Metropolitan Wastewater Management Commission

partners in wastewater management

Greenhouse Gas Inventory for 2010 and 2012

JUNE 2013

CONTENTS

City of Eugene Wastewater Division's EMS/ISO 14001- Environmental Policy

Thirteen years ago, the Division became certified under the ISO 14001 Environmental Management System (EMS) and committed to continually improving its environmental performance and being an environmental steward.

Recognizing that environmental impacts result from both management decisions and from operational activities, the scope of the EMS encompasses all organizational and operational functions of the Wastewater Division and encourages movement toward sustainable policies and practices. The Division's Environmental Management System is well suited to provide the structure needed for future greenhouse gas reduction strategies and efforts.

The Wastewater Division will continue to:

- Communicate and reinforce the policy to all persons working for or on behalf of the Division.
- Comply with legal and other requirements.
- Consider environmental consequences and sustainability concepts in planning and decision-making.
- Strive to prevent pollution prevent pollution and promote reduction, reuse, recycle and proper disposal of waste.
- Provide leadership in environmental protection.

Note: ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The standards were developed to provide a management system to help organizations reduce their environmental impact - http://www.acsregistrars.com/iso14001.asp

EXECUTIVE SUMMARY

A Greenhouse Gas (GHG) Inventory was conducted for the Metropolitan Wastewater Management Commission (MWMC). This inventory covers the Eugene/Springfield Regional Sewerage Facilities (MWMC Facilities) comprising the regional wastewater treatment plant, biosolids operations, and local and regional pump stations. Under the MWMC regional partnership agreement, the MWMC Facilities are operated by the City of Eugene Public Works Wastewater Division.

The inventory will be used to continue to identify opportunities and strategies for operational cost savings including energy efficiency improvements, fuel alternatives, procurement decisions, as well as reducing the MWMC Facilities' environmental impact. These strategies will be managed under the Wastewater Division's ISO 14001 Environmental Management System (EMS) program. Additionally, the inventory will help evaluate the impacts to the MWMC Facilities' operations from possible future regulatory requirements associated with GHG emissions. The Wastewater Division staff will also use the inventory to educate and engage employees, stakeholders, and the community.

As a signatory city to the U.S. Mayors' Climate Protection Agreement, the City of Eugene conducted a GHG inventory and developed a City of Eugene Internal Climate Action Plan. The action plan identifies strategies to reduce GHG emissions to meet the council's adopted goal of making the city carbon neutral by 2020.[1] As the plan applies to all city staff and operations, Wastewater Division staff has adopted several of the strategies including increasing the use of alternative fuels in vehicles and the City's no idling policy. In addition, the City of Springfield also conducted a GHG inventory as part of the City of Springfield's Strategic Plan in order to develop new and modify existing strategies to address climate impact.

Recently, both cities requested GHG information from Eugene's Wastewater Division staff to supplement and complete their inventories. The GHG emissions calculated from the MWMC Facilities will be incorporated into the cities' inventory as Scope 3 emissions.

MWMC's GHG inventory was completed using established GHG inventory protocols and Good Company's Carbon Calculator (G3C) with training and assistance from Good Company. Because wastewater treatment process emissions are unique, primarily emitting methane (CH_4), nitrous oxide (N_2O) and biogenic[2] carbon dioxide (CO_2), methodologies specific to the wastewater treatment processes were utilized. The inventory covers two periods, calendar years 2010 and 2012, to coincide with both cities' GHG inventories.

GHG emissions are divided into three "scopes". Scope 1 emissions are direct emissions which originate from equipment and facilities owned by MWMC - primarily fossil fuel combustion for energy and wastewater treatment process emissions. Scope 2 emissions are indirect emissions from purchased electricity. Scope 3 emissions are all other indirect emissions that result from the activities of the facility, but where the direct sources are controlled by other entities. Scope 3 emissions include supply chain, solid waste, employee commute and business travel, and transmission and distribution losses.

[1] This goal is specific to Scope 1 and 2 emissions only.

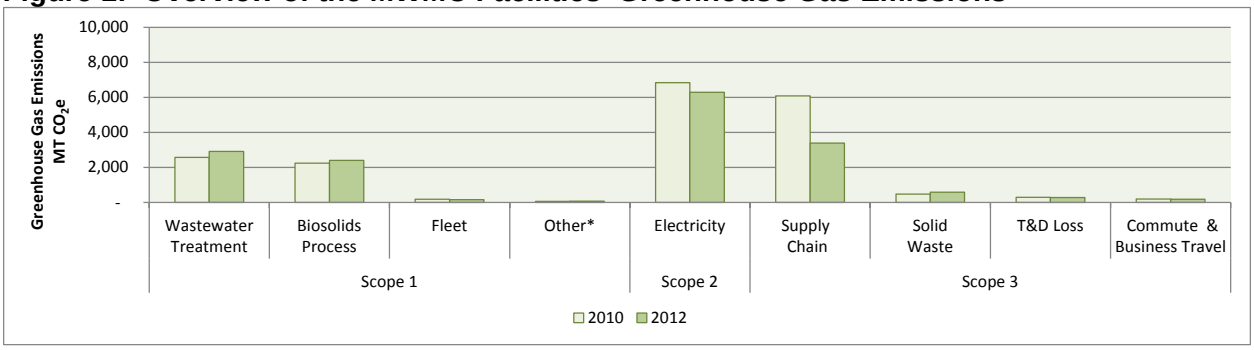
[2] Biogenic emissions are GHG emissions generated during the combustion or decomposition of biologically based material. Anthropogenic emissions are GHG emissions generated from human-caused activities such as combustion of fossil fuels.

