City of Marquette

Marquette, MI | 300 W Baraga Ave, MI 49855



City of Marquette

Wastewater and Water System Improvements State Revolving Fund (SRF) Amendment No. 1 to Project Plan

March 2020



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Donohue Project No.: 13546



TABLE OF CONTENTS

1.	Introdu	iction	4
	1.1	Proposed Projects	4
	1.1.1	Wastewater Treatment Facility	4
	1.1.2	Floodplains	4
	1.2	Project Needs	6
2.	Analysi	s of Alternatives	7
	2.1 Reserve	Wastewater Treatment Solids Handling Improvements (Considered for Green Project)7	
	2.1.1 Receivir	Alternative 4 - New Cake Storage, New Dewatering Building and Septage/HSW/Fog ng (Eligible for Green Project Reserve)	7
	2.2	Summary and Recommendation	9
3.	Selecte	d Alternatives12	2
	3.1.1	Description of Selected Alternatives1	2
	3.1.2	Project Schedule	2
	3.1.3	Authority to Implement the Selected Alternatives1	2
	3.1.4	User Costs	3
4.	Public F	Participation14	4
	4.1.1	Public Hearing14	4
5.	Green I	Project Reserve Business Plan1	5

LIST OF TABLES

Table 1-1 Project Plan Summary Cost Table by Major Project (Updates are Highlighted in Bold) Bookmark not defined.	.Error!
Table 2-1 Thickening and Dewatering Loading Alternative 3	8
Table 2-2 Alternatives Summary Table (Average Day)	9
Table 2-3 Alternatives Cost Summary Table	10
Table 2-4 Alternatives Cost Summary Table	11
Table 3-2 Funding Strategy and User Costs (2021)	13

LIST OF FIGURES

Figure 1-1 Large-Scale FEMA 100-Year Floodplain	. 5
Figure 1-2 Wastewater Treatment Facility - 100-Year Floodplain	.6
Figure 3-1 Project Schedule	12

APPENDICES

Appendix A – Project Need/Request Forms

Appendix B – WWTP Solids Handling Project Cost Worksheets

Appendix C – Public Hearing and Resolution Information

1. INTRODUCTION

The City of Marquette Water & Sewer Utility (Utility), submitted a State Revolving Fund (SRF)/Drinking Water Revolving Fund (DWRF) Project Plan in April, 2019. The Utility routinely reviews capital planning and improvement needs and funding obligations as part of the asset management process. This Amendment to the SRF/DWRF addresses changes to the Wastewater Treatment Plant Solids Handling Improvements project.

1.1 PROPOSED PROJECTS

The project plan provides an overview, evaluates alternatives and makes recommendations for projects eligible for SRF funding. This document provides updates to the Wastewater Treatment Plant Solids Handling Improvements Project. The updated costs for the solids handling improvements is \$5,667,000.

1.1.1 WASTEWATER TREATMENT FACILITY

The Utility is planning improvements to the solids handling system as follows:

- Receive and process septage, high strength waste (HSW) and fats, oils and grease (FOG)
- Produce additional biogas
- Utilize additional biogas in existing engine generators to produce electricity
- Reduce sludge volume, solids disposal costs and environmental impact through dewatering
- Improve system reliability by providing biosolids processing flexibility

A business case for Green Project Reserve is included as a separate document.

1.1.2 FLOODPLAINS

Figure 1-1 provides 2017 FEMA 100 year floodplain mapping for the Marquette service area. The map can be accessed through the following web address and searching for Marquette, MI: <u>https://msc.fema.gov/portal/search#searchresultsanchor</u>.

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Figure 1-1 Large-Scale FEMA 100-Year Floodplain

The wasteater treatment plant solids handling improvements include structural additions to the WWTP site. The site is adjacent to US 41 Highway and the Carp River. The property map, floodplain map and wetland delineation map were reviewed to identify preferred locations for new facilities.

Figure 1-2 illustrates the FEMA 100-year floodplain mapping for the treatment facility along with the proposed improvements. As part of the 2008 construction, a berm was provided that protects the existing secondary clarifiers, aeration, cake storage and other assets from a 100-year flood.

The wetland delineation map from 2006 was also reviewed. The delineation did not include the entire site. The project proposes to complete a wetland delineation for the proposed construction area as part of the project.

