Attachment H

Board Contract Summary

BC 17 _104

For use with Expenditure Contracts submitted to the Board for approval. Complete information below, print, obtain signature of authorized departmental representative, and submit this form, along with attachments, to the appropriate departments for signature. See also: *Auditor-Controller Intranet Policies->Contracts.*

D1.	Fiscal Year	12 year agreement
D2.	Department Name	Public Works
D3.	Contact Person	Mark Schleich
D4.	Telephone	882-3605

K1.	Contract Type *(check one)*: ☐ Personal Service ☑ Capital	
K2.	Brief Summary of Contract Description/Purpose	Design, construction and operation of Tajiguas Resource Recovery Project
K3.	Department Project Number	828368
K4.	Original Contract Amount	$ $110,820,000; $5.60/ton
K5.	Contract Begin Date	When Conditions Precedent are met
K6.	Original Contract End Date	12 years after Conditions Precedent met
K7.	Amendment? (Yes or No)	Yes
K8.	- New Contract End Date	Same
K9.	- Total Number of Amendments	Two
K10.	- This Amendment Amount	$Increased construction $19,693,000; $4
K11.	- Total Previous Amendment Amounts	$$290,000 construction increase; $15.15
K12.	- Revised Total Contract Amount	$ $130,513,000 construction; $16.23/ton

B1.	Intended Board Agenda Date	November 14, 2017
B2.	Number of Workers Displaced *(if any)*	0
B3.	Number of Competitive Bids *(if any)*	5
B4.	Lowest Bid Amount *(if bid)*	Public/Private Partnership Govt Code
B5.	If Board waived bids, show Agenda Date	
	and Agenda Item Number	
B6.	Boilerplate Contract Text Changed? *(If Yes, cite Paragraph)*	Unique contract

F1.	Fund Number	1930
F2.	Department Number	054
F3.	Line Item Account Number	8200
F4.	Project Number *(if applicable)*	828368
F5.	Program Number *(if applicable)*	1850
F6.	Org Unit Number *(if applicable)*	
F7.	Payment Terms	Lump sum & periodic payments; per to

V1.	Auditor-Controller Vendor Number	
V2.	Payee/Contractor Name	MSB Investors, LLC
V3.	Mailing Address	750 Pismo Street
V4.	City State (two-letter) Zip (include +4 if known)	San Luis Obispo, CA 93401
V5.	Telephone Number	(805)259-9499
V6.	Vendor Contact Person	John Dewey
V7.	Workers Comp Insurance Expiration Date	Unique insurance & bond requirements
V8.	Liability Insurance Expiration Date	Unique insurance & bond requirements
V9.	Professional License Number	
V10	Verified by (print name of county staff)	Les

V11 Company Type *(Check one)*: ☐ Individual ☐ Sole Proprietorship ☐ Partnership ☑ Corporation

I certify information is complete and accurate; designated funds available; required concurrences evidenced on signature page.

Date: 11/7/17 Authorized Signature: _____

Revised 1/13/2014

SECOND AMENDMENT to the AMENDED CONTRACT between the COUNTY of SANTA BARBARA and MSB INVESTORS, LLC for DEVELOPMENT and OPERATION of the TAJIGUAS RESOURCE RECOVERY PROJECT

This Second Amendment dated November 14, 2017 ("Second Amendment") is made by and between the County of Santa Barbara, California ("County"), and MSB Investors, LLC, ("Contractor"). This Second Amendment, along with the First Amendment dated February 14, 2017, modifies and is incorporated into the Amended Contract between the County of Santa Barbara and MSB Investors, LLC for Development and Operation of the Tajiguas Resource Recovery Project dated November 15, 2016 (collectively referred to as the "Contract").

This Second Amendment amends the Contract as follows:

1. The definition of "Contract" in Section 1.31 (lines 240-242 of Amended Contract) is replaced in its entirety by the following:

   Section 1.31 Contract

   "Contract" means the Amended Contract dated November 15, 2016, the First Amendment dated February 14, 2017 and this Second Amendment dated November 14, 2017 including all exhibits and attachments which are incorporated herein by reference.

2. The definition of "Project Development Schedule" in Section 1.111 (lines 619-621 of Amended Contract) is replaced in its entirety by the following:

   Section 1.111 Project Development Schedule

   "Project Development Schedule" means the Amended Project Development Schedule for performing and completing all Development activities as specified in Article 4 and Amended Exhibit C: "Amended Project Development Schedule," attached as part of this Second Amendment. Amended Exhibit C: "Amended Project Development Schedule" supersedes and replaces the original Exhibit C "Project Development Schedule" as referenced in all sections of the Contract.

3. The definition of "Proposal" in Section 1.113 (lines 626-629 of Amended Contract) is replaced in its entirety by the following:

   Section 1.113 Proposal

   "Proposal" means the Contractor's Proposal, as presented in Exhibit J and Amended Exhibit J which include the original proposal submitted by the Contractor on June 2, 2010 in response to the Request for Proposals issued on October 20, 2009, updated on October 28, 2014 in response to a request for an updated proposal dated July 25, 2014, amendments provided to the County on May 18, 2016, and subsequent updates submitted in May 2017 in response to a request for an updated proposal dated March 27, 2017. Addendum to Exhibit E - Project Design and Construction and Exhibit J - Contractor's Proposal, is attached as part of this Second Amendment.

4. Subsection C "Statements and Information in Proposal" of Section 2.6 "Representations and Warranties of Contractor" (lines 918-927 of Amended Contract) is amended and replaced in its entirety by the following:

Section 2.6 Representations and Warranties of Contractor

C. Statements and Information in Proposal

Contractor's Proposal, as presented in Exhibit J, which was originally submitted by the Contractor on June 2, 2010 in response to the Request for Proposals issued on October 20, 2009, updated on October 28, 2014 in response to a request for an updated proposal dated July 25, 2014, amendments provided to the County on May 18, 2016, and subsequent updates submitted in May 2017 in response to a request for an updated proposal dated March 27, 2017, which collectively constitute an Addendum to the Contractor's Proposal upon which the County has relied in entering into this Contract, and representations as set forth in this Contract, are correct and complete in all material respects at the time originally submitted to the County or executed by Contractor, as the case may be. Contractor shall advise County of any changes to the Addendum to Exhibit E - Project Design and Construction and Exhibit J - Contractor's Proposal, attached as part of this Second Amendment, if any occur between the time of submittal and the Effective Date.

5. Subsection L "Time to Satisfy Conditions Precedent to Contract Extended" is added to Section 2.7 "Conditions Precedent to Contract" as follows:

Section 2.7 Conditions Precedent to Contract

L. Time to Satisfy Conditions Precedent to Contract Extended

Notwithstanding the expiration of the 180-day time period for satisfying, waiving, revising or extending the Conditions Precedent set forth in subsections A through and including J of Section 2.7 of the Contract, the County and Contractor agree to revive the Contract and extend the time period to satisfy all Conditions Precedent to 365 days after the County's approval of this 2nd Amendment. Reviving the Contract and extending this time period for 365 days from the date the County executes this 2nd Amendment does not constitute a waiver of any of the Conditions Precedent specified in Section 2.7.

6. Subsection 8 of Section 4.1.C "Specific Contractor Responsibilities" (lines 1310-1313 of Amended Contract) is amended and replaced in its entirety as follows

Section 4.1 Responsibilities of the Parties

C. Specific Contractor Responsibilities

8. Developing and operating the Facility in conformance with Amended Exhibit E: "Project Design and Construction", Amended Exhibit J: "Contractor's Proposal" and mitigation measures described and contained in Exhibit X: "Mitigation and Monitoring Requirements Plan," and in compliance with all applicable regulatory approvals and Permits subject to the occurrence of the CEQA Completion Date and the availability of County financing.

7. Subsection 21 of Section 5.1.B "County Responsibilities" (lines 1906-1909 of Amended Contract) is amended and replaced in its entirety as follows:

Section 5.1 Responsibilities of the Parties

B. County Responsibilities

21. Providing for sale to Contractor, a minimum of two hundred and fifty (250) SCFM of landfill gas, as is, normalized to forty five percent (45%) methane, on an Annual basis for use in operating the AD biogas powered CHP units pursuant to payment terms stipulated in section 10.5.B. The County may (but it not obligated to) provide additional landfill gas, as is, normalized to forty five percent (45%) methane based on terms mutually agreeable to the Parties.

8. Subsection 22 is added to Section 5.1.B "County Responsibilities" as follows:

Section 5.1 Responsibilities of the Parties

B. County Responsibilities

22. Providing for sale to Contractor, a minimum of six hundred (600) SCFM of landfill gas, as is, normalized to forty five percent (45%) methane on an Annual basis for the specific use of operating the landfill gas powered CHP units subject to the payment provisions in section 10.5.C. The County may (but is not obligated to) provide additional landfill gas subject to the terms of section 10.5.C.

9. Subsection 23 is added to Section 5.1.B "County Responsibilities" as follows:

Section 5.1 Responsibilities of the Parties

B. County Responsibilities

23. Parties agree that Contractor cannot sell any part of this landfill gas or benefit derived from it to any other entity without prior notification to the County. If landfill gas supply becomes interrupted, the Parties agree to meet and confer and develop a cost effective and equitable solution. If needed, a third party, agreeable to Parties, may be retained to provide assistance and the cost of the services will be divided between the County and the Contractor.

10. Subsection 23 is added to Section 5.1.C "Primary Contractor Responsibilities" as follows:

Section 5.1 Responsibilities of the Parties

C. Primary Contractor Responsibilities

23. Contractor will receive landfill gas from the County and deliver the gas to combined heating and power (CHP) units for combustion and generation of electrical power. Contractor will handle and dispose of all liquids (e.g. condensate) associated with the collection, treatment and combustion of the landfill gas. Power generated by the CHP units will be used on-site to operate the Project. Contractor agrees to operate the CHP units at a minimum of ninety percent (90%) run time over a three month average while achieving a minimum electrical generation net output of eighty five percent (85%) from the operation of the CHP units or such amount that allows the landfill gas CHP units to qualify for

the most advantageous Southern California Edison tariff program (i.e. net energy metering) from the operation of the CHP units.

Contractor agrees that the usage of the landfill gas, and operation of the CHP units and associated flares, are to benefit the County in regards to compliance, at all times, with all applicable laws, regulations, permits and other limitations imposed by regulatory agencies having jurisdiction over the County at the Tajiguas Landfill. As such, the County may require that Contractor accept additional landfill gas from the County, as deemed necessary, for the County to maintain compliance, at all times, with all applicable laws, regulations, permits and other limitations imposed by regulatory agencies having jurisdiction over the County at the Tajiguas Landfill. Contractor will not use any fuel to replace the County's landfill gas for use in the operation of the CHP units and associated flares without prior County approval. With prior notification to County of 365 days, the Contractor has the right to use or sell surplus landfill gas to the above uses or benefits derived from it to any other entity without prior approval of the County. If landfill gas supply becomes interrupted, the Parties agree to meet and confer and develop a cost effective and equitable solution. If needed, a third party, agreeable to Parties, may be retained to provide assistance and the cost of the services will be divided between the County and the Contractor.

Contractor will operate and maintain all CHP units and associated flares using Good and Accepted Operating Practice and Maintenance activities as defined in this Contract and included in the CHP unit manufacturer's Operation and Maintenance Manual. The Operation and Maintenance Manual will be submitted for County review at least thirty (30) days prior to commencing operations of the CHP units.

11. The last sentence of Section 7.2 "Anaerobic Digestion of Organic Materials" is amended and replaced as follows:

Section 7.2 Anaerobic Digestion of Organic Materials

Following anaerobic digestion, Contractor shall transport digestate via conveyor belt to the portion of the Project Site designated for Composting Operations.

12. Subsection A "Compensation for Pre-Construction" of Section 10.2 "Development, Pre-Construction, Construction, and Equipping Compensation" is amended and replaced in its entirety as follows:

Section 10.2 Development, Pre-Construction, Construction, and Equipping Compensation

A. Compensation for Pre-Construction

County shall pay Contractor compensation for Facility Pre-Construction (Permits and Entitlements of $4,450,000 and Design and Engineering of $5,390,000) totaling nine million eight hundred forty thousand dollars ($9,840,000) or such lesser amount as the Parties may agree as of the closing date of the public financing, which includes the Facility ("Financial Close"). This is an agreed sum based on Contractor's actual expenses that will be necessarily incurred as of the end of the month preceding Financial Close: but specifically excludes costs and

attorney fees related to the investment tax credit, but which specifically includes the payment of a return on its Facility Development Costs. County shall pay Contractor (following receipt of the proceeds from the enterprise revenue bond financing, which includes the Facility) in accordance with the Progress Payment Provisions contained in Exhibit AA.

13. Subsection C "Construction and Equipment Costs" of **Section 10.2** "Development, Pre-Construction, Construction, and Equipping Compensation" is amended and replaced in its entirety as follows:

Section 10.2 Development, Pre-Construction, Construction, and Equipping Compensation

C. Construction and Equipment Costs

County shall pay Contractor one hundred seventeen million five hundred and eighty three thousand dollars ($117,583,000) or such lesser amount as the parties may agree in writing, which is an agreed sum based on Contractor's Construction and Equipment Cost budget: Contractor shall be compensated for Constructing and equipping the Facility (but not for purchase of Non-Fixed Equipment, costs related to attorney fees related to the investment tax credit, interest on the purchase of turbine engines, two years depreciation on the turbine engines, and storage of the turbine engines) in accordance with the periodic payment schedule and payment terms to be included in the public bond financing documents.

14. Subsection D "Adjustment to Pre-Construction Compensation, and Construction and Equipment Costs" is added to Section 10.2 "Development, Pre-Construction, Construction, and Equipping Compensation" as follows:

Section 10.2 Development, Pre-Construction, Construction, and Equipping Compensation"

D. Adjustment to Pre-Construction Compensation, and Construction and Equipment Costs

CPI Adjustment. As of the date of Financial Close, Contractor's Facility Pre-Construction and Construction and Equipment Costs shall be adjusted using the following steps:

1. The sum of Contractor's Facility Pre-Construction Costs and Construction and Equipment Costs subject to CPI Adjustment equal to $127,423,000 ("Contractor's Total Cost Budget Exclusive of the Development Fee") shall be multiplied by one (1) plus the Percentage Change in the Consumer Price Index (CPI-U) for the period ending March 31, 2018 through the last day of the month preceding the date of Financial Close to arrive at the "Adjusted Contractor's Total Cost Budget Exclusive of the Development Fee."

2. The Percentage Change in the CPI-U is calculated by subtracting the Index for the period ending March 31, 2018 from the Index Value for the month ending immediately prior to the date of Financial Close and

dividing the result by the Index Value for the period ending March 31, 2018. For example:

(a) If the Contractor is calculating the Adjusted Contractor's Total Cost Budget Exclusive of the Development Fee, the Percentage Change for the CPI-U would be calculated as follows:

(b) [(CPI-U for April 2018 if the date of Financial Close were to occur in May 2018) minus (CPI-U for March 2018)] divided by (CPI-U for March 2018)].

(c) If CPI-U for April 2018 is 230.644 and the CPI-U for March 2018 is 230.260, the Percentage Change for the CPI-U would be equal to: (230.644 - 230.260) / 230.260 = 0.1667%. The Percentage Change applicable to the Adjusted Contractor's Total Cost Budget Exclusive of the Development Fee shall be subject to a maximum Percentage Change of 2.0% per annum on an annualized basis; which would represent a maximum Percentage Change of 0.1667% on a monthly basis applied against the number of months delay to financial close beyond April 30, 2018. In the event the CPI-U is not yet available for the month preceding Financial Close as of the date of Financial Close, the relative CPI-U Percentage Change for the period from February 2018 through the 2nd month preceding Financial Close may be used to calculate the applicable CPI-U Percentage Change to be used in calculating the Adjusted Contractor's Total Cost Budget Exclusive of the Development Fee.

Then, the Contractor's Total Cost Budget Exclusive of the Development Fee of $127,423,000 shall be multiplied by 1.001667, yielding the Contractor's Total Cost Budget Exclusive of the Development Fee of $127,635,372, an increase of $212,372.

15. Subsections A-1, A-2 and A-3 "Per Ton Processing Rate" of Section 10.3 "Facility Operations Compensation" are amended and replaced in their entirety as follows:

Section 10.3 Facility Operations Compensation

A. Per Ton Processing Rate

1. Initial Per Ton Processing Rate

The Initial Per Ton Processing Rate to be paid Contractor by County shall be sixteen dollars and twenty three cents ($16.23) per Ton as identified in the Amended Contractor's Final Pro-Forma (included as Amended Exhibit H).

The Per Ton Processing Rate to be paid to County by Other Users (and any corresponding amount to be paid by County to Contractor) shall be subject to the terms approved by the County as described in Section 10.6.

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2. Payment of Per Ton Processing Rate

County will operate the Scale House at the entrance to the Project Site, and will record customer, truck number, number of Tons, type of delivered material, and originating Public Participant. The County will provide Contractor full access to Scale House records.

Monthly, County shall pay Contractor an amount equal to the Tons delivered to the Facility multiplied by sixteen dollars and twenty three cents ($16.23) per Ton. For example: If the County directed 15,893 Tons to the Facility it would pay the Contractor $257,943.39.

Payment shall be made no later than the thirtieth (30th) Day following the month such services were rendered (for example, for services delivered in February the payment shall be made no later than March 30) accompanied by a statement of Tons delivered by Day, which shall include the truck number, date of delivery and Tons delivered.

Within fifteen (15) Days of receipt of the payment and statement, the Contractor shall review the payment and statement against its own records and notify the County, in writing, of any discrepancies (including overpayments and deficiencies) in the payment ("Notice of Discrepancies"). The Contractor's failure to notify the County of an overpayment is a breach of the Contract, and, if it is a material amount, is grounds for termination of the Contract by the County in its sole discretion as well as the reimbursement of the overpayment to the County. Within fifteen (15) Days of receipt of the Notice of Discrepancies, Contractor and County shall meet and attempt to resolve any dispute concerning said payment. Should they not resolve the dispute, the Parties may seek such dispute resolution process otherwise available to them.

3. Adjustment to Per Ton Processing Rate

a. CPI Adjustment Year 1. As of the date of Financial Close, Contractor's Year 1 Revenue Requirement shall be adjusted using the following steps:

i. The Contractor's Year 1 Revenue Requirement of $13,593,424 shall be multiplied by one (1) plus the Percentage Change in the Consumer Price Index (CPI-U) for the period of February 1, 2018 through the last day of the month immediately preceding the date of Financial Close to arrive at the "Adjusted Year 1 Revenue Requirement."

ii. The Percentage Change in the CPI-U is calculated by subtracting the Index for the period ending January 31, 2018 from the Index Value for the month ending immediately prior to the date of Financial Close and dividing the result by the Index Value for the period ending January 31, 2018. For example:

iii. If the Contractor is calculating the Adjusted Year 1 Revenue Requirement, the Annual Percentage Change for the CPI-U would be calculated as follows:

iv. [(CPI-U for March 2018 if the date of Financial Close were to occur in April 2018) minus (CPI-U for January 2018)] divided by (CPI-U for January 2018)].

v. If CPI-U for March 2018 is 231.028 and the CPI-U for January 2018 is 230.260, the Percentage Change for the CPI-U would be equal to: (231.028 - 230.260) / 230.260 = 0.333%.

vi. Then, the Contractor's Year 1 Revenue Requirement of $13,593,424 shall be multiplied by 1.00333, yielding the Contractor's Adjusted Year 1 Revenue Requirement of $13,638,690 an increase of $45,266.

b. CPI Adjustment After Year 1. Annually, beginning July 1, 2020 ("Year 2"), the Per Ton Processing Rate shall be recalculated using the following steps:

i. The Contractor's Year 1 Revenue Requirement of $13,593,424, as adjusted per the requirements of section 10.3.A.3.a above, shall be increased by $300,000 for additional repair and maintenance expense to equal $13,893,424, as adjusted per the requirements of section 10.3.A.3.a above, that is divided by the 190,717 Tons anticipated to be delivered in accordance with the Material Delivery and Service Agreements to arrive at an adjusted Year 1 per Ton Revenue Requirement of $72.85, as adjusted by section 10.3.A.3.a above. In addition, the Contractor's Year 1 Revenue Requirement includes the County payment of $146,500 for the anticipated loss of revenue during the six (6) month startup phase for the AD facility. If the startup phase and the anticipated loss is less than a total of $1,465,000 then the County shall adjust its annual payment to reflect 1/10th of the total actual cost.

ii. The Contractor's Year 1 per Ton Revenue Requirement of $72.85, as adjusted by section 10.3.A.3.a above, shall be multiplied by one (1) plus the Annual Percentage Change in the Consumer Price Index, All Urban Consumers (CPI-U) to arrive at the Year 2 per Ton Revenue Requirement.

iii. The annual change in the CPI-U is calculated by subtracting the Average Index Value (the sum of the monthly index values during the 12 month period ending September 30 divided by 12 with the value carried three places to the right of the decimal and rounded to the nearest thousandth) for the 12-month period ending September 30 of the then-current Rate Year from the Average Index Value for the 12-month period ending September 30 of the most-recently completed year and dividing the result by the Average Index Value for the 12-month period ending September 30 of the most recently completed year. For example:

iv. If the Contractor is calculating the Per Ton Processing Rate for Contract Year 2 (Commencing July 1, 2020), the Annual Percentage Change for the CPI-U would be calculated as follows:

v. [(Average CPI-U for October 2018 through September 2019) minus (Average CPI-U for October 2017 through September 2018] divided by (Average CPI-U for October 2017 through September 2018)].

vi. If Average CPI-U for October 2018 through September 2019 is 235.822 and the Average CPI-U for October 2017 through September 2018 is 230.260, the Annual Percentage Change for the CPI-U would be equal to: (235.822 - 230.260) / 230.260 = 2.416%.

vii. Then, the Contractor's Year 1 per Ton Revenue Requirement of $72.85 shall be multiplied by 1.02416, yielding a Year 2 per Ton Revenue Requirement of $74.61, an increase of $1.76 per Ton.

viii. The Increase in the Contractor's Year 2 per Ton Revenue Requirement shall be added to Contractor's Year 1 Per Ton Processing Rate plus the per ton increase in repair and maintenance expense ($300,000/190,717= $1.57) to arrive at the adjusted Year 2 Per Ton Processing Rate. For example: The Contractor's Year 1 per Ton Revenue Requirement Processing Rate of $16.23 plus the per ton increase in repair and maintenance expense of $1.57 shall be increased by $1.76, from the example in subsection 2 above to arrive at a Year 2 per Ton Processing Rate of $19.56.

ix. Annually, steps 1 through 3 will be repeated to arrive at the following year's increase in the per Ton Revenue Requirement which will be added, in accordance with step iii, to the prior year's Per Ton Processing Rate to arrive at the following year's Per Ton Processing Rate. Except the per Ton Revenue Requirement shall reflect an additional increase in repair and maintenance expense ($250,000 / 190,717= $1.31) to arrive at the adjusted Year 3 per Ton Processing Rate of $20.89 ($19.58 + $1.31). Thereafter, the per Ton Revenue Requirement shall not be adjusted further for any additional increase in repair and maintenance expense but shall be adjusted for the CPI adjustment.

c. Other Adjustments. In addition, the Per Ton Processing Rate shall be adjusted for material changes directed by the County and in the event of an Extraordinary Review.

However, the Per Ton Processing Rate shall not be adjusted (except as expressly provided in this Contract) for increased costs of Facility Development or Construction or Operations; Contractor's failure to perform; or changes in Tonnage or composition of material delivered, except where a rate adjustment is expressly authorized by other provisions in this Contract.

d. Approval. Annually, beginning July 1, 2020 ("Year 2"), the recalculated Per Ton Processing Rate shall be approved by the Board of Supervisors.

16. Subsections A and C of Section 10.4 "Revenue Sharing" are amended and replaced in their entirety as follows:

Section 10.4 Revenue Sharing

A. Additional revenue received greater than projected from the sale of Recyclable Materials (eight million one hundred eighty eight thousand nine hundred and fifteen dollars ($8,188,915) as described in 10.3 above) up to nine

million four hundred sixty four thousand dollars ($9,464,000) will all be received by County and not be shared with Contractor. Additional revenue received greater than nine million four hundred sixty four thousand dollars ($9,464,000) from the sale of Recyclable Materials will be shared with seventy-five percent (75%) being received by the County and twenty-five percent (25%) by Contractor and the MRF Operator up to the point that Contractor and the MRF Operator receive an additional five hundred thousand dollars ($500,000) in income (i.e., total additional revenue of $2 million) and thereafter the County will receive ninety percent (90%) and Contractor and the MRF Operator will receive ten percent (10%) of incremental additional revenues above eleven million four hundred sixty-four thousand dollars ($11,464,000).

C. Additional revenue received greater than projected from the sale of electricity (two million three hundred and nine thousand two hundred and twenty nine dollars ($2,309,229) as described in 10.3 above plus reimbursement of one hundred forty six thousand five hundred dollars $146,500 for AD startup funding) up to two million four hundred fifty five thousand seven hundred and twenty nine dollars ($2,455,729) will all be received by County and not be shared with Contractor. Additional revenue received greater than two million four hundred fifty five thousand seven hundred and twenty nine dollars ($2,455,729) from the sale of electricity will be shared with seventy-five percent (75%) being received by the County and twenty-five percent (25%) by Contractor up to the point that Contractor receives an additional five hundred thousand dollars ($500,000) in income (i.e., total additional revenue of $2 million) and thereafter the County will receive ninety percent (90%) and Contractor will receive ten percent (10%) of incremental additional revenues above the four million three hundred nine thousand two hundred and twenty nine dollars ($4,309,229).

17. Subsection B of Section 10.5 "Other Payments to County" is amended and replaced in its entirety as follows:

Section 10.5 Other Payments to County

B. Contractor shall pay the County three hundred thousand dollars ($300,000) (increased annually by the percentage change in CPI-U as described in 10.3.A.3) per year once the AD biogas powered CHP units become operational (estimated to be February 2020) for a quantity of no less than two hundred and fifty (250) SCFM of landfill gas, as is, normalized to forty five percent (45%) methane, for use in operating the AD biogas powered CHP units. Payment will be made at the end of the Contract Year as part of the Financial Reconciliation during the Annual Settlement Process detailed in section 10.9.B. The County may (but is not obligated to) provide additional landfill gas, as is, normalized to forty five percent (45%) methane based on terms mutually agreeable to the Parties.

18. Subsections C and D are added to Section 10.5 "Other Payments to County" as follows:

Section 10.5 Other Payments to County

C. Contractor shall pay the County three hundred thousand dollars ($300,000) per year once the landfill gas powered CHP units become operational

(estimated to be February 2020) (increased annually by the percentage change in CPI-U as described in 10.3.A.3) for a quantity of no less than six hundred (600) SCFM of landfill gas, normalized to forty five percent (45%) methane for the specific use of operating the landfill gas powered CHP units. This price for the landfill gas is contingent on Contractor fulfilling its requirement in section 10.4 C to receive $2,309,229 in revenue from the sale of energy to offset Project operational costs. If Contractor does not meet section 10.4 C requirements, new terms for the landfill gas will have to be negotiated. Any additional landfill gas used by Contractor will be charged a rate of five hundred dollars ($500) per SCFM and at the sole cost of the Contractor and not passed on as an increased cost to the County through an adjusted Per Ton Processing Rate.

D. County assumes Contractor will operate under the grant and incentive programs directed by the County. Contractor shall pay the County (within forty five (45) days of receipt from Southern California Edison) any reimbursement funds that are eligible through the Self Generating Incentive Program administered by Southern California Edison that are associated with the landfill gas powered CHP units. It is estimated that the reimbursement will be nine hundred and twenty five thousand dollars ($925,000) upon completion of construction, and two hundred thirty one thousand, two hundred and fifty dollars ($231,250) each year for four years thereafter. Any reimbursement amount exceeding these estimations will be paid to County in full. Contractor will provide and prepare any necessary paperwork to submit to Southern California Edison or similar to seek reimbursement under these programs. Any changes to the SCE programs anticipated to be used must be approved by the County before being implemented.

19. Subsections B and C of Section 13.2 "Contractor Security and Bonds" are amended and replaced in their entirety as follows:

Section 13.2 Contractor Security and Bonds

B. Construction Performance Bond

Contractor and/or its Primary Subcontractors shall provide one or more performance bond(s), or other surety device as may be reasonably required by the County in the aggregate amount of one hundred fifteen million seventy one thousand dollars ($115,071,000), the estimated full cost of Construction of the Project of one hundred seventeen million five hundred eighty three thousand dollars ($117,583,000) exclusive of the costs of the SoCal Edison Interconnection, Construction & Start-up Insurance, Start-up & Acceptance and Contract Administration (i.e., $2,512,000 in the aggregate), securing the Construction of the Project, including ensuring that the Primary Subcontractors receive full payment for services provided, and in a form acceptable to the County as co-beneficiary. Such bond shall be in standard AIA form, and shall be issued by a surety company or companies rated "A" or better pursuant to current AM. Best Company ratings and listed in the United States Treasury Department's Circular 570. Such surety shall be an admitted surety in California. Contractor may discontinue maintaining this performance bond upon written County

approval, which shall be provided within ten (10) Week Days of issuance of the Notice to Proceed with Full Operations as provided in section 4.9.B.