As shown in Figure 1, Scope 1 and Scope 2 emissions are dominated by process emissions and electricity consumption. MWMC's Scope 1 and Scope 2 emissions from wastewater treatment and biosolids processes, fuel combustion by stationary and mobile sources, fugitive refrigerants, and electricity consumption are 11,896 MT CO_2e for 2010 and 11,830 MT CO_2e for 2012.

- In 2010, total emissions for MWMC Facilities were 18,937 metric tons of carbon dioxide equivalents (MT CO_2e). This roughly equates to annual GHG emissions from 3,945 passenger vehicles or energy consumed by 975 homes.
- In 2012, total emissions were 16,271 metric tons of carbon dioxide equivalents (MT CO_2e). This roughly equates to annual GHG emissions from 3,390 passenger vehicles or energy consumed by 837 homes in one year's time.

Scope 3 emissions sources, which include commute, air travel, solids waste and electricity transmission and distribution loss, in aggregate, equal 7,041 MT CO_2 in 2010 and 4,441 MT CO_2 in 2012. The largest of the Scope 3 emissions sources is supply chain followed by solid waste.

Figure 1: Overview of the MWMC Facilities' Greenhouse Gas Emissions



* "Other" category represents emissions from natural gas, refrigerants, and non-fleet fuels.

INTRODUCTION, POLICY AND REGULATORY CONTEXT

The Intergovernmental Panel on Climate Change (IPCC) has identified human activity as the primary cause of climate change that has occurred over the past few decades and quickened in recent years. Consensus statements from the IPCC suggest that human-caused emissions must be reduced significantly – perhaps more than 50% globally, and by 90% in the wealthier nations that are the largest emitters – by mid-century in order to avoid the worst potential climate impacts on human economies.

Many individual corporations, government agencies, universities, non-profits and even individuals have proactively sought to take on this challenge. In addition, there has recently been significant regulatory action regarding GHG emissions at the international, national, regional, state and local levels. Action is taking place at the international, national, regional, state and local levels as shown in the table below.

Table 1: Overview of Policy Activity Related to Greenhouse Gas Emissions Management

Scale	Recent Activity
International	The world's leaders have been meeting annually to determine what steps can be taken to address climate change on a global level. The climate talks in Doha, Qatar in December 2012 had two notable outcomes. First, a second period was added to the Kyoto Protocol, which will run from 2013-2020 and signatories agreed to modest second period goals of cutting 1990-baseline emissions by 20% by 2020. Since the Kyoto Protocol only covers about 14% of global GHG emissions (the United States is not currently a signatory), the second outcome from Doha was a commitment to develop an international "legally binding" agreement to reduce GHG emissions by all nations by 2015, which is expected to come into effect by 2020.
Federal	In 2007, the Supreme Court unanimously ruled GHG emissions were pollutants under the Clean Air Act and if they were found to endanger human health, the Environmental Protection Agency (EPA) could regulate them. Greenhouse gas emissions were declared to threaten human health in 2009 and the EPA has since issued mandatory reporting guidelines for large emitters. The EPA's recent actions have focused on developing "new source performance standards" to establish acceptable emissions levels for power plants and oil refineries. Other energy and economic stimulus legislation passed by the federal government has supported renewable energy development and other climate-related initiatives.
Regional	California has enacted the most significant climate legislation in the United States to date. Under AB-32, the California Global Warming Solutions Act, the state is required to reduce GHG emissions 30% below 1990 levels by 2020 and 80% by 2050. In order to achieve these reductions, the California Air Resources Board has been given the authority to enact a cap-and-trade program. The program began in 2012 with the first compliance period starting in 2013. The cap on GHG emissions applies to large emitters from industry and the electricity-generating sector and will eventually cover fuel distributors as well. Regulated businesses need to procure enough allowances to cover their emissions but the number of available allowances (the cap) will decline annually.
State	In Oregon, recent legislation includes climate and energy bills targeting fuels, solar power opportunities, and GHG emissions from land use and transportation. A number of statewide efforts are facilitating the widespread deployment of electric vehicles. The state is also discussing a possible carbon tax.
Local	Over 1,000 cities across the country have signed the US Mayors Climate Protection Agreement, including the City of Eugene and 15 other communities in Oregon. The MWMC has contracted with the City of Eugene, under a service agreement, for the operations and maintenance of MWMC's regional wastewater system. Accordingly, the City of Eugene's GHG reduction policies and strategies also apply to the daily operations of MWMC's facilities.

CURRENT RELATED MANDATORY-REPORTING REQUIREMENTS

Federal

US EPA has issued mandatory reporting guidelines, finalized in September 2009.[3]
The minimum threshold for reporting is entities with Scope 1 emissions of 25,000 MT CO_2e per year or greater. Given the current structure, very few Oregon entities are required to report including domestic wastewater treatment facilities.

