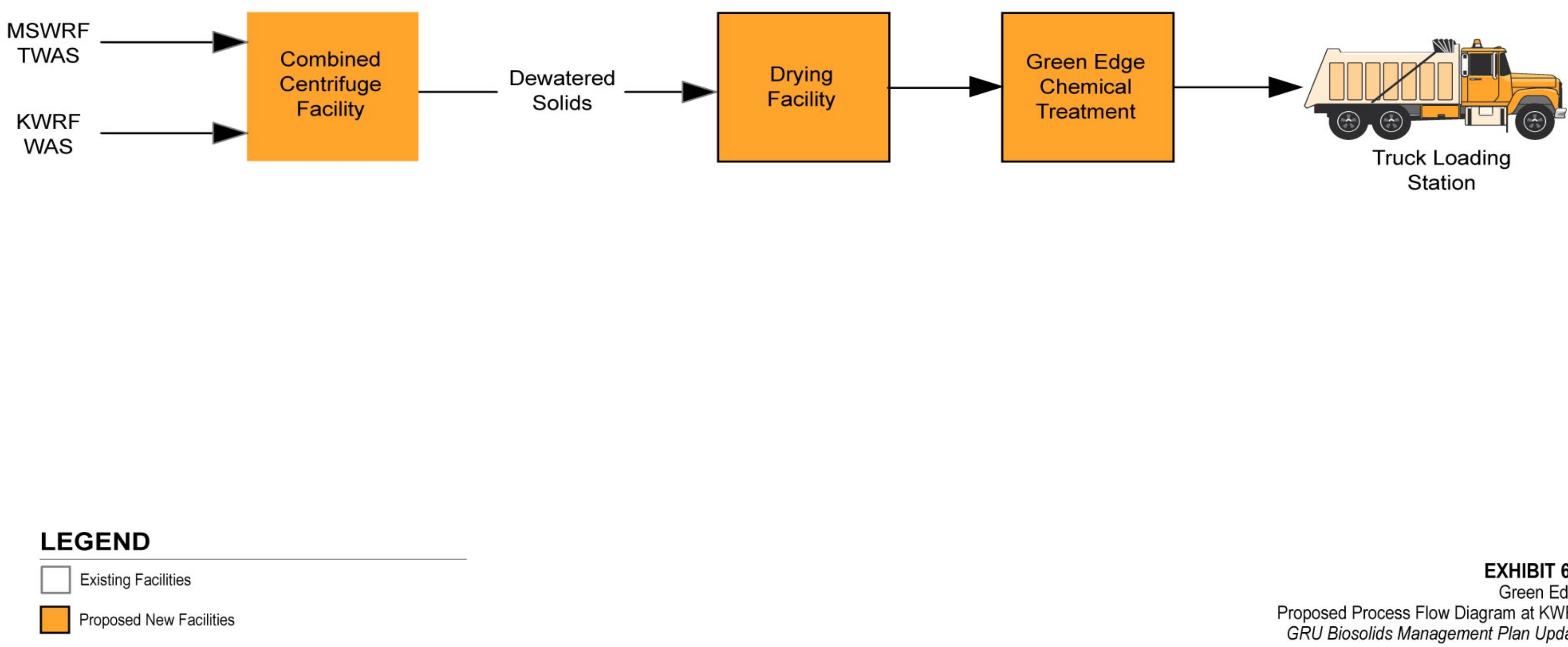
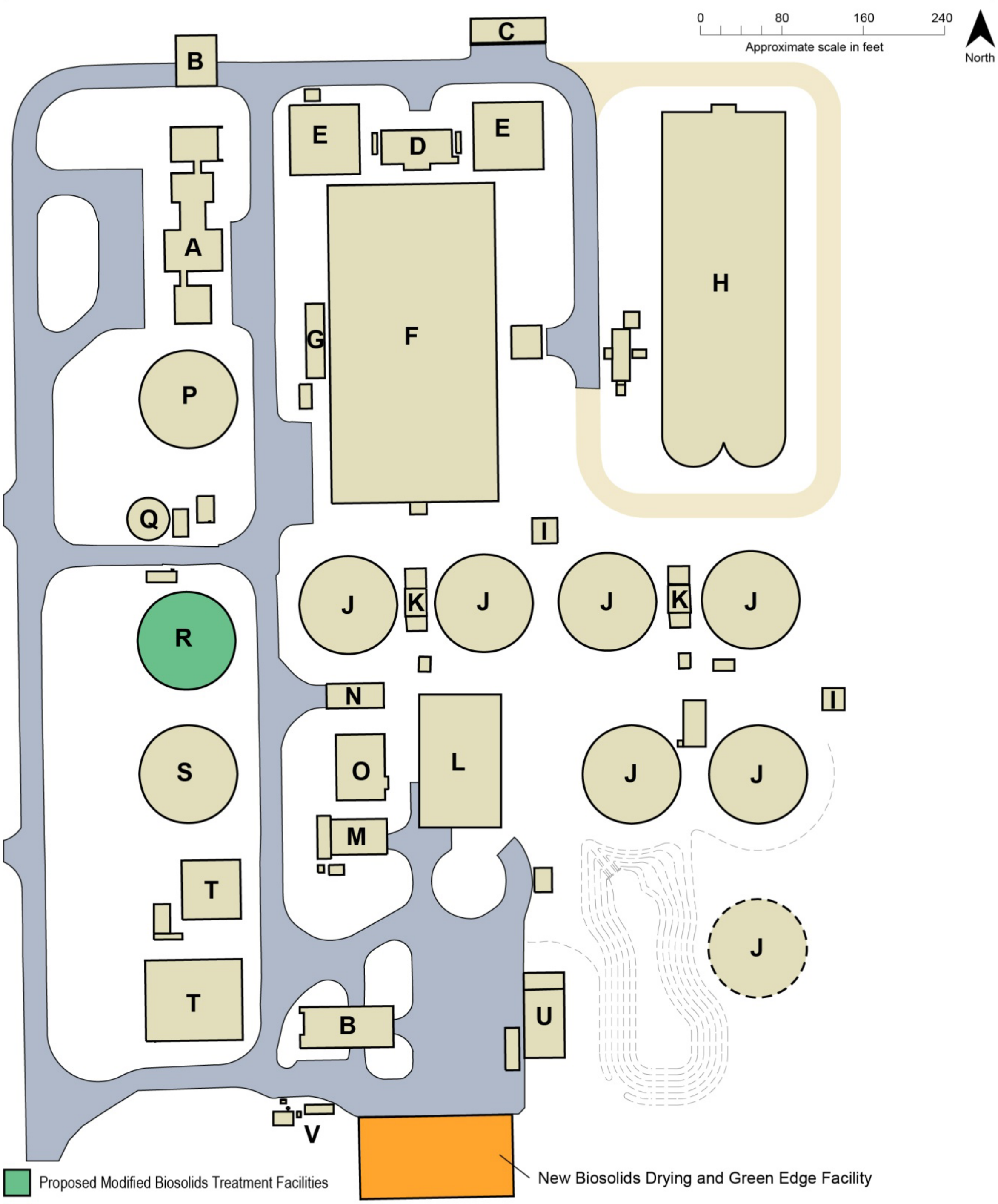