C. Operations Bond

Contractor and/or its Primary Subcontractors shall provide one or more performance bond(s), letters of credit or other surety device as may be reasonably required by the County in the aggregate amount of thirteen million five hundred ninety three thousand four hundred and twenty four dollars ($13,593,424), the estimated full cost of annual Operations and Maintenance of the Project for the first year of Operations, to secure the Operations and Maintenance of the Project, including ensuring that the Primary Subcontractors receive full payment for services provided, and in a form acceptable to the County as co-beneficiary. Such bond shall be in standard AIA form, and shall be issued by a surety company or companies rated "A" or better per current AM. Best Company ratings and listed in the United States Treasury Department's Circular 570. Such surety shall be an admitted surety in California. Such bond shall be in force as of the Full Operations Date, will be modified as necessary to reflect updated annual cost information as of the Full Operations Date as provided in section 4.9.B, and must remain in force through the Term. As part of the Annual Settlement Process specified in section 10.9, the value of the of the bond will be annually adjusted by CPI-U, or may be modified up or down to reflect changes of greater than ten (10) percent in annual O&M costs.

20. Contractor hereby acknowledges that upon Financial Close, the adjustments included in the amendments to subsections A, C and D of Section 10.2 and the amendments to subsection A of Section 10.3 as set forth above in this Second Amendment address all costs and compensation due to Contractor arising from the relocation and redesign of certain facilities in relation to the Coastal Zone boundary and revisions to the Amended Project Development Schedule, attached hereto as Amended Exhibit C. Upon Financial Close and payment of the amounts stated in the preceding sentence, Contractor relinquishes any additional claims for extra compensation arising out of the need to relocate and redesign certain facilities in relation to the Coastal Zone boundary

21. Exhibit C: "Project Development Schedule," is replaced in its entirety with the attached **"Amended Exhibit C - Amended Project Development Schedule," Attachment A.**

22. Exhibit E: "Project Design and Construction," is amended to include the attached, **"Addendum to Exhibit E - Project Design and Construction and Exhibit J Contractor's Proposal, "Attachment B.**

23. Exhibit H: "Contractor's Final Pro Forma," is replaced in its entirety with the attached, **"Amended Exhibit H - Amended Contractor's Final Pro Forma," Attachment C.**

24. Exhibit I: "Development Cost Detail," is replaced in its entirety with the attached, **"Amended Exhibit I - Amended Development Cost Detail," Attachment D.**

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25. Exhibit J: "Contractor's Proposal," is amended to include the attached, **"Addendum to Exhibit E - Project Design and Construction and Exhibit J - Contractor's Proposal," Attachment B.**

26. Exhibit K: "Secretary's Certificate" is replaced in its entirety with the attached, "**Exhibit K Secretary's Certificate," Attachment E.**

27. Exhibit L: "Project Permits" is replaced in its entirety with the attached, "**Amended Exhibit L - Amended Project Permits," Attachment F.**

28. Except as set forth in this Second Amendment, the Contract (the Amended Contract dated 11/15/16, and the First Amendment dated 02/14/17) is unaffected and shall continue in full force and effect in accordance with its terms. If there is conflict between this Second Amendment and the Contract, the terms of this Second Amendment will prevail.

IN WITNESS WHEREOF, the parties have executed this Second Amendment to Contract to be effective on the date executed by the COUNTY.

ATTEST:
Mona Miyasato
County Executive Officer
Clerk of the Board

By:_____
Deputy Clerk

COUNTY OF SANTA BARBARA:

By:_____
Joan Hartmann, Chair,
Board of Supervisors

Date:_____

RECOMMENDED FOR APPROVAL:
Santa Barbara County Public Works Department

By:_____
Scott D. McGolpin Department
Head, Public Works Director

CONTRACTOR
MSB INVESTORS, LLC

By:_____
Authorized Representative
Name: John Dewey Member
Title: CEO & Managing

APPROVED AS TO FORM:
Michael C. Ghizzoni
County Counsel

By: _____
Deputy County Counsel

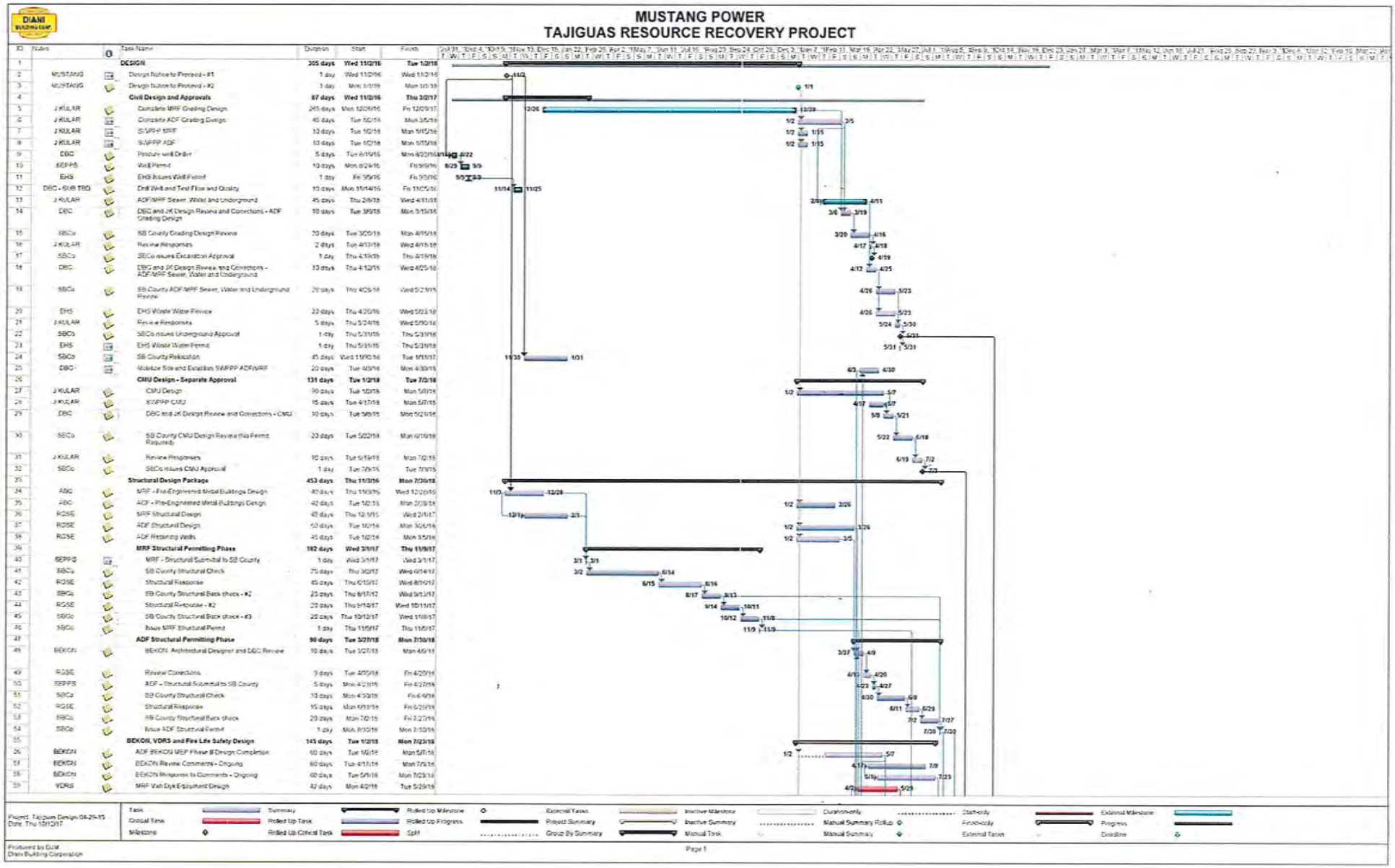
APPROVED AS TO ACCOUNTING FORM:
Theodore A. Fallati, CPA
Auditor-Controller

By: _____
Deputy

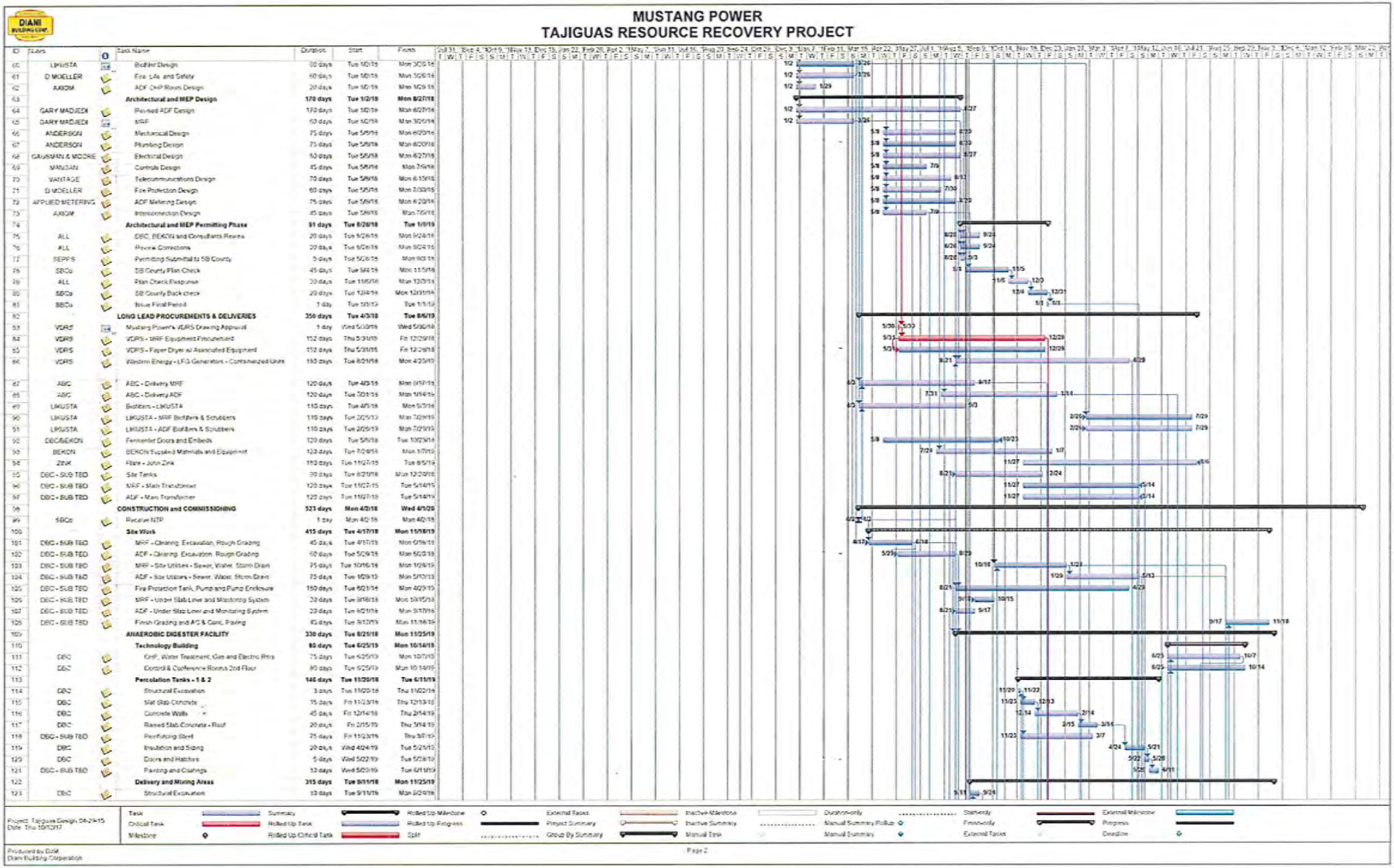
APPROVED AS TO FORM:
Risk Management

By: _____
Risk Management

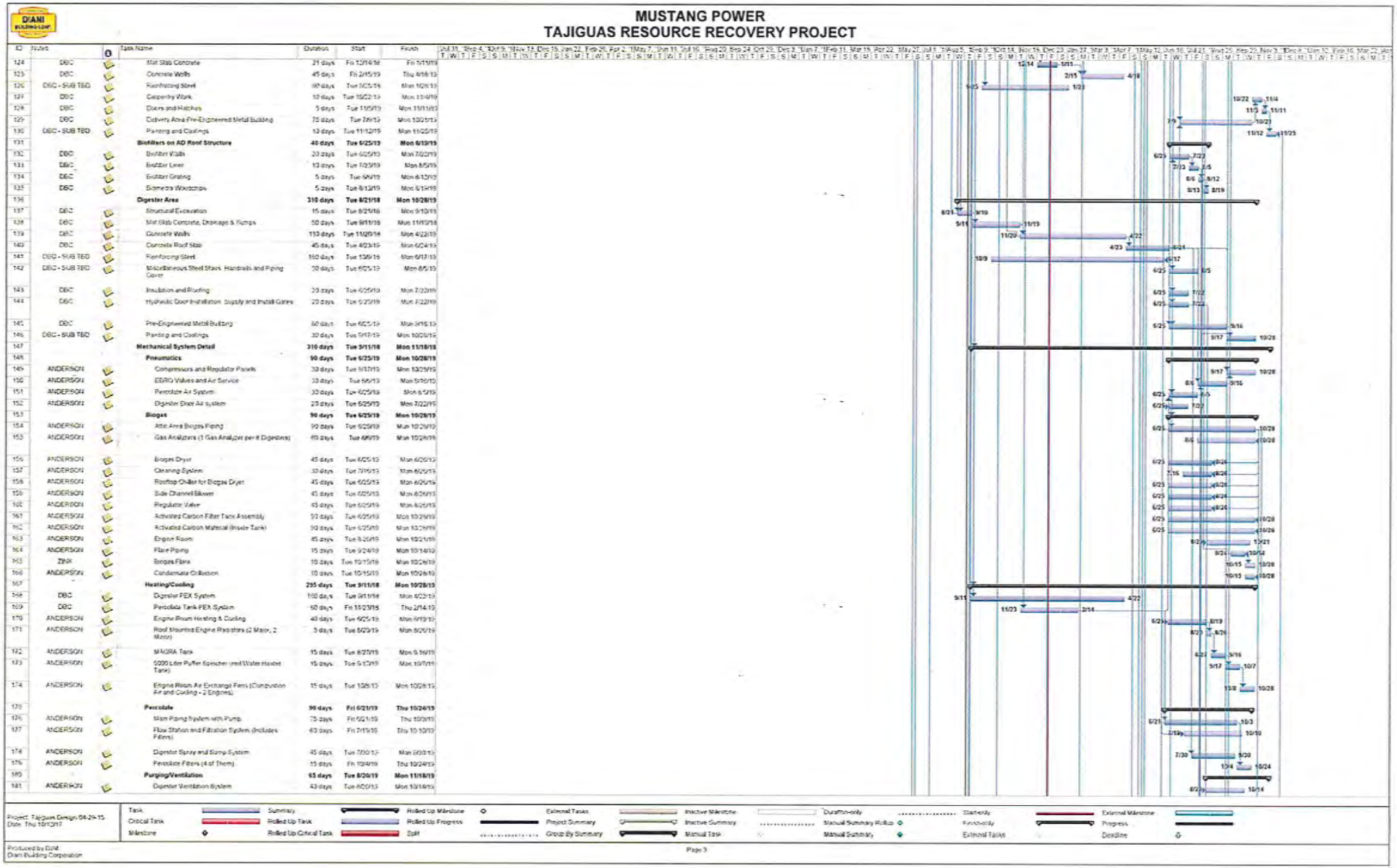
AMENDED EXHIBIT C - AMENDED PROJECT DEVELOPMENT SCHEDULE



AMENDED EXHIBIT C - AMENDED PROJECT DEVELOPMENT SCHEDULE



AMENDED EXHIBIT C - AMENDED PROJECT DEVELOPMENT SCHEDULE



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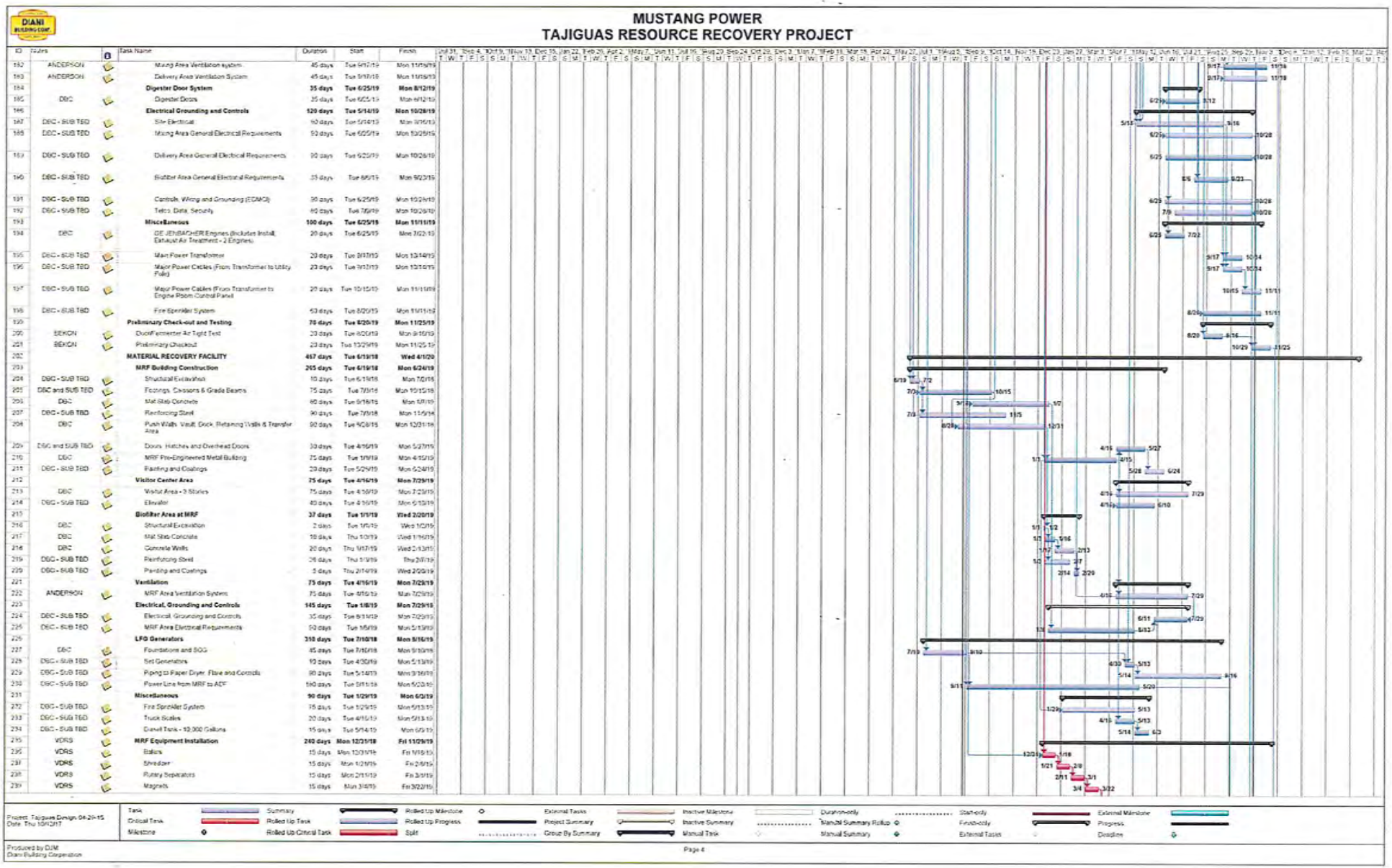
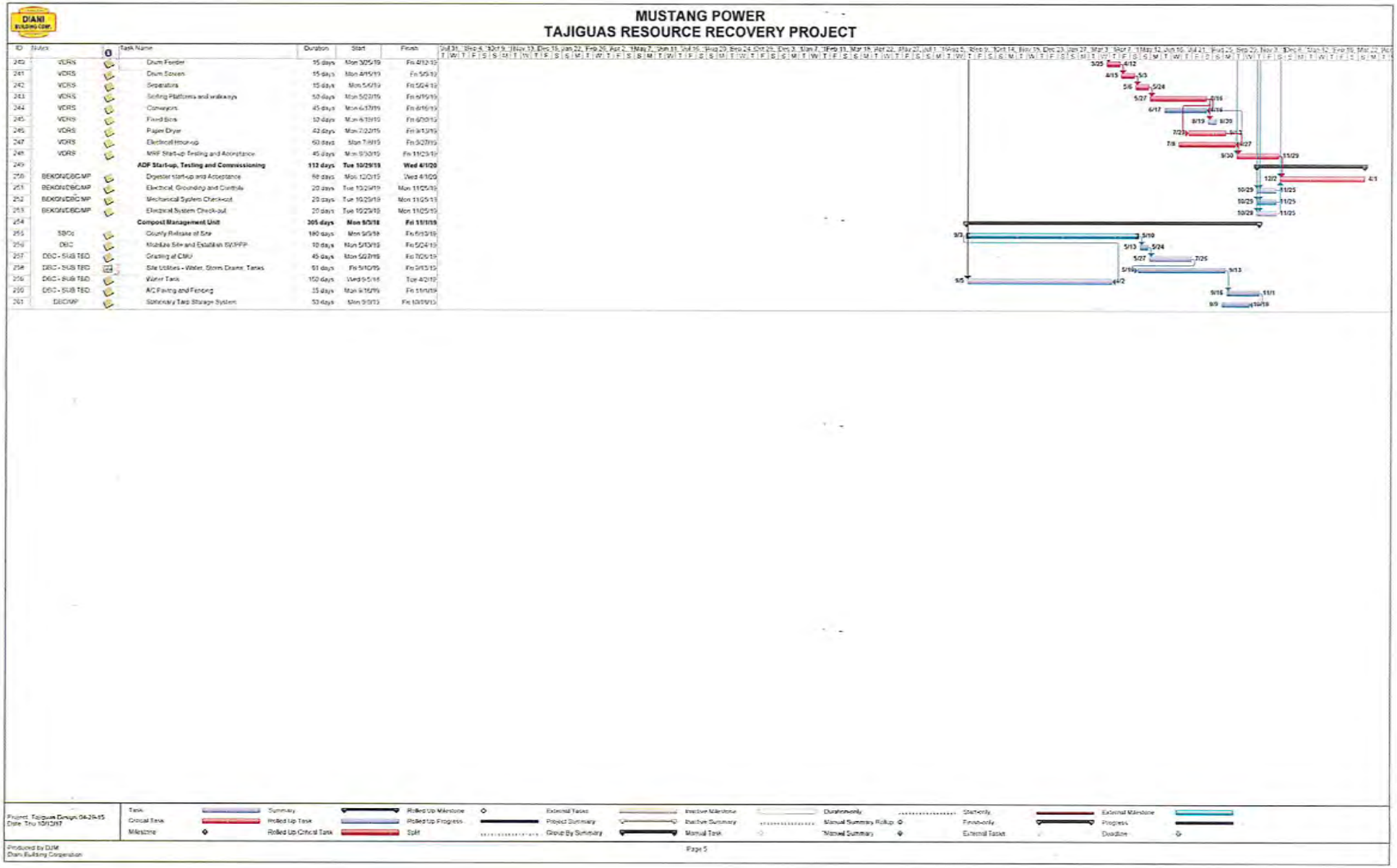


AMENDED EXHIBIT C - AMENDED PROJECT DEVELOPMENT SCHEDULE



ADDENDUM to Exhibit E - Project Design and Construction and Exhibit J - Contractor's Proposal

Relocation of Anaerobic Digester

A map showing a general overview of the proposed TRRP changes is provided in Figure 1, including the Revised TRRP construction disturbance area associated with the relocation of the AD Facility, and the revised Waste Disposal Facility Overlay boundary. Figures 2 through 10 provide site plans and elevation drawings of the revised MRF, AD Facility and Composting Area.

Relocation of the AD Facility has required changes to its design to suit the revised location and modifications to the MRF and ancillary facilities affected by physically separating the MRF and AD Facility. With the proposed Waste Disposal Facility Overlay boundary change, all of the TRRP facilities would be located within the Waste Disposal Facility Overlay.

Table 1. Summary of TRRP Changes

Component	Tajiguas Resource Recovery Project as described in the Certified Final SEIR	Revised TRRP
General		
Amendment to the Waste Disposal Facility Overlay	Not proposed.	Amendment to 1) reduce the net area within the Waste Disposal Facility Overlay by 51.07 acres and 2) extend the Waste Disposal Facility Overlay to encompass the revised location of the AD Facility
Construction Disturbance Area (acres)	23.9 (22.5 previously disturbed by Landfill activities)	27.6 (25.1 previously disturbed by Landfill activities)
TRRP Earthwork (with 15% compaction)	142,600 cubic yards of cut, 102,765 cubic yards of fill	31,420 cubic yards of cut (8,000 for the MRF, 23,420 for the ADF) 103,100 cubic yards of fill (46,970 for the MRF, 56,130 for the ADF)
MRF and AD Facility combined building area	130,100 square feet	135,050 square feet
Parking spaces	72, bus parking area	62, bus parking area
Electrical balance (MW-hours/year)	14,905 generated by solar panels and AD Facility CHP engines, 6,595 consumed, 8,301 net produced	16,571 generated by solar panels and AD Facility CHP engines, 9,616 consumed, 6955 net produced
MRF		
Location	Within the Landfill Solid Waste Facility Permit Operational area on the Operations deck (APN 081-150-019)	No change
Site area (acres)	~6 (combined MRF and AD Facility area)	5.8 (MRF only)
Building area (square feet)	66,500	No change
Maximum building height (feet)	51.3	No change
Building skylights	Included	Deleted
Bio-filters (odor control)	Two – 6,300 sf at ground level and 4,200 sf on	Two – 6,600 sf and 4,620 sf located at ground level

Component	Tajiguas Resource Recovery Project as described in the Certified Final SEIR	Revised TRRP
	the AD Facility Roof	
Rolling bed (paper) dryer	Included, using waste heat from the Energy Facility adjacent to the AD Facility	Included, using waste heat from the replacement LFG Control System engines adjacent to the MRF
Treated water tank	6,500 gallons	Deleted
AD Facility		
Location	Within the Landfill Solid Waste Facility Permit Operational area on the operations deck (APN 081-150-019)	Within the Landfill Solid Waste Facility Permit Operational area east of the Composting Area. (APN 081-150-019, APN 081-150-026 and APN 081-150-032)
Site area (acres)	~6 (combined MRF and AD Facility area)	3.9 (AD Facility only)
Building area (square feet)	63,600	68,550
Maximum building height (feet)	37.0	No change
Building skylights	Included	Deleted
Bio-filters	Two roof-top – 4,200 sf each	Two at grade – 4,320 sf each
Energy Facility	2,900 sf building adjacent to the ADF, housing two 1,573 BHP CHP engines, with flare extending 62 feet above the MRF/AD Facility floor elevation (394 feet above mean sea level [msl])	1,900 sf building adjacent to the ADF, housing two 1,573 BHP CHP engines, with flare extending 54 feet above the flare pad finished grade (590 feet above msl), and 39 feet above the AD Facility finished floor elevation (605 feet above msl)
Organic waste conveyor to ADF	Included	Deleted (organic waste would be transported by truck replacing truck trips that were proposed to transport digestate from the ADF to the Composting Area under the approved TRRP)
Digestate conveyor to Composting Area	Not proposed (digestate transported by truck)	Included, ~110 feet long (truck trips associated with digestate transport under the approved TRRP would transport organic waste recovered by the MRF instead)
Mobile equipment (includes Composting Area)	One scrubber-sweeper, two wheeled loaders, post AD screening, trommel screen, plastic film sorter, windrow turner, tub grinder	Two scrubber-sweepers, two wheeled loaders, post AD screening, trommel screen, plastic film sorter, windrow turner, tub grinder
Other Components		
Fire water tank (northwest of the MRF) capacity (gallons)	220,000 (33.5 feet in diameter, 33 feet tall)	256,000 (36 feet in diameter, 33 feet tall)
Composting Area Runoff Collection Tank	325,000 gallons (50 feet in diameter, 24 feet tall), located 1,500 feet north of the Composting Area	436,000 gallons (42 feet in diameter, 42 feet tall), located 700 feet north of the Composting Area (formerly the planned location of the Landfill maintenance building)
Fire water tank near Composting Area	Not proposed	256,000 gallons (36 feet in diameter, 33 feet tall), located adjacent to the Composting Area Runoff Collection Tank
Relocated Landfill maintenance facility	650 feet north of the Composting Area, outside the buried waste footprint	Located on the operations deck, immediately east of the MRF site and outside the buried waste footprint
Above-ground power line between the MRF and AD Facility sites	Not proposed	Included (approximately 2,550 linear feet of power line and support poles)

EARTHWORK

As noted in Table 1, the volume of earthwork completed as part of construction of the Revised TRRP would be substantially less than the amount identified and analyzed in the certified Final SEIR. The decrease in the total cut volume (a reduction of approximately 111,180 cubic yards) is associated with planned Landfill operations through 2017 that will have substantially reduced the required amount of excavation needed in the West Borrow Area where the MRF would be located. Borrow soil from this area has and will continue to be used for ongoing Landfill cover activities.