Oregon

The Oregon Department of Environmental Quality and Lane Regional Air Protection Authority (LRAPA) require GHG reporting for a wide range of entities. The threshold for reporting is currently set at 2,500 MT CO_2e annually. In general, the sources and entities required to report are holders of Title V air pollution permits or Air Contaminant Discharge Permits (ACDP), with at least one discrete permitted source emitting above the threshold. The MWMC Facilities is required to report as it is regulated by an ACDP and emits GHG above the threshold from one discrete source. That source is the engine generator that produces electricity from the Facilities' biogas. Wastewater Division staff submits the required reports to LRAPA annually.

At the current time, DEQ and LRAPA have not adopted protocols for determining GHG emissions from wastewater treatment processes. However, DEQ is currently developing protocols for this sector.[4]

MEASURING AND REPORTING GREENHOUSE GASES

Biogenic Versus Anthropogenic Emissions

Existing GHG inventory protocol accounting of greenhouse gas emissions draw a distinction between human-caused emissions ("anthropogenic") and greenhouse gases from natural processes ("biogenic").

Anthropogenic GHG emissions are those emissions associated with human activities such as the carbon dioxide emitted from combustion of fossil fuels or are the result of natural processes that have been affected by human activities (e.g., methane emitted from the anaerobic decomposition of organic matter).

Biogenic emissions are carbon dioxide from the combustion of nonfossilized, biologically based materials, such as biogas and biofuels (e.g., biodiesel) and natural processes such as the decomposition of organic materials.

The focus of this inventory is on anthropogenic emissions which are the root cause of climate change. It is these sources that are the target of climate action, locally and globally. Biogenic emissions are included for completeness sake (and as directed by GHG inventory protocols), but they should be understood as part of the biological carbon cycle.

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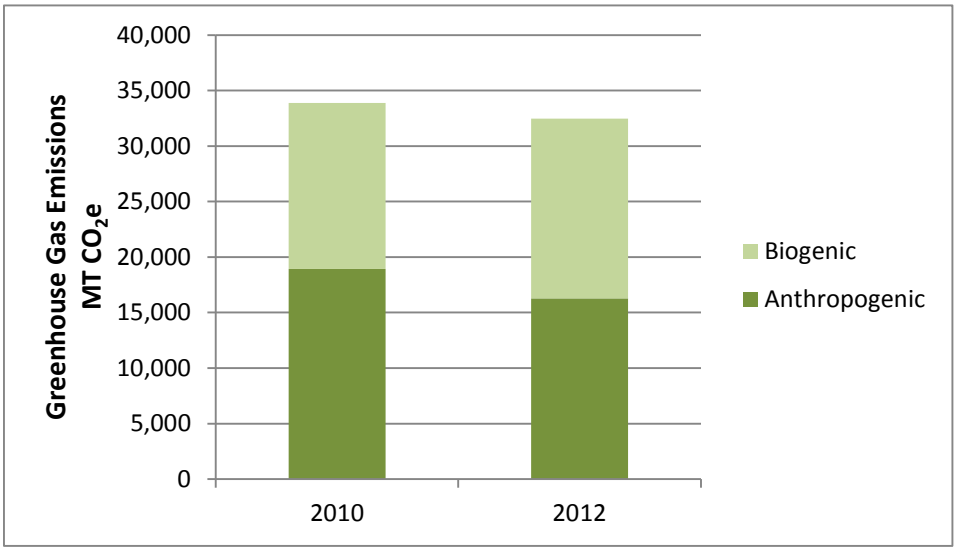
[3] http://www.epa.gov/climatechange/emissions/ghgrulemaking.html.
[4] For more information on Oregon's rules, visit DEQ's GHG reporting page: http://www.deq.state.or.us/aq/climate/reporting.htm

Figure 2: Comparison of the MWMC Facilities' Anthropogenic and Biogenic Emissions for 2010 and 2012



An insight from this analysis is that climate action for wastewater treatment plants should focus on energy reduction and reducing fugitive methane from anaerobic processes. Conversely, biogenic emissions, the inevitable CO_2 from the decomposition of waste from any animal, including humans, do not warrant the same attention.

GHG INVENTORY SCOPES

In many GHG inventory protocols, emissions sources and activities are classified as either producing direct or indirect GHG emissions. Direct emissions are those that stem from sources owned or controlled by a particular organization. Indirect emissions occur because of the organization's actions, but the direct source of emissions is controlled by a separate entity.

To distinguish direct from indirect emissions sources, three "scopes" are defined for traditional GHG accounting and reporting purposes (Western Regional Institute, The Greenhouse Gas Protocol).