EXHIBIT 6-6
Green Edge
Proposed Process Flow Diagram at KWRF
GRU Biosolids Management Plan Update

WBG090110062159GNV KWRF_Exhibit6-6_Green_Edge.ai



Proposed Modified Biosolids Treatment Facilities

Proposed New Biosolids Treatment Facilities

A	Laboratory	L	Effluent Filters
B	Maintenance Shop	M	Filter Building
C	Odor Control (Bio-filter)	N	Storage Building
D	Preliminary Treatment	O	Post Aeration/Filter Backwash Basins
E	Anoxic Basins	P	Preliminary Digester
F	Original Oxidation Basins	Q	Gravity Thickener
G	Operations Building	R	North Digester
H	New Oxidation Basins	S	South Digester
I	Mixed Liquor Splitter Box	T	Chlorine Contact Basins
J	Secondary Clarifier	U	Gravity Belt Thickening Building
K	RAS/WAS Pump Station	V	Reuse Water Pump Station

EXHIBIT 6-7
Green Edge
Proposed Site Plan for KWRF
GRU Biosolids Management Plan Update
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Both KWRF and MSWRF will also require improvements to their respective thickening facilities. The proposed improvements listed in Section 5 for MSWRF in the combined layout were also proposed for KWRF.

A process flow diagram and site plan at KWRF for this alternative are included as **Exhibit 6-8** and **Exhibit 6-9**, respectively. A process flow diagram for MSWRF is included as **Exhibit 6-10**.

Hauling

Thickened Class B biosolids will be hauled 20 miles one way from MSWRF to WPR for land application.

Thickened Class B biosolids will be hauled 10 miles one way from KWRF to WPR for land application.

Disposal

To secure WPR for the future, GRU would purchase the site and oversee the land application operation. To comply with Alachua County special exception requirements, GRU would also build a berm and a 75-foot planted buffer in a 300-foot setback.

6.1.10 Class B Aerobic Digestion, Land Apply at WPR without Potential Special Exception Requirements (Baseline)

Required Treatment Facilities

The required treatment facilities for this alternative are the same as those identified for the previous alternative, Class B Aerobic Digestion, Land Apply at WPR with Potential Special Exception Requirements of a 300-ft Setback with a 75-ft Planted Buffer.

Hauling

Thickened Class B biosolids will be hauled 20 miles from MSWRF to WPR for land application.

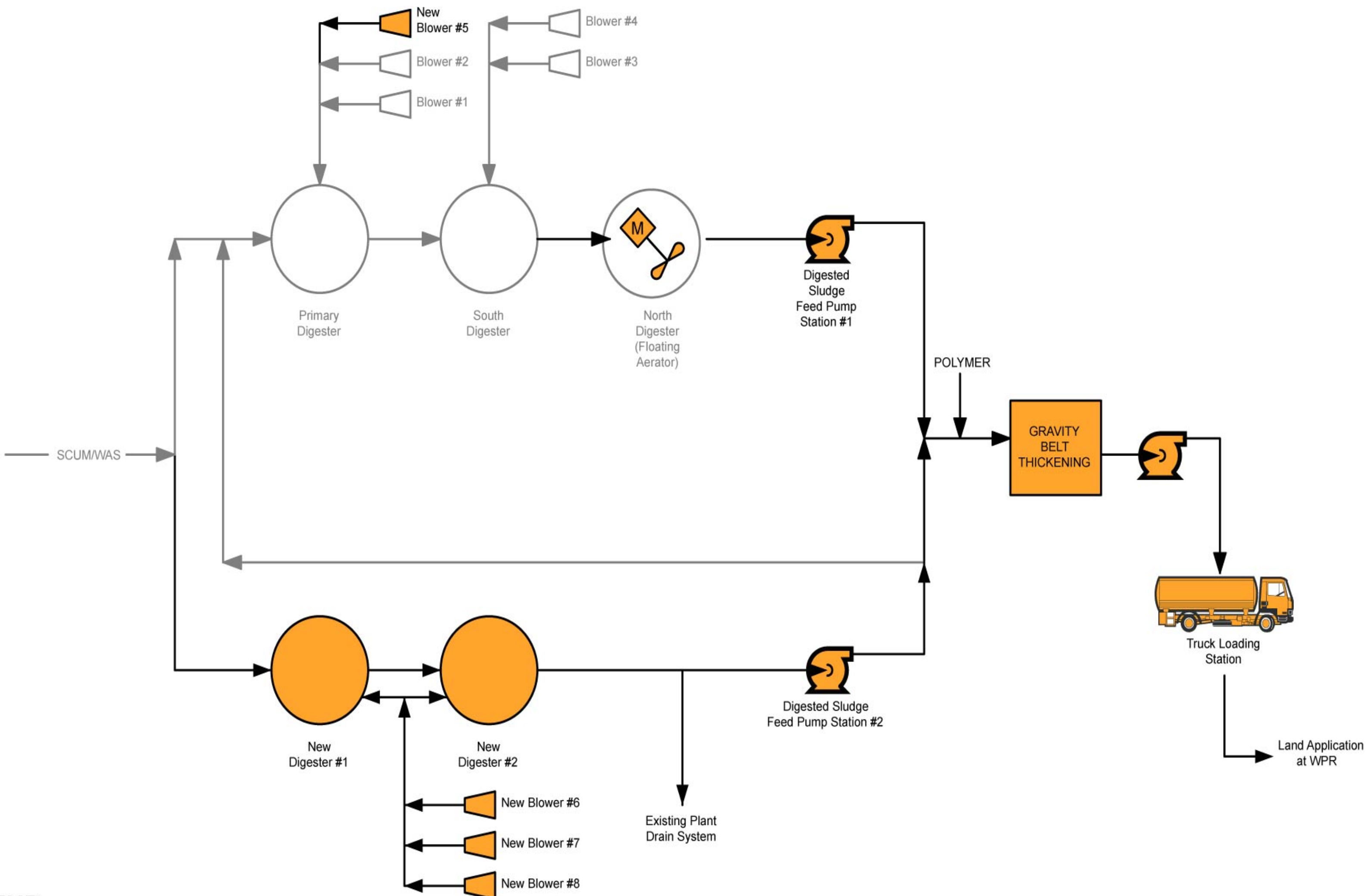
Thickened Class B biosolids will be hauled 10 miles from KWRF to WPR for land application.