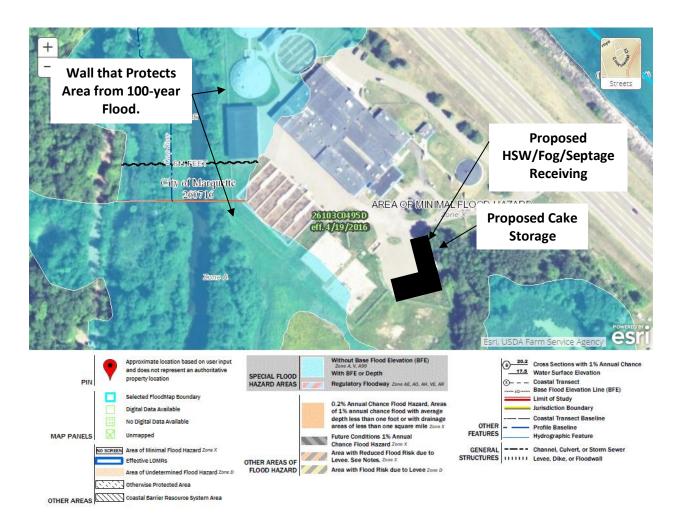


Figure 1-2 Wastewater Treatment Facility - 100-Year Floodplain

1.2 PROJECT NEEDS

An updated project needs form for the solids handling project is included in Appendix A.

2. ANALYSIS OF ALTERNATIVES

2.1 WASTEWATER TREATMENT SOLIDS HANDLING IMPROVEMENTS (CONSIDERED FOR GREEN PROJECT RESERVE)

Removal of solids from the wastewater treatment process is essential for NPDES permit compliance and process efficiency. The Utility evaluated long-term biosolids processing, storage and disposal alternatives to improve the system including:

- Provide system redundancy a single piece of equipment performs both thickening and dewatering.
- Increase biosolids storage capacity (currently less than 180 days of storage)
- Support beneficial reuse of solids
- Reduce the cost of biosolids disposal
- Receive septage and high strength waste
- Increase energy production to leverage utilization of existing dual fuel generators.

This amendment addresses the analysis of an additional alternative (Alternative No. 4) to the Project Plan. Alternative 4 includes the following major elements:

- New Dewatering Facility with a single belt filter press and room for a second
- Sludge cake storage
- Sludge cake transfer and storage
- Septage, high strength waste and fats oil and grease receiving

2.1.1 ALTERNATIVE 4 - NEW CAKE STORAGE, NEW DEWATERING BUILDING AND SEPTAGE/HSW/FOG RECEIVING (ELIGIBLE FOR GREEN PROJECT RESERVE)

This alternative includes a new dewatering building and cake storage building. The buildings are located on the south end of the site adjacent to each other. Pavement is added to the north side of the building for truck loading access, chemical delivery and equipment removal. The cake structure is similar to the existing cake storage building with concrete walls, a pole shed cover and multiple bays. A CMU wall building is constructed for the dewatering equipment. The roof is flat, constructed of pre-cast concrete with an EPDM roofing system.

One new BFP is installed in the dewatering building with space for a second. The building is split into three rooms: dewatering room, electrical room and polymer room. Overhead doors are provided adjacent to the driveway for the polymer room and dewatering room. A booster pump is required in the dewatering room for belt washing. A conveyor, common to both BFPs, transfers dewatered cake to a cake storage pad. A front end loader is used to move cake from the cake storage pad to the cake storage building. Cake handling options that could be provided at additional cost include:

- 1. Loadout conveyor to truck located within dewatering building.
- 2. Loadout conveyor to Cake Storage Bay No. 3. Loadout conveyor includes heat tracing to prevent freezing.

3. Inclined conveyor to distributing conveyor. Distributing conveyor has drop point in all three cake storage bays. All conveyor components exterior to the dewatering building include heat tracing to prevent freezing.

The new BFP is sized to match the capacity of the existing combination BFP/GBT. The BFP is intended for normal service. The combination BFP is available for a backup unit and space is provided for a future unit in the new Dewatering Building. The existing combination BFP/GBT is utilized for thickening under normal operations. There is no backup GBT in this alternative. See Table 2-1 for the Alternative 4 design basis.