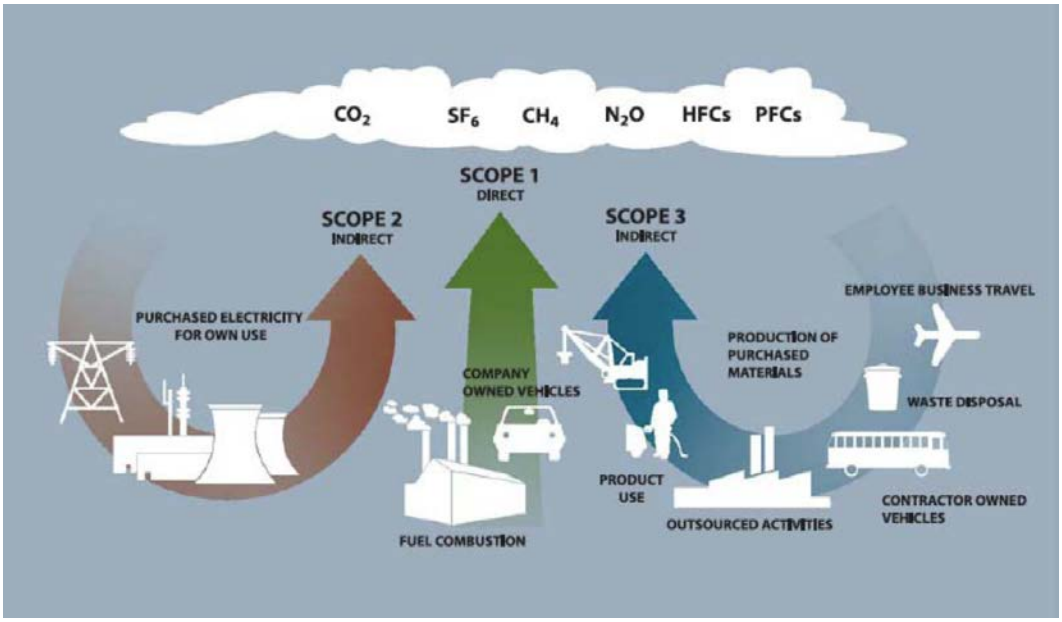
Scope 1 – Direct sources of GHG emissions that originate from equipment and facilities owned or operated by the MWMC Facilities.

Scope 2 – Indirect GHG emissions from purchased electricity heat or steam.

Scope 3 – All other indirect sources of GHG emissions that may result from the activities of the MWMC Facilities, but occur from sources owned or controlled by another company or entity, such as: business air travel; embodied emissions in material goods purchased; emissions from solid waste; and employee commute.

Scope 1 (direct) and Scope 2 (indirect) emissions must be reported for most protocols and registries. Scope 3 emissions are indirect and usually considered optional when reporting emissions, but serve to clarify an organization's entire carbon footprint and illuminate the potential regulatory and financial risks an institution may face due to its carbon footprint. Figure 3 illustrates the three scopes of emissions.

Figure 3: Greenhouse Gases Accounting and Reporting Scopes



Source: WRI/WBCSD Greenhouse Gas Protocol, Corporate Accounting and Reporting Standard (Revised Edition).

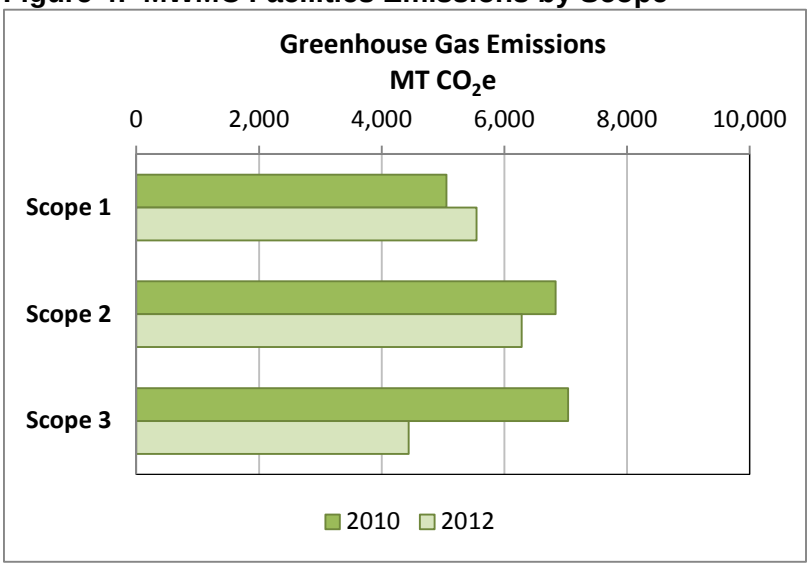
All emissions are reported in metric tons of carbon-dioxide equivalent (MT CO_2e). The analysis includes carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and hydrofluorocarbons (HFCs). As the MWMC Facilities does not use perfluorocarbons (PFCs) or sulfur hexafluoride (SF_6) in its process, these two greenhouse gases are not included here. Overwhelmingly, the direct and indirect CO_2-equivalent emissions are CO_2 from combustion of fossil fuels.

OVERVIEW OF RESULTS

As shown in Figure 4, in 2010, the largest source of emissions was from Scope 3 – primarily Capital Improvement Projects (CIP) and operations supply chain. Electricity consumption also had a large impact on GHG emissions and decreased slightly, 8.1%, from 2010 to 2012.

Electricity emissions decreased between 2010 and 2012 due primarily to energy efficiency improvements made at the treatment plant (see page 10 for more details). Supply chain emissions also show a reduction between 2010 and 2012 due to a decrease in capital construction spending.

Figure 4: MWMC Facilities Emissions by Scope



Scopes 1 and 2 (2012) yield 11,830 MT CO_2e. For a sense of scale, this is equivalent to[5]:

- Annual emissions from 2,465 passenger vehicles or
- Annual emissions from the energy consumed by 609 homes (US average)

Scope 3 emissions (2012) yield 4,441 MT CO_2e. For a sense of scale, this is equivalent to:

- Annual emissions from 925 passenger vehicles or
- Annual emissions from the energy consumed by 229 homes (US average)

Description of Greenhouse Gas Emissions Categories

Table 2 provides detailed information on sources of anthropogenic emissions.