Disposal

In this alternative GRU would purchase WPR and continue to operate the land application of Class B biosolids.

6.2 Cost Estimate Assumptions

Detailed cost estimates are included in **Appendix A**. These estimates include project and contractor markups and contingency for capital costs, and all inputs for O&M, hauling, and land application costs. Cost estimates for each alternative and comparison between all alternatives are included in Section 7, Analysis of Updated Alternatives.



LEGEND

- Existing Facilities
- Proposed New/Rehabilitated Facilities

EXHIBIT 6-8
Class B Aerobic Digestion, Land Apply at WPR
Proposed Process Flow Diagram for KWRF
GRU Biosolids Management Plan Update

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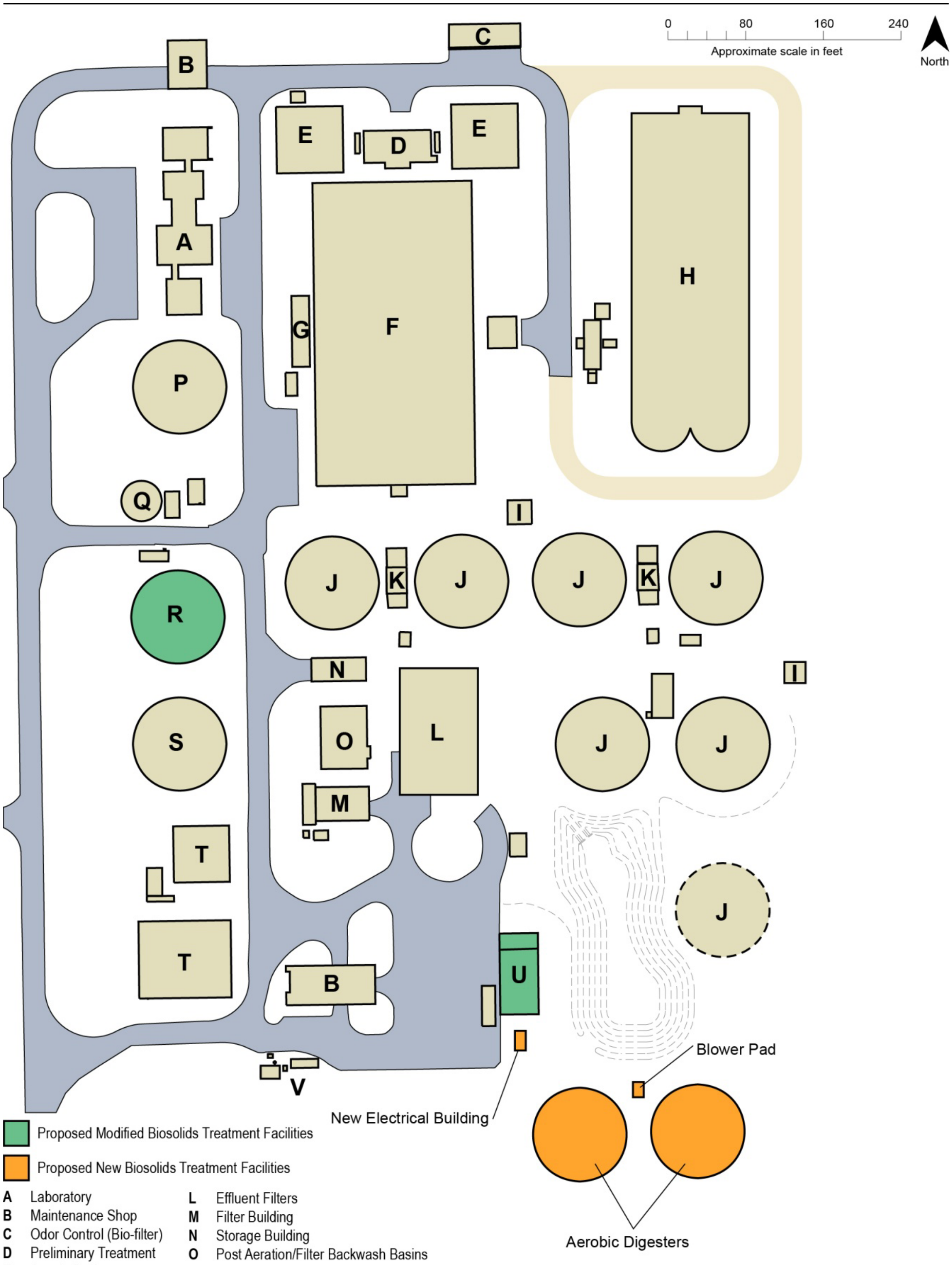

A	Laboratory	**L**	Effluent Filters
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G	Operations Building	**R**	North Digester
H	New Oxidation Basins	**S**	South Digester
I	Mixed Liquor Splitter Box	**T**	Chlorine Contact Basins
J	Secondary Clarifier	**U**	Gravity Belt Thickening Building
K	RAS/WAS Pump Station	**V**	Reuse Water Pump Station

EXHIBIT 6-9
Class B Aerobic Digestion, Land Apply at WPR
Proposed Site Plan for KWRF
GRU Biosolids Management Plan Update