BUILDING AREA

The total building area will increase by approximately 5,000 sf. The increase is due to a change in AD Facility design. In the revised location, the concrete digester bunkers will run along one side of the AD Facility Mixing Hall rather than both sides resulting a minor increase in the building area.

PARKING SPACES

Design changes associated with the Revised TRRP would reduce the number of parking spaces from 72 to 62. Based on anticipated staffing the maximum number of staff expected to be on-site is 59. An employee vanpool was included as part of the approved TRRP, and is anticipated to achieve an equivalent average vehicle occupancy of 2.5 for workers and 1.6 for administrative staff. Therefore, 26 parking spaces are required for TRRP staff (52 workers/2.5 + 7 administrative staff/1.6).

The approved TRRP would also provide parking for Landfill operations staff, which includes 14 full-time employees and two contract employees, which is reduced as compared to current Landfill operations. Overall, the Revised TRRP would provide 62 parking spaces, which is adequate for both TRRP staff (26 spaces) and Landfill operations staff (16 spaces).

MRF TREATED WATER TANK

The 6,500 gallon treated water tank previously proposed to be located adjacent to the MRF will not be constructed. The purpose of this tank was to provide storage of chlorinated water for domestic purposes following treatment of groundwater at the approved water treatment facility. Instead, all water used for fire protection, process, and domestic purposes will be chlorinated by the water treatment facility (see keynote 3 on Figure 3) prior to entering the water storage tank located northwest of the MRF (see component 2 on Figure 2). This design change has eliminated the need for a treated water tank. Chlorination of groundwater is a component of the approved TRRP and would continue to be conducted under the Revised TRRP.

FIRE WATER STORAGE TANKS

Relocation of the AD Facility requires construction of an additional fire protection water storage tank on the east side of the Landfill (Keynote 8 on Figure 2) to meet County Fire Department requirements for fire protection (fire protection to both the MRF and AD Facility was previously provided by the single storage tank northwest of the MRF). The additional tank to serve the relocated AD Facility will be located on the pad that was proposed for the Landfill maintenance facility and the Landfill maintenance building will be located on the operations

deck, immediately east of the MRF site and outside the buried waste footprint. The tank will be 36 feet in diameter and 33 feet tall (256,000 gallons).

The fire water storage tank serving the MRF will also be increased in size from 220,000 gallons (33.5 feet in diameter, 33 feet tall) to 256,000 (36 feet in diameter, 33 feet tall). The increase in volume is due to the need to provide additional freeboard within the tank to address American Water Works Association seismic standards.

COMPOSTING AREA RUNOFF COLLECTION TANK

The composting runoff collection tank which was previously proposed to be located on a pad at 690 feet above msl will be relocated to the approved location of the Landfill maintenance building at 630 feet above msl, adjacent to the AD Facility fire water storage tank discussed in Section 4.6 (Keynote 7 on Figure 2). The tank will be increased in volume from 325,000 gallons (50 feet in diameter, 24 feet tall), located 1,500 feet north of the composting area to 436,000 gallons (42 feet in diameter, 42 feet tall), located 700 feet north of the Composting Area. Similar to the fire water storage tanks, the increase in volume is required to address updated seismic standards.

ABOVE-GROUND POWER LINE

Under the approved project, a combination of energy generated from combustion of bio-gas in the AD Energy Facility, roof-mounted solar panels and the regional power grid was proposed to power the MRF. The energy sources would remain the same with the Revised TRRP. With the relocation of the AD Facility to the eastern side of the Landfill, a new power line (see Figure 2) is required to connect the two facilities so a portion of the AD Facility-generated power not delivered to the grid may reduce the MRF's reliance on the grid during peak periods, and serve as a backup energy source if grid power is interrupted.

Existing power lines run along the eastern and western boundary of the Landfill. Use of these existing poles is planned; however, SCE is responsible for construction of the power lines and determining whether the existing poles and/or pole locations will be maintained or replaced in association with the execution of an interconnection agreement and completion of a field survey. It is anticipated that the existing poles/pole locations will be used.

LANDFILL FACILITY CHANGES

Implementation of the approved TRRP included changes in Landfill facilities including relocation of Landfill operations trailers, fuel tanks and material storage, construction of a new water tank, and relocation of the Landfill maintenance facility. As identified in Table 1, the Landfill maintenance facility was analyzed and approved for relocation to an area east of the Landfill top deck. Under the Revised TRRP, the maintenance facility would be relocated to the area of the operations deck northeast of the MRF (see Figure 3).

Continued operation of the Tajiguas Landfill (including its required environmental control systems), was previously identified as a part of the TRRP. The existing LFG Control System, constructed in 1999 is located at the southern end of the Landfill within the Coastal Zone and operates under Conditional Use Permit (95-CP-046) and Coastal Development Permit (95-CDP-118). The permitted system includes a LFG collection system connected to an electrical power plant (Caterpillar engine) and gas-burning flare and related facilities (e.g., blower, metal

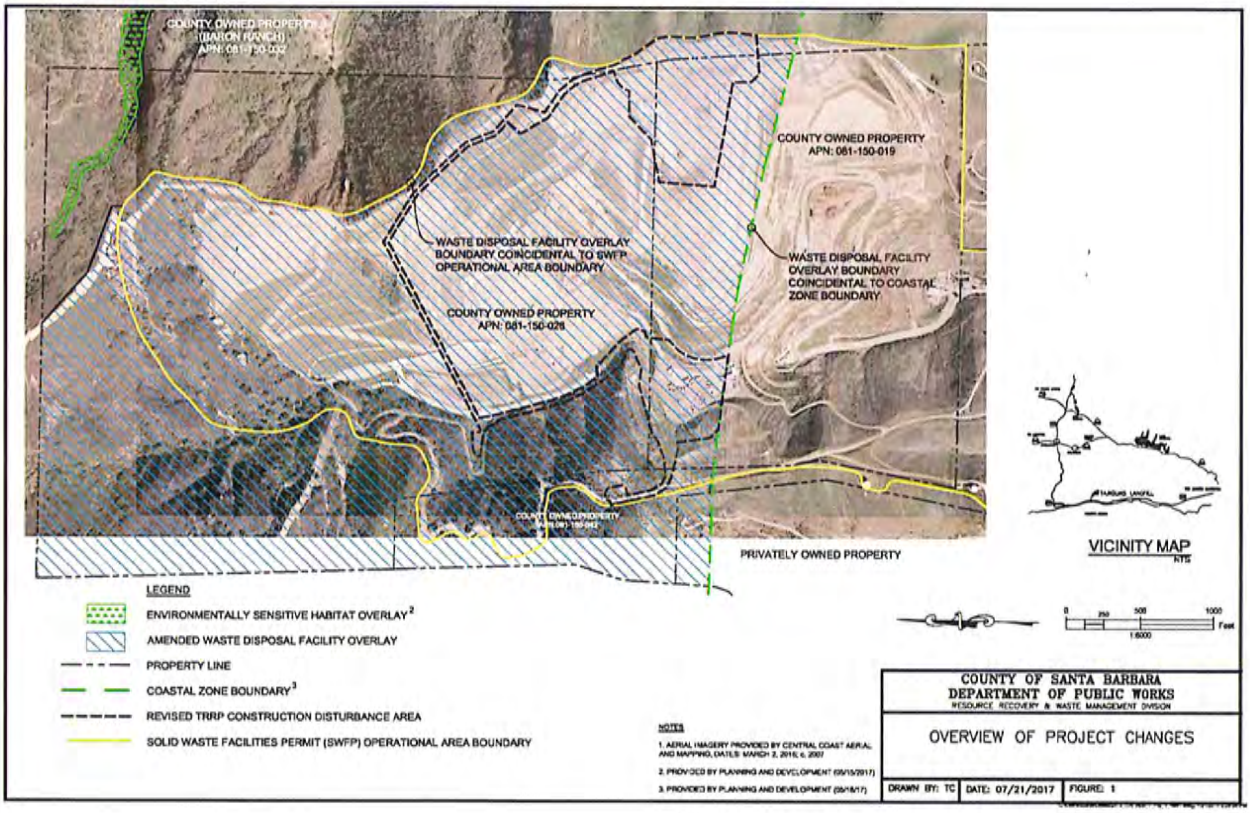
building, radiators, gas cooling system, transformer and transmission lines connection to the regional power grid).

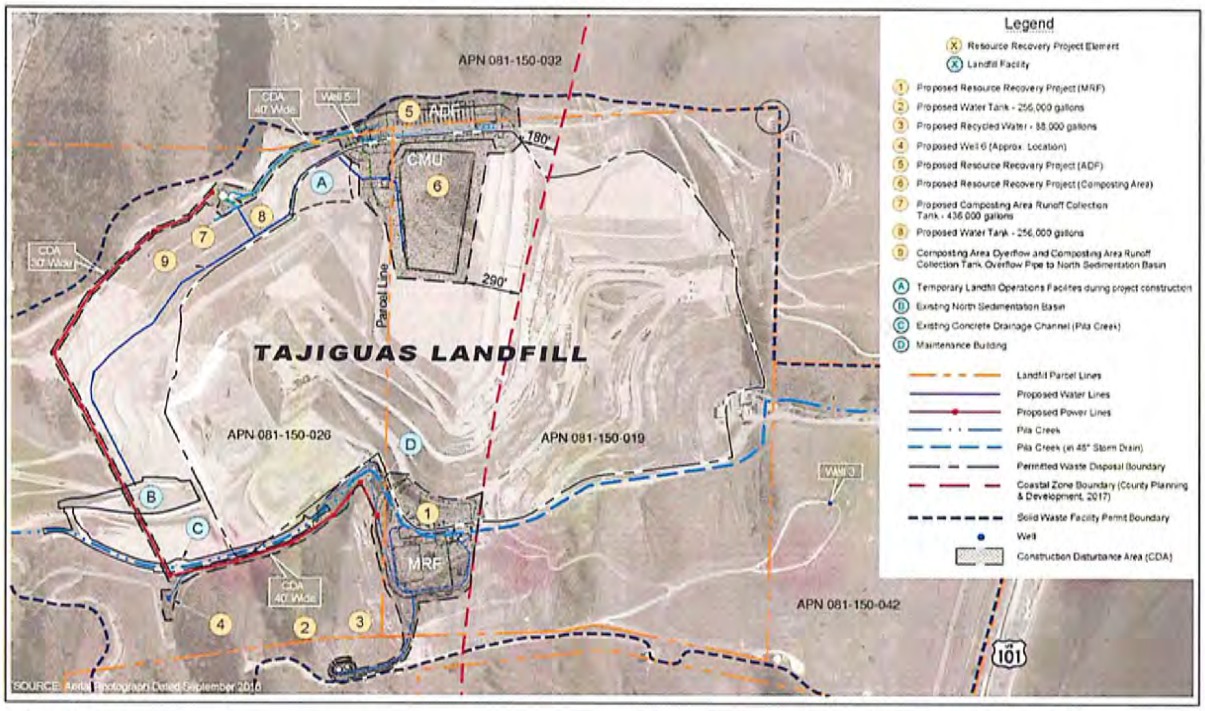
The Revised TRRP includes decommissioning some of the existing LFG Control System in place (engine and flare) and installing new GE Jenbacher engines (or equivalent) to provide up to 2.8 megawatts of electricity, one John Zink ZTOF-type enclosed flare (or equivalent) and one switchgear/transformer on the operations deck just south of the MRF building, outside of the Coastal Zone (see Keynotes 4 and 16 on Figure 3). The new engines and flare would be connected to the existing LFG collection network of wells and pipelines adjacent to their location consistent with on-going LFG collection system deployment for Landfill operations, and would be connected to the existing electrical distribution network. The power transmission lines serving the MRF would also serve the new engines and supporting equipment.

The new engines would each be housed in a 756 square foot container with noise attenuating features, and provided with engine exhaust silencers and acoustical gaskets on the doors. The engines would be provided with APCD-required control systems (selective catalytic reduction, SCR) to reduce oxides of nitrogen (NO_x) emissions. The new flare would be six feet in diameter and 50 feet in height, and located on a concrete pad. The switchgear and transformers would also be located on a concrete pad. Up to 2.8 megawatts of electricity would be produced by the facility and excess power would be distributed to the regional power grid.

The engine exhaust would be blended with ambient air to produce hot air, and ducted to the approved MRF rolling bed dryer to dry paper. Exhaust air from the rolling bed dryer would be ducted to a baghouse to filter particulate matter originating from both the engine exhaust and the paper dried in the rolling bed dryer. Under the approved TRRP, the AD Facility CHP engines were to be used to provide waste heat (exhaust) for the rolling bed dryer.

Like the existing permitted LFG Control System, the updated LFG Control System would be operated by Landfill staff in compliance with Title 27 Section 20921 of the California Code of Regulations and would operate 24 hours per day. Periodic maintenance and inspections would be performed on all of the equipment and a continuous operating and emissions monitoring system would be installed to and inform all pertinent personnel in the case of operational failure.


COUNTY OWNED PROPERTY
(BARON RANCH)
APN: 081-150-022
COUNTY OWNED PROPERTY
APN: 081-150-019
WASTE DISPOSAL FACILITY OVERLAY BOUNDARY COINCIDENTAL TO SWFP OPERATIONAL AREA BOUNDARY
WASTE DISPOSAL FACILITY OVERLAY BOUNDARY COINCIDENTAL TO COASTAL ZONE BOUNDARY
COUNTY OWNED PROPERTY
APN: 081-150-026
PRIVATELY OWNED PROPERTY
VICINITY MAP
NTS
LEGEND
ENVIRONMENTALLY SENSITIVE HABITAT OVERLAY[2]
AMENDED WASTE DISPOSAL FACILITY OVERLAY
PROPERTY LINE
COASTAL ZONE BOUNDARY[3]
REVISED TRRP CONSTRUCTION DISTURBANCE AREA
SOLID WASTE FACILITIES PERMIT (SWFP) OPERATIONAL AREA BOUNDARY
NOTES
1. AERIAL IMAGERY PROVIDED BY CENTRAL COAST AERIAL AND MAPPING, DATES: MARCH 2, 2016, & 2007
2. PROVIDED BY PLANNING AND DEVELOPMENT (05/15/2017)
3. PROVIDED BY PLANNING AND DEVELOPMENT (05/16/17)
0 250 500 1000 Feet
1:6000
COUNTY OF SANTA BARBARA
DEPARTMENT OF PUBLIC WORKS
RESOURCE RECOVERY & WASTE MANAGEMENT DIVISION
OVERVIEW OF PROJECT CHANGES
DRAWN BY: TC
DATE: 07/21/2017
FIGURE: 1



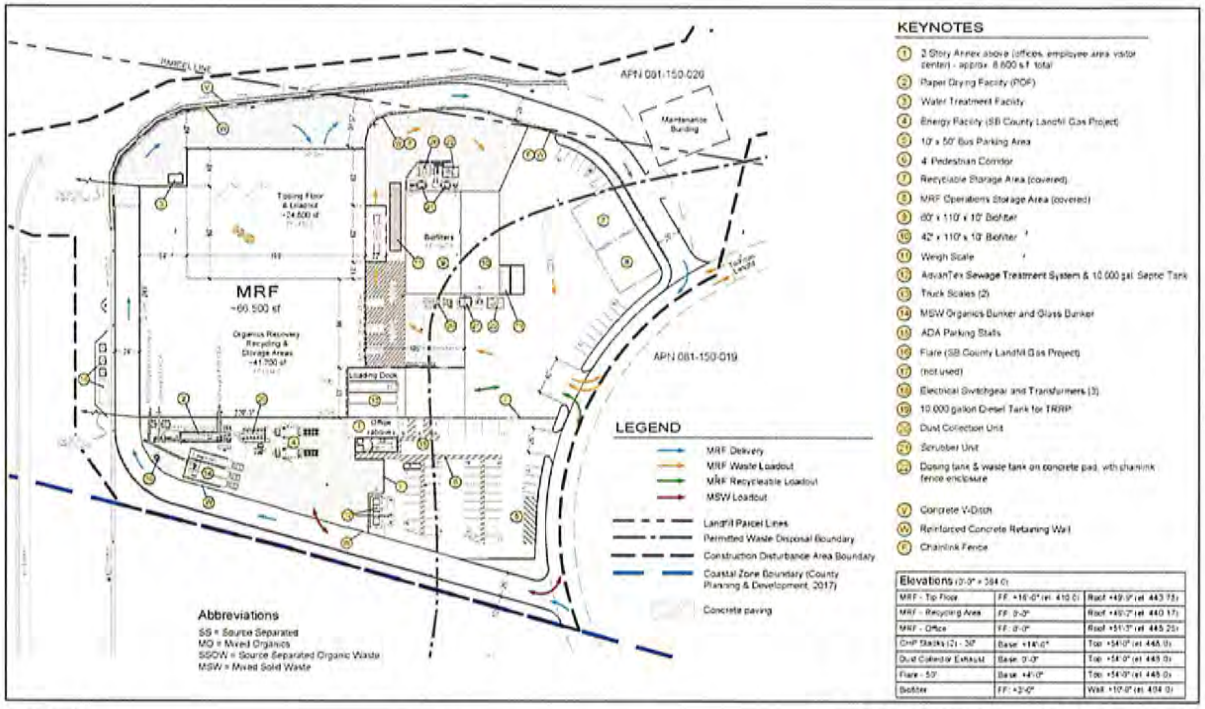
Prepared by:
John Kular Consulting
12107 Bedfordshire Drive, Bakersfield, CA 93311
661-302-1292 kularconsult.com

SCALE (FEET)
0 400' 800'

Tajiguas Resource Recovery Project

REVISED PROJECT FACILITIES PLAN

FIGURE 2

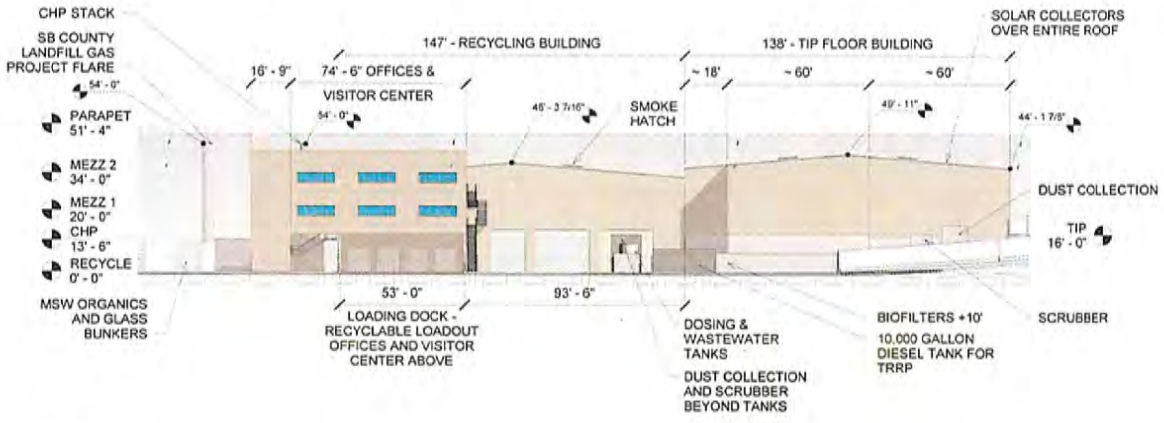


Prepared by
John Kular Consulting
62107 Bedfordshire Drive, Bakersfield, CA 93311
661-302-1292 kularconsult.com

SCALE (FEET)
0 80' 160'

Tajiguas Resource Recovery Project

REVISED MRF SITE PLAN
FIGURE 3



1 EAST
1/32" = 1'-0"

DIANI COMPANIES
295 NORTH BLOSSER ROAD
PO BOX 636
SANTA MARIA, CA 93456-0636
(805) 925-9533
FAX (805) 922-3630

GARY W. MADJEDI, ARCHITECT

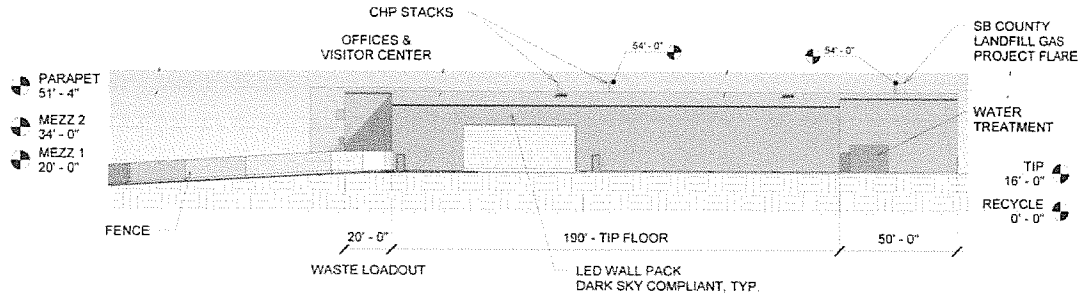
TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED MRF EAST ELEVATION

150201

5/9/2017

FIGURE 4



1 NORTH
1/32" = 1'-0"

DIANI COMPANIES
295 NORTH BLOSSER ROAD
PO BOX 636
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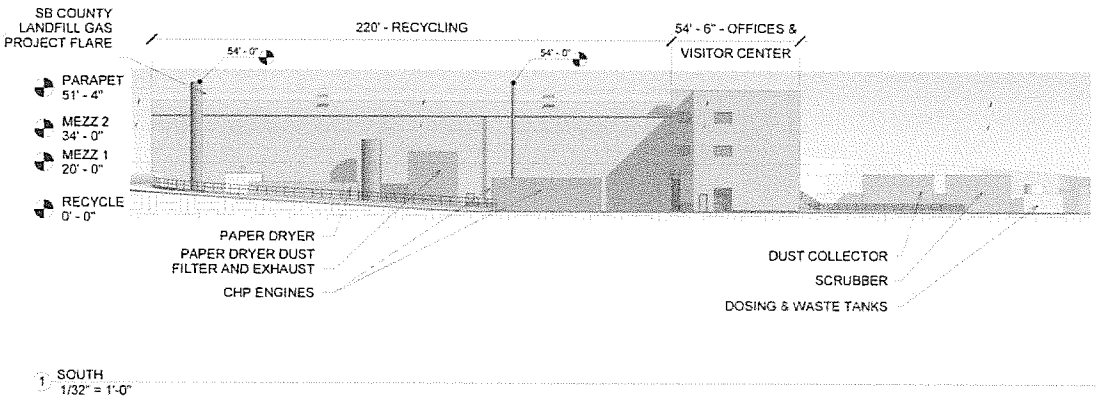
TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED MRF NORTH ELEVATION

150201

5/9/2017

FIGURE 5



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GARY W. MADJEDI, ARCHITECT

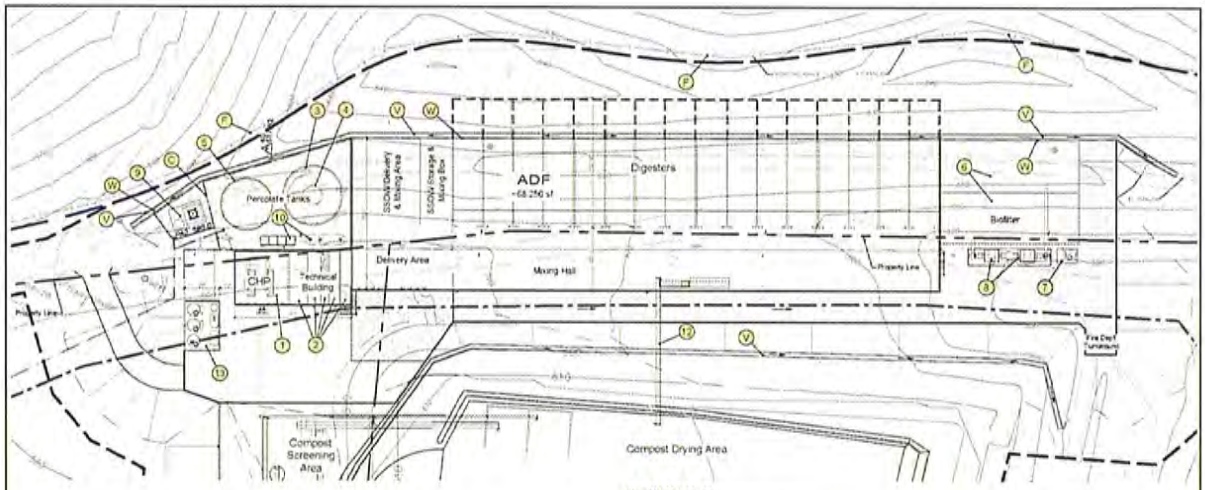
TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED MRF SOUTH ELEVATION

150201

5/9/2017

FIGURE 6



Elevations (0'-0" = 605.0)		
ADF - Delivery Hall	FF: 0'-0"	Roof: +28'-11" (el. 641.9)
ADF - Mixing Area	FF: 0'-0"	Roof: +27'-1" (el. 632.1)
CHP / Technical Bldg	FF: 0'-0"	Roof: +14'-0" (el. 619.0)
CHP Stacks - 24'	Base: +14'-0"	Top: +58'-0" (el. 663.0)
Flare - 50'	Base: +11'-0"	Top: +59'-0" (el. 644.0)
Dual Percolate Tank	Base: 0'-0"	Top: +31'-8" (el. 636.5)
Small Percolate Tank	Base: 0'-0"	Top: +24'-8" (el. 629.5)
Biofilter	FF: +3'-0"	Wall: +10'-0" (el. 615.0)

LEGEND

- Landfill Parcel Lines
- Solid Waste Facility Permit Boundary
- Permitted Waste Disposal Boundary
- Construction Disturbance Area Boundary

KEYNOTES

1. Energy Facility - CHP Engines
2. Technical Building - Gas Cleaning & Electrical Rooms, Lockers & Washrooms, ADF Control Room
3. Large Percolate Tank (300,000 gallons capacity, 46' O.D. x 33' H)
4. Inner Tank (35,700 gallon capacity, 18' O.D. x 31' H)
5. Small Percolate Tank (204,000 gallons capacity, 40' O.D. x 24' H)
6. 42' x 100' x 10' Biofilters (2)
7. Concrete Tank Pad with chainlink fence enclosure - Dosing Tank
8. Scrubber Unit
9. Flare (50' tall) and Scrubber Unit
10. AdvanTex Sewage Treatment System & 10,000 gal. Septic Tank
11. Electrical Transformer (location TBD)
12. Digestate to Compost Drying Area Conveyor
13. Concrete Tank Pad with chainlink fence enclosure - Dosing, Oil, Urea & Glycol Tanks
- V. Concrete V-Ditch
- W. Reinforced Concrete Retaining Wall
- C. Spill Containment Wall
- F. Chainlink Fence

Prepared by:
John Kular Consulting
12107 Bedfordshire Drive, Bakersfield, CA 93311
661-362-1292 kularconsult.com

SCALE (FEET)
0 60' 120'

Tajiguas Resource Recovery Project

REVISED ADF SITE PLAN

FIGURE 7

1 WEST - NORTH END
1/32" = 1'-0"

2 WEST - SOUTH END
1/32" = 1'-0"

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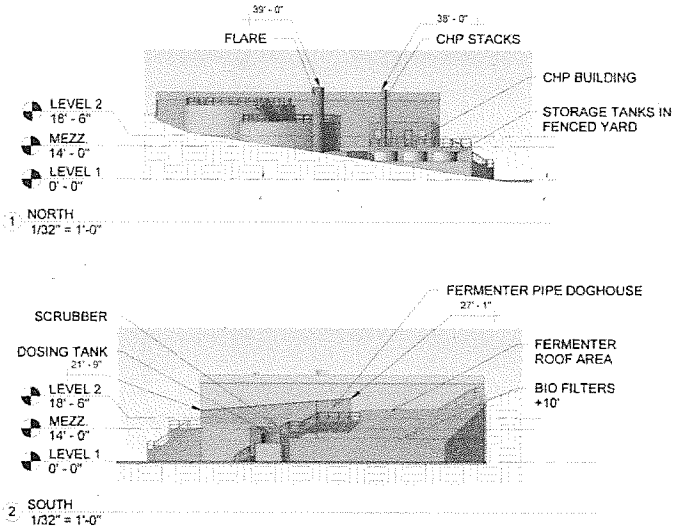
GARY W. MADJEDI, ARCHITECT

TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED AD FACILITY WEST ELEVATION