Table 2: Greenhouse Gas Emissions Categories for 2010 and 2012

WRI Scope	Emissions Sources	Description	2010 MT CO_2e	2012 MT CO_2e
	Wastewater Treatment and Biosolids Process Emissions			
Scope 1 (Direct Emissions)	Effluent discharge to the Willamette River	N_2O emissions are generated as nitrogen is discharged to the Willamette River in the treatment plant's effluent.	1,599	1,920
	Nitrogen removal from wastewater	The generation of N_2O results during both nitrification and denitrification processes.	643	647
	Biosolids storage lagoons	Lagoons may, at times, have an anaerobic layer and therefore are capable of producing methane.	1,059	1,257

[5] EPA equivalency calculator: http://www.epa.gov/cleanenergy/energy-resources/calculator.html

WRI Scope	Emissions Sources	Description	2010 MT CO_2e	2012 MT CO_2e
Scope 1 (Direct Emissions)	Biogas combustion	System inefficiencies result in a fugitive loss of methane. It is assumed that 1% of biogas escapes to the atmosphere regardless of the equipment used (generator, boiler, and flare).	330	344
	Land application of biosolids	As biosolids are land applied, a portion of the nitrogen in the fertilizer is oxidized N_2O.	924	942
	Biosolids drying beds	When biosolids are stored in piles with no aeration for a period of time, the potential exists for pockets of the storage piles to turn anaerobic and generate methane.	258	205
	Non-Process Emissions			
	Fleet	The Division's fleet includes 54 vehicles which operate on gasoline, biodiesel, diesel or propane.	188	161
	Natural gas	The MWMC Facilities uses natural gas for the waste gas burner pilot light, boiler pilot light, space heating, water heating, and as backup fuel for the boiler.	52	52
	Refrigerants	Refrigerant loss from heating, ventilation, and air-conditioning (HVAC) systems.	3	15
	Other fuels	Diesel fuel is used in emergency generators at pump stations and the treatment plant.	2	3
Scope 2 (Indirect Emissions)	Electricity	The MWMC Facilities used 18.3 million kWh of electricity in 2010 and 17 million kWh in 2012.	6,838	6,284
Scope 3 (Indirect Emissions)	Supply Chain (Embodied emissions in purchased goods and services)	In 2010, there were $13.9 million worth of goods and services purchased. In 2012 there were $7.5 million in purchases. The reduction in 2012 was mainly due to less capital construction work done as compared to 2010.	6,077	3,391
	Solid waste	Solid waste emissions include operational waste and the volatile organic material in the grit hauled to the Lane County Landfill.	480	587

WRI Scope	Emissions Sources	Description	2010 MT CO_2e	2012 MT CO_2e
Scope 3 (Indirect Emissions)	T & D Losses	Transmission and distribution (T&D) losses from power occur as electricity travels from the point of generation to the point of consumption. This figure assumes slightly more than 6% T&D losses for the US grid.	290	278
	Commute	Employees primarily commute to work by driving alone in their vehicles. The average distance staff commutes round trip is 14 miles/day.	185	179
	Business travel	Business travel encompasses employees' use of air travel and rental cars associated with meetings, conferences, and trainings.	9	6
Total MT CO_2e			**18,937**	**16,271**

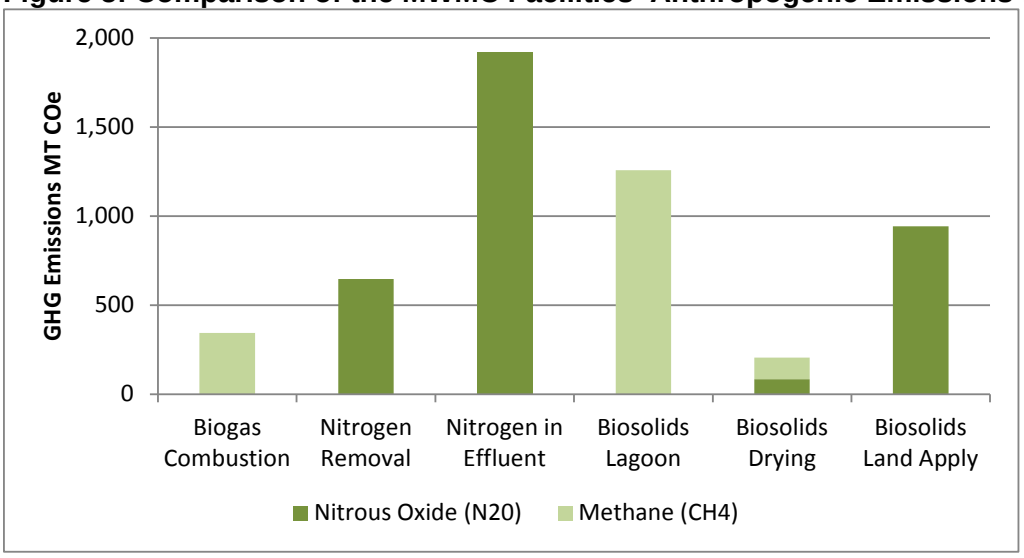
Emissions Details by Scope Category

Scope 1- Wastewater Treatment and Biosolids Process Emissions

Wastewater treatment and biosolids process emissions accounted for 95% of Scope 1 emissions in 2010 and 96% of Scope 1 emissions in 2012.