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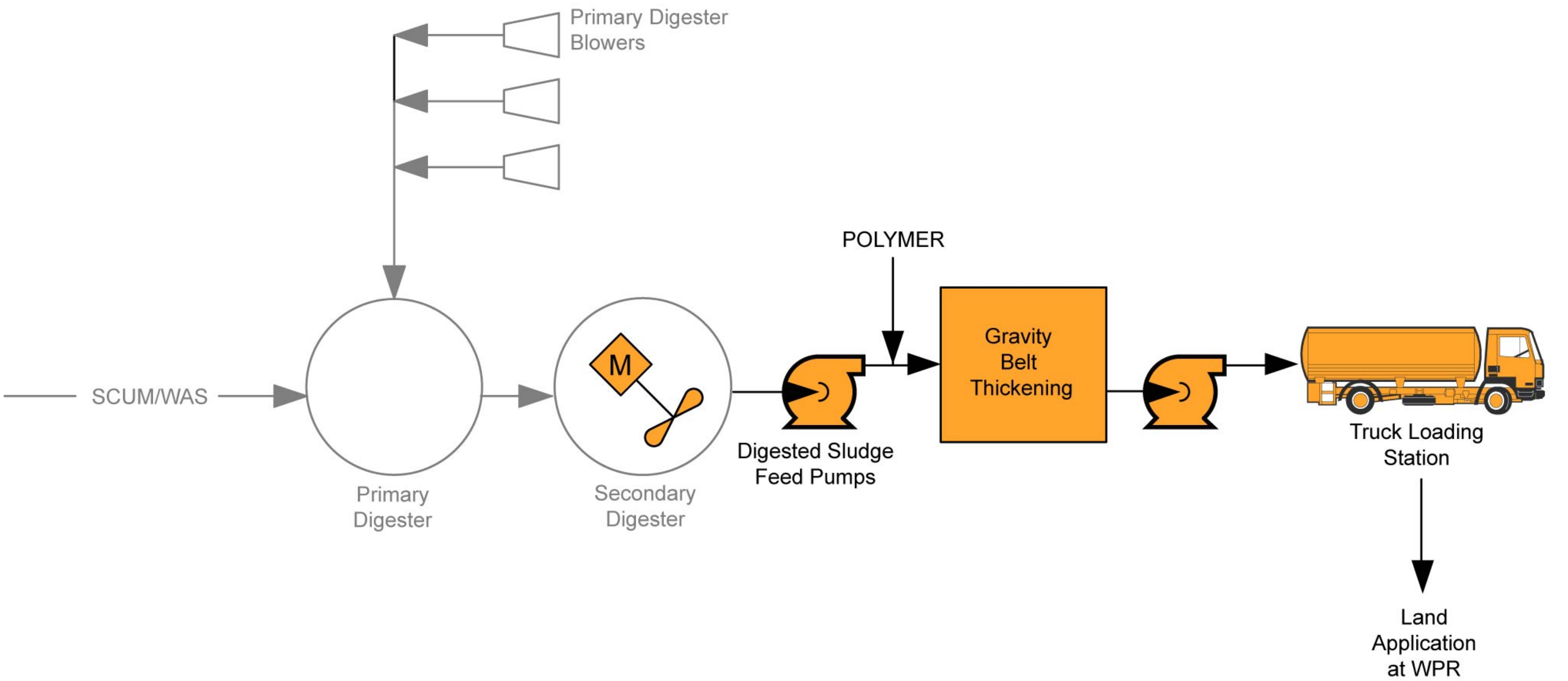

LEGEND

- Existing Facilities
- Proposed New Facilities

EXHIBIT 6-10
Class B Aerobic Digestion, Land Apply at WPR
Proposed Process Flow Diagram for MSWRF
GRU Biosolids Management Plan Update

WBG090110062159GNV KWRF_Exhibit6-10_B_Aerobic_Digestion.ai

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SECTION 7

Analysis of Updated Alternatives

Cost estimates for each of the ten biosolids management alternatives described in **Section 6** were determined using the methodology included in **Appendix A**. The capital and O&M costs were partitioned into categories: treatment facility costs, hauling costs, and land application or disposal costs. A tabular summary of all of these cost estimates for each alternative is presented in **Exhibit 7-1**.

Exhibit 7-2 shows a comparison of the capital costs for each of the alternatives from lowest to highest. The Max West, KWRF, and N-Viro alternatives require the lowest capital outlay as only dewatering facilities and equipment for hauling thickened WAS from MSWRF to KWRF are required. The Max West, Remote; Landfill; and Waste-to-Energy Facility ORB Scenario No. 2 have slightly higher capital costs because these alternatives require GRU to haul dewatered WAS from KWRF. The next highest capital costs alternatives are the remaining ORB scenarios (Nos. 3 and 4) with additional capital investment to construct the ORB, and the aerobic digestion alternatives that include costs to secure operate the land application site. Finally, the largest capital costs are for the Green Edge, BCR, and Deerhaven alternatives. Each of these alternatives requires more intensive treatment facilities and thus higher capital costs.

Exhibit 7-3 shows a graphical comparison of the total present worth for each alternative. The three ORB alternatives had the lowest total present worth, followed by N-Viro and then the two aerobic digestion alternatives. All other alternatives had higher present worth values as compared to the existing operation. As for the ORB, the analysis indicated that ORB Scenario No. 3 and ORB Scenario No. 4 (includes upfront capital for ORB construction) had the lowest overall costs over a 20-year period. ORB Scenario No. 2 has a higher overall cost than the other two, but does have the advantage of lower capital costs, and thus lower initial costs.

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EXHIBIT 7-1
Present Worth Cost Summary for Alternatives (In Millions)
GRU Biosolids Management Plan Update

	Biosolids Treatment Process			Transportation			Disposal				Summary Total for the Alternative		
Alternative	**PW of Capital Costs**	**PW of Annual O&M Costs**	**Total PW**	**PW of Capital Costs**	**PW of Annual O&M Costs**	**Total PW**	**PW of Land Costs**	**PW of Capital Costs**	**PW of Annual O&M Costs**	**Total PW**	**PW of Capital Costs**	**PW of Annual O&M Costs**	**Total PW**
Gasification and Cogeneration (Max West), Kanapaha	$11.80	$6.47	$18.26	$0.52	$1.22	$1.74	$0.00	$0.00	$24.83	$24.83	$12.32	$32.52	**$44.84**
Gasification and Cogeneration (Max West), Remote Site	$11.80	$6.47	$18.26	$1.65	$6.13	$7.78	$0.00	$0.00	$24.83	$24.83	$13.44	$37.43	**$50.87**
Alkaline Treatment, N-Viro	$11.80	$6.47	$18.26	$0.52	$1.22	$1.74	$0.00	$0.00	$18.08	$18.08	$12.32	$25.77	**$38.08**
Landfill	$11.80	$6.47	$18.26	$1.65	$8.03	$9.68	$0.00	$0.00	$15.25	$15.25	$13.44	$29.74	**$43.19**
Waste to Energy Facility, ORB Scenario No. 2	$11.80	$6.47	$18.26	$1.65	$2.96	$4.60	$0.00	$0.00	$13.18	$13.18	$13.44	$22.61	**$36.05**
Waste to Energy Facility, ORB Scenario No. 3	$19.88	$6.47	$26.35	$1.65	$2.96	$4.60	$0.00	$0.00	$0.00	$0.00	$21.53	$9.42	**$30.95**
Waste to Energy Facility, ORB Scenario No. 4	$15.79	$6.47	$22.25	$1.65	$2.96	$4.60	$0.00	$0.00	$5.30	$5.30	$17.43	$14.72	**$32.16**
Thermal Oxidation at Deerhaven	$56.17	$16.59	$72.76	$1.65	$6.25	$7.89	$0.00	$0.00	$0.00	$0.00	$57.82	$22.84	**$80.66**
Class AA Chemical Treatment, BCR Neutralizer, WPR	$35.40	$10.85	$46.25	$1.93	$3.76	$5.68	$5.57	$0.48	$1.92	$7.96	$43.37	$16.52	**$59.89**
Aerobic Digestion and Drying, GreenEdge	$33.50	$15.24	$48.74	$0.52	$1.22	$1.74	$0.00	$0.00	($1.14)	($1.14)	$34.03	$15.31	**$49.34**
Class B Aerobic Digestion, WPR w/ 300-ft Setback	$10.01	$16.35	$26.36	$1.32	$4.08	$5.40	$5.57	$3.60	$1.92	$11.09	$20.49	$22.35	**$42.85**
Class B Aerobic Digestion, WPR	$10.01	$16.35	$26.36	$0.79	$4.08	$4.88	$5.57	$0.48	$1.92	$7.96	$16.85	$22.35	**$39.20**