150201
4/19/17

FIGURE 8



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FAX (805) 922-3620

GARY W. MADJEDI, ARCHITECT

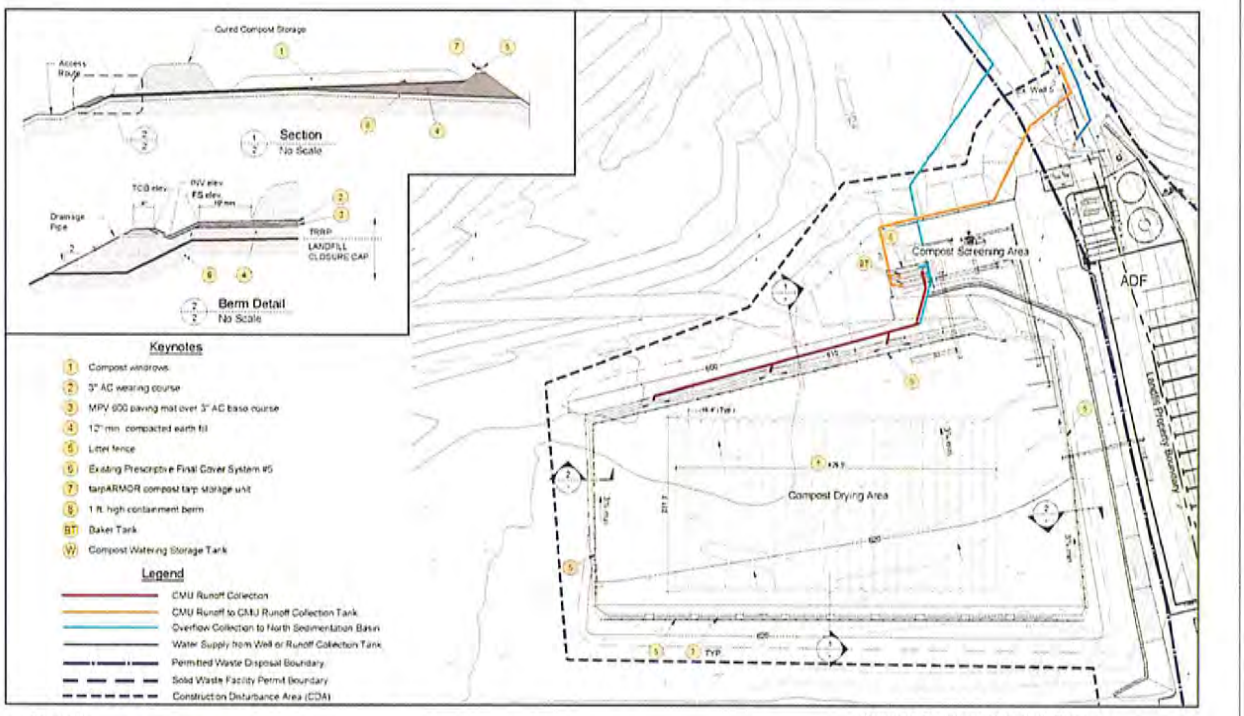
TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED AD FACILITY NORTH AND SOUTH ELEVATIONS

150201

4/19/17

FIGURE 9



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661-302-1292 kularconsult.com

Tajiguas Resource Recovery Project

REVISED COMPOSTING AREA SITE PLAN
FIGURE 10

Landfill Gas Project

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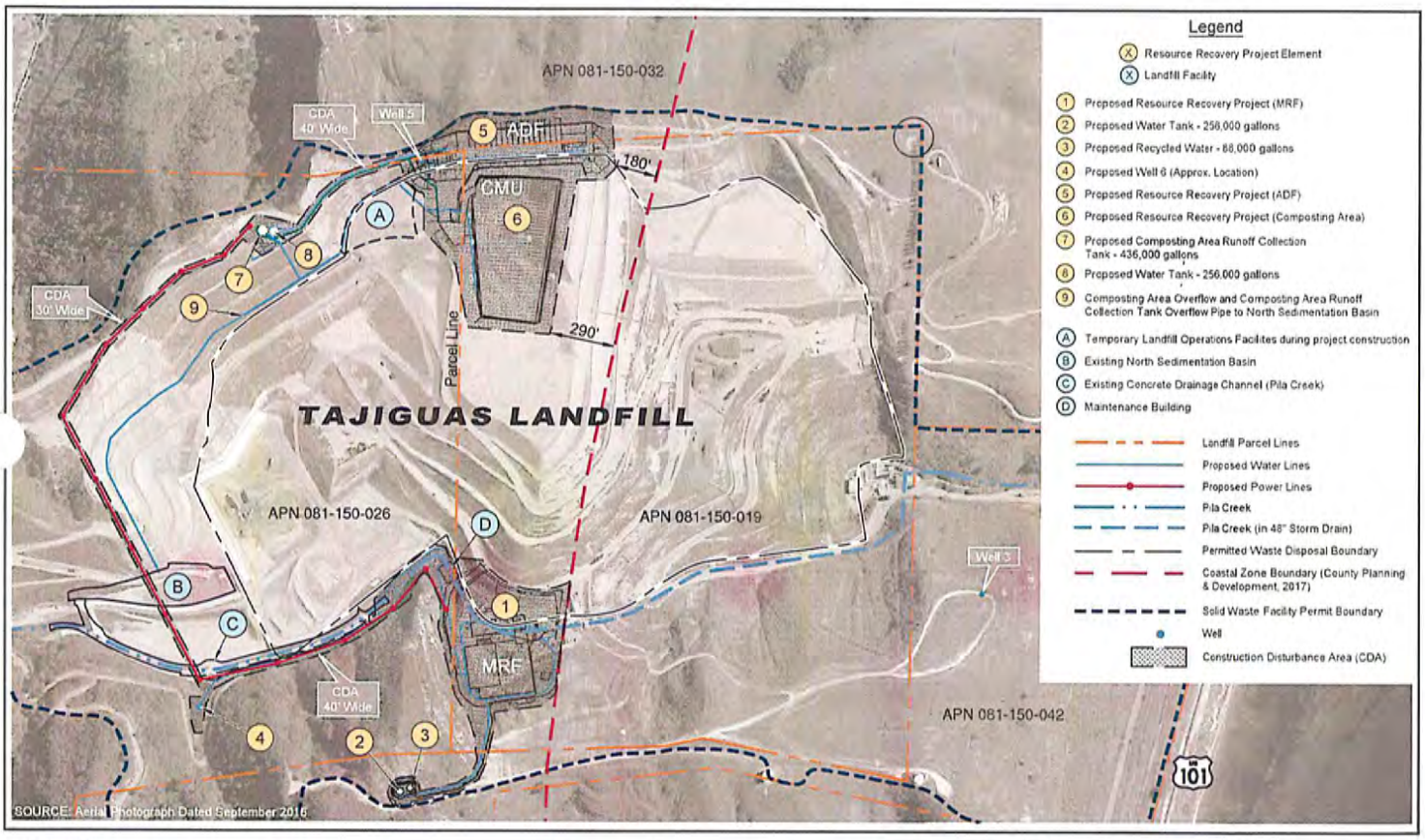

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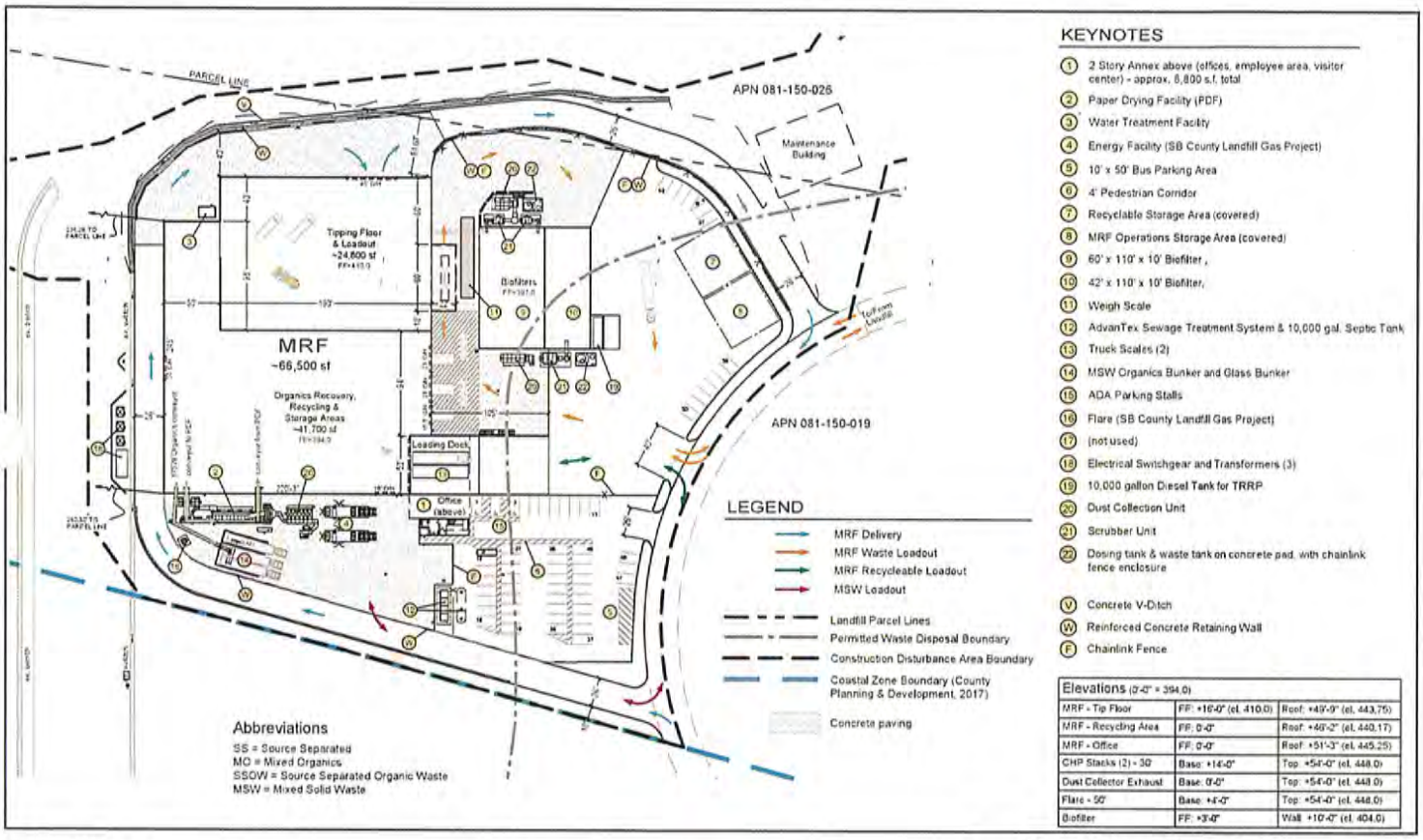
SCALE (FEET)
0 400' 800'

Tajiguas Resource Recovery Project

REVISED PROJECT FACILITIES PLAN

FIGURE 2

10/19/2017



KEYNOTES

1. 2 Story Annex above (offices, employee area, visitor center) - approx. 8,800 s.f. total
2. Paper Drying Facility (PDF)
3. Water Treatment Facility
4. Energy Facility (SB County Landfill Gas Project)
5. 10' x 50' Bus Parking Area
6. 4' Pedestrian Corridor
7. Recyclable Storage Area (covered)
8. MRF Operations Storage Area (covered)
9. 60' x 110' x 10' Biofilter ,
10. 42' x 110' x 10' Biofilter,
11. Weigh Scale
12. AdvanTex Sewage Treatment System & 10,000 gal. Septic Tank
13. Truck Scales (2)
14. MSW Organics Bunker and Glass Bunker
15. ADA Parking Stalls
16. Flare (SB County Landfill Gas Project)
17. (not used)
18. Electrical Switchgear and Transformers (3)
19. 10,000 gallon Diesel Tank for TRRP
20. Dust Collection Unit
21. Scrubber Unit
22. Dosing tank & waste tank on concrete pad, with chainlink fence enclosure

V. Concrete V-Ditch
W. Reinforced Concrete Retaining Wall
F. Chainlink Fence

Elevations (0'-0" = 394.0)		
MRF - Tip Floor	FF: +16'-0" (el. 410.0)	Roof: +49'-9" (el. 443.75)
MRF - Recycling Area	FF: 0'-0"	Roof: +46'-2" (el. 440.17)
MRF - Office	FF: 0'-0"	Roof: +51'-3" (el. 445.25)
CHP Stacks (2) - 30'	Base: +14'-0"	Top: +54'-0" (el. 448.0)
Dust Collector Exhaust	Base: 0'-0"	Top: +54'-0" (el. 448.0)
Flare - 50'	Base: +4'-0"	Top: +54'-0" (el. 448.0)
Biofilter	FF: +3'-0"	Wall: +10'-0" (el. 404.0)

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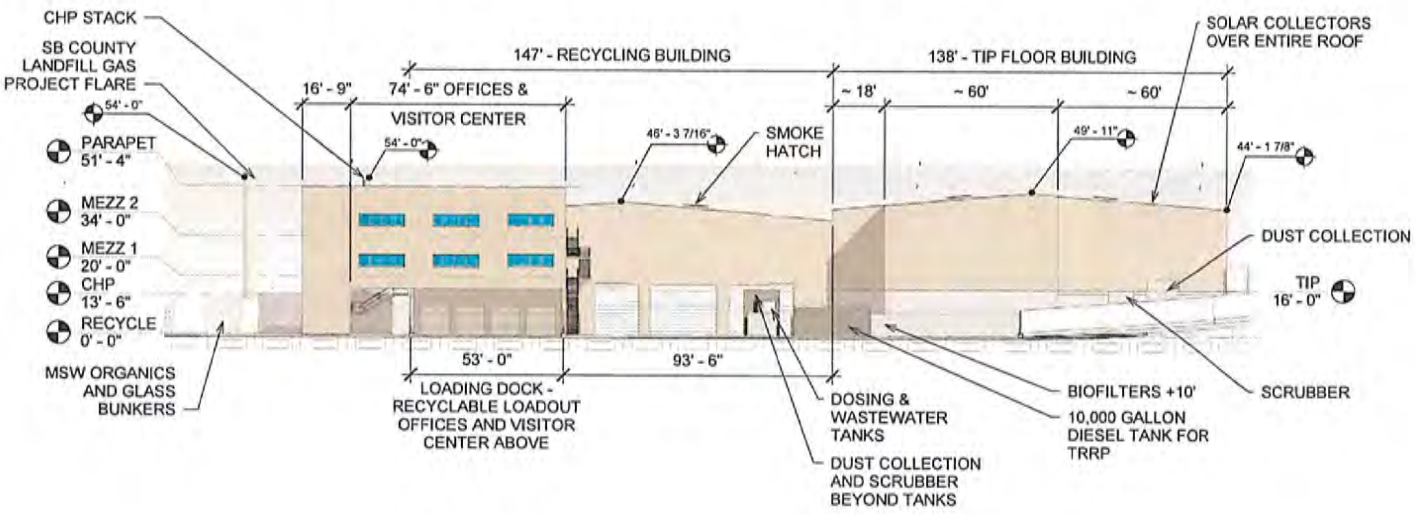
SCALE (FEET)
0 80' 160'

Tajiguas Resource Recovery Project

REVISED MRF SITE PLAN
FIGURE 3

10/19/2017



1 EAST
1/32" = 1'-0"

DIANI COMPANIES
295 NORTH BLOSSER ROAD
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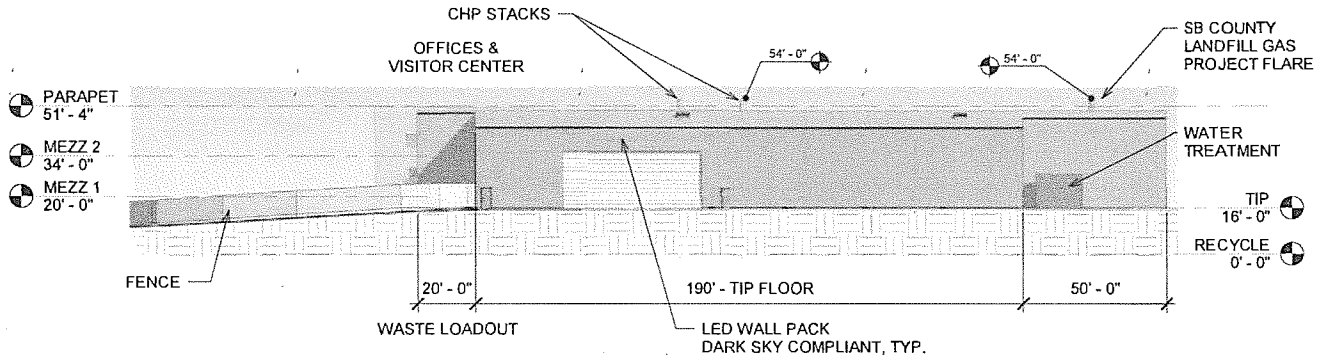
TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED MRF EAST ELEVATION

150201

5/9/2017

FIGURE 4



1 NORTH
1/32" = 1'-0"

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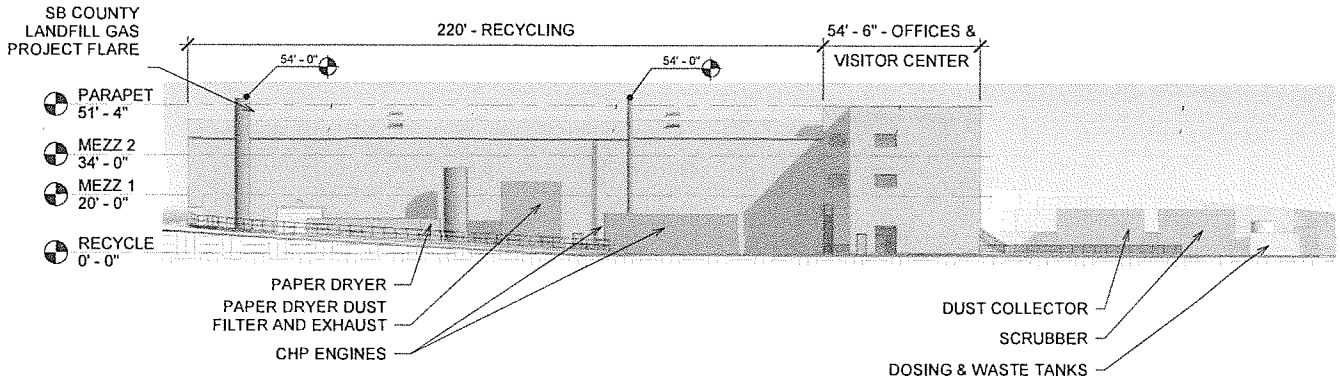
TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED MRF NORTH ELEVATION

150201

5/9/2017

FIGURE 5



1 SOUTH
1/32" = 1'-0"

DIANI COMPANIES
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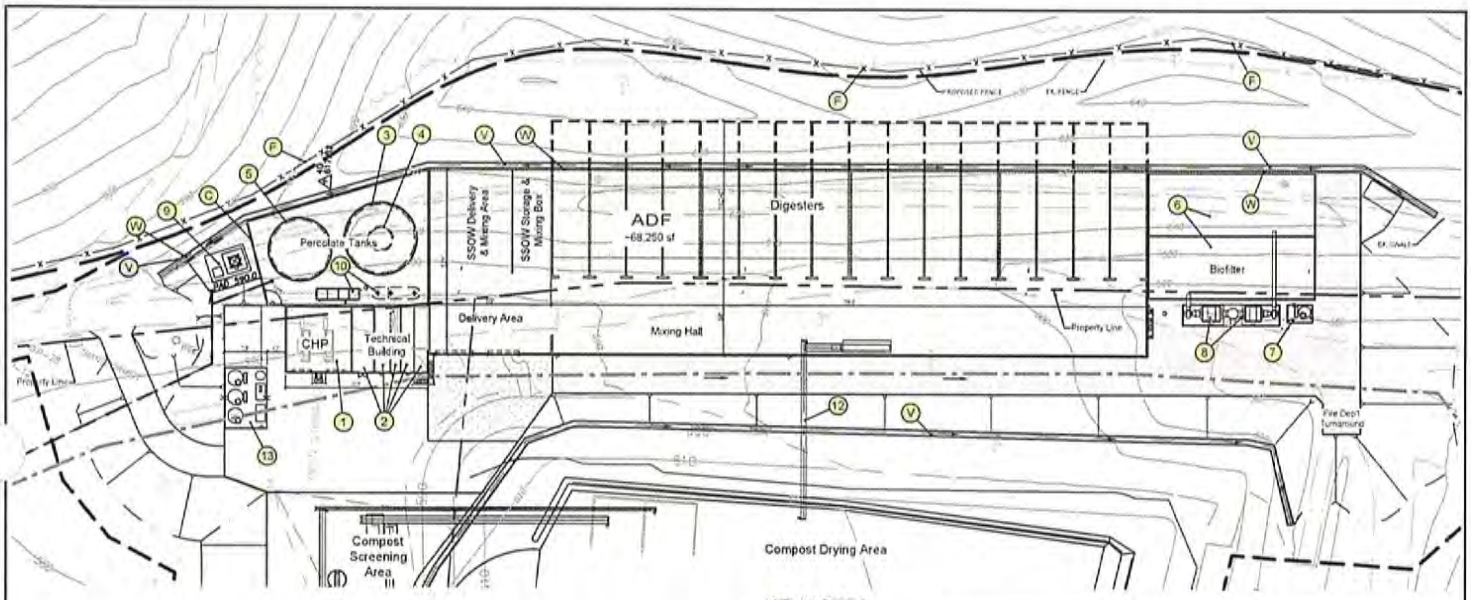
TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED MRF SOUTH ELEVATION

150201
5/9/2017
FIGURE 6



Elevations (0'-0" = 605.0)		
ADF - Delivery Hall	FF: 0'-0"	Roof: +36'-11" (el. 641.9)
ADF - Mixing Area	FF: 0'-0"	Roof: +27'-1" (el. 632.1)
CHP / Technical Bldg.	FF: 0'-0"	Roof: +14'-0" (el. 619.0)
CHP Stacks - 24'	Base: +14'-0"	Top: +38'-0" (el. 643.0)
Flare - 50'	Base: -11'-0"	Top: +39'-0" (el. 644.0)
Dual Percolate Tank	Base: 0'-0"	Top: +31'-0" (el. 636.5)
Small Percolate Tank	Base: 0'-0"	Top: +24'-6" (el. 629.5)
Biofilter	FF: +3'-0"	Wall: +10'-0" (el. 615.0)

LEGEND

- Landfill Parcel Lines
- Solid Waste Facility Permit Boundary
- Permitted Waste Disposal Boundary
- Construction Disturbance Area Boundary

KEYNOTES

1. Energy Facility - CHP Engines
2. Technical Building - Gas Cleaning & Electrical Rooms, Lockers & Washrooms, ADF Control Room
3. Large Percolate Tank (306,000 gallons capacity, 46' O.D. x 33' H)
4. Inner Tank (35,700 gallon capacity, 16' O.D. x 31' H)
5. Small Percolate Tank (204,000 gallons capacity, 40' O.D. x 24' H)
6. 40' x 108' x 10' Biofilters (2)
7. Concrete Tank Pad with chainlink fence enclosure - Dosing Tank
8. Scrubber Unit
9. Flare (50' tall) and Scrubber Unit
10. AdvanTex Sewage Treatment System & 10,000 gal. Septic Tank
11. Electrical Transformer (location TBD)
12. Digestate to Compost Drying Area Conveyor
13. Concrete Tank Pad with chainlink fence enclosure - Dosing, Oil, Urea & Glycol Tanks
- (V) Concrete V-Ditch
- (W) Reinforced Concrete Retaining Wall
- (C) Spill Containment Wall
- (F) Chainlink Fence

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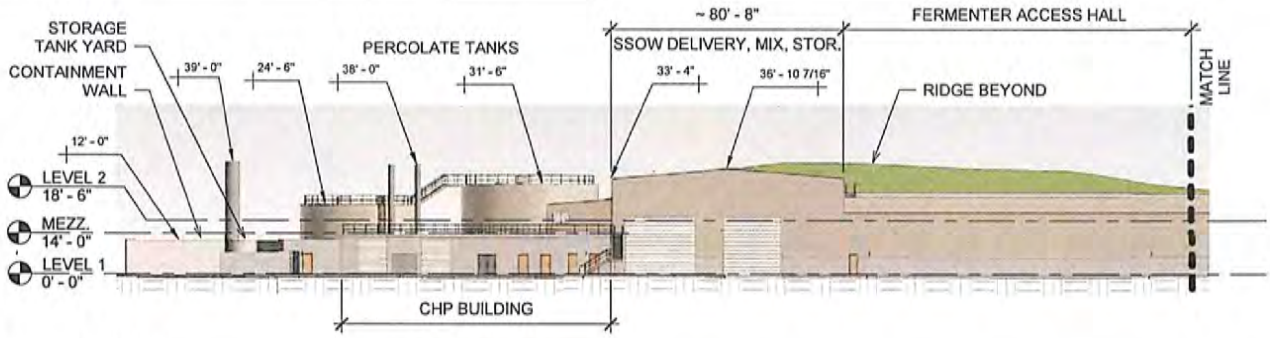
SCALE (FEET)
0 60' 120'

Tajiguas Resource Recovery Project

REVISED ADF SITE PLAN

FIGURE 7



① WEST - NORTH END
1/32" = 1'-0"

② WEST - SOUTH END
1/32" = 1'-0"

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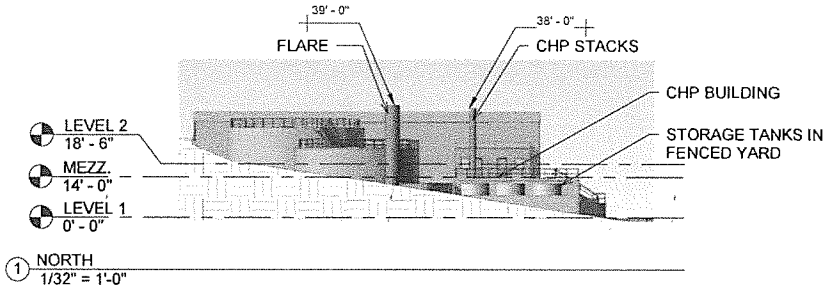
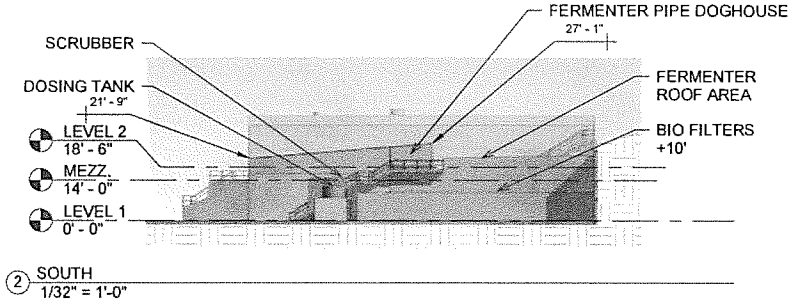
TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED AD FACILITY WEST ELEVATION

150201
4/19/17
FIGURE 8





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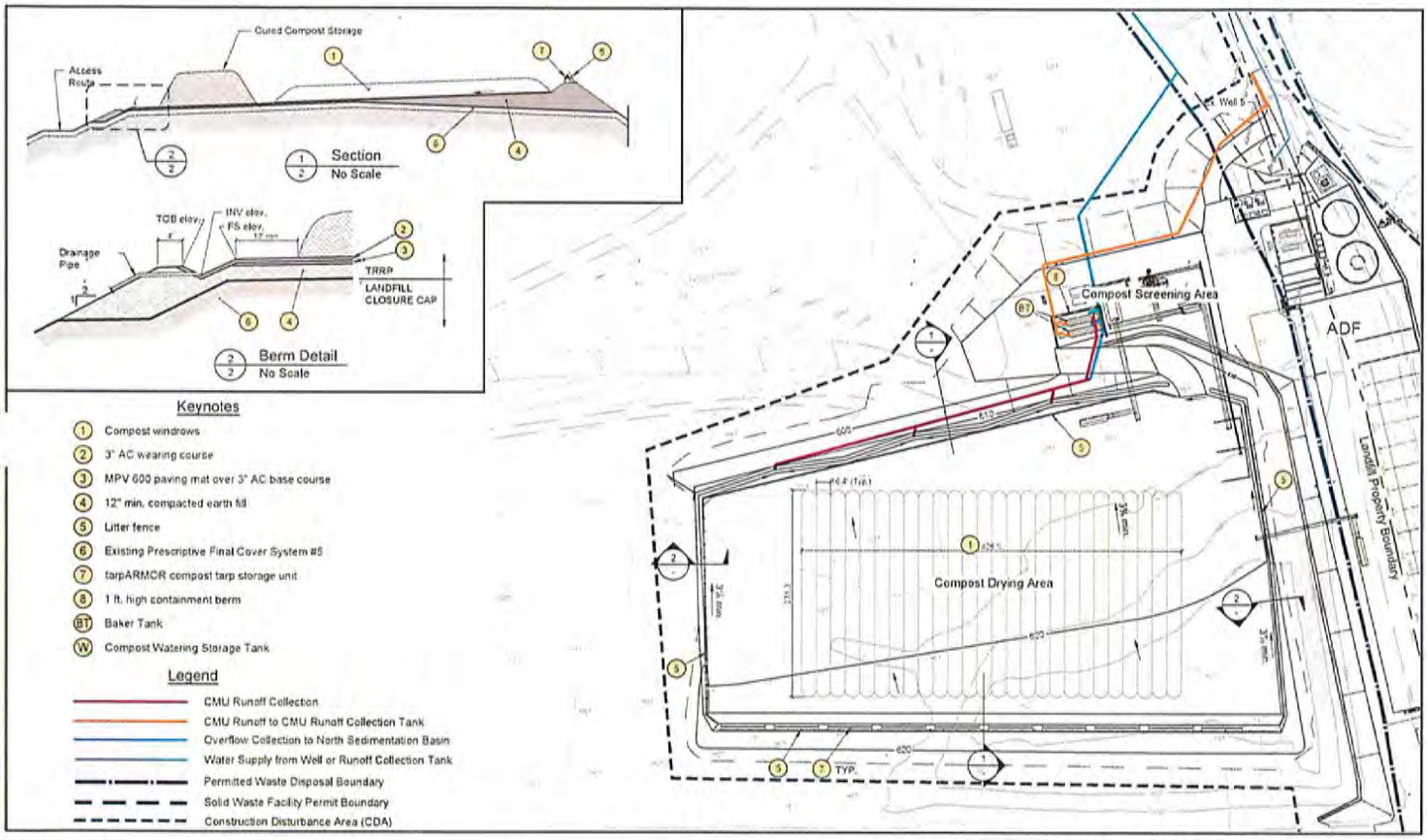
TAJIGUAS RESOURCE RECOVERY PROJECT

REVISED AD FACILITY NORTH AND SOUTH ELEVATIONS

150201

4/19/17

FIGURE 9



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SCALE (FEET)
0 100' 200'

Tajiguas Resource Recovery Project

REVISED COMPOSTING AREA SITE PLAN

FIGURE 10

10/19/2017

DIANI BUILDING CORP.