As indicated in Figure 5, nitrogen in the effluent is the largest source of anthropogenic GHG emissions from the wastewater treatment process.

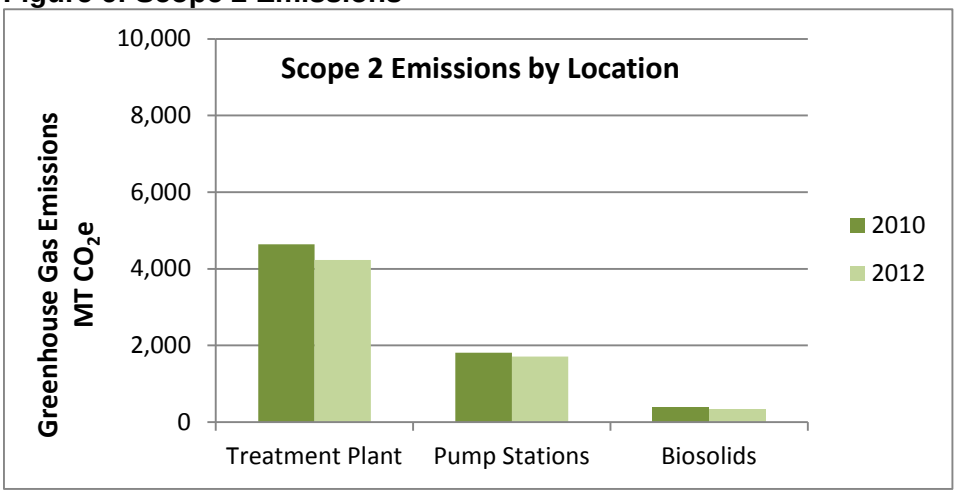
Figure 5: Comparison of the MWMC Facilities' Anthropogenic Emissions for 2012



Scope 2 - Electricity

Scope 2 emissions, resulting from consumption of electricity, decreased by 8.1% between 2010 and 2012. The reduction, as shown in Figure 6, was achieved even though the annual flow volume increased 4.4% from 2010 to 2012. This savings at the MWMC Facilities, particularly the treatment plant, was a result of large-scale energy efficiency projects. The projects included installation of a passive grit collection system, replacement of pump station equipment with more efficient variable frequency drive pumps, and improvements to odorous air controls.

Figure 6: Scope 2 Emissions

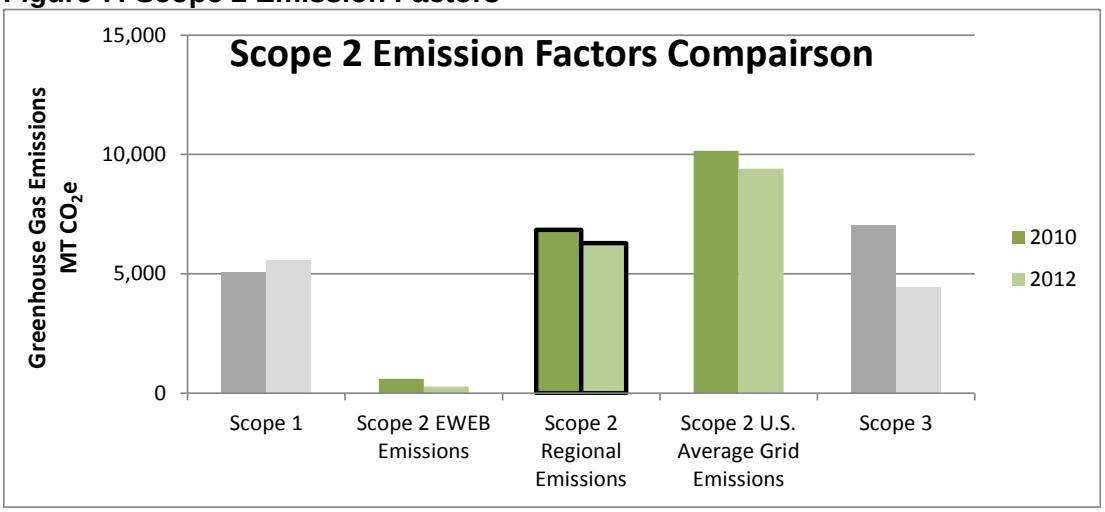


Scope 2 - Electricity Use Emission Factor

Greenhouse gas inventories require assumptions to be used in order to estimate GHG emissions from certain sources. The most significant assumption in this inventory is the emissions factor used to calculate emissions from electricity use. An emissions factor is a representation of the carbon intensity per unit of electricity (e.g., MT CO_2e / megawatt-hour). This inventory uses the Northwest Power Pool (NWPP) regional grid emissions factor to calculate the amount of emissions resulting from electrical usage. This factor was chosen as it is consistent with Eugene and Springfield's GHG inventories, and current GHG inventory protocol.