EXHIBIT 7-2
Total Capital Costs for Alternatives
GRU Biosolids Management Plan Update

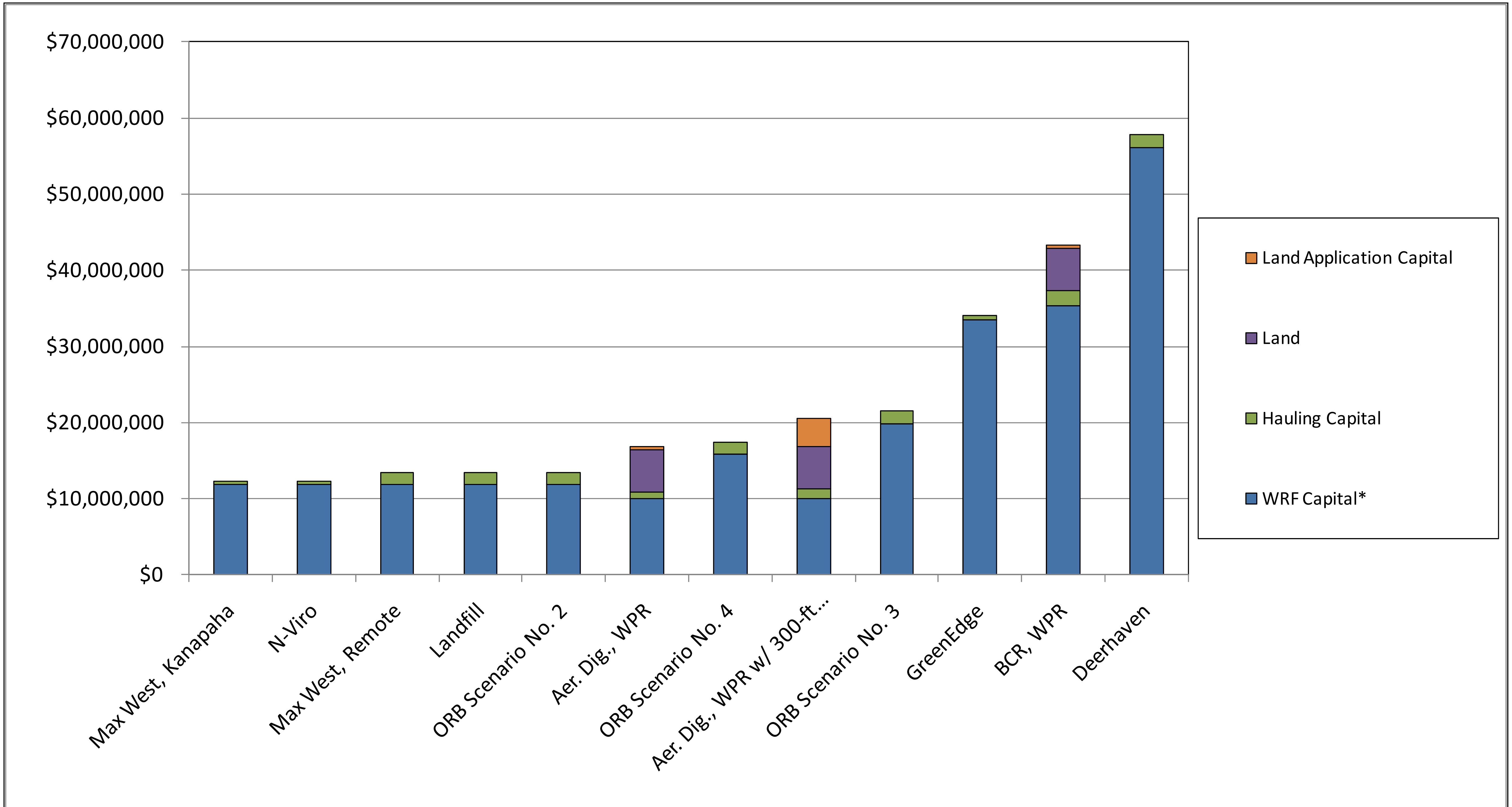
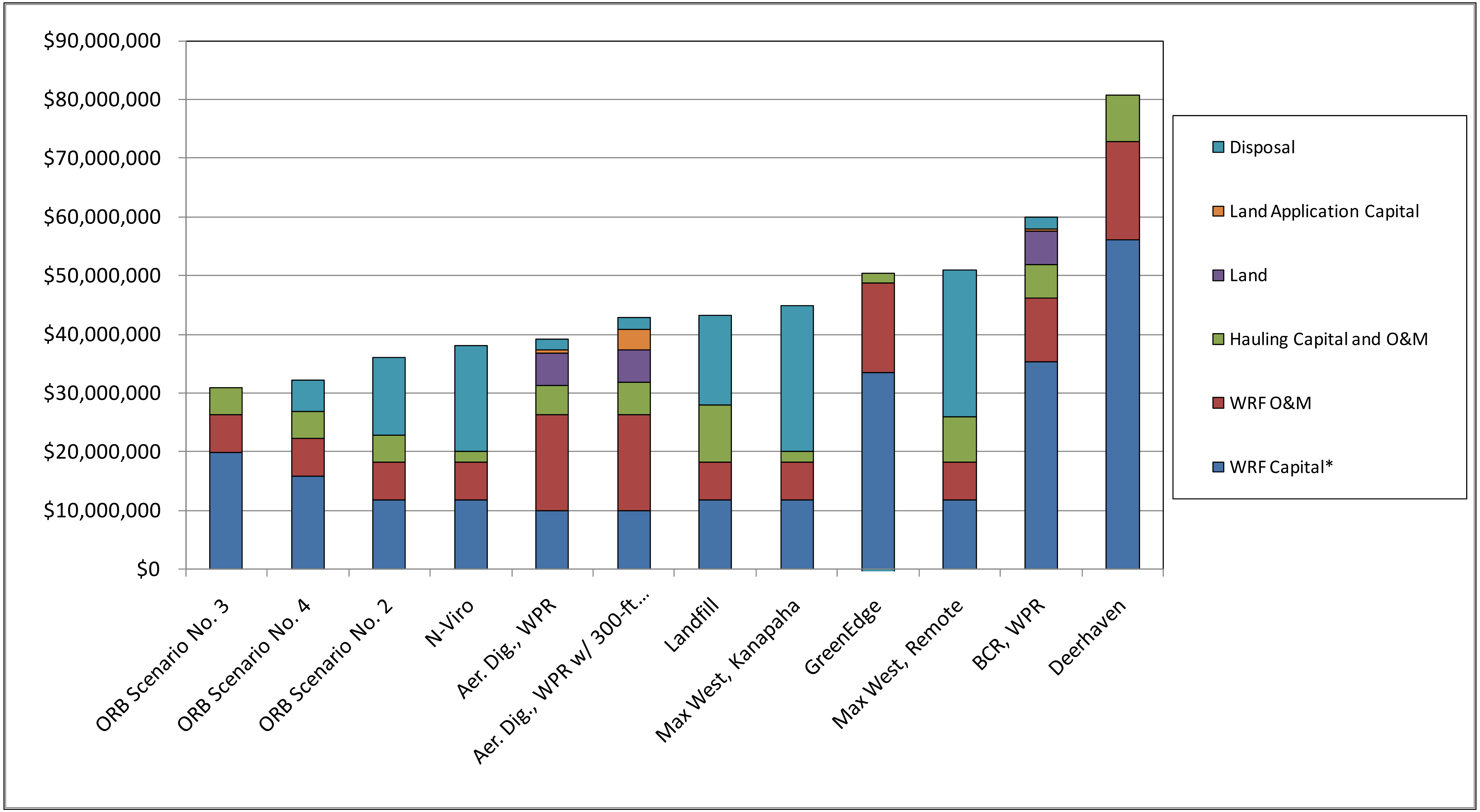