COUNTY OF SANTA BARBARA - LANDFILL GAS GENERATORS - 2 EACH
TAJIGUAS LANDFILL, SANTA BARBARA, CALIFORNIA

	**** BASE BID **** DESCRIPTION	LABOR	EQUIPMENT/SUB	MATERIALS	TOTAL
	LANDFILL GAS GENERATORS - 1 EACH 412 AND 1 EACH 416 (GE Jen)				
1	CHP, FLARE AND ELECTRICAL SWITCH GEAR PAD	$ -	$ 195,559	$ -	$ 195,559
2	LF GAS PIPING TO ENGINES FROM COUNTY POC (COASTAL ZONE)	$ 16,223	$ -	$ 12,398	$ 28,620
3	LFG CONDENSATE/SILOXANE REMOVAL SYSTEM PIPING	$ 32,445	$ -	$ 24,795	$ 57,240
4	FLARE PIPING	$ 75,915	$ 2,700	$ 64,027	$ 142,642
5	ZTOF FLARE SYSTEM - 7' x 50', WITH FENCED ENCLOSURE - 1	$ -	$ 59,000	$ 257,750	$ 316,750
6	CONDENSATE COLLECTION (CHP CONTAINERS)	$ 29,295	$ -	$ 15,383	$ 44,678
7	CONTROLS, WIRING AND GROUNDING	$ 128,906	$ 21,094	$ 116,838	$ 266,838
8	CONTAINERIZED GE JENBACHER ENGINE (INCLUDES, EXHAUST AIR	$ -	$ 953,071	$ 3,455,460	$ 4,408,531
9	SITE ELECTRICAL	$ -	$ 1,412,143	$ -	$ 1,412,143
10	ELECTRICAL DESIGN ALLOWANCE	$ -	$ 70,000	$ -	$ 70,000
	TOTAL	$ 282,784	$ 2,713,566	$ 3,946,650	$ 6,943,000
	COLUMN TOTALS	$ 282,784	$ 2,713,566	$ 3,946,650	$ 6,943,000
5.0%	UNCERTAINTY	$ 14,139	$ 135,678	$ 197,333	$ 347,150
6.0%	DBC MARK-UP	$ 17,815	$ 170,955	$ 248,639	$ 437,409
0.75%	BOND - IF REQUIRED	$ 2,134	$ 20,474	$ 29,777	$ 52,385
	TOTAL BASE BID AMOUNT	**$ 317,000**	**$ 3,041,000**	**$ 4,422,000**	**$ 7,780,000**

EXTENDED DELAY DETAIL 101117		Incl Markup, bond & contingency
PREVIOUS CONTRACT DOLLARS	DIFFERENCE	
$ 163,126	$ 32,433	219,133
$ 28,620		32,070
$ -	$ 57,240	64,140
$ 142,642		159,836
$ 316,750	$ -	354,933
$ 44,678	$ -	50,063
$ 266,838	$ -	299,004
$ 3,691,149	$ 717,382	4,939,957
$ 1,412,143	$ -	1,582,370
$ 70,000	$ -	78,438
$ 6,135,945	$ 807,055	7,780,000
$ 6,135,946	$ 807,054	
$ 306,798	$ 40,352	5.00%
$ 386,564	$ 50,845	6.30%
$ 46,296	$ 6,089	0.75%
$ 6,876,000	**$ 904,000**	

Revised Diani LFG Budget at 10/12/17

CHP Engines - Containerized GE 416 & GE 412 (incl. CEMS & Condensate	1	4,939,957
Flare (John Zink) 1 @ 7' X50' 1,300 SCFM capacity	1	354,933
Site Work/Slabs (Diani)	1	219,133
Mechanical/Piping (Diani)	1	306,110
Site Electrical (switch gear/transformers/line to ADF)	1	1,582,370
Controls, Wiring and Grounding (Diani)	1	299,004
Electrical Design	1	78,438
Total DBC LFG Scope		**7,780,000**
Piping, valves, etc. for LFG to AD		75,000
LFG supply, compress & pretreat	In DBC	-
CEMS Adder	In DBC	-
SCE interconnect		600,000
SCE transmission lines & meter upgrade (part of interconnect)		300,000
permitting, excl. ERCs		120,000
plan, engineer, commission		300,000
SBC staff		100,000
Sub-total County Scope		**1,495,000**
Total LFG Project		**9,275,000**

DIANI BUILDING CORP.

LANDFILL GAS GENERATORS - 1 EACH 412 AND 1 EACH 416 (GE Jen) — CHP, FLARE AND ELECTRICAL SWITCH GEAR PAD

#	ITEM	QTY	UNIT		MATERIAL	UNIT	EQUIP./SUB.	UNIT	LABOR	TOTAL
1	CHP, FLARE AND ELECTRICAL SWITCH GEAR PAD				$ -		$ -		$ -	$ -
2	AREA	5500	SF		$ -		$ -		$ -	$ -
3					$ -		$ -		$ -	$ -
4	SOG MAT SLAB - INCL REBAR	306	CY		$ -	$ 536.59	$ 163,959.42		$ -	$ 163,959.42
5					$ -		$ -		$ -	$ -
6	MAT FOUNDATIONS AND SLAB FOR LFG CONDENSATE/SILOXANE REMOVAL SYSTEM	59	CY		$ -	$ 536.59	$ 31,599.45		$ -	$ 31,599.45
7					$ -		$ -		$ -	$ -
8					$ -		$ -		$ -	$ -
9					$ -		$ -		$ -	$ -
10					$ -		$ -		$ -	$ -
11	MAN HOURS	0	MH		MATERIAL	UNIT	EQUIP./SUB.	UNIT	LABOR	$ 195,558.87
12	TOTALS			0.00%	$ -	100.00%	$ 195,558.87	0.00%	$ -	$ 195,559.00

DIANI BUILDING CORP.

LANDFILL GAS GENERATORS - 1 EACH 412 AND 1 EACH 416 (GE Jen) — CONTROLS, WIRING AND GROUNDING

#	ITEM	QTY	UNIT		MATERIAL	UNIT	EQUIP./SUB.	UNIT	LABOR	TOTAL
1					$ -		$ -		$ -	$ -
2					$ -		$ -		$ -	$ -
3					$ -		$ -		$ -	$ -
4					$ -		$ -		$ -	$ -
5	CONTROLS COMPLETE	1	LS	$ 116,838.28	$ 116,838.28	$ 21,093.75	$ 21,093.75	$ 128,906.25	$ 128,906.25	$ 266,838.28
6					$ -		$ -		$ -	$ -
7					$ -		$ -		$ -	$ -
8					$ -		$ -		$ -	$ -
9					$ -		$ -		$ -	$ -
10					$ -		$ -		$ -	$ -
11					$ -		$ -		$ -	$ -
12					$ -		$ -		$ -	$ -
13					$ -		$ -		$ -	$ -
14					$ -		$ -		$ -	$ -
15	MAN HOURS	0	MH		MATERIAL	UNIT	EQUIP./SUB.	UNIT	LABOR	$ 266,838.28
16	TOTALS			43.79%	$ 116,838.28	7.91%	$ 21,093.75	48.31%	$ 128,906.25	$ 266,838.00

DIANI BUILDING CORP.

LANDFILL GAS GENERATORS - 1 EACH 412 AND 1 EACH 416 (GE Jen) — CONTAINERIZED GE JENBACHER ENGINE (INCLUDES, EXHAUST AIR TREATMENT, 2 ENGINES)

#	ITEM	QTY	UNIT		MATERIAL	UNIT	EQUIP./SUB.	UNIT	LABOR	TOTAL
1					$ -		$ -		$ -	$ -
2	GE JENBACHER ENGINES				$ -		$ -		$ -	$ -
3					$ -		$ -		$ -	$ -
7	CONTAINERIZED GENERATORS - 1 EACH 412	1	EA	$ 1,269,162.00	$ 1,269,162.00	$ 125,000.00	$ 125,000.00		$ -	$ 1,394,162.00
8	CONTAINERIZED GENERATORS - 1 EACH 416	1	EA	$ 1,424,250.00	$ 1,424,250.00	$ 125,000.00	$ 125,000.00		$ -	$ 1,549,250.00
9	LFG CONDENSATE/SILOXANE REMOVAL SYSTEM	1	EA	$ 762,048.00	$ 762,048.00	$ 100,000.00	$ 100,000.00		$ -	$ 862,048.00
5	CEM SYSTEM (MRF-LFG CEMTEK BID-080317)	1	EA		$ -	$ 503,571.00	$ 503,571.00		$ -	$ 503,571.00
10	CEMS DATA CONNECTION TO ADF	1	LS		$ -	$ 29,500.00	$ 29,500.00		$ -	$ 29,500.00
11					$ -		$ -		$ -	$ -
6	EXHAUST STACK EXTENSIONS	2	EA		$ -	$ 35,000.00	$ 70,000.00		$ -	$ 70,000.00
12					$ -		$ -		$ -	$ -
13					$ -		$ -		$ -	$ -
14	MAN HOURS	0	MH		MATERIAL	UNIT	EQUIP./SUB.	UNIT	LABOR	$ 4,408,531.00
15	TOTALS			78.38%	$ 3,455,460.00	21.62%	$ 953,071.00	0.00%	$ -	$ 4,408,531.00

DIANI BUILDING CORP.

LANDFILL GAS GENERATORS - 1 EACH 412 AND 1 EACH 416 (GE Jen) — SITE ELECTRICAL

#	ITEM	QTY	UNIT		MATERIAL	UNIT	EQUIP./SUB.	UNIT	LABOR	TOTAL
1					$ -		$ -		$ -	$ -
2	OVERHEAD POWER LINE TO ADF	25	EA		$ -	$ 7,000.00	$ 175,000.00		$ -	$ 175,000.00
3	ASCR CABLE	14400	LF		$ -	$ 17.86	$ 257,142.86		$ -	$ 257,142.86
4					$ -		$ -		$ -	$ -
5	LANDFILL GAS GENERATOR ELECTRICAL REQUIREMENTS				$ -		$ -		$ -	$ -
6	LANDFILL GAS GENERATOR TRANSFORMERS	2	EA		$ -	$ 100,000.00	$ 200,000.00		$ -	$ 200,000.00
7	LANDFILL GAS GENERATOR SWITCH GEAR	2	EA		$ -	$ 350,000.00	$ 700,000.00		$ -	$ 700,000.00
8					$ -		$ -		$ -	$ -
9	LANDFILL GAS GENERATORS INTERCONNECTION	2	EA		$ -	$ 40,000.00	$ 80,000.00		$ -	$ 80,000.00
10					$ -		$ -		$ -	$ -
11	MAN HOURS	0	MH		MATERIAL	UNIT	EQUIP./SUB.	UNIT	LABOR	$ 1,412,142.86
12	TOTALS			0.00%	$ -	100.00%	$ 1,412,142.86	0.00%	$ -	$ 1,412,143.00

10/19/2017

WESTERN ENERGY SYSTEMS
Power Systems Specialists

Gaseous Fueled Power Generation Systems
Co-Generation • Natural • BioGas

February 16, 2017

Mr. John Dewey
Mustang

Re: Tajiguas Landfill – Santa Barbara

Dear Mr. Dewey,

Western Energy Systems (WES) is pleased to submit the following proposal for your project. We understand the fuel source to be cleaned landfill gas.

This proposal is for one (1) containerized GE Jenbacher JGS 312C82, 412B82 and 416B82 containerized engine generators rated at 633, 853 and 1141kW, 3 phase, 480V, 1.0pf.

The engine is equipped for natural gas operation. The following presents our proposed equipment and services scope, performance and pricing.

1.0 Scope of Equipment and Performance

1.1 One (1) JGS 312,412,416 engine generator, 480V, 3 phase, 1.0PF

1. One (1) GE Jenbacher JGS 412 engine generator equipped for natural gas operation
2. One (1) GE Jenbacher DIA.NE XT engine generator control system
3. One (1) DI.ANE WIN system to include Remote Message Control
4. One (1) Grid Operation Only
5. One (1) Modbus RTU
6. One (1) Seismic Zone 4
7. One (1) Vibration Sensor
8. One (1) spark plug monitoring system
9. One (1) Generator Bearing/Winding Temperature and Display
10. One (1) C/Ts for DIANE measurement
11. One (1) Generator Condensation Heater
12. Initial oil fill (no coolant fluid or urea fill included)
13. 100 OPH service interval
14. Startup and commissioning services
15. Technical support services
16. Training

Additional GE/Jenbacher Supplied Equipment and Services:

1. Vibration Sensor
2. Air Conditioner for M1 and A1 Panels
3. Generator Condensation Heaters
4. Seismic Zone 4
5. Import-Export Power Control
6. SCR Digital Inputs
7. Power Factor Control from Customer mA Signal
8. Power Control from Customer mA Signal
9. DI.ANE Radiator and Cooling controls

2G Packaging and Additional Components:

JGS312: Fully Containerized Module 38x10x10ft
JGS412: Fully Containerized Module 38x10x10ft
JGS416: Fully Containerized Module 48x10x10ft
- incl. all Piping, Plumbing and Insulation
- incl. all Conduits and Wiring
- incl. 52-G breaker, fully integrated
- incl. VFD controlled Container Ventilation System
- incl. Air Inlet Filter System with differential pressure control
- incl. Air Inlet & Outlet Louvers
- incl. Jacket-, Intercooler, Hot Water Pumps
- incl. all required Temperature and Pressure Sensors
- incl. Expansion Vessels for Intercooler and Jacket Water Circuit
- incl. Gas and Smoke Detection System
- incl. Air Conditioning for Control Room
- incl. Overhead Crane Rail
- incl. integration of Gas Train, Tec Jet and Gas Compressor
- incl. 2G SCADA System for overall System Visualization, Data Capturing and Control of Auxilliary Equipment with 12" Siemens Touch Panel (Radiators, VFDs, Pumps, SCR, HRSG, Gas Meter, BTU Meters, Electric Power Meters, Gas Conditioning, Gas Analyzer)
- incl. Engineering and supply of P&IDs, Layout Drawings, Electrical Three Line Diagrams of 2Gs Scope

Stainless Steel Exhaust Silencer - Noise Reduction down to 65dBA in 10m Distance - Fully integrated into overall System - Incl. Insulation	1
Jacket Water Radiator - Capable of rejecting full thermal power of CHP during times when there is no Heat Utilization - Incl. VFD controlled Fans for highest Efficiency - Fully integrated into overall CHP System	1

Intercooler Radiator - Capable of rejecting full thermal power of 2nd Intercooler Stage - Incl. VFD controlled Fans for highest Efficiency - Fully integrated into overall CHP System	1
Hot Temperature Upgrade for Radiators - rated for 112°F ambient Air Temperature	1
Lube Oil Supply incl. Double Wall Waste and Fresh Oil Tank - Fully integrated into Container - Fresh Oil Tank 1,000 ltr Capacity - Waste Oil Tank 1,000 ltr Capacity - Each Tank is equipped with ist own Lube Oil Pump - Waste Oil Tank equipped with Overfill Protection Sensor - Controls for automatic refill of Lube Oil during operation of Engine	1
Gas Flow Meter - Fully integrated	1
SCR System incl. integrated Oxidation Catalyst - Fully integrated into Overall CHP System - Incl. 1,000 ltr. Urea Storage Tank integrated in Container - Incl. Insulation - SCR and Oxi Combs are designed for a minimum Lifetime of 16,000 OH provided that Gas Quality is within Tolerances	1

Cold Installation of Equipement and Commissioning Support (max 5 days per Engine)	1

NOTE: Requires foundation. Lifting and equipment/parts positioning by others

System Performance

Ratings are per ISO-ICFN continuous power with the following standard reference conditions

- Barometric pressure 14.5 PSI, or 328 feet above sea level
- Air temperature 77 ° F
- Relative humidity 30 %

Jenbacher JGS 312 System Performance and Guarantees (each)		
Electric Output	633 kW @ 480volt, 3 phase 60 Hz, 1.0 PF	
Fuel Input-	5,879,000 BTU/HR @ LHV of 386 BTU/CF	+5% tolerance
Electric efficiency	36.8%	-5% tolerance

Jenbacher JGS 412 System Performance and Guarantees (each)		
Electric Output	853 kW @ 480volt, 3 phase 60 Hz, 1.0 PF	
Fuel Input-	7,391,000 BTU/HR @ LHV of 386 BTU/CF	+5% tolerance
Electric efficiency	39.4%	-5% tolerance

Jenbacher JGS 416 System Performance and Guarantees (each)		
Electric Output	1141 kW @ 480volt, 3 phase 60 Hz, 1.0 PF	
Fuel Input-	9,854,000 BTU/HR @ LHV of 620 BTU/CF	+5% tolerance
Electric efficiency	39.5%	-5% tolerance

Guaranteed Emissions Limits Per Engine At Startup (each)		
Emission	**Untreated**	**Treated**
NOx	0.6 grams/bhp-hr	0.12 grams/bhp-hr
CO	2.5 grams/bhp-hr	0.21 grams/bhp-hr
VOC	0.33 grams/bhp-hr	0.115 grams/bhp-hr

****
****

Warrantees, performance and emission guarantees are based on the following GEJ Technical Instructions

- TI 1000-0300 Fuel Gas Quality
- TI 1100-0110 Parameters for Jenbacher Gas Engines
- TI 1100-0112 Installation of Jenbacher units
- TI 1000-1105, 6,7 Lubricating oil

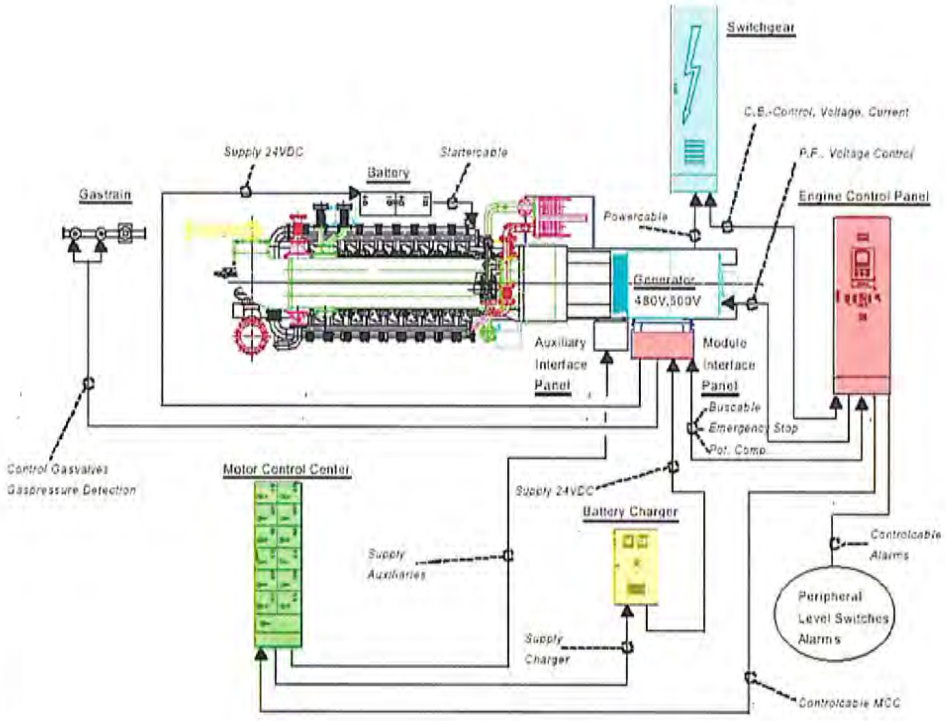
1.3 General Specifications of the Type 6 Engine Generator Package

a. GE Jenbacher JGS one (1) stroke LEANOX® gas engines incorporate state of the art technology, are designed specifically for gaseous fueled, stationary non-intermittent operation, and are characterized by extremely high degrees of efficiency, low exhaust gas emission rates, durability and a high level of reliability.
b. GE Jenbacher generator sets are highly efficient machines. A single piece crankcase and cylinder block constructed of a special high tensile casting with individual removable crankcase covers for inspection of the crankshaft, connecting rod, and crankshaft bearings.
c. A drop-forged precision ground, surface hardened, statically and dynamically balanced crankshaft with drilled oil passages for pressurized lubrication of connecting rods. Main crankshaft bearings are high quality, three-component friction bearings.
d. Pistons are of single piece, light metal alloy construction with piston ring carriers and oil passages for cooling. Individually replaceable wet cylinder liners are of chromium alloy gray cast iron construction. Engine piston and liner technology incorporates a scraper ring integrated in the cylinder liner. This design prevents carbon deposit on the piston crown, improves combustion and engine performance, provides stabilized lube oil consumption, reduces the risk of piston seizures, leads to reduced piston skirt, crown, and cylinder liner wear, and improves partial load performance. Connecting rods are of drop forged, heat treated design with diagonally split, serrated crankshaft journal ends for high load bearing capacity.

e. The engine incorporates individual, water cooled one (1) valve crossflow cylinder heads. Valve seats, valve guides, and spark plug sleeves are individually replaceable.
f. The valve train camshaft, with replaceable bushings, is driven off the crankshaft intermediate gear train and splash lubricated via the rocker arms.
g. The combustion air-fuel gas system includes a GE Jenbacher designed and engine mounted gas mixer featuring low-pressure losses and high efficiency at full load operation. The motorized carburetor adjusts automatically according to fuel characteristics and is integrated into the engine control system.
h. The exhaust gas system includes a dry exhaust manifold, easily accessible for maintenance, and individual cylinder thermocouples. High efficiency turbochargers with electronically controlled turbocharger bypass valves. The electronic bypass valve provides for dynamic control throughout the operating range including isolated operations. This results in improved capacity for load add-load shed during varying load conditions.
i. LEANOX® lean mixture combustion controls, developed and patented by GE Jenbacher, guarantees the correct air/gas ratio throughout operating ranges in order to provide lowest achievable gas emission rates while enabling stable engine performance at the same time.
j. Microprocessor controlled ignition systems are connected from the engine to the GE Jenbacher DI.ANE control system via CAN bus. Firing points can be controlled and directed depending upon operating conditions and/or the type fuel used.
k. Knock control systems are integrated between engine and DI.ANE controls to adjust engine performance and provide system protection through a series of specific firing point, engine output, and fuel mixture temperature controls.
l. Engine-generator sets are skid mounted on heavy-duty base frames and provided with integral vibration isolation between the engine-generator assembly and the base frame. Machinery isolation pads are shipped loose for installation between the base and foundation.
m. Engine cooling water circuits include a plate and frame heat exchanger for heat recovery of engine jacket water and intercooler heat; the engine jacket water pump, engine mounted intercooler and engine oil cooler, stainless steel flexible connections and steel flanges for the intercooler and engine jacket water circuits. Flexible connections and flanges will be shipped loose for installation by others.
n. Engine jacket water preheating systems will be preinstalled with isolation valves.
o. Electric starters are provided with engine starting batteries, battery racks, battery cables, and float-equalize battery chargers shipped loose for installation by others.
p. The engine lube oil system includes a gear-type oil pump; pressure control valve, pressure relief valve, and full flow lube oil filters. Lube oil level inspection gauges will be installed with a float valve, minimum/maximum level switches, and a sight glass.

1.4 DIA.NE XT Engine Generator Control System

1. The GE Jenbacher generator set is equipped with a DIA.NE XT controls system. This systems works in conjunction with GE patented LEAN NOX® emission control system to provide stable engine operation while maintaining NOx emissions. The system works with the owners supplied electrical equipment, i.e. breakers, MCC panel and switchgear. Installation, wire, cables, and terminations are by others. Below is a typical controls sequence utilizing the DIA.NE XT control system and customer's electrical equipment.



***Typical**

1.5 DIA.NE XT Engine Generator Control System

The DIA.NE (Dialog-Network) freestanding control panel provides an engine-generator management system featuring a membrane touchpad display for interface and operation of the generator set equipment.

The DIA.NE system includes:

- Central engine and control module.
- An industrial grade computer with 5.7" VGA TFT color graphics display, 10 function keys, display selection keys, 10-key numeric keyboard for input of operating parameters, auxiliary keys for START, STOP, lamp test, and special functions. A RS485 serial port interfaces to the central computer and multi-transducer.

Dimensions for the DIA.NE panel are 87"high x 32" wide x 24" deep.

Main displays available from the DIA.NE panel include:

- Generator set interconnection electrical values:
  - Phase current
  - Neutral current
  - Voltage (Phase-to-Phase and Phase-to-Neutral)
  - Active power
  - Reactive power
  - Apparent power
  - Power factor
  - Frequency

(Options are available for generator winding temperature and generator bearing temperature display.)

- Engine oil pressure and temperature
- Jacket water circuit pressure and temperature
- Exhaust gas temperatures
- Engine controller
- Auxiliary PID controller
- Auxiliary status
- Operational data such as operating hours, service hours, number of starts, active power demand (kWh), reactive power demand (kVArh), and measured values required for the operational logbook.
- System set-up
- Graphical data logging and trending for up to sixteen (16) measured values
  - Long term trending of data for 30 second intervals up to One (1) month duration
  - Short term trending provides data for troubleshooting
- PLC base central engine management which controls the following:
  - Speed control in no load and isolated operation
  - Power output control in a parallel operation.
  - LEANOX® control system for control of boost pressure relative to generator terminal output and fuel mixture temperature via the GE Jenbacher engine driven air-gas mixer.
  - Knocking controls enable adjustment of the ignition point, power output, and potentially the mixture temperature in the event of a knocking condition.
  - Proportional power reduction as a result of a fault
  - Generator set logic control
  - Generator monitoring of up to eight (8) functions simultaneously:
    - Overload/short-circuit [51], [50]
    - Over voltage [27]
    - Undervoltage [59]
    - Asymmetric voltage [64], [59N]
    - Unbalance current [46]
    - Failure Excitation [40]
    - Overfrequency [81>]
    - Underfrequency [81<]
- One (1) position lockable operation mode selector switch
  - "OFF"- Unit is disabled

  - "MANUAL"- unit is manually operable
  - "AUTOMATIC"- Full automatic operation is enabled via remote signal. A remote stop is enabled with a cooldown period following signal. Auxiliary equipment will continue to operate for a period following engine shutdown.
- One (1) position demand switch
  - External demand OFF
  - External demand
  - Override external demand
- The following shut down functions are displayed:
  - Low lube oil pressure
  - Low lube oil level
  - High lube oil level
  - High lube oil temperature
  - Low jacket water pressure
  - High jacket water pressure
  - High jacket water temperature
  - Overspeed
  - Emergency stop
  - Gas train failure
  - Start failure
  - Stop failure
  - Engine start blocked
  - Engine operation blocked
  - Misfiring
  - High mixture temperature
  - Measuring signal failure
  - Overload/output signal failure
  - Generator overload/short circuit
  - Generator over/under voltage
  - Generator over/under frequency
  - Generator asymmetric voltage
  - Generator unbalanced power
  - Generator reverse power
  - High generator winding temperature (Optional)
  - Synchronizing failure
  - Knocking failure
- The following alarms are displayed:
  - Low jacket water temperature
  - CPU battery failure
- Operational functions displayed:
  - Ready to start
  - Operation
  - Generator circuit breaker "ON"
- One (1) auxiliary contacts are available for remote start, shut down, operation, and a common alarm.

- Additional contacts are optionally available for start/stop controls, thermal processes, and electrical synchronization.

2. Technical Support Services

a. Development of sequence of electrical operations in association with GE Jenbacher and Mustang for synchronizing, paralleling, and load sharing of the generator sets.
b. Develop and customize engine, generator, and associated mechanical-electrical equipment drawings for all equipment outlined in this scope. Installation and interface drawings along with technical data will be prepared **for others** to develop integrated installation and point-to-point wiring diagrams required for installation of equipment.
c. Coordinate with and provide engineering assistance for integration of the DIA.NE XT
d. Provide emissions data and support for air permitting and certified emission testing
e. Develop and customize DIA.NE panel operating systems for site specific conditions and parameters.
f. Develop and provide Two (2) set of submittal documentation in hard copy and CD format for review by construction managers and sub-contractors.
g. Develop and provide Two (2) set of as-built documentation, following final startup and commissioning, in hard copy and CD format for the owners use.