Thickening (Existing GBT/BFP)		Average	Max Month
Operation	Days/week	4	5
Operation	Hours/day	7	7
Flow Capacity*	gpm	440	440
Flow Rate	gpm	185	180
Solids Capacity*	lb/hr	1,100	1,100
Solids Loading	lb/hr	780	760
Dewatering (New BFP)			
Operation	Days/week	1	2
Operation	Hours/day	8	8
Flow Capacity*	gpm	140	140
Flow Rate	gpm	133	128
Solids Capacity*	lb/hr	2,100	2,100
Solids Loading	lb/hr	1,880	1,658

Table 2-1 Thickening and Dewatering Loading Alternative 3

* Per manufacturers design basis recommendations

A new cake biosolids storage building is proposed in this alternative. The new storage building holds 700 cubic yards of dewatered bisolids to provide a total of 180 days combined storage time. The building is a pole shed installed on concrete walls with approximate overall dimensions of 50 feet by 120 feet. The building is split into three bays.

Septage, FOG and HSW facilities consist of the following:

- Septage receiving equipment
- Storage tanks (two tanks)
- Positive displacement pumps
- Waste receiving structure
- Electrical, controls and HVAC

Key elements of each alternative are provided in Table 2-2 (key elements for Alternatives 1 - 3 are provided for reference).

Parameter	Units	(Project Plan Amendment		
		Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
Thickening		(1) New GBT	(1) New GBT	(1) Existing	(1) Existing
Equipment		(2) Existing	(2) Existing	GBT/BFP	GBT/BFP
		GBT/BFP	GBT/BFP		
Dewatering		(1) Existing	(1) Existing	(1) New BFP No.	(1) New BFP No. 1
Equipment		GBT/BFP	GBT/BFP	1	(2) Existing
				(2) Existing GBT/BFP	GBT/BFP
Cake Disposal	dtpy	258	399	399	531
Liquid Disposal	dtpy	218	77	77	73
Biosolids Cake	Cubic	890	1 600	1,600	1,600
Storage Volume	yards	890	1,600		
Septage	gal/yr	0	0	0	1,000,000
Receiving		0	0	0	1,000,000
FOG and HSW	gal/yr	0	0	0	365,000
Receiving		0	0	0	303,000
Digester Gas	Cubic Feet	41,000	41,000	41,000	55,000
Production	per day	41,000	41,000	41,000	33,000
Electrical Energy	kw	105	105	105	141
Production		105	105	105	747
Heat Production	MMBTU/d	7.4	7.4	7.4	9.9
Digester Loading	Lb Vs/kcf/d	39	39	39	53
Digester SRT	days	57	57	57	45

2.2 SUMMARY AND RECOMMENDATION

The key considerations for each alternative are:

- Providing additional solids handling redundancy and operational flexibility
- Increasing disposal of cake biosolids to reduce annual expenses
- Provide at least 180 days of biosolids storage
- Capital and life cycle cost.

Life cycle cost for Alternative No. 4 is summarized in Table 2-3 (highlighted in **bold**). The table also includes Alternative Nos. 1 - 3 included in the SRF/DWRF Project Plan for reference.

Alternative and Description	Initial Cost	Annual O&M	20-Year PW	Salvage Value
Alternative 1: New Liquids Storage & New GBT in Existing Building	2,565,000	182,000	6,300,000	0
Alternative 2: New Cake Storage and New GBT in Existing Building	2,211,000	147,000	5,231,000	0
Alternative 3: New Cake Storage and New Dewatering Building	4,006,000	147,000	7,026,000	0
Alternative 4: New Cake Storage and New Dewatering Building, Septage/HSW and FOG Receiving	5,667,000	(21,000)	5,230,000	0

Advantages and disadvantages for each alternative are summarized in Table 2-4. The table highlights Alternative No. 4 in **bold**.