EXHIBIT 7-3
Total Present Worth for Alternatives
GRU Biosolids Management Plan Update



SECTION 8

Summary and Recommendations for Biosolids Management

8.1 Summary

In 2008, CH2M HILL completed a *Biosolids Management Plan* for GRU. Based on that evaluation, GRU decided to continue their current practice of using aerobic digestion to treat to Class B standards and land applying the biosolids at WPR. Part of this solution required the purchase of WPR to ensure long-term availability of the site. Because of new regulations and additional requirements at WPR imposed by Alachua County, GRU reevaluated their biosolids management practices. Under an agreement and consent order with Alachua County, GRU will cease Class B biosolids land application at WPR by February 21, 2016.

Several additional biosolids management alternatives were identified for use at MSWRF and KWRF. A preliminary review of the alternatives revealed that some were not currently viable at this time and were not evaluated in detail. Eight viable alternatives were identified and evaluated based on a net present worth of capital and operating costs over a 20-year period and other non-monetary criteria. Included in the cost analysis were treatment plant facilities and operations, hauling equipment and costs, and disposal or land application.

The results indicated that based on the preliminary pricing information provided by Alachua County, the waste-to-energy Organics Recycling Biomodule (ORB) facility had similar or lower cost as compared to continuation of Class B aerobic digestion with land application at WPR. The proposed ORB also provides additional benefits to the community including energy recovery from methane gas, and helping Alachua County meet state recycling goals. As with Class B land application, the ORB would also beneficially reuse nutrients since the resulting compost product is proposed to be used at sod farms.

However, the ORB is an innovative process. This process has been demonstrated with other waste types at other locations, but has not been demonstrated using the combination of waste feeds proposed here. Potential concerns with the proposed ORB are the ability to site the facility, odors, unforeseen operational and/or regulatory issues, and the risk that the capital and operating costs proposed by Alachua County are not sufficient to maintain the project's long term viability. Further evaluation of the proposed ORB should be performed to define pricing, and to provide assurance that the process will be able to reliably meet GRU's biosolids disposal needs.

8.2 Recommendations

Based on the evaluation of alternatives in this report, it is recommended that GRU pursue the following path forward:

1. **Issue RFP for Beneficial Use of Waste Activated Sludge (WAS) or Biosolids**. The proposal evaluated in this report (ORB Option 3) is for a process that does not have a

proven track record and the quality of the cost information cannot be easily verified. In addition, the costs for the other alternatives evaluated in this report were based on preliminary budgetary numbers from the vendors representing each process. In order for GRU to proceed to the next level in the decision making process, higher quality capital and operating cost numbers will have to be secured. Therefore, the Engineer recommends that GRU issue a Request for Proposals (RFP) from vendors interesting in providing biosolids hauling, processing and beneficial reuse.

The RFP should identify the volume and characteristics of biosolids that will be available over the next 20-year period. The RFP should require that the proposing vendors include with their proposal, at a minimum, the following requirements:

- Proposal shall include the vendor’s plan to design, build, own and operate the proposed facility for a minimum period of 20 years. If the vendor already owns and operates a facility, the proposal should state that capacity for GRU’s WAS or biosolids is available and will be dedicated to GRU.
- Guarantee to haul, process and beneficially reuse GRU’s biosolids in a manner that is consistent with all Federal, State and local laws, rules, ordinances, and regulations. The vendor shall assume ownership of GRU’s biosolids when the hauling truck leaves the gate on the KWRF site.
- Provide a not-to-exceed cost to GRU for hauling, processing, and beneficially reusing biosolids beginning in October 2015. This cost shall be made on a cost per wet ton basis. The not-to-exceed costs shall include a schedule for any proposed escalation in price over the 20-year period of operation.
- Hauling of WAS or biosolids from KWRF is the responsibility of the vendor. The vendor has the option of hauling liquid at 5% solids or dewatered at 20% solids.
- Provide evidence that the vendor’s proposed technology has been proven in full-scale facilities.
- Demonstrate successful financial and operational experience with WAS or biosolids management.
- Submit the location of the vendor’s proposed site for processing the WAS or biosolids.
- Demonstrate core competencies necessary to cover all aspects of the project including WAS or biosolids handling, engineering design, process development, quality assurance, financing, construction, operations and management.
- Submit references demonstrating experience in WAS or biosolids management using the proposed technology.
- Submit a timeline from notice to proceed to commissioning of a fully functional facility. The timeline shall demonstrate that the proposed facility can be operational on or before October 2015.
- Submit references and resumes demonstrating experience in biosolids management using the proposed technology on Standard Form 330.