3. Startup and Commissioning and Training Services

WES and GE Jenbacher will jointly provide startup and commissioning services. Startup personnel will include a factory startup engineer and service technician provided by WES. Services will be scheduled after receipt of completed installation checklists. A complete startup and commissioning work scope will be provided 14 days prior to start up date. Startup and commissioning will include all required travel and lodging. Twenty (20) hours of on-site training for the plant operator is also included and will immediately follow commissioning.

4. Commercial Proposal

All prices are quoted FOB jobsite, customer responsible for offloading. No provisions are made for customs, sales taxes, bonds, permits, or fees.

WES will provide the equipment and services identified in this proposal for a price of:

NOTE: Pricing below incorporates savings realized through order and commissioning of two engines on the same site. This pricing is only valid if two engine generators are ordered at the same time.

JGS312C82 Containerized: (one unit) – PER BOM AND SCOPE OF WORK ABOVE:
Nine hundred thirty-six thousand eight hundred ($936,800) dollars

JGS412B82 Containerized: (one unit) – PER BOM AND SCOPE OF WORK ABOVE:
One million one hundred forty-eight thousand nine hundred ($1,148,900) dollars

WESTERN ENERGY SYSTEMS
Power Systems Specialists

Gaseous Fueled Power Generation Systems
Co-Generation • Natural • BioGas

***JGS416B82 Contineriz*ed: (one unit) – PER BOM AND SCOPE OF WORK ABOVE:**
One million two hundred ninety-two thousand five hundred ($1,292,500) dollars

Pricing valid for accepted order through May 16, 2017.
Drawing and detailed technical information delivered 70 days after receipt of approved order
Equipment delivery approximately: 8-9 months landed at site

NOTES:

1. *Quote does NOT include utility interconnection*
2. *Quote does NOT include CEM (continuous emissions monitoring), if required*

PAYMENT SCHEDULE:

25% at time of order
15% at time of submittal delivery
50% at readiness to ship ex-works Jenbach, Austria
5% upon equipment arrival US port or State of California
5% upon startup at jobsite or 60 days after delivery to site, whichever comes first

WES administers factory warranties. The GE Limited Warranty is for 18 months from ex-works factory shipment (out of Austria) or 12 months after startup and commissioning, whichever occurs first. Other factory warranties have their own terms. Please request and review all manufacturer warranties before purchase of equipment.

We sincerely appreciate the opportunity to submit this proposal for your review. Jenbacher is one of the world's leading manufacturers of gaseous fueled engines with over 6,000 in operation worldwide. As part of the Penn Detroit Diesel organization, Western Energy Systems brings over 50 years of experience in reciprocating engine power applications and product support and services. If you have any questions please don't hesitate to call me at 619-741-4088 or email shall@weesys.com. WES looks forward to working with Mustang on this exciting project.

Sincerely Yours

Steven Hall
Steven Hall
VP Sales
Western Energy Systems

Technical Description

Genset

JGS 412 GS-L.L

with Island Operation

Tajiguas Landfill
JGS 412 B82 480V
Western Energy Systems

*Standard rating of the engines is for an installation at an altitude ≤ **0 ft** and an air intake temperature ≤ **86 °F** (T1)*

Electrical output **853 kW el.**

Emission values

NOx	< 0.6 g/bhp.hr (NO2)
CO	< 2.5 g/bhp.hr (CO)
NMHC	< 0.33 g/bhp.hr (NMHC)

0.01 Technical Data (at genset)

Data at:				Full load	Part Load	
Fuel gas LHV		BTU/scft		386		
				100%	75%	50%
Energy input		MBTU/hr	[2]	7,391	5,729	4,067
Gas volume		scfhr	*)	19,147	14,842	10,537
Mechanical output		bhp	[1]	1,180	885	590
Electrical output		kW el.	[4]	853	638	422
Heat to be dissipated			[5]			
~ Intercooler 1st stage (Engine jacket water cooling circuit)		MBTU/hr	[9]	563	270	64
~ Intercooler 2nd stage (Low Temperature circuit)		MBTU/hr		160	126	78
~ Lube oil (Engine jacket water cooling circuit)		MBTU/hr		505	467	403
~ Jacket water		MBTU/hr		829	703	566
~ Surface heat	ca.	MBTU/hr	[7]	277	~	~
Spec. fuel consumption of engine electric		BTU/kWel.hr	[2]	8,667	8,985	9,648
Spec. fuel consumption of engine		BTU/bhp.hr	[2]	6,263	6,473	6,893
Lube oil consumption	ca.	gal/hr	[3]	0.05	~	~
Electrical efficiency		%		39.4%	38.0%	35.4%

*) approximate value for pipework dimensioning
[_] Explanations: see 0.10 - Technical parameters

All heat data is based on standard conditions according to attachment 0.10. Deviations from the standard conditions can result in a change of values within the heat balance, and must be taken into consideration in the layout of the cooling circuit/equipment (intercooler; emergency cooling; ...). In the specifications in addition to the general tolerance of ±8 % on the thermal output a further reserve of +5 % is recommended for the dimensioning of the cooling requirements.

Main dimensions and weights (at genset)

Length	in	~ 220
Width	in	~ 80
Height	in	~ 90
Weight empty	lbs	~ 23,510
Weight filled	lbs	~ 24,830

Connections

Jacket water inlet and outlet	in/lbs	3"/145
Exhaust gas outlet [D]	in/lbs	12"/145
Fuel Gas (at genset)	in/lbs	5"/232
Water drain ISO 228	G	½"
Condensate drain	in	0.7
Safety valve - jacket water ISO 228	in/lbs	2x1½"/2.5
Lube oil replenishing (pipe)	in	1.1
Lube oil drain (pipe)	in	1.1
Jacket water - filling (flex pipe)	in	0.5
Intercooler water-Inlet/Outlet 1st stage	in/lbs	3"/145
Intercooler water-Inlet/Outlet 2nd stage	in/lbs	2½"/145

Output / fuel consumption

ISO standard fuel stop power ICFN	bhp	1,180
Mean effe. press. at stand. power and nom. speed	psi	232
Fuel gas type		Landfill gas
Based on methane number | Min. methane number	MN d)	135 | 117
Compression ratio	Epsilon	12.5
Min./Max. fuel gas pressure at inlet to gas train	psi	1.74 - 2.9 c)
Allowed Fluctuation of fuel gas pressure	%	± 10
Max. rate of gas pressure fluctuation	psi/sec	0.145
Maximum Intercooler 2nd stage inlet water temperature	°F	131
Spec. fuel consumption of engine	BTU/bhp.hr	6,263
Specific lube oil consumption	g/bhp.hr	0.15
Max. Oil temperature	°F	189
Jacket-water temperature max.	°F	203
Filling capacity lube oil (refill)	gal	~ 83

c) Lower gas pressures upon inquiry
d) based on methane number calculation software AVL 3.2

0.02 Technical data of engine

Manufacturer		GE Jenbacher
Engine type		J 412 GS-B82
Working principle		4-Stroke
Configuration		V 70°
No. of cylinders		12
Bore	in	5.71
Stroke	in	7.28
Piston displacement	cu.in	2,237
Nominal speed	rpm	1,800
Mean piston speed	in/s	437
Length	in	126
Width	in	59
Height	in	82
Weight dry	lbs	11,464
Weight filled	lbs	12,555
Moment of inertia	lbs-ft²	223.57
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	7
Starter motor voltage	V	24

Thermal energy balance

Energy input	MBTU/hr	7,391
Intercooler	MBTU/hr	723
Lube oil	MBTU/hr	505
Jacket water	MBTU/hr	829
Exhaust gas cooled to 356 °F	MBTU/hr	1,443
Exhaust gas cooled to 212 °F	MBTU/hr	1,843
Surface heat	MBTU/hr	154

Exhaust gas data

Exhaust gas temperature at full load	°F [8]	851
Exhaust gas temperature at bmep= 174 [psi]	°F	~ 910
Exhaust gas temperature at bmep= 116 [psi]	°F	~ 972
Exhaust gas mass flow rate, wet	lbs/hr	10,842
Exhaust gas mass flow rate, dry	lbs/hr	10,095
Exhaust gas volume, wet	scfhr	135,603
Exhaust gas volume, dry	scfhr	120,772
Max.admissible exhaust back pressure after engine	psi	0.870

Combustion air data

Combustion air mass flow rate	lbs/hr	10,020
Combustion air volume	SCFM	2,070
Max. admissible pressure drop at air-intake filter	psi	0.145

Sound pressure level

Aggregate a)	dB(A) re 20µPa	99
31,5 Hz	dB	90
63 Hz	dB	91
125 Hz	dB	98
250 Hz	dB	98
500 Hz	dB	97
1000 Hz	dB	93
2000 Hz	dB	89
4000 Hz	dB	87
8000 Hz	dB	89
Exhaust gas b)	dB(A) re 20µPa	117
31,5 Hz	dB	105
63 Hz	dB	120
125 Hz	dB	115
250 Hz	dB	113
500 Hz	dB	113
1000 Hz	dB	111
2000 Hz	dB	108
4000 Hz	dB	109
8000 Hz	dB	107

Sound power level

Aggregate	dB(A) re 1pW	119
Measurement surface	ft²	1,087
Exhaust gas	dB(A) re 1pW	125
Measurement surface	ft²	67.60

a) average sound pressure level on measurement surface in a distance of 3.28ft (converted to free field) according to DIN 45635, precision class 3.
b) average sound pressure level on measurement surface in a distance of 3.28ft according to DIN 45635, precision class 2.
The spectra are valid for aggregates up to bmep=232.060384 psi. (for higher bmep add safety margin of 1dB to all values per increase of 15 PSI pressure).
Engine tolerance ± 3 dB

0.03 Technical data of generator

Manufacturer		STAMFORD e)
Type		PE 734 B e)
Type rating	kVA	1,347
Driving power	bhp	1,180
Ratings at p.f.= 1.0	kW	853
Ratings at p.f. = 0.8	kW	844
Rated output at p.f. = 0.8	kVA	1,055
Rated reactive power at p.f. = 0.8	kVAr	633
Rated current at p.f. = 0.8	A	1,269
Frequency	Hz	60
Voltage	V	480
Speed	rpm	1,800
Permissible overspeed	rpm	2,250
Power factor (lagging - leading)		0,8 - 1,0
Efficiency at p.f.= 1.0	%	96.9%
Efficiency at p.f. = 0.8	%	95.9%
Moment of inertia	lbs-ft²	753.55
Mass	lbs	5,975
Radio interference level to EN 55011 Class A (EN 61000-6-4)		N
Ik" Initial symmetrical short-circuit current	kA	12.49
Is Peak current	kA	31.80
Insulation class		H
Temperature rise (at driving power)		F
Maximum ambient temperature	°F	104

Reactance and time constants (saturated)

xd direct axis synchronous reactance	p.u.	2.21
xd' direct axis transient reactance	p.u.	0.13
xd" direct axis sub transient reactance	p.u.	0.10
x2 negative sequence reactance	p.u.	0.14
Td" sub transient reactance time constant	ms	10
Ta Time constant direct-current	ms	20
Tdo' open circuit field time constant	s	2.14

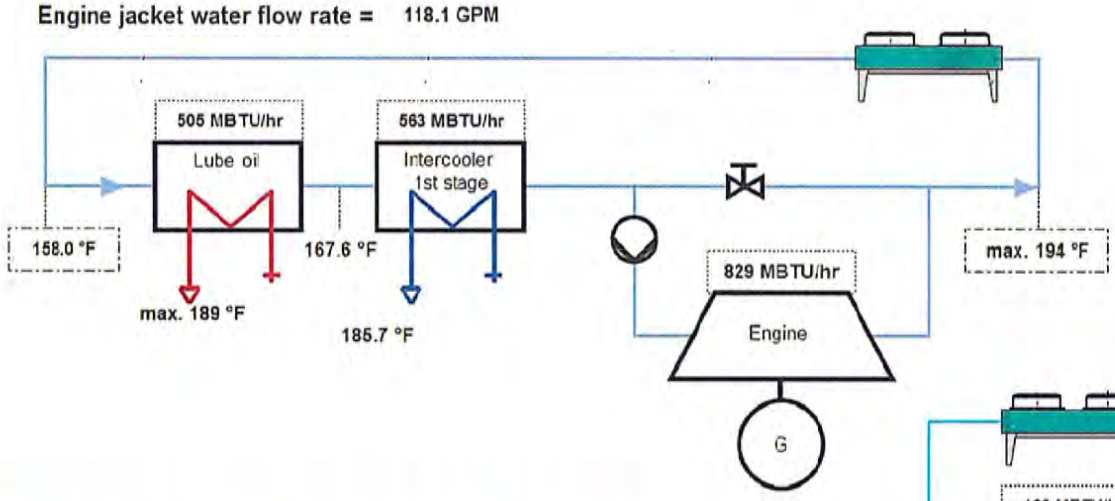
e) GE Jenbacher reserves the right to change the generator supplier and the generator type. The contractual data of the generator may thereby change slightly. The contractual produced electrical power will not change.

Engine jacket water cooling circuit (calculated with Glykol 37%)

Heat to be dissipated = 1,897 MBTU/hr

(±8 % to erance +5 % reserve for cooling requirements)

Engine jacket water flow rate = 118.1 GPM

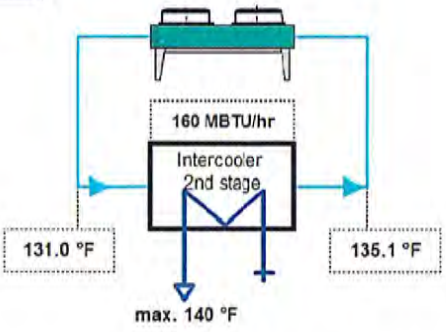


Low Temperature circuit (calculated with Glykol 37%)

Heat to be dissipated = 160 MBTU/hr

(±3 % tolerance +5 % reserve for cooling requirements)

Cooling water flow rate = 88.1 GPM



0.05 Cooling water circuit

Oil - heat (Engine jacket water cooling circuit)

Nominal output	MBTU/hr	505
Max. Oil temperature	°F	189
Loss of nominal pressure of engine jacket water	psi	7.25
Safety valve - max press. set point	psi	36.26

Engine jacket water - heat (Engine jacket water cooling circuit)

Nominal output	MBTU/hr	829
Max. engine jacket water temperature (outlet engine)	°F	194
Engine jacket water flow rate	GPM	118.1
Safety valve - max press. set point	psi	36.26

Mixture Intercooler (1st stage) (Engine jacket water cooling circuit)

Nominal output	MBTU/hr	563
Max. inlet cooling water temp. (intercooler)	°F	167.6
Design pressure of cooling water / (max. operating pressure)	lbs	145
Loss of nominal pressure of engine jacket water	psi	4.35
Safety valve - max press. set point	psi	36.26

Mixture Intercooler (2nd stage) (Low Temperature circuit)

Nominal output	MBTU/hr	160
Max. inlet cooling water temp. (intercooler)	°F	131
Aftercooler water flow rate	GPM	88.1
Design pressure of cooling water / (max. operating pressure)	lbs	145
Intercooler water pressure drop	psi	11.60
Safety valve - max press. set point	psi	36.26

The final pressure drop will be given after final order clarification and must be taken from the P&ID order documentation.

0.10 Technical parameters

All data in the technical specification are based on engine full load (unless stated otherwise) at specified temperatures as well as the methane number and subject to technical development and modifications. For isolated operation an output reduction may apply according to the block load diagram. Before being able to provide exact output numbers, a detailed site load profile needs to be provided (motor starting curves, etc.).

All pressure indications are to be measured and read with pressure gauges (psi.g.).

(1) At nominal speed and standard reference conditions ICFN according to DIN-ISO 3046 and DIN 6271, respectively
(2) According to DIN-ISO 3046 and DIN 6271, respectively, with a tolerance of +5 %.
Efficiency performance is based on a new unit (immediately upon commissioning).Effects of degradation during normal operation can be mitigated through regular service and maintenance work;
reference value --> 65%CH4 /
(3) Average value between oil change intervals according to maintenance schedule, without oil change amount
(4) At p. f. = 1.0 according to VDE 0530 REM / IEC 34.1 with relative tolerances
(5) Total output with a tolerance of ±8 %
(6) According to above parameters (1) through (5)
(7) Only valid for engine and generator; module and peripheral equipment not considered (at p. f. = 0,8) (guiding value)
(8) Exhaust temperature with a tolerance of ±8 %
(9) Intercooler heat on:
*** standard conditions (Vxx)** - If the turbocharger design is done for air intake temperature > 86°F w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/K starting from 77°F. Deviations between 77 – 86°F will be covered with the standard tolerance.
*** Hot Country application (Vxxx)** - If the turbocharger design is done for air intake temperature > 104°F w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/K starting from 95°F. Deviations between 95 – 104°F will be covered with the standard tolerance.

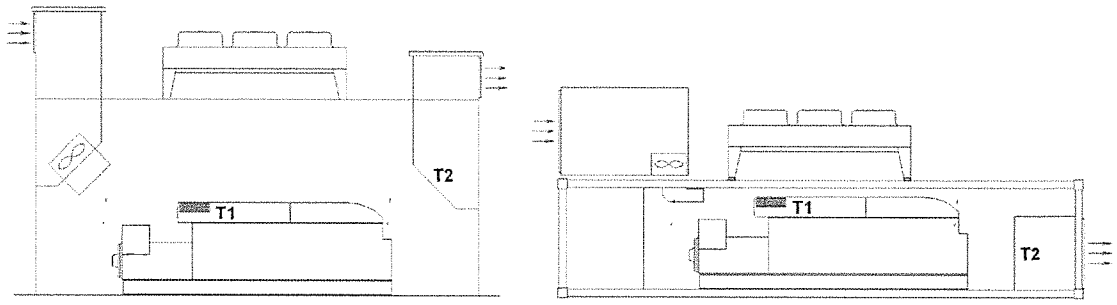
Radio interference level
The ignition system of the gas engines complies the radio interference levels of CISPR 12 and EN 55011 class B, (30-75 MHz, 75-400 MHz, 400-1000 MHz) and (30-230 MHz, 230-1000 MHz), respectively.

Definition of output
- ISO-ICFN continuous rated power:
  Net break power that the engine manufacturer declares an engine is capable of delivering continuously, at stated speed, between the normal maintenance intervals and overhauls as required by the manufacturer. Power determined under the operating conditions of the manufacturer's test bench and adjusted to the standard reference conditions.
- Standard reference conditions:

Barometric pressure:	14.5 psi (1000 mbar) or 328 ft (100 m) above sea level
Air temperature:	77°F (25°C) or 298 K
Relative humidity:	30 %

- Volume values at standard conditions (fuel gas, combustion air, exhaust gas)
  Pressure: 1 atmosphere (1013.25 mbar)
  Temperature: 32°F (0°C)

Output adjustment for turbo charged engines
Standard rating of the engines is for an installation at an altitude ≤ **0 ft** and an air intake temperature ≤ **86 °F** (T1)
Maximum room temperature: **122°F** (T2) -> engine stop



If the actual methane number is lower than the specified, the knock control responds. First the ignition timing is changed at full rated power. Secondly the rated power is reduced. These functions are done by the engine management.
Exceedance of the voltage and frequency limits for generators according to IEC 60034-1 Zone A will lead to a derate in output.

Parameters for the operation of GE Jenbacher gas engines
The genset fulfills the limits for mechanical vibrations according to ISO 8528-9.
The following "Technical Instruction of GE JENBACHER" forms an integral part of a contract and must be strictly observed: **TA 1000-0004, TA 1100 0110, TA 1100-0111**, and **TA 1100-0112.**
Transport by rail should be avoided. See **TA 1000-0046** for further details

Failure to adhere to the requirements of the above mentioned TA documents can lead to engine damage and may result in loss of warranty coverage.

Parameters for the operation of control unit and the electrical equipment
Relative humidity 50% by maximum temperature of 104°F.
Altitude up to 2000m above the sea level.

Parameters for using a gas compressor Parameters for using a gas compressor
The gas quantity indicated under the technical data refers to standard conditions with the given calorific value. The actual volume flow (under operating conditions) has to be considered for dimensioning the gas compressor and each gas feeding component – it will be affected by:
- Actual gas temperature (limiting temperature according to TA 1000-0300)

- Gas humidity (limiting value according to TA 1000-0300)
- Gas Pressure
- Calorific value variations (can be equated with methane (CH4) variations in the case of biogas)
- The gas compressor is designed for a max. relative under pressure of 0.22 psi(g) (15 mbar(g)) and a inlet temperature of 104°F (40°C) , if within scope of supply GE Jenbacher.

1.00 Scope of supply - Genset

Design:
The genset is built as a compact package.
Engine and generator are mounted to the base frame. To provide the best possible isolation from the transmission of vibrations the engine is mounted to the frame by means of anti-vibrational mounts. The remaining vibrations are eliminated by mounting the module on isolating pads (e.g. Sylomer). This, in principle, allows for placing of the genset to be directly on any floor capable of carrying the static load. No special foundation is required. Prevention of sound conducted through solids has to be provided locally.

1.01 Spark ignited gas engine

Four-stroke, air/gas mixture turbocharged, aftercooled, with high performance ignition system and electronically controlled air/gas mixture system.
The engine is equipped with the most advanced

LEANOX® LEAN-BURN COMBUSTION SYSTEM

Developed by GE JENBACHER.

1.01.01 Engine design

Engine block
Single-piece crankcase and cylinder block made of special casting; crank case covers for engine inspection, welded steel oil pan.

Crankshaft and main bearings
Drop-forged, precision ground, surface hardened, statically and dynamically balanced; main bearings (upper bearing shell: 3-material bearing / lower bearing shell: sputter bearing) arranged between crank pins, drilled oil passages for forced-feed lubrication of connecting rods.

Vibration damper
Maintenance free viscous damper

Flywheel
With ring gear for starter motor

Pistons
Single-piece, made of light metal alloy, with piston ring carrier and oil passages for cooling; piston rings made of high quality material, main combustion chamber specially designed for lean burn operation.

Connecting rods
Drop-forged, heat-treated, big end diagonally split and toothed. Big end bearings (upper bearing shell: sputter bearing / lower bearing shell: sputter bearing) and connecting rod bushing for piston pin.

Cylinder liner
Chromium alloy gray cast iron, wet, individually replaceable.

Cylinder head
Specially designed and developed for GE JENBACHER-lean burn engines with optimized fuel consumption and emissions; water cooled, made of special casting, individually replaceable; Valve seats and valve guides and spark plug sleeves individually replaceable; exhaust and inlet valve made of high quality material.

Crankcase breather
Connected to combustion air intake system.

Valve train
Camshaft, with replaceable bushings, driven by crankshaft through intermediate gears, valve lubrication by splash oil through rocker arms.

Combustion air/fuel gas system
Motorized carburetor for automatic adjustment according fuel gas characteristic. Exhaust driven turbocharger, mixture manifold with bellows, water-cooled intercooler, throttle valve and distribution manifolds to cylinders.

Ignition system
Most advanced, fully electronic high performance ignition system, external ignition control.
MORIS: Automatically, cylinder selective registration and control of the current needed ignition voltage.

Lubricating system
Gear-type lube oil pump to supply all moving parts with filtered lube oil, pressure control valve, pressure relief valve and full-flow filter cartridges. Cooling of the lube oil is arranged by a heat exchanger.

Engine cooling system
Jacket water pump complete with distribution pipework and manifolds.

Exhaust system
Turbocharger and exhaust manifold

Exhaust gas temperature measuring
Thermocouple for each cylinder

Electric actuator
For electronic speed and output control

Electronic speed monitoring for speed and output control
By magnetic inductive pick up over ring gear on flywheel

Starter motor
Engine mounted electric starter motor

1.01.02 Additional equipment for the engine (spares for commissioning)

The initial set of equipment with the essential spare parts for operation after commissioning is included in the scope of supply.

1.01.03 Engine accessories

Insulation of exhaust manifold:
Insulation of exhaust manifold is easily installed and removed

Sensors at the engine:
- Jacket water temperature sensor
- Jacket water pressure sensor
- Lube oil temperature sensor
- Lube oil pressure sensor
- Mixture temperature sensor
- Charge pressure sensor
- Minimum and maximum lube oil level switch
- Exhaust gas thermocouple for each cylinder
- Knock sensors
- Gas mixer / gas dosing valve position reporting.

Actuator at the engine:
- Actuator - throttle valve
- Bypass-valve for turbocharger
- Control of the gas mixer / gas dosing valve

1.01.04 Standard tools (per installation)

The tools required for carrying out the most important maintenance work are included in the scope of supply and delivered in a toolbox.

1.02 Generator-low voltage

The 2 bearing generator consists of the main generator (built as rotating field machine), the exciter machine (built as rotating armature machine) and the digital excitation system.
The digital regulator is powered by an auxiliary winding at the main stator or a PMG system

Main components
- Enclosure of welded steel construction
- Stator core consist of thin insulated electrical sheet metal with integrated cooling channels.

- Stator winding with 2/3 Pitch
- Rotor consists of shaft with shrunken laminated poles, Exciter rotor, PMG (depending on Type) and fan.
- Damper cage
- Excitation unit with rotating rectifier diodes and overvoltage protection
- Dynamically balanced as per ISO 1940, Balance quality G2,5
- Drive end bracket with re greaseable antifriction bearing
- Non-drive end bracket with re grease antifriction bearing
- Cooling IC01 - open ventilated, air entry at non-drive end , air outlet at the drive end side
- Main terminal box includes main terminals for power cables
- Regulator terminal box with auxiliary terminals for thermistor connection and regulator.
- Anti-condensation heater
- 3 PT100 for winding temperature monitoring+3 PT100 Spare
- 2 PT100 for bearing temperature monitoring

Option:
Current transformer for protection and measuring in the star point
xx/5A, 10P10 15VA , xx/5A, 1FS5, 15VA

Electrical data and features

- Standards: IEC 60034, EN 60034, VDE 0530, ISO 8528-3, ISO 8528-9
- Voltage adjustment range: +/- 10 % of rated voltage (continuous)
- Frequency: -6/+4% of rated frequency
- Overload capacity: 10% for one hour within 6 hours, 50% for 30 seconds
- Asymmetric load : max. 8% I2 continuous, in case of fault I2 x t=20
- Altitude: < 1000m
- Max permitted generator intake air temperature: 5°C - 40°C
- Max. relative air humidity: 90%
- Voltage curve THD Ph-Ph: <3,5% at idle operation and <5% at full load operation with linear symmetrical load
- Generator suitable for parallel operating with the grid and other generators
- Sustained short circuit current at 3-pole terminal short circuit: minimum 3 times rated current for 5 seconds.
- Over speed test with 1.2 times of rated speed for 2 minutes according to IEC 60034

Digital Excitation system ABB Unitrol 1010 mounted within the AVR Terminal box with following features:

- Compact and robust Digital Excitation system for Continuous output current up to 10 A (20A Overload current 10s)
- Fast AVR response combined with high excitation voltage improves the transient stability during LVRT events.
- The system has free configurable measurement and analog or digital I/Os. The configuration is done via the local human machine interface or CMT1000
- Power Terminals
  3 phase excitation power input from PMG or auxiliary windings

Auxiliary power input 24VDC

- Excitation output
- Measurement terminals: 3 phase machine voltage, 1 phase network voltage, 1 phase machine current
- Analog I/Os: 2 outputs / 3 inputs (configurable), +10 V / -10 V
- Digital I/O: 4 inputs only (configurable), 8 inputs / outputs (configurable)
- Serial fieldbus: RS485 for Modbus RTU or VDC (Reactive power load sharing for up to 31 GEJ engines in island operation), CAN-Bus for dual channel communication
- Regulator Control modes: Bump less transfer between all modes
  Automatic Voltage Regulator (AVR) accuracy 0,1% at 25°C ambient temperature
  Field Current Regulator (FCR)
  Power Factor Regulator (PF)
  Reactive Power Regulator (VAR)
- Limiters: Keeping synchronous machines in a safe and stable operation area
  Excitation current limiter (UEL min / OEL max)
  PQ minimum limiter
  Machine current limiter
  V / Hz limiter
  Machine voltage limiter
- Voltage matching during synchronization
- Rotating diode monitoring
- Dual channel / monitoring: Enables the dual channel operation based on self-diagnostics and setpoint follow up over CAN communication.. As Option available
- Power System Stabilizer (PSS) is available as option. Compliant with the standard IEEE 421.5-2005 2A / 2B, the PSS improves the stability of the generator over the highest possible operation range.
- Computer representation for power system stability studies: ABB 3BHS354059 E01
- Certifications: CE, cUL certification according UL 508c (compliant with CSA), DNV Class B,

- **Commissioning and maintenance Tool CMT1000** (for trained commissioning/ maintenance personal)
- With this tool the technician can setup all parameters and tune the PID to guarantee stable operation. The CMT1000 software allows an extensive supervision of the system, which helps the user to identify and locate problems during commissioning on site. The CMT1000 is connected to the target over USB or Ethernet port, where Ethernet connection allows remote access over 100 m.
- Main window
  - Indication of access mode and device information.
  - Change of parameter is only possible in CONTROL access mode.
  - LED symbol indicates that all parameter are stored on none volatile memory.
- Setpoint adjust window
  - Overview of all control modes, generator status, active limiters status and alarms.
  - Adjust set point and apply steps for tuning of the PID.
- Oscilloscope
- 4 signals can be selected out of 20 recorded channels. The time resolution is 50ms.Save files to your PC for further investigation.
- Measurement
  - All measurements on one screen.