Figure 7 presents a sensitivity analysis for electricity emissions by comparing the results using different emissions factors to calculate electricity emissions: Eugene Water and Electric Board's (EWEB) utility specific factor, the regional factor, and the average factor for the U.S. grid. These Scope 2 emissions are also compared to Scope 1 and Scope 3 emissions to provide a sense-of-scale comparison. As can be seen, there is an extreme difference between the emissions as calculated with the regional and EWEB emissions factors. This difference is primarily the result of EWEB's priority access to hydroelectric power from Bonneville Power Administration, as a publically-owned utility.

Figure 7: Scope 2 Emission Factors



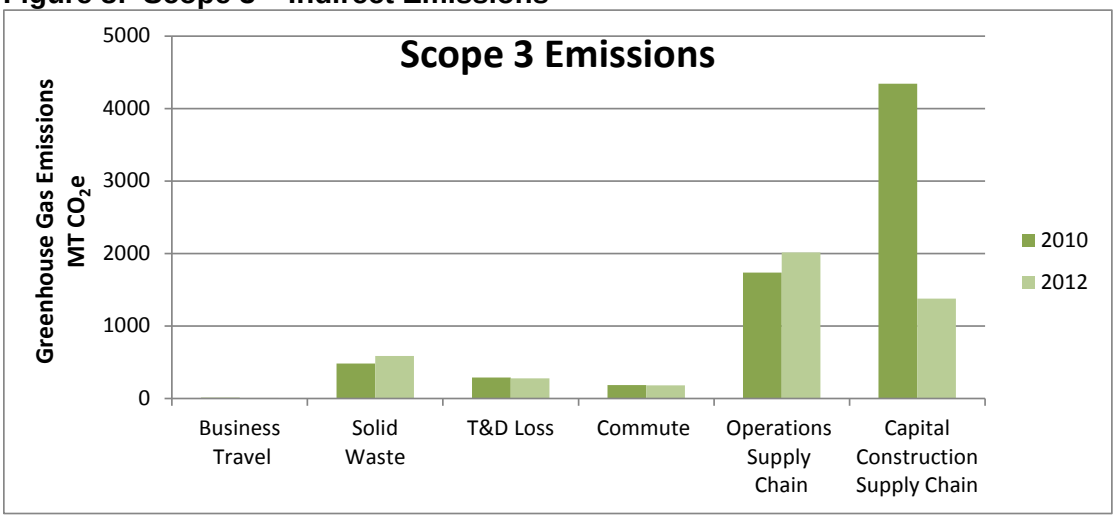
Emission Factors Source: EPA eGRid2012 Version 1.0 (2009 data)

The calculation methodology of a utility-specific emissions factor is a question still being studied and debated. The World Resource Institute and The Climate Registry, two organizations responsible for development and improvement of GHG inventory protocol, are currently engaged in a multi-year stakeholder process meant to improve the methodology for calculating electricity emissions factors for a given location.

Scope 3 – Indirect Emissions

As indicated in Figure 8, the primary emissions categories for Scope 3 were operations supply chain and capital construction supply chain. Embodied emissions in purchased goods and services estimates the quantity of GHG emissions produced by suppliers and service providers. The emissions are shared by both the vendors and the MWMC Facilities.

Figure 8: Scope 3 – Indirect Emissions



The operations supply chain includes chemicals used in the treatment process. Chemicals are a significant component of the materials and supplies emissions. The purchase of replacement parts and components is another significant item in this category. Purchases of vehicles, heavy

equipment, laboratory supplies, and professional services comprise the remaining items accounted for in supply chain emissions.

The capital construction and maintenance category has the largest amount of supply chain emissions. This category includes the capital construction projects. The remaining emissions are mainly from purchases related to building, equipment, and facility maintenance. Construction activities that utilize concrete, steel, and other building materials have a substantial GHG emissions footprint.

METHODS: DATA, PROTOCOLS, AND SENSITIVITY ANALYSIS

This inventory follows the Local Government Operations Protocol (LGOP) which provides the highest-consensus guidelines for minimum reporting scope and was developed jointly by The Climate Registry and other organizations.[6] However, the protocol only requires the reporting of emissions in Scopes 1 and 2 as defined by the World Resources Institute. Therefore, this inventory has been expanded to include several additional Scope 1 process emission sources, specific to biosolids management, as well as shared emission categories from Scope 3. This use of additional high-quality public-domain tools to estimate these additional emissions sources presents a more accurate picture of MWMC Facilities' GHG emissions.

The protocols and methods used to account for the additional Scope 1 and Scope 3 emissions sources are documented in Good Company's Carbon Calculator (G3C) and the G3C-WW (Wastewater) module used to calculate emissions for this inventory. The additional Scope 1 emissions sources were estimated using either LGOP (for emissions associated with denitrification and discharge of effluent) or the Canadian of Ministers of the Environment's *Biosolids Emissions Assessment Model (BEAM)* for emissions associated with biosolids storage, drying and land application.

Displaced emissions from grid electricity and conventional natural gas are calculated to be the same as an equal quantity of grid purchased electricity or natural gas. BEAM was used to estimate benefits associated with displaced conventional fertilizer and soil carbon sequestration from land application of biosolids. Carbon sequestration by poplar trees at the Biocycle Farm was calculated using the methodology specified by the Climate Action Reserve's *Urban Forest Protocol*.[7]

It is important to note that in the course of this project it was found that, in general, GHG inventory protocols for wastewater treatment emissions sources are either non-existent, limited, or cannot account for differences between individual wastewater plants and treatment processes. This inventory used the best currently available protocols, guidance and tools, but these resources will undoubtedly become more sophisticated and accurate in the future. That said – the methods used in this inventory, specific to process emissions, will require review in future years' GHG inventories to make use of evolving science and GHG inventory guidance as it become available.