2. **Construction of Facilities at KWRF and MSWRF.** All but one of the alternatives in this report require dewatering facilities at the KWRF and thickening improvements at the MSWRF be completed. The findings of this report were that the most cost effective option was for dewatering facilities that were 20% solids. GRU should pursue dewatering facilities in parallel with the RFP described above. If a responder to the RFP offers a more cost effective option using thickened biosolids instead, then the design of the dewatering facilities should be halted. Improvements to KWRF and MSWRF thickening facilities would still be required.

   The project to furnish dewatering and thickening improvements will require that procurement of engineering services, design document preparation, permitting, bidding, construction and commissioning be completed on or before October 2015. The recommended dewatering facilities at KWRF and thickening improvements at MSWRF are as described in Exhibits 5-8 and 5-9, respectively.

   A proposed project schedule for this portion of the project is as follows:

Activity	Deadline to Complete Activity
Procure Engineering Services	April 2012
Pilot Testing by Centrifuge Manufacturers	September 2012
Schematic Design Report documenting Preliminary Engineering	December 2012
Complete Dewatering Design Drawings and Specifications	October 2013
Complete Bidding and Site Permitting	March 2014
NTP to Contractor	March 2014
Construction Substantial Completion	June 2015
Construction Final Completion	August 2015
Phase-in hauling to Vendor's Site	October 2015
Cease Land Application of Class B Biosolids at WPR	October 2015

3. **Interim Land Application at WPR.** The land application of Class B biosolids should be continued until dewatered WAS or biosolids can be hauled to the vendor's site or the consent order deadline of February 21, 2016, whichever comes first.

4. **Short-Term Contingency Plan.** Because of the potential that the consent order deadline could expire before the completion of the vendor's facilities, GRU should develop a short-term contingency plan to evaluate alternatives that can be implemented quickly and on a short term basis (i.e. monthly). The short-term contingency plan should maintain GRU in compliance with FDEP regulations until the long term solution can be implemented.

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SECTION 9

References

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APPENDIX A

Cost Estimating Methodology

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APPENDIX A

Cost Estimating Methodology

Capital and operations and maintenance (O&M) costs were used to calculate the total present-worth value for each alternative. Detailed drawings and specifications of each alternative were not available to the Engineer to make definitive estimates. Therefore, the Engineer's best judgment was used to establish the relative weight of each alternative's capital and O&M cost - thus maintaining the integrity of ranking the alternatives. For example, the same unit cost for a process building ($/sf) was used for each alternative. The Vendor's representing each alternative may believe that their process could be optimized to obtain a better cost ranking. But this would necessitate optimizing all alternatives and time was not available for this exercise.

The assumptions used for cost development are documented in this appendix. The cost estimates presented are considered to be Class 5 estimates in the new Association of the Advancement of Cost Engineering International (AACEI) classification system 18R-97 or order-of-magnitude in the older American National Standards Institute (ANSI) Z94.2–1989 standard. Based on AACEI guidelines, these estimates are considered accurate to within plus 40 percent and minus 25 percent of the actual cost. This level of estimate is prepared from the following information:

- Outline design criteria
- General assumptions of existing soils conditions and/or foundation requirements
- Rough sketches
- Approximate size and types of construction
- Rough utility requirements
- Process flow diagrams
- Parametric cost models
- Vendor quotes

Capital Costs

New Facilities

In calculating the capital costs, it is assumed that new facilities and major equipment would be installed in 2010. Capital costs were therefore incorporated in year 2010 dollars without regard for discounting or inflation. It was also assumed that there would be no phasing of construction over the 20-year life of the analysis. All facilities required for build-out conditions would be designed and constructed immediately.

The capital costs were based primarily on major equipment quotes and facility layouts generated for each option. Building costs are based on cost per square foot (ft^2) data from previous GRU projects. Concrete costs for tankage and structures were based on current information from CH2M HILL construction cost estimators.

To complete the construction cost estimates for all WRF related construction, allowances were used to determine the approximate total construction costs. A summary of the allowances is presented in **Exhibit A-1.** As agreed upon with GRU staff, a construction contingency of 30 percent was applied to all cost estimates because of the conceptual nature of these evaluations. The construction contingency accounts for unidentified project components. Standby power needs will also require further analysis to determine the compatibility with the existing generators; therefore, the cost of additional generators was not included in any of the options presented.

EXHIBIT A-1
Capital Cost Assumptions
GRU Biosolids Management Plan

Item	Percentage of Capital Cost
General Conditions	3%
Site Work	7%
Electrical and Instrumentation and Control (I&C)	19%
Overhead (construction)	10%
Profit (construction)	8%
MOB/Bonding	5%
Contingency	30%
Auxiliary Power	Not included
Design[1]	10%
Services During Construction[1]	10%
Administrative[1]	5%

Note: 1. The capital cost for the construction of the Max West, N-Viro, Landfill and ORB alternatives only include markups for design and services during construction (SDC) for the dewatering facilities. The design and SDC of the ORB will be managed by Alachua County.

Transportation

Biosolids can be transported from a water reclamation facility (WRF) to an application/ disposal site using trucks, railroad, or pipeline. For short distances, however, truck hauling is a flexible, economical, and widely used method of hauling biosolids. Currently, liquid biosolids from both GRU WRFs are transported via trucks to the Whistling Pines Ranch (WPR) land application site. Since the sites for all the current and proposed application/disposal options considered in this management plan are in north Florida, transporting biosolids using trucks is considered to be the most cost-effective method. For all the current and proposed options described in this report, biosolids transportation from the WRFs to the application/disposal site will be via trucks.

For each alternative, annual estimates of transportation costs were developed for the years 2010 to 2032. Transportation capital costs were based on the number of vehicles needed for hauling biosolids. The number of vehicles for each year was calculated based on the maximum month average daily load (MMADL) projections and the estimated transport cycle times. Useful life of the vehicles was also considered and the cost of any replacement vehicles needed before 2032 was added to the capital cost as needed. Cost of replacement vehicles was calculated based on its cost in 2010 with 4 percent annual escalation to the year the replacement vehicle is needed. For the treatment alternatives that produce liquid biosolids, the existing fleet of transportation owned by GRU was used until a replacement vehicle was needed, based on the useful life and the year of vehicle purchase. GRU currently uses a 6,000-gallon tanker and a Freightliner highway tractor to transport liquid biosolids to the WPR. For the dewatered biosolids alternatives, costs for new equipment were included in the startup year of 2010. Details of the transportation vehicles used for different alternatives are provided in **Exhibit A-2**.