Routine Test
Following routine tests will be carried out by the generator manufacturer

- Measuring of the DC-resistance of stator and rotor windings
- Check of the function of the fitted components (e.g. RTDs, space heater etc.)
- Insulation resistance of the following components
  - Stator winding, rotor winding
  - Stator winding RTDs
  - Bearing RTDs
  - Space heater
- No Load saturation characteristic (residual voltage)
- Stator voltage unbalance
- Direction of rotation, phase sequence
- High voltage test of the stator windings (2 x Unom. + 1000 V) and the rotor windings (min. 1500 V)

1.03 Module Accessories

Base frame
Common Base Frame fabricated with welded structural steel. Frame to mount the engine, jacket water heat exchangers, pumps and engine auxiliaries, as well as generator.

Coupling
Engine to Generator coupling is provided. The coupling isolates the major sub-harmonics of engine alternating torque from generator.

Coupling housing
Provided for Coupling

Anti-vibration mounts
2 sets of isolation, one is arranged between engine block assembly and base frame. The second is via insulating pads (SYLOMER) for placement between base frame and foundation, delivered loose.

Exhaust gas connection
A flanged connection is provided that collects the exhaust gas turbocharger output flows, includes flexible pipe connections (compensators) to compensate for heat expansions and vibrations.

Combustion air filter
A Dry type air filter with replaceable filter cartridges is fitted. The assembly includes flexible connections to the fuel mixer/carburetor and service indicator.

Interface panel (M1 cabinet)
Totally enclosed sheet steel cubicle with hinged doors, pre-wired to terminals, ready to operate. All Cable entry will be via bottom mounted cable gland plates.

Painting: RAL 7035

Protection: External NEMA 3 (IP 54), Internal IP 20 (protection against direct contact with live parts)

Cabinet design is according to IEC 439-1 (EN 60 439-1/1990) and DIN VDE 0660 part 500, respectively. Ambient temperature 41 - 104 °F (5 - 40 °C), Relative humidity 70%

Dimensions:

- Height: 51 in (1300 mm)
- Width: 47 in (1200 mm)
- Depth: 16 in (400 mm)

Control Power Source: The starter batteries and the cabinet mounted battery chargers will provide the power source for this enclosure.

Interface Panel contents and control functions:

- The cabinet houses the unit Battery Charger and primary 24VDC Control Power Distribution (breakers, fuses, and terminals) from the unit Batteries
- Distributed PLC Input and Output cards, located in the cabinet, gather all Engine and Generator Control I/O. These cards transmit data via data bus interface to the central engine control of the module control panel located in the A1 cabinet. Data bus is via CAN and B&R Proprietary Data Highway (Data Cables provided by GE)
- Speed monitoring relays for protection are provided.
- Gas Train I/O Collection, including interface relays and terminals for gas train shutoff valves.
- Transducer for generator functions, such as excitation voltage.
- Door Mounted Emergency Stop Switch with associated Emergency Stop Loop interface relays.
- Miscellaneous control relays, contacts, fuses, etc. for additional control valves, and auxiliaries.
- Interface Terminal Strips

Skid Mounted 3 Phase Devices are Powered by 3 x **480/277** V, **60** Hz, 50 A

AC Power for engine mounted auxiliaries (heater, pumps, etc.) are routed through a separate J-box mounted on the side M1 cabinet (Box E1). This is done to maintain signal segregation (AC from control)

NOTE: Generator Current Transformer wiring is connected directly to the Generator and does NOT pass through the M1 cabinet.

1.03.01 Engine jacket water system

Engine jacket water system

Closed cooling circuit, consisting of:

- Expansion tank
- Filling device (check and pressure reducing valves, pressure gauge)
- Safety valve(s)
- Thermostatic valve
- Required pipework on module
- Vents and drains

- Electrical jacket water pump, including check valve
- Jacket water preheat device

1.03.02 Automatic lube oil replenishing system incl. extension tank

Automatic lube oil replenishing system:
Includes float valve in lube oil feed line, including inspection glass. Electric monitoring system will be provided for engine shut-down at lube oil levels "MINIMUM" and "MAXIMUM". Solenoid valve in oil feed line is only activated during engine operation. Manual override of the solenoid valve, for filling procedure during oil changes is included.

Oil drain
By set mounted cock

Oil sump extension tank 39.6 gal
To increase the time between oil changes

Pre-lubrication- and aftercooling oil pump:
Mounted on the module base frame; it is used for pre-lubrication and aftercooling of the turbochargers.
Period of operation: Pre-lubrication: 1 minute
Aftercooling: 15 minutes from engine stop
Consisting of:
- 1 piece oil pump 1500 W, 24 V
- All necessary vents
- Necessary pipework

1.05.01 Gas train <500mbar (7.3 psi)

Pre-assembled, delivered loose, for installation into gas pipework to the module.

Consisting of:
- Manual shut off valve
- Gas filter, filter fineness <3 µm
- Pressure gauge with push button valve
- Gas admission pressure regulator
- Solenoid valves
- Leakage detector
- Gas pressure switch (min.)
- TEC JET (has to be implemented horizontal)
- Gas flow meter (option)
- p/t compensation (option)

The gas train complies with DIN - DVGW regulations.
Maximum distance from TEC JET outlet to gas entry on engine, including flexible connections, is 39,37in (1m)

1.07 Painting

• Quality:	Oil resistant prime layer Synthetic resin varnish finishing coat	
• Color:	Engine:	RAL 6018 (green)
	Base frame:	RAL 6018 (green)
	Generator:	RAL 6018 (green)
	Module interface panel:	RAL 7035 (light grey)
	Control panel:	RAL 7035 (light grey)

1.11 Engine generator control panel per module- Dia.ne XT4 incl. Single synchronization of the generator breaker

Dimensions:

- Height: 87 in (including 8 in pedestal *)
- Width: 32 -48 in*)
- Depth: 24 in *)

Protection class:

- external IP42
- Internal IP 20 (protection again direct contact with live parts)

*) Control panels will be dimensioned on a project specific basis. Actual dimensions will be provided in the preliminary documentation for the project.

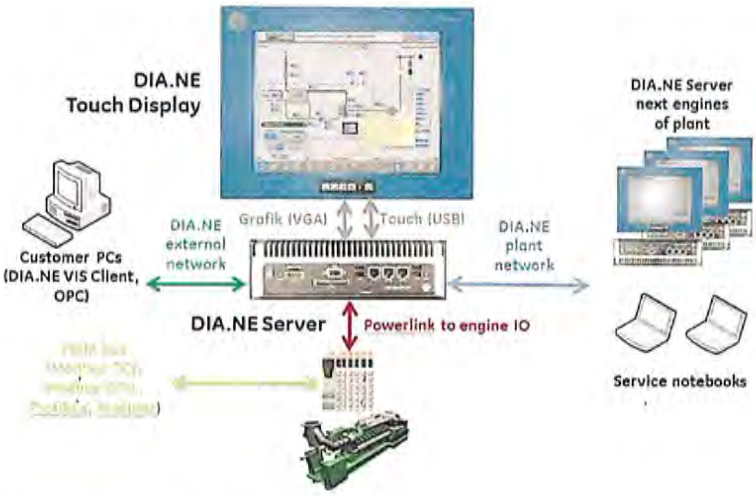
Control supply voltage from starter and control panel batteries: 24V DC

Auxiliaries power supply: (from provider of the auxiliary supply)
3 x **480/277** V, **60** Hz

Consisting of:
Motor - Management - System DIA.NE

Setup:

- a) Touch display visualization
- b) Central engine and unit control



Touch Display Screen:

15" Industrial color graphic display with resistive touch.

Interfaces:

- 24V voltage supply
- VGA display connection
- USB interface for resistive touch

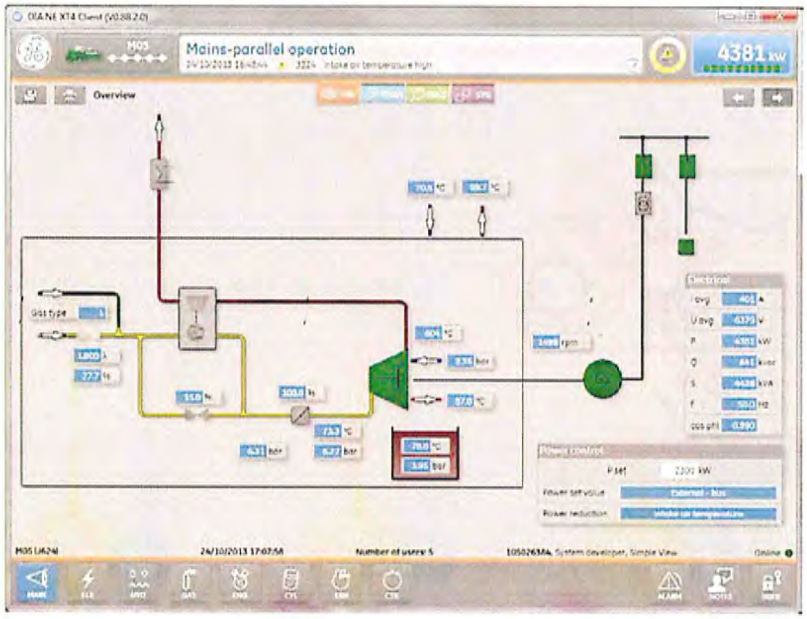
Protection class of DIA.NE XT panel front: IP 65
Dimensions: W x H x D = approx. 16x12x3in

The screen shows a clear and functional summary of the measurement values and simultaneously shows a graphical summary.

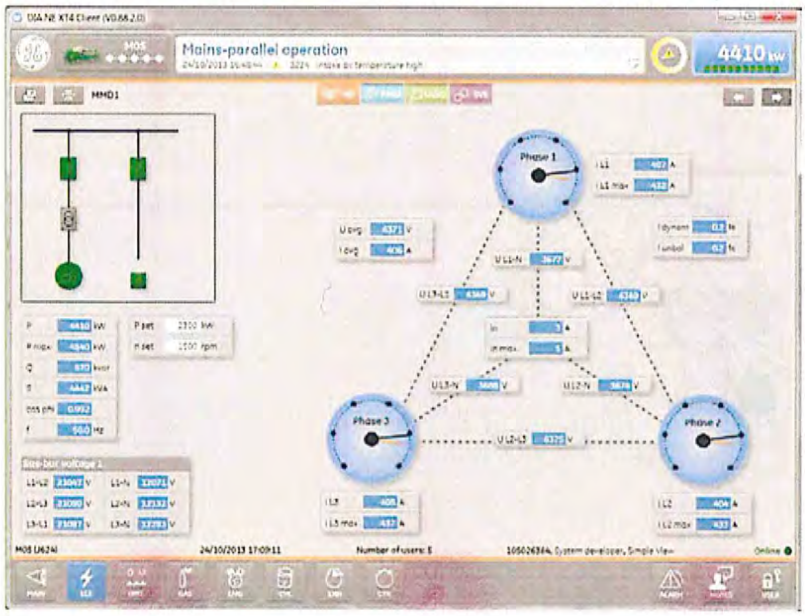
Operation is via the screen buttons on the touch screen
Numeric entries (set point values, parameters...) are entered on the touch numeric pad or via a scroll bar.
Determination of the operation mode and the method of synchronization via a permanently displayed button panel on the touch screen.

Main screens (examples):

Main: Display of the overview, auxiliaries status, engine start and operating data.



ELE: Display of the generator connection with electrical measurement values and synchronization status



OPTION: Generator winding and bearing temperature
Trending
Trend with 100ms resolution

Measurement values:

- 510 data points are stored
- Measurement interval = 100ms
- Raw data availability with 100ms resolution: 24 hours + max. 5.000.000 changes in value at shut down (60 mins per shut down)
- Compression level 1: min, max, and average values with 1000ms resolution: 3 days
- Compression level 2: min, max, and average values with 30s resolution: 32 days
- Compression level 3: min, max, and average values with 10min resolution: 10 years

Messages:
10.000.000 message events

Actions (operator control actions):
1.000.000 Actions

System messages:
100.000 system messages

Central engine and module control:

An industrial PC- based modular industrial control system for module and engine sequencing control (start preparation, start, stop, aftercooling and control of auxiliaries) as well as all control functions.

Interfaces:

- Ethernet (twisted pair) for remote monitoring access
- Ethernet (twisted pair) for connection between engines
- Ethernet (twisted pair) for the Powerlink connection to the control input and output modules.
- USB interface for software updates

Connection to the local building management system according to the GE Jenbacher option list (OPTION)

- MODBUS-RTU Slave
- MODBUS-TCP Slave,
- PROFIBUS-DP Slave (160 words),
- PROFIBUS-DP Slave (190 words),
- ProfiNet
- OPC

Control functions:

- Speed control in idle and in island mode
- Power output control in grid parallel operation, or according to an internal or external set point value on a case by case basis
- LEANOX control system which controls boost pressure according to the power at the generator terminals, and controls the mixture temperature according to the engine driven air-gas mixer
- Knocking control: in the event of knocking detection, ignition timing adjustment, power reduction and mixture temperature reduction (if this feature is installed)
- Load sharing between engines in island mode operation (option)
- Linear power reduction in the event of excessive mixture temperature and misfiring
- Linear power reduction according to CH4 signal (if available)
- Linear power reduction according to gas pressure (option)
- Linear power reduction according to air intake temperature (option)

Multi-transducer to record the following alternator electrical values:

- Phase current (with slave pointer))
- Neutral conductor current
- Voltages Ph/Ph and Ph/N
- Active power (with slave pointer)
- Reactive power
- Apparent power
- Power factor
- Frequency
- Active and reactive energy counter

Additional 0 (4) - 20 mA interface for active power as well as a pulse signal for active energy

The following alternator monitoring functions are integrated in the multi-measuring device:

- Overload/short-circuit [51], [50]
- Over voltage [59]
- Under voltage [27]
- Asymmetric voltage [64], [59N]
- Unbalance current [46]
- Excitation failure [40]
- Over frequency [81>]
- Under frequency [81<]

Lockable operation modes selectable via touch screen:

- "OFF" operation is not possible, running units will shut down immediately;
- "MANUAL" manual operation (start, stop) possible, unit is not available for fully automatic operation.
- "AUTOMATIC" fully automatic operation according to external demand signal:

Demand modes selectable via touch screen:

- external demand off („OFF")
- external demand on („REMOTE")
- overide external demand („ON")

Malfunction Notice list:

Shut down functions e.g.:

- Low lube oil pressure
- Low lube oil level
- High lube oil level
- High lube oil temperature
- Low jacket water pressure
- High jacket water pressure
- High jacket water temperature
- Overspeed
- Emergency stop/safety loop
- Gas train failure
- Start failure
- Stop failure
- Engine start blocked
- Engine operation blocked
- Misfiring
- High mixture temperature
- Measuring signal failure
- Overload/output signal failure

- Generator overload/short circuit
- Generator over/undervoltage
- Generator over/underfrequency
- Generator asymmetric voltage
- Generator unbalanced load
- Generator reverse power
- High generator winding temperature
- Synchronizing failure
- Cylinder selective Knocking failure

Warning functions e.g.:
- Cooling water temperature min.
- Cooling water pressure min.
- Generator winding temperature max.

Remote signals:
(volt free contacts)

1NO = 1 normally open
1NC = 1 normally closed
1COC = 1 change over contact

• Ready for automatic start (to Master control)	1NO
• Operation (engine running)	1NO
• Demand auxiliaries	1NO
• Collective signal "shut down"	1NC
• Collective signal "warning"	1NC

External (by others) provided command/status signals:

• Engine demand (from Master control)	1S
• Auxiliaries demanded and released	1S

Single synchronizing Automatic

For automatic synchronizing of the module with the generator circuit breaker to the grid by PLC- technology, integrated within the module control panel.

Consisting of:
- Hardware extension of the programmable control for fully automatic synchronization selection and synchronization of the module and for monitoring of the generator circuit breaker closed signal.
- Lockable synchronization selection via touch screen with the following selection modes:
  - "MANUAL" Manual initiation of synchronization via touch screen button followed by fully automatic synchronization of the module

- "AUTOMATIC" Automatic module synchronization, after synchronizing release from the module control
- "OFF" Selection and synchronization disabled
  Control of the generator circuit breaker according to the synchronization mode selected via touch screen.
- "Generator circuit breaker CLOSED/ Select" Touch-button on DIA.NE XT
- "Generator circuit breaker OPEN" Touch-button on DIA.NE XT

Status signals:
Generator circuit breaker closed
Generator circuit breaker open

Remote signals:
(volt free contacts)

Generator circuit breaker closed	1 NO

The following reference and status signals must be provided by the switchgear supplier:

• Generator circuit breaker CLOSED	1 NO
• Generator circuit breaker OPEN	1 NO
• Generator circuit breaker READY TO CLOSE	1 NO
• Mains circuit breaker CLOSED	1 NO
• Mains circuit breaker OPEN	1 NO

Mains voltage 3 x **480/277**V or 3x 110V/v3 other measurement voltages available on request
Bus bar voltage 3 x **480/277** V or 3x 110V/v3 – other measurement voltages available on request
Generator voltage 3 x **480 V** or 3x 110V/v3 – other measurement voltages available on request

Voltage transformer in the star point with minimum 50VA and Class 0,5

The following volt free interface-signals will be provided by GE Jenbacher to be incorporated in switchgear:

• CLOSING/OPENING command for generator circuit breaker (permanent contact)	1 NO + 1 NC
• Signal for circuit breaker undervoltage trip	1 NO

Maximum distance between module control panel and engine/interface panel:	99ft
Maximum distance between module control panel and power panel:	164ft
Maximum distance between module control panel and master control panel:	164ft
Maximum distance between alternator and generator circuit breaker:	99ft

1.11.01 Remote messaging over MODBUS-TCP

Data transfer from the Jenbacher module control system to the customer's on-site central control system via MODBUS TCP using the ETHERNET 10 BASE-T/100BASE-TX protocol TCP/IP.

The Jenbacher module control system operates as a SLAVE unit.
The data transfer via the customer's MASTER must be carried out in cycles.

Data transmitted:
Individual error messages, operational messages, measured values for generator power, oil pressure, oil temperature, cooling water pressure, cooling water temperature

GE Jenbacher limit of supply:
RJ45 socket at the interface module in the module control cabinet

1.11.06 Remote Data-Transfer with DIA.NE XT4

General
DIA.NE XT4 offers remote connection with Ethernet.

Applications:

1.) DIA.NE XT4 HMI
DIA.NE XT4 HMI is the human-machine-interface of DIA.NE XT4 engine control and visualization system for GE Jenbacher gas engines.
The system offers extensive facilities for commissioning, monitoring, servicing and analysis of the site.
By installation of the DIA.NE XT4 HMI client program it can be used to establish connection to site, if connected to a network and access rights are provided.
The system runs on Microsoft Windows Operating systems (Windows XP, Windows 7, Windows 8)

Function
Functions of the visualization system at the engine control panel can be used remotely. These are among others control and monitoring, trend indications, alarm management, parameter management, and access to long term data recording. By providing access to multiple systems, also with multiple clients in parallel, additional useful functions are available like multi-user system, remote control, print and export functions and data backup.DIA.NE XT4 is available in several languages.

Option - Remote demand/blocking

If the service selectors switch at the module control panel is in pos."Automatic" and the demand-selector switch in pos."Remote", it is possible to enable (demanded) or disable (demand off) the module with a control button at the DIA.NE XT4 HMI
Note:
With this option it makes no sense to have an additional clients demand (via hardware or data bus)

or a self-guided operation (via GE Jenbacher master control, grid import /export etc.).

Option - Remote - reset (see TA-No. 1100-0111 chapter 1.7 an d1.9)

Scope of supply

- Software package DIA.NE XT4 HMI Client Setup (Download)
- Number of DIA.NE XT4 HMI - Client user license (Simultaneous right to access of one user to the engine control)

Nr. of license	Access
1	1 Users can be logged in at the same time with a PC (Workplace, control room or at home).
2 - "n" (Optional)	2- "n" Users can be logged in at the same time with a PC (Workplace, control room or at home). If 2- "n" users are locally connected at Computers from office or control room, then it is not possible to log in from home.

Caution! This option includes the DIA.NE XT4 HMI client application and its license only – NO secured, encrypted connection will be provided by GE Jenbacher! A secured, encrypted connection – which is mandatory – has to be provided by the customer (via LAN connection or customer-side VPN), or can be realized by using option myPlant™.

Customer requirements

- Broad band network connection via Ethernet(100/1000BASE-TX) at RJ45 Connector (ETH3) at DIA.NE XT4 server inside module control panel
- Standard PC with keyboard, mouse or touch and monitor (min. resolution 1024*768)
- Operating system Windows XP, Windows 7, Windows 8
- DirectX 9.0 c compatible or newer 3D display adapter with 64 MB or higher memory

2.) myPlant™

myPlant™ is the GE Jenbacher remote monitoring and diagnostic (RM&D) service

	Offering Feature	Connect	Protect
Asset Management	Online data transfer	✓	✓
	Big Data cloud storage	✓	✓
	Engine status visibility	✓	✓
	Control alarms visibility	✓	✓
	Basic data trends	✓	✓
	Remote access to DIA.NE HMI	-	✓
	Unlimited data trending	-	✓
	Advanced diagnostics	-	✓
Fleet	Fleet status on world map	-	✓

Management	Fleet summaries and reporting	-	✓
Mobility	SMS/Email notifications	-	✓
	Smartphone app	✓	✓

Web application with following features:

- Visualization of the current state of the engine (available, in operation, fault)
- View of various readings of the Gen-set
- Visualization of counts as a trend graph (if plant available online, or by manually entering of the counter readings)
- Trend graph of the performance value (low resolution; only if system available online)

myPlant™ Connect is free of charge for registered customers
myPlant™ Protect is free of charge within the warranty period (limited to 1 year) and is also included as part of any contractual service agreement (CSA).

Scope of supply

- Access to myPlant™
- Connection between plant server and myPlant™ system

Customer requirements

- Permanent Internet line (wired or mobile, (see option 4))
- See technical instruction TA 2300-0008
- Outbound data connectivity (from plant server to Internet) ONLY – INBOUND connections must NOT be allowed!

CAUTION!
It is in the responsibility of the customer to prevent direct access from the Internet to the plant server using technical equipment like firewalls.
GE Jenbacher does not provide such security devices and services as part of this option!

3.) Mobile Internet (OPTION)

Connection Plant - Customer via secured Internet - connection
See also technical instruction **TA 2300 - 0006**

Scope of delivery

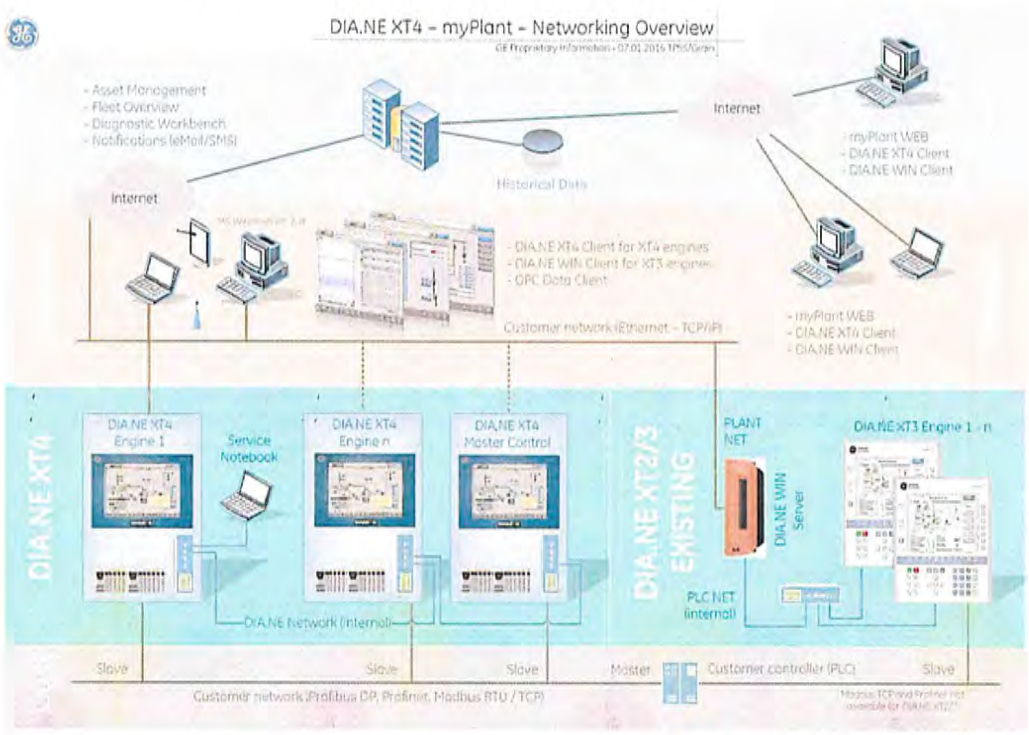
- Mobile Internet router with antenna to connect to the DIA.NE Server XT4

Customer requirements

- SIM card for 3G / 4G

4.) Network overview

For information only!



1.20.03 Starting system

Starter battery (is not included in GE Jenbacher scope):
2 piece 12 V Pb battery, 200 Ah (according to DIN 72311), complete with cover plate, terminals and acid tester.

Battery voltage monitoring:
Monitoring by an under voltage relay.

Battery charging equipment:
Capable for charging the starter battery with I/U characteristic and for the supply of all connected D.C. consumers.
Charging device is mounted inside of the module interface panel or module control panel.

- **General data:**
  - Power supply — **3 x 320 - 550 V, 47 - 63 Hz**
  - max. power consumption — 1060 W
  - Nominal D.C. voltage — 24 V(+/-1%)
  - Voltage setting range — 24V to 28,8V (adjustable)
  - Nominal current (max.) — 40 A
  - Dimensions — ca. 10 x 5 x 5 inch (240 x 125 x 125 mm)
  - Degree of protection — IP20 to IEC 529
  - Operating temperature — 32 °F – 140 °F (0 °C - 60 °C)
  - Protection class — 1
  - Humidity class — 3K3, no condensation.
  - Natural air convection
  - Standards — EN60950,EN50178
    UL/cUL (UL508/CSA 22.2)

Signalling:

Green Led:	Output voltage > 20,5V
Yellow Led:	Overload, Output Voltage < 20,5V
Red Led:	shutdown

Control accumulator:
- Pb battery 24 VDC/18 Ah

1.20.05 Electric jacket water preheating

Installed in the jacket water cooling circuit, consisting of:
- Heating elements
- Water circulating pump

The jacket water temperature of a stopped engine is maintained between 133 °F (56°C) and 140°F (60°C), to allow for immediate loading after engine start.

1.20.08 Flexible connections

Following flexible connections per module are included in the GE Jenbacher -scope of supply:

No.	Connection	Unit	Dimension	Material
2	Warm water in-/outlet	**in/lbs**	**4"/145**	Stainless steel
1	Exhaust gas outlet	**in/lbs**	**12"/145**	Stainless steel
1	Fuel gas inlet	**in/lbs**	**5"/145**	Stainless steel
2	Intercooler in-/outlet	**in/lbs**	**4"/145**	Stainless steel
2	Lube oil connection	**in**	**1.1"**	Hose

Seals and flanges for all flexible connections are included.

2.00 Electrical equipment

Totally enclosed floor mounted sheet steel cubicle with front door wired to terminals. Ready to operate, with cable entry at bottom. Naturally ventilated.

Protection:	IP 42 external, NEMA 12 IP 20 internal (protection against direct contact with live parts)

Design according to EN 61439-2 / IEC 61439-2 and ISO 8528-4.
Ambient temperature 41 - 104 °F (5 - 40 °C), 70 % Relative humidity

Standard painting:	Panel:	RAL 7035
	Pedestal:	RAL 7020

2.02 Grid monitoring device

Standard without static Grid - 60Hz alternator

Function:
For immediate disconnection of the generator from the grid in case of grid failures.

Consisting of:
- High/low voltage monitoring
- High/low frequency monitoring
- Specially adjustable independent time for voltage and frequency monitoring
- Vector jump monitoring or df/dt monitoring for immediate disconnection of the generator from the grid for example at short interruptions
- Indication of all reference dimensions for normal operation and at the case of disturbance over LCD and LED
- Adjusting authority through password protection against adjusting of strangers

Scope of supply:
Digital grid protection relay with storage of defect data, indication of reference dimensions as well as monitoring by itself.

Grid protection values:

Parameter	Parameter limit	Max time delay[s]	**Comments**
59-61Hz			Do work normal
f<[ANSI 81U]	59Hz	0,5	Load reduction with 10%/HZ below 59Hz!

f<<[ANSI 81U]	58.5Hz	0,1	
f>[ANSI 81O]	61,5Hz	0,1	Load reduction with 30%/HZ above 61Hz!
U<[ANSI 27]	90%	1	Load reduction with 1%P /%U below 95%
U<<[ANSI 27]	80%	0,2	Load reduction with 1%P /%U below 95%
U>[ANSI 59]	110%	30	Load reduction with 1%P /%U above 105%
U>>[ANSI 59]	115%	0,2	Load reduction with 1% P/%U above 105%
Df/dt [ANSI 81R] **Or** **Vector shift** [ANSI 78]	2Hz/s, 5 Periods Or 8° -3pol		Cos phi range: 0,8ind (overexcited) - 1

3.71 Vibration Switch

A structural Vibration Switch will be installed on the package base frame to detect excessive vibrations. A signal we will be sent to the control panel to indicate an alarm condition.