Alternative No. and Description	Advantages	Disadvantages
Alternative 1: New Liquids Storage & New GBT in Existing Building	 Provides thickening and dewatering redundancy Exceeds 180 day biosolids storage requirement 	 Does not provide flexibility for biosolids disposal Highest biosolids disposal cost with reliance on liquid hauling
Alternative 2: New Cake Storage and New GBT in Existing Building	 Provides thickening redundancy Exceeds 180 day biosolids storage requirement Increases biosolids disposal flexibility with cake disposal opportunities Lowers disposal cost and operations time to manage cake Lowest capital cost 	 No dewatering redundancy. Limited flexibility for dewatering without additional cake storage (more reliance on liquid hauling) Stormwater management issues with hauling biosolids around site
Alternative 3: New Cake Storage, New Dewatering Building	 Provides dewatering redundancy Exceeds 180 day biosolids storage requirement Increases biosolids disposal flexibility with cake disposal opportunities Lowers disposal cost and operations time to manage cake 	 Highest capital cost Highest lifecycle cost No thickening redundancy
Alternative 4: New Cake Storage, New Dewatering Building and Septage/HSW/FOG Processing	 Provides dewatering redundancy and additional cake storage Provides lowest life cycle costs. Leverages existing CHP infrastructure and digester capacity Increases digester gas production and utilization Provides septage/HSW/FOG disposal service to area. Increases revenues 	 Highest capital cost. Relies on market for septage, HSW and FOG Results in more challenging operation No thickening redundancy

The costs for each alternative are summarized in Table 2-2. A detailed cost review for Alternative No. 4 is includes in **Appendix B**.

3. SELECTED ALTERNATIVES

3.1.1 DESCRIPTION OF SELECTED ALTERNATIVES

Based on a review of both economic and non-economic factors, it is recommended that Alternate No. 4 for the WWTP Solids Handling Project is constructed. The City will re-evaluate this plan on a year-by-year basis, during the normal annual budgeting process.

3.1.2 PROJECT SCHEDULE

The anticipated project schedule is presented in Figure 3-1. The project considers a Q3 loan closing.

		2019 2020					2021					
Item	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. DEQ Review of Project Plan												
Draft Pro	ject Plan											
Present P	Project Plan to City and MDEQ											
Public He	aring	*										
Submit P	art ISRF Loan Application											
Project P	lan Approval											
Project P	lan Amendment/GPR					٢						
Notice to	Apply											
2. Design									•			
Design					*			2				
MDEQ Re	eview								5			
Develop (User Charge System								1			
Submit P	art I, Part II and Part III of SRF	Application							4	678		
										~~~		
3. Bidding/Construction of Year 2 Projects												
Bidding												
Construct	tion											

For Q3 Loan Closing

Ð	Jan-21 MDEQ Rate Methodology Approved	
2	Oct-20 Draft EA s to EGLE for review (preference 4 months)	
9	Feb-21 EA spublished	
4	Feb-21 Part I and II Applications Due	
٦	Mar-21 Plans and Specs Approved Bid Ad Published	
6	Apr-21 Part III Application Due/Tentative Award	
Ð	May-21 EGLE Approval	
8	Jun-21 Loan Closing	

#### Figure 3-1 Project Schedule

#### 3.1.3 AUTHORITY TO IMPLEMENT THE SELECTED ALTERNATIVES

For the wastewater plant upgrades, the cost share amongst the city and the townships would be based on the terms of the current inter-municipal agreement. Under that agreement, the City of Marquette would be responsible for 84% of those project components' cost, Marquette Township would be responsible for 9% of those costs, and Chocolay Township would be responsible for 7% of the project cost. The City of Marquette has agreed to operate the wastewater treatment facility and the contract communities are charged operating costs based on usage. The wastewater treatment facility is managed by an Advisory Board made up of representatives of the three contract communities.

#### 3.1.4 USER COSTS

The funding strategy and user costs for the WWTP Solids Handling Project are summarized in Table 3-1. The plan assumes the project components are eligible for financing from a Michigan EGLE State Revolving Fund low interest loan. The loan amount assumes a 20 year loan at 2.25% interest rate. The costs does not include estimates for possible Green Project Reserve principle forgiveness. The costs also do not include estimates for revenue or operational costs savings resulting from the project.