EXHIBIT A-2
Details of Transportation Vehicles
GRU Biosolids Management Plan

Origination	Purchase year	Cost [a]	Useful Life (years)
Current GRU Vehicle			
6,000-gallon tanker truck	1997	$65,000	20
Freightliner highway tractor	2002	$125,000	10
New Vehicle			
25-cubic-yard truck	2010	$123,000	20
Freightliner highway tractor	2010	$165,000	10

[a] Cost at the time of purchase.

Land Application

Capital costs for the proposed end-use alternatives included the cost of application equipment or application vehicles, cost of storage facilities need (for example, storage facility to provide for 14 days of wet weather storage for dewatered land application options), and cost of purchasing land, if applicable. The number of application vehicles was calculated for each year based on the MMADL projections. The cost of an additional vehicle, if needed, and cost of replacement vehicle based on its useful life was also added to the total capital cost of an alternative. For alternatives where liquid biosolid was land applied, application equipment currently owned by GRU was considered in the capital cost estimations. GRU currently has one liquid biosolids application vehicle, a Houle 9500, which has a carrying capacity of 9,500 gallons. General assumptions for computing the capital cost of the application equipment used are included in **Exhibit A-3**.

EXHIBIT A-3
Details of Land Application Vehicles
GRU Biosolids Management Plan

Origination	Purchase Year	Capacity	Cost[1]	Useful Life (years)
Current GRU Vehicle				
9500 Houle applicator	2002	9,500 gallons	$350,000	15
New Vehicle				
Liquid applicator [a]	2010	6,000 gallons	$322,000	15
Side spreader [b]	2010	16 yd^3	$149,000	15
Front End Loader	2010	3 yd^3	$257,000	15

[a] For agricultural application of liquid biosolids
[b] For agricultural application of dewatered biosolids
yd^3 cubic yards

Cost of Land

The cost of purchasing WPR, for those alternatives including that purchase, was based on an estimate of $12,000 per acre (provided by GRU). The cost estimate for the special exception requirements (the 300-foot setback, berm and 75-foot planted buffer) was $2,500,000.

In order to quantify the value of WPR on a present worth basis, the future value of the land was first assumed to escalate at a rate of 2% a year. The net present worth of the calculated future land price was then determined based on a discount rate of 4.5%. Therefore the present worth cost of WPR was determined to be the 2010 purchase price minus the discounted 20 year value.

O&M Costs

New Facilities

The O&M costs for new facilities were derived from estimates of electrical power, labor, chemicals, repair, replacement, and miscellaneous costs for each treatment alternative. The costs were computed on an annual basis based on projected flow at each facility. Subsequently, present-worth O&M costs for each alternative were calculated assuming a 4.5 percent discount rate over the 20-year planning period (2010-2032).

Electrical Power

Power costs were calculated based on the horsepower (hp) rating of the equipment. For this cost estimate, it is assumed that the equipment necessary to meet the average daily flow requirements is in service. For alternatives that did not require aerobic digestion for stabilization, it was assumed that the WRFs would only use digesters with floating aerators for storage prior to dewatering. The annual costs per kilowatt-hour were provided by GRU and are presented in **Exhibit A-4.**

EXHIBIT A-4
Anticipated Electrical Power Costs
GRU Biosolids Management Plan

Year	Power, Cost per Kilowatt-hour[a]
2011	0.078
2012	0.080
2013	0.081
2014	0.083
2015	0.084
2016	0.075
2017	0.077
2018	0.078
2019	0.079
2020	0.080
2021	0.081
2022	0.082
2023	0.083

EXHIBIT A-4
Anticipated Electrical Power Costs
GRU Biosolids Management Plan

Year	Power, Cost per Kilowatt-hour[a]
2024	0.084
2025	0.086
2026	0.087
2027	0.088
2028	0.090
2029	0.092
2030	0.092
2031	0.092
2032	0.092

[a] Data provided by GRU/Strategic Planning Department.

Labor

Unless otherwise specified in the detailed description of a selected alternative, a labor rate of $28.00 per hour was assumed. This rate, provided by GRU, is based on the average 2010 pay rate of a plant operator. A 3 percent annual escalation was used to estimate labor rates through 2032. This labor cost was intended to represent an average cost of an operator and does not represent a particular level of operator. This rate also includes a 40 percent mark-up for fringe benefits and overhead costs.

Chemicals

Chemical usage was calculated based on annual average daily load (AADL) requirements. Historical records show that chemical costs have fluctuated throughout the last two decades. Factors affecting local prices include local market conditions (production versus demand) and international oil prices. It is therefore difficult to predict future chemical prices based on historical trends with a good level of confidence. For this reason, year 2010 prices were escalated by 3 percent to estimate chemical prices in subsequent years. A summary of chemical costs is provided in **Exhibit A-5**.

EXHIBIT A-5
Estimate Chemical Costs
GRU Biosolids Management Plan

Chemical Name	2006 Price
Polymer	$1.5/pound

Replacement and Repair

For each alternative, a value equal to 2 percent of the equipment cost was budgeted for miscellaneous repairs, with a 3 percent escalation per year to account for inflation. This is a general assumption based on CH2M HILL project experience.

Transportation

The O&M cost for transportation and land application alternatives were calculated based on the methodology provided by EPA (1985). The O&M costs for biosolids transport and land application were based on the AADL. The O&M cost included fuel cost, labor cost, and vehicle maintenance cost. Fuel was priced as $ 2.60 per gallon in 2010 with an annual increase of 3 percent per year to estimate fuel costs for subsequent years. Fuel requirement for transportation cost was a function of the hauling distance and number of trips annually. Labor cost for transportation and land application was based on cost assumptions as described in the pertinent subsection. Annual labor requirement was calculated based on the round trip travel time and the annual number of trips. Vehicle maintenance cost was calculated based on the mileage for the transportation vehicles with an annual escalation factor of 3 percent. A distance for each of the alternatives is included in the evaluation. Based on the recent project budget calculated by CH2M HILL, the vehicle maintenance cost was estimated at 53 cents/mile for the 6,000-gallon tanker and 59 cents/mile for the 25-yd^3 flatbed truck.

Land Application

After the purchase of WPR, the land application operation would become the responsibility of GRU. Various cost basis and assumptions for land application at WPR are included in **Exhibit A-6**.

EXHIBIT A-6
Land Application Operation Details
GRU Biosolids Management Plan

Item	Value	Note
Application days per year	200	
Maximum month application days	20	
Daily application time	8 hours	
Application truckload time	48 minute	
Fuel consumption rate	7 gallons/hour	
Fuel Cost	$2.60/gallon	2010, escalated at 3%
Cost of vehicle maintenance	$11/hour	2010, escalated at 3%
Land application labor cost	$20/hour	2010, escalated at 3%