3.72 Seismic Protection

The main base will be supplied with pre-drilled holes to accommodate customer furnished bolts to act as retaining elements in the event of an earthquake. These customer foundation mounted bolts cannot come into contact with the unit base frame, as these bolts are for retention only, not mounting.

Details will be provided at first drawing submittal.

3.74 Control Strategy and Options (Type 4)

Control Strategy – The following control modes will be available in the Diane Control

- Grid Parallel with KW Control – Real Power Load Control of the Generator set will be either via a 4-20mA input from the customer representing a unit KW load setpoint or a KW load setpoint entered on the Diane XT3 screen. Upon breaker closure, the unit will ramp to the setpoint at a maximum rate of (Rated Unit KW) / 180 seconds.

- Grid Parallel with PF Control – Reactive Power Load Control of the Generator set will be either via a 4-20mA input from the customer representing a unit Power Factory setpoint or a Power Factor setpoint entered on the Diane XT3 screen. Upon breaker closure, the unit will maintain the setpoint.

- Grid Parallel with Import/Export Control - Load Control via an Import/Export KW level entered on the Diane XT3 screen. Required will be a customer 4-20mA signal representing the Site KW (Imported and/or Exported Power) that is to be controlled. Upon breaker closure, the unit will ramp to a load that will drive the KW value represented by the 4-20mA input signal to the level entered on Customer Import/Export Setpoint entered in the Diane XT3 screen. Once at the setpoint, the unit will raise and lower load to maintain this value. If the generator load required to maintain this setpoint drops below the minimum load level of the generator set, the unit 52G circuit breaker will be opened.

- Island Mode Operations with Blackout Starting – Island Operations with Black start capability will allow the engine to start and run without utility being present. The engine will be able to start the engine on battery power, close the generator breaker against a dead bus, and operate independently of a utility power source. The customer must ensure that there is sufficient fuel gas and pre-chamber gas at pressure in the event of a Type 6 engine so configured. The engine will start without the normal confirmation of engine block temperature or operation of a circulating AC water pump. It will be required of the operators that once the engine is connected to the generator bus, power to the engine auxiliaries be restored. Load Management is expected to be limited by the operators to the limits of the engine, as per GE Jenbacher TI 2108-0031. This system will work in conjunction with a GE Jenbacher Master Synchronizing Control (see appropriate Spec Section) if so equipped. If this is a single unit and synchronization with the utility after assuming operations is required, a *Grid Parallel with Single Unit Island Operations* option will be required.

Per Unit Hot Water Loop Controls - Hot Water Loop Panel Controls and Software to include:

- Hot Water Pump (Panel Control Parts and SW Only) - The option will add specific contact output and feedback input to/from an MCC for the Hot Water Pump. This will include relays and software.

- Hot Water Monitoring (Panel Control Parts and SW Only) - This option will monitor 3 hot water loop switches, flow, pressure and temperature. This option includes hardwired relays added to the trip loop, and internal software

- Hot Water Return Temperature Control (Panel Parts and SW Only) - This feature will provide all necessary controls to operate a 3 Way temperature control valve. The customer will provide a PT100 as a feedback signal and the Diane will provide a 4-20mA Analog Output to a customer provided valve. Control and Display Software are also provided.

- Emergency Hot Water Temperature Control (Panel Parts and SW Only) - This feature will provide all necessary controls to operate a 3 Way temperature control valve. The customer will provide a PT100 as a feedback signal and the Diane will provide a 4-20mA Analog Output to a customer provided valve. Control and Display Software are also provided.

Per Unit Intercooler Loop Controls - Intercooler Loop Panel Controls and Software to include:

- IC Temperature Control (Panel Parts and SW Only) - This feature will provide all necessary controls to operate a 3 Way temperature control valve in the IC Loop if Not Required by Site Conditions. The Diane will provide a 4-20mA Analog Output to a customer provided valve and will utilize mixture temperature as a feedback input. Control and Display Software are also provided.

- Intercooler Pump Control (Panel Control Parts and SW Only) - The option will add specific contact output and feedback input to/from an MCC for the Intercooler Water Pump. This will include relays and software.

- Intercooler Loop Pressure (Panel Parts and SW Only) - This feature will provide an discrete input and associated software for the Intercooler Loop system pressure.

Per Unit Radiator Controls - Radiator Panel Controls and Software to include:

- Single Circuit High Temperature Loop Radiator Fan Control (Panel Parts and SW Only) - This feature will provide controls for a customer provided single circuit High Temperature Loop radiator (4 fan). The MCC control signals (DO/DI) will be provided, along with the necessary software

- Single Circuit Low Temperature Loop Radiator Fan Control (Panel Parts and SW Only) - This feature will provide controls for a customer provided single circuit Low Temperature Loop radiator (4 fan). The MCC control signals (DO/DI) will be provided, along with the necessary software

Per Unit Ventilation Related Controls - Diane XT3 System will be provided with the following additional features to operate a customer enclosure

- Ventilation Fan control Option 1 - Customer Ventilation Fan control based on container internal temperature. Signal is based on a customer provide PT100 inside the container. A 4-20mA signal is provided for use by a customer provided VFD. Discrete IO is provided for starting and feedback signals to the VFD. It is assumed that the customer MCC will provide starter motor protection.

- Ventilation System Louver Control - Electrical and Control features are provided for louver opening and closing based on engine operation and compartment temperature. 4 Louver driver contacts are provided

- Discrete Input for Air Filter Differential Pressure – Additional Discrete Input and associated software for control

Per Unit Miscellaneous Controls - Diane XT3 System will be provided with the following additional features to operate a customer enclosure

- Exhaust By-Pass Control -The exhaust by-pass consists of two flaps (one open, one closed) housed in a tee section of piping, which are controlled by a single actuator. The position of the by-pass is determined by the outlet temperature of the process heat exchanger. A PT100 sensor is used to send the outlet temperature of the process heat exchanger to the DIA.NE. The DIA.NE monitors this temperature, and if the temperature is at or above set point, moves the flaps to reduce the flow to the Exhaust Heat Exchanger while increasing the flow to the exhaust bypass. For temperatures below set point, all flow is directed through the Exhaust Heat Exchanger (analog output = 20 mADC).

  [4 mADC = full bypass, 20 mADC = full Enalco. A broken wire or loss of signal will produce a full bypass output condition.] *

  *There is a presumption is that a broken wire alarm already exists in the code.

- Additional Emergency Stop Signals - Additional Terminals for customer Estop switches

- Audible and Visual Alarm Indications - Hardware and software to drive a customer provided horn and strobe. Power for these devices is provided from the control system and is 24VDC

- SCR Control Signals – 2 additional discrete inputs and 1 analog will be required:
  - Discrete In 1 - Unit Operation/Engine Running (SSL20) to start the unit
  - Discrete In 2 - SCR Alarm (SS69) for display on the alarm Diane XT screen.
  - Analog Out 1 – Generator Power (0-100% = 4-20mA) for control of the SCR spray mechanism.

- Gas Flow Meter Trending - Gas Flowmeter Trending and Display (Flowmeter not included). Option includes a 4-20mA input that will accept the pressure and temperature corrected gas flow from a customer provided flow meter computer and will incorporate the signal into trending and displays in the Diane system.

- Gas Flow Meter Correction - Gas Flowmeter temperature and pressure compensation. Option includes three (3) 4-20mA inputs that will represent actual measured flow, pressure and temperature. Along with a customer provided flow meter calibration sheet, these 3 signals will be input to a calculation that will compensate the flowmeter flow signal to current gas conditions. The results will be incorporated into trending and displays in the Diane system.

4.00 Delivery, installation and commissioning

4.01 Carriage
According to contract.

4.02 Unloading
Unloading, moving of equipment to point of installation, mounting and adjustment of delivered equipment on intended foundations is not included in GE Jenbacher scope of supply.

4.03 Assembly and installation
Assembly and installation of all GE Jenbacher -components is not included in GE Jenbacher scope of supply.

4.04 Storage
The customer is responsible for secure and appropriate storage of all delivered equipment.

4.05 Emission measurement (exhaust gas analyser)
Emission measurement by GE Jenbacher personnel, to verify that the guaranteed toxic agent emissions have been achieved (costs for measurement by an independent agency will be an extra charge).

5.01 Limits of delivery - Genset

Electrical:
- Genset:
  - At terminals of genset interface panel
  - At terminals of generator terminal box
    (screwed glands to be provided locally)
- Genset control panel:
  At terminal strips
- Auxiliaries:
  At terminals of equipment which is supplied separately

Cooling water
At inlet and outlet flanges on genset

Exhaust gas
At outlet flange of the genset

Combustion air
The air filters are set mounted

Fuel gas
At inlet and outlet flange of gas train
At inlet flange of gas pipework on genset

Lube oil
At lube oil connections on genset

Draining connections and pressure relief
At genset

Insulation
Insulation of heat exchangers and pipework is not included in our scope of supply and must be provided locally.

First filling
The first filling of genset, (lube oil, engine jacket water, anti-freeze, anti-corrosive agent, battery acid) is not included in our scope of supply.

The composition and quality of the used consumables are to be strictly monitored in accordance with the "Technical Instructions" of GE JENBACHER.

Suitable bellows and flexible connections **must be provided locally** for all connections.
Cables from the genset must be flexible.

5.02 Factory tests and inspections

The individual module components shall undergo the following tests and inspections:

5.02.01 Engine tests
Carried out as combined Engine- and Module test according to DIN ISO 3046 at GE Jenbacher test bench.
The following tests are made at 100%, 75% and 50% load, and the results are reported in a test certificate:
- Engine output
- Fuel consumption
- Jacket water temperatures
- Lube oil pressure
- Lube oil temperatures
- Boost pressure
- Exhaust gas temperatures, for each cylinder

5.02.02 Generator tests
Carried out on the premises of the generator supplier.

5.02.03 Module tests
The engine will be tested with natural gas (methane number 94). The performance data achieved at the test bench may therefore vary from the data as defined in the technical specification due to differences in fuel gas quality.
Carried out as combined Engine- and Module test commonly with module control panel at GE Jenbacher test bench, according to ISO 8528, DIN 6280. The following tests are made and the results are reported in a test certificate:

Visual inspection of scope of supply per specifications.

- Functional tests per technical specification of control system.
  - Starting in manual and automatic mode of operation
  - Power control in manual and automatic mode of operation
  - Function of all safety systems on module
- Measurements at 100%, 75% and 50% load:
  - Frequency
  - Voltage
  - Current
  - Generator output
  - Power factor
  - Fuel consumption
  - Lube oil pressure
  - Jacket water temperature
  - Boost pressure
  - Mixture temperature
  - Exhaust emission (NOx)

The module test will be carried out with the original generator, except it is not possible because of the delivery date. Then a test generator will be used for the module test.
To prove characteristics of the above components, which are not tested on the test bench by GE JENBACHER, the manufacturers' certificate will be provided.

5.03 Documentation

Preliminary documentation 60 days after receipt of a technically and commercially clarified order:

- Module drawing 1)
- Technical diagram 1)
- Drawing of control panel 3)
- List of electrical interfaces 2)
- Technical specification of control system 2)
- Technical drawing auxiliaries (if included in GE Jenbacher-limit of delivery) 1)

At delivery:

- Wiring diagrams 3)
- Cable list 3)

At start-up and commissioning (or on clients request):

- Operating and maintenance manual 4)
- Spare parts manual 4)
- Operation report log 4)

Technical Description

Genset

JGS 416 GS-L.L

with Island Operation

Tajiguas Landfill
JGS 416 B82 480V
Western Energy Systems

Standard rating of the engines is for an installation at an altitude ≤ *0 ft* and an air intake temperature ≤ *86 °F* (T1)

Electrical output **1141 kW el.**

Emission values

NOx	< 0.6 g/bhp.hr (NO2)
CO	< 2.5 g/bhp.hr (CO)
NMHC	< 0.33 g/bhp.hr (NMHC)

0.01 Technical Data (at genset)

Data at:				Full load	Part Load	
Fuel gas LHV		BTU/scft		386		
				100%	75%	50%
Energy input		MBTU/hr	[2]	9,854	7,640	5,425
Gas volume		scfhr	*)	25,529	19,792	14,055
Mechanical output		bhp	[1]	1,573	1,180	787
Electrical output		kW el.	[4]	1,141	854	565
Heat to be dissipated			[5]			
~ Intercooler 1st stage (Engine jacket water cooling circuit)		MBTU/hr	[9]	749	357	87
~ Intercooler 2nd stage (Low Temperature circuit)		MBTU/hr		217	169	104
~ Lube oil (Engine jacket water cooling circuit)		MBTU/hr		676	624	539
~ Jacket water		MBTU/hr		1,106	938	754
~ Surface heat	ca.	MBTU/hr	[7]	341	~	~
Spec. fuel consumption of engine electric		BTU/kWel.hr	[2]	8,633	8,947	9,603
Spec. fuel consumption of engine		BTU/bhp.hr	[2]	6,265	6,474	6,892
Lube oil consumption	ca.	gal/hr	[3]	0.07	~	~
Electrical efficiency		%		39.5%	38.1%	35.5%

*) approximate value for pipework dimensioning
[_] Explanations: see 0.10 - Technical parameters

All heat data is based on standard conditions according to attachment 0.10. Deviations from the standard conditions can result in a change of values within the heat balance, and must be taken into consideration in the layout of the cooling circuit/equipment (intercooler; emergency cooling; ...). In the specifications in addition to the general tolerance of ±8 % on the thermal output a further reserve of +5 % is recommended for the dimensioning of the cooling requirements.

Main dimensions and weights (at genset)

Length	in	~ 250
Width	in	~ 80
Height	in	~ 90
Weight empty	lbs	~ 28,060
Weight filled	lbs	~ 29,490

Connections

Jacket water inlet and outlet	in/lbs	3"/145
Exhaust gas outlet [D]	in/lbs	12"/145
Fuel Gas (at genset)	in/lbs	5"/232
Water drain ISO 228	G	½"
Condensate drain	in	0.7
Safety valve - jacket water ISO 228	in/lbs	2x1½"/2.5
Lube oil replenishing (pipe)	in	1.1
Lube oil drain (pipe)	in	1.1
Jacket water - filling (flex pipe)	in	0.5
Intercooler water-Inlet/Outlet 1st stage	in/lbs	3"/145
Intercooler water-Inlet/Outlet 2nd stage	in/lbs	2½"/145

Output / fuel consumption

ISO standard fuel stop power ICFN	bhp	1,573
Mean effe. press. at stand. power and nom. speed	psi	232
Fuel gas type		Landfill gas
Based on methane number | Min. methane number	MN d)	135 | 117
Compression ratio	Epsilon	12.5
Min./Max. fuel gas pressure at inlet to gas train	psi	1.74 - 2.9 c)
Allowed Fluctuation of fuel gas pressure	%	± 10
Max. rate of gas pressure fluctuation	psi/sec	0.145
Maximum Intercooler 2nd stage inlet water temperature	°F	131
Spec. fuel consumption of engine	BTU/bhp.hr	6,265
Specific lube oil consumption	g/bhp.hr	0.15
Max. Oil temperature	°F	189
Jacket-water temperature max.	°F	203
Filling capacity lube oil (refill)	gal	~ 95

c) Lower gas pressures upon inquiry
d) based on methane number calculation software AVL 3.2

0.02 Technical data of engine

Manufacturer		GE Jenbacher
Engine type		J 416 GS-B82
Working principle		4-Stroke
Configuration		V 70°
No. of cylinders		16
Bore	in	5.71
Stroke	in	7.28
Piston displacement	cu.in	2,983
Nominal speed	rpm	1,800
Mean piston speed	in/s	437
Length	in	144
Width	in	59
Height	in	82
Weight dry	lbs	14,991
Weight filled	lbs	16,391
Moment of inertia	lbs-ft²	320.41
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	7
Starter motor voltage	V	24

Thermal energy balance

Energy input	MBTU/hr	9,854
Intercooler	MBTU/hr	966
Lube oil	MBTU/hr	676
Jacket water	MBTU/hr	1,106
Exhaust gas cooled to 356 °F	MBTU/hr	1,924
Exhaust gas cooled to 212 °F	MBTU/hr	2,460
Surface heat	MBTU/hr	201

Exhaust gas data

Exhaust gas temperature at full load	°F [8]	851
Exhaust gas temperature at bmep= 174 [psi]	°F	~ 910
Exhaust gas temperature at bmep= 116 [psi]	°F	~ 972
Exhaust gas mass flow rate, wet	lbs/hr	14,456
Exhaust gas mass flow rate, dry	lbs/hr	13,461
Exhaust gas volume, wet	scfhr	180,805
Exhaust gas volume, dry	scfhr	161,029
Max.admissible exhaust back pressure after engine	psi	0.870

Combustion air data

Combustion air mass flow rate	lbs/hr	13,360
Combustion air volume	SCFM	2,760
Max. admissible pressure drop at air-intake filter	psi	0.145

Sound pressure level

Aggregate a)		dB(A) re 20µPa	100
31,5	Hz	dB	87
63	Hz	dB	91
125	Hz	dB	100
250	Hz	dB	98
500	Hz	dB	96
1000	Hz	dB	91
2000	Hz	dB	90
4000	Hz	dB	93
8000	Hz	dB	91
Exhaust gas b)		dB(A) re 20µPa	113
31,5	Hz	dB	101
63	Hz	dB	111
125	Hz	dB	116
250	Hz	dB	105
500	Hz	dB	102
1000	Hz	dB	96
2000	Hz	dB	108
4000	Hz	dB	107
8000	Hz	dB	104

Sound power level

Aggregate	dB(A) re 1pW	120
Measurement surface	ft²	1,130
Exhaust gas	dB(A) re 1pW	121
Measurement surface	ft²	67.60

a) average sound pressure level on measurement surface in a distance of 3.28ft (converted to free field) according to DIN 45635, precision class 3.
b) average sound pressure level on measurement surface in a distance of 3.28ft according to DIN 45635, precision class 2.
The spectra are valid for aggregates up to bmep=232.060384 psi. (for higher bmep add safety margin of 1dB to all values per increase of 15 PSI pressure).
Engine tolerance ± 3 dB

0.03 Technical data of generator

Manufacturer		STAMFORD e)
Type		PE 734 E e)
Type rating	kVA	1,910
Driving power	bhp	1,573
Ratings at p.f.= 1.0	kW	1,141
Ratings at p.f. = 0.8	kW	1,132
Rated output at p.f. = 0.8	kVA	1,415
Rated reactive power at p.f. = 0.8	kVAr	849
Rated current at p.f. = 0.8	A	1,702
Frequency	Hz	60
Voltage	V	480
Speed	rpm	1,800
Permissible overspeed	rpm	2,250
Power factor (lagging - leading)		0,8 - 1,0
Efficiency at p.f.= 1.0	%	97.3%
Efficiency at p.f. = 0.8	%	96.5%
Moment of inertia	lbs-ft²	1055.93
Mass	lbs	7,882
Radio interference level to EN 55011 Class A (EN 61000-6-4)		N
Ik" Initial symmetrical short-circuit current	kA	21.04
Is Peak current	kA	53.57
Insulation class		H
Temperature rise (at driving power)		F
Maximum ambient temperature	°F	104

Reactance and time constants (saturated)

xd direct axis synchronous reactance	p.u.	1.95
xd' direct axis transient reactance	p.u.	0.12
xd" direct axis sub transient reactance	p.u.	0.08
x2 negative sequence reactance	p.u.	0.12
Td" sub transient reactance time constant	ms	20
Ta Time constant direct-current	ms	20
Tdo' open circuit field time constant	s	2.46

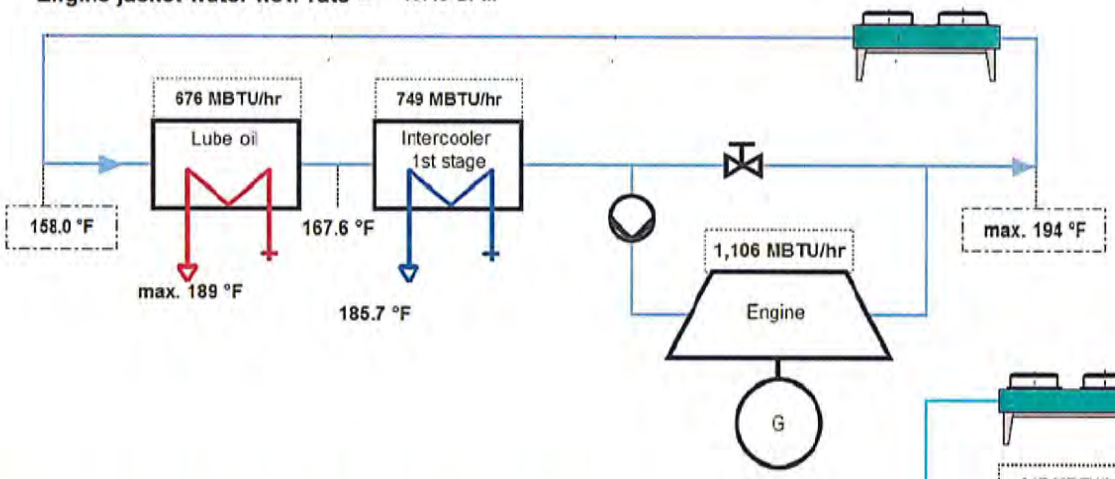
e) GE Jenbacher reserves the right to change the generator supplier and the generator type. The contractual data of the generator may thereby change slightly. The contractual produced electrical power will not change.

Engine jacket water cooling circuit (calculated with Glykol 37%)

Heat to be dissipated = 2,530 MBTU/hr

(±8 % tolerance +5 % reserve for cooling requirements)

Engine jacket water flow rate = 157.6 GPM

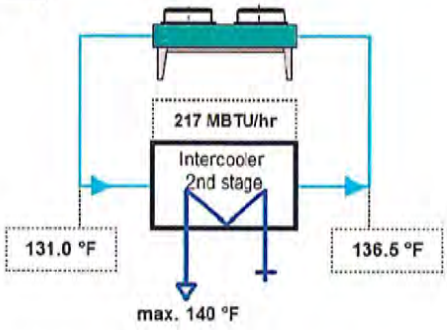


Low Temperature circuit (calculated with Glykol 37%)

Heat to be dissipated = 217 MBTU/hr

(±3 % tolerance +5 % reserve for cooling requirements)

Cooling water flow rate = 88.1 GPM



0.05 Cooling water circuit

Oil - heat (Engine jacket water cooling circuit)

Nominal output	MBTU/hr	676
Max. Oil temperature	°F	189
Loss of nominal pressure of engine jacket water	psi	7.25
Safety valve - max press. set point	psi	36.26

Engine jacket water - heat (Engine jacket water cooling circuit)

Nominal output	MBTU/hr	1,106
Max. engine jacket water temperature (outlet engine)	°F	194
Engine jacket water flow rate	GPM	157.6
Safety valve - max press. set point	psi	36.26

Mixture Intercooler (1st stage) (Engine jacket water cooling circuit)

Nominal output	MBTU/hr	749
Max. inlet cooling water temp. (intercooler)	°F	167.6
Design pressure of cooling water / (max. operating pressure)	lbs	145
Loss of nominal pressure of engine jacket water	psi	4.35
Safety valve - max press. set point	psi	36.26

Mixture Intercooler (2nd stage) (Low Temperature circuit)

Nominal output	MBTU/hr	217
Max. inlet cooling water temp. (intercooler)	°F	131
Aftercooler water flow rate	GPM	88.1
Design pressure of cooling water / (max. operating pressure)	lbs	145
Intercooler water pressure drop	psi	11.60
Safety valve - max press. set point	psi	36.26

The final pressure drop will be given after final order clarification and must be taken from the P&ID order documentation.

0.10 Technical parameters

All data in the technical specification are based on engine full load (unless stated otherwise) at specified temperatures as well as the methane number and subject to technical development and modifications. For isolated operation an output reduction may apply according to the block load diagram. Before being able to provide exact output numbers, a detailed site load profile needs to be provided (motor starting curves, etc.).

All pressure indications are to be measured and read with pressure gauges (psi.g.).

(1) At nominal speed and standard reference conditions ICFN according to DIN-ISO 3046 and DIN 6271, respectively
(2) According to DIN-ISO 3046 and DIN 6271, respectively, with a tolerance of +5 %.
Efficiency performance is based on a new unit (immediately upon commissioning).Effects of degradation during normal operation can be mitigated through regular service and maintenance work;
reference value --> 65%CH4 /
(3) Average value between oil change intervals according to maintenance schedule, without oil change amount
(4) At p. f. = 1.0 according to VDE 0530 REM / IEC 34.1 with relative tolerances
(5) Total output with a tolerance of ±8 %
(6) According to above parameters (1) through (5)
(7) Only valid for engine and generator; module and peripheral equipment not considered (at p. f. = 0,8) (guiding value)
(8) Exhaust temperature with a tolerance of ±8 %
(9) Intercooler heat on:
* **standard conditions (Vxx)** - If the turbocharger design is done for air intake temperature > 86°F w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/K starting from 77°F. Deviations between 77 – 86°F will be covered with the standard tolerance.
* **Hot Country application (Vxxx)** - If the turbocharger design is done for air intake temperature > 104°F w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/K starting from 95°F. Deviations between 95 – 104°F will be covered with the standard tolerance.

Radio interference level
The ignition system of the gas engines complies the radio interference levels of CISPR 12 and EN 55011 class B, (30-75 MHz, 75-400 MHz, 400-1000 MHz) and (30-230 MHz, 230-1000 MHz), respectively.

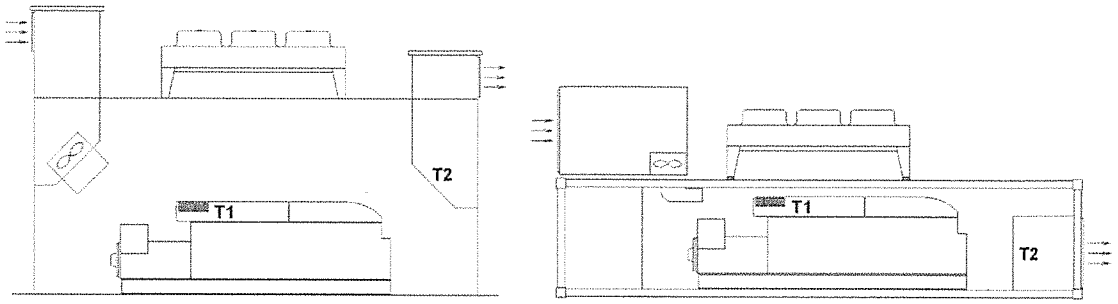
Definition of output
- ISO-ICFN continuous rated power:
  Net break power that the engine manufacturer declares an engine is capable of delivering continuously, at stated speed, between the normal maintenance intervals and overhauls as required by the manufacturer. Power determined under the operating conditions of the manufacturer's test bench and adjusted to the standard reference conditions.
- Standard reference conditions:
  Barometric pressure: 14.5 psi (1000 mbar) or 328 ft (100 m) above sea level

Air temperature:	77°F (25°C) or 298 K
Relative humidity:	30 %

- Volume values at standard conditions (fuel gas, combustion air, exhaust gas)

Pressure:	1 atmosphere (1013.25 mbar)
Temperature:	32°F (0°C)

Output adjustment for turbo charged engines
Standard rating of the engines is for an installation at an altitude ≤ **1640 ft** and an air intake temperature ≤ **86 °F** (T1)
Maximum room temperature: **122°F** (T2) -> engine stop



If the actual methane number is lower than the specified, the knock control responds. First the ignition timing is changed at full rated power. Secondly the rated power is reduced. These functions are done by the engine management.
Exceedance of the voltage and frequency limits for generators according to IEC 60034-1 Zone A will lead to a derate in output.

Parameters for the operation of GE Jenbacher gas engines
The genset fulfills the limits for mechanical vibrations according to ISO 8528-9.
The following "Technical Instruction of GE JENBACHER" forms an integral part of a contract and must be strictly observed: **TA 1000-0004, TA 1100 0110, TA 1100-0111**, and **TA 1100-0112.**
Transport by rail should be avoided. See **TA 1000-0046** for further details

Failure to adhere to the requirements of the above mentioned TA documents can lead to engine damage and may result in loss of warranty coverage.

Parameters for the operation of control unit and the electrical equipment
Relative humidity 50% by maximum temperature of 104°F.
Altitude up to 2000m above the sea level.

Parameters for using a gas compressor Parameters for using a gas compressor
The gas quantity indicated under the technical data refers to standard conditions with the given calorific value. The actual volume flow (under operating conditions) has to be considered for dimensioning the gas compressor and each gas feeding component – it will be affected by:
- Actual gas temperature (limiting temperature according to TA 1000-0300)
- Gas humidity (limiting value according to TA 1000-0300)
- Gas Pressure
- Calorific value variations (can be equated with methane (CH4) variations in the case of biogas)

- The gas compressor is designed for a max. relative under pressure of 0.22 psi(g) (15 mbar(g)) and a inlet temperature of 104°F (40°C) , if within scope of supply GE Jenbacher.