Impact of Debt Repayment	Sewer Fund			
Impact of Debt Repayment on City of Marquette				
Total Year 1 Project Cost (WWTP Solids Handling Project)	\$5,667,000			
EGLE SRF normal interest rate	2.25%			
Annual Debt Payment Related to Project	\$355,000			
Annual City of Marquette Share (assumes 84%)	\$298,200			
Impact of Debt Repayment on Users				
Number of Water & Sewer Customers	6,141			
Average Debt Retirement Cost Per Customer/yr	\$57.80			
Average Debt Retirement Cost Per Customer/mo	\$4.80			

#### Table 3-1 Funding Strategy and User Costs (2021)

## 4. PUBLIC PARTICIPATION

#### 4.1.1 PUBLIC HEARING

The formal public hearing for the amendment is scheduled for April, 2020. A copy of the public hearing transcript, advertisement for the public hearing, presentation and resolution will be incorporated into the final Project Plan

## 5. GREEN PROJECT RESERVE BUSINESS PLAN

The Solids Handling Project meets the Green Project Reserve eligibility requirements for Energy Efficiency and Environmentally Innovative. The business case for Green Project Reserve is provided as a separate document.

Appendix A – Project Need Request Form

## 2017 - 2022 CAPITAL IMPROVEMENT PROGRAM – 2021 PROJECT REQUEST FORM I.D. #___



DEPARTMENT CONTACT INFORMATION				
BROUETA	Date: 1/27/2020		Department Priority: Low, Medium, High High	
	Department: Water & Wastewater		Project Location: Wastewater Facility- 1930 U.S. 41 South	
ATTCHICAT	Project Title: Solids Handling Storage Facility		Estimate Funding Request: \$5,667,000	
CHIG	Contact: Curt Goodman		Estimate Useful Life of Asset (Years): 30	

SYSTEM CATEGORY:		PURPOSE OF PROJECT:		
Street System	Sidewalk/Pathway System	⊠ Regulatory or Ordinance Requirement	⊠ Expanded Service	
Sanitary Sewer System	Public Buildings	⊠ Conforms to Adopted Plan	⊠ New Operation	
Water System	Public Parks/Grounds	□ Upgrade/Replace Existing Asset	Scheduled Replacement	
□ Storm Sewer/Drainage System	Marinas	🖂 New Asset	Extend Asset Useful Service Life	
Bridge System	Motor Pool/Fleet/Major Equipment	Health and Safety Issue	□ Other	
Transportation Safety	Public Safety	Economic Development		

#### **PROJECT DESCRIPTION**

Provide a new dewatering building and cake storage building. The buildings are located on the south end of the site adjacent to each other. Pavement is added to the north side of the building for truck loading access, chemical delivery and equipment removal. The cake structure is similar to the existing cake storage building with concrete walls, a pole shed cover and multiple bays. A CMU wall building is constructed for the dewatering equipment. Details include:

- New Dewatering Facility (2 Belt Filter Presses one relocated existing, one new) .
- Relocate existing BFP/Thickener to Dewatering ٠
- Provide new thickener (gravity belt thickener or rotary drum thickener) ٠
- Sludge cake transfer and storage ٠
- Septage and high strength waste (HSW) receiving •
  - a. Consider utilization and value of septage and HSW for tipping fees and gas production/heat for existing CHP systems

#### **PROJECT PLANNING AND FINANCING**

Proposed Fiscal Year Planned: 2021		Estimate New Effect on Operating Cost, Revenues, Staffing, etc.? \$ 150,000 - \$200,000		
		Explain: Lower Biosolids annual disposal cost, revenue from septic and extra strength		
Outside Funding Sources: Yes State Revolving Fund-principle forgiveness Amount: \$2,000,000		waste, Increase digester gas production for co-gen operation.		
Does Asset Have a Salvage Value? No	Amount: \$	Total reduced biosolids disposal costs, increase revenues and increase in biogas production and electrical production:		
Estimate Asset Useful Life Extension (Years): 30		Preliminary estimate: \$150,000 - \$200,000		



Picture Title: Proposed Site Layout

Appendix B – WWTP Solids Handling Project Cost Worksheets

#### City of Marquette Solids Handling Study Marquette, MI

#### Alternative 4: New Cake Storage and New Dewatering Building, Septage/HSW and FOG Receiving

#### **INITIAL COST ESTIMATE**

#### **General Description**

This alternative includes one new BFP in a new Dewatering Building and a new cake storage building adjacent to liquid storage tank no. 2. The Dewatering Building is a CMU block building with metal siding and a flat precast roof with an EPDM roofing system. The new cake storage structure is similar to the existing cake storage structure. There is a conveyor that transfers cake from the Dewatering Building to Cake Storage. This alternative also includes a septage and FOG receiving station. The cost estimate does not include modifications to the FEW system, decant pumping system or improvements to the existing liquid storage tanks.