In Oregon, very few wastewater facilities have committed to an in-depth inventory, primarily due to the lack of regulatory requirements and adopted protocols specific to wastewater operations.

[6] The Local Government Operations (LGO) Protocol was developed as a collaboration of The Climate Registry (TCR), the California Air Resources Board (CARB), the California Climate Action Registry (CCAR, now the Climate Action Reserve), and ICLEI Local Governments for Sustainability. The LGO Protocol follows the same format as The Climate Registry's General Reporting Protocol (GRP).

[7] For more information on CAR's Urban Forest Protocol visit http://www.climateactionreserve.org/how/protocols/urban-forest/.

Emissions from wastewater operations can be significant and wastewater treatment facilities can have a direct impact through emission reductions. By measuring emissions from the MWMC Facilities' operations, this inventory is a step toward taking action, managing risk and leading the way forward.

COST OF CARBON: QUANTIFICATION AND RISK

Assembling a GHG inventory is an opportunity to analyze a particular kind of financial risk, i.e., the implications of a "cost of carbon" – a direct or indirect cost associated with GHG emissions. Many analyses of proposed legislation have indicated a likely range of this cost and we can see examples in countries that have already capped CO_2 emissions.

Recent EPA analysis[8] of proposed climate policy suggests that, within a few years of implementing a cap-and-trade system, the cost of carbon could be around $15 per MT CO_2e. One proposed "reserve price" (or price floor) is $10, while short-term "escape hatch" prices (or price ceilings) have been around $30. This range provides a sense of MWMC total direct and indirect financial exposure related to a cost of carbon.

A portion of the carbon footprint is shared with others, from employees who commute to vendors that supply the organization with goods and services. This total financial risk is unlikely to be the sole responsibility of MWMC.

EMISSION BENEFITS FROM EXISTING MWMC PRACTICES

In addition to the emissions emitted by MWMC Facilities' operations, this inventory also estimated the GHG emissions "benefits" that result from wastewater operations. These benefits include *displaced* GHG emissions *(*e.g., electricity generated from biogas) and *carbon sequestration* (e.g., poplar tree farm). See below for details.

It's important to note that these benefits are not subtracted from MWMC's operational inventory results to determine "net emissions" due to lack of guidance from GHG inventory protocol or precedent in other similar GHG inventories. The following content is meant to highlight and scale the existing, positive practices used at MWMC that provide a GHG benefit - whether that benefit can be claimed or not in current GHG accounting.

Displaced GHG Emissions Categories

- **Displaced Grid Electricity (2010: -2,358 MT CO_2e, 2012: -1,997 MT CO_2e)**
  Biogas-generated electricity, which is considered renewable and the emissions largely biogenic, displaces sub-regional grid electricity[9] that has significantly higher anthropogenic carbon intensity. The "renewableness" of biogas-generated electricity is accounted for with Renewable Energy Certificates, or RECs (1 kWh of electricity = 1 REC). The MWMC Facilities sells 100% of the RECs generated at the treatment plant to EWEB and therefore cannot claim any of the associated environmental benefits.

[8] http://www.epa.gov/climatechange/economics/pdfs/HR2454_Analysis.pdf
[9] Oregon is part of the Northwest Power Pool (NWPP) sub-regional electricity grid. In 2009 the GHG emissions intensity of the NWPP grid is approximately 823 pounds CO_2e / MWh. Source: EPA eGRID.

- **Displaced Conventional Natural Gas (2010: -1,622 MT CO_2e, 2012: -1,719 MT CO_2e)**
  The treatment plant substitute's natural gas with biogas in boilers as well as capturing the heat generated with the plant's combined heat and power (CHP) system. If the plant purchased and combusted natural gas to generate an equivalent amount of heat, it would have resulted in an additional 1,622 MT CO_2e in 2010 and 1,719 MT CO_2e in 2012. These benefits are accounted for by not including emissions from the equivalent quantity of natural gas and the biogenic emission from the biogas.

- **Displaced Conventional Fertilizer (2010: -153 MT CO_2e, 2012: -132 MT CO_2e)**
  Substituting biosolids for conventional fertilizer displaces the emissions that would have otherwise been created in the production of conventional fertilizers.

Carbon Sequestration Categories

- **Carbon Sequestration by Biocycle Poplar Trees (2010: -20,581 MT CO_2e, 2012: -25,670 MT CO_2e)**
  The nearly 88,000 poplar trees growing at the Biocycle Farm sequester carbon through photosynthesis. In 2012, the trees represented a "carbon sink" roughly equivalent to two years' worth of operational emissions. While these trees currently store a significant quantity of carbon, they are proposed to be harvested in the near future. How the wood is ultimately utilized will determine the fate of the stored carbon. Using the wood for durable goods such as furniture or cabinetry will result in longer-term storage of the sequestered carbon than if the wood is combusted for power. Combustion of the wood will release the 12-years of stored biogenic carbon in an instant. Because the ultimate fate of the poplar trees has not been determined, this