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Architectural/Structural				
Earthwork		for Detailed Cost B		115,000
Concrete		for Detailed Cost B		890,066
Metals		for Detailed Cost B		34,660
Buildings		for Detailed Cost B		319,000
Demolition	See Worksheet	for Detailed Cost B	reakdown	0
Belt Filter Presses	EA	1	310,000	310,000
Polymer Systems	EA	2	10,000	20,000
Conveyors	LS	1	75,000	75,000
Booster Pumps	LS	1	9,000	9,000
Electrical	LS	1	300,000	300,000
Instrumentation and Control	LS	1	50,000	50,000
HVAC	LS	1	100,000	100,000
Plumbing	LS	1	50,000	50,000
HW Rotary Lobe Pump	EA	2	19,500	39,000
HW Septage Receiving System	LS	1	304,850	304,850
HW Recirculation Pumps	EA	2	26,000	52,000
HW Heat Exchangers and Pumps	EA	2	25,000	50,000
Buried Piping	LS	1	116,903	116,903
Building Process-Mechanical Piping and Valves	LS	1	194,838	194,838
Subtotal				3,031,000
Contingency			30%	910,000
Subtotal				3,941,000
Contractor Overhead & Profit			25%	986,000
Total Construction Cost				4,927,000
Engineering			15%	740,000
Total Initial Cost				5,667,000

#### City of Marquette Solids Handling Study Marquette, MI

#### Alternative 4: New Cake Storage and New Dewatering Building, Septage/HSW and FOG Receiving ARCHITECTURAL/STRUCTURAL WORKSHEET Unit Cost **Initial Cost** ITEM Units Quantity (\$) (\$) 100,000 Earthwork: Site Excavation lump sum 1 100,000 Earthwork: Dewatering gal 300 50 15,000 Earthwork: Earthwork: Earthwork: Earthwork: Earthwork: 115,000 Earthwork Concrete: Cake Storage Building lump sum 1 120,000 120,000 Concrete: Dewatering Building 480,000 lump sum 1 480,000 Concrete: Septage Receiving Base Slab cu yd 45 1,108 49,842 1,381 Concrete: Septage Receiving Walls 174 240,224 cu yd Concrete: Concrete: Concrete: Concrete: 890,066 Concrete 12,400 400 Metals: Aluminum Bar Grating 31 sq ft Metals: Aluminum Handrail 60 86 5,160 ft Metals: Aluminum Stairway 20 455 9,100 risers Metals: Structural steel lbs 2,000 4 8,000 Metals: 34,660 Metals 195,000 195,000 Building: Cake storage pre-engineered metal canopy LS 1 Building: Overhead doors 9,000 18,000 each 2 **Building: Mandoors** each 3 2,000 6,000 Building: Septage Receiving sq. ft 500 200 100,000 Building: Building: 319,000 Buildings Demolition: Liquid Storage Tank No. 1 Demolition: Demolition: Demolition: Demolition 0

.

#### City of Marquette Solids Handling Study Marquette, MI

#### Alternative 4: New Cake Storage and New Dewatering Building, Septage/HSW and FOG Receiving

#### INITIAL ANNUAL O&M COST ESTIMATE

#### **Biosolids Disposal**

ITEM	Units	Annual Quantity	Unit Cost (\$)	Annual Cost (\$)
Liquid Biosolids Disposal	\$/gal	400,000	0.10	40,000
Cake Biosolids Disposal	\$/cubic yard	4,700	25.00	117,500
Cake Processing	\$/dry ton	531	50.000	26,550
Septage Tipping fee	gal	1,007,400	0.110	-110,814
FOG Tipping fee	gal	365,000	0.220	-80,300
Digester Gas Production	MMBTU	3,030	4.700	-14,239
Ferric Chloride	gal	7,461	1.50	0
Electricity	kw	285,120	0.00	
Heat (capture from CHP)	MMBTU	913	0.000	

O&M Sum

-21,303

Appendix C – Public Hearing and Resolution Information

Information will be provided once hearing is held and resolution is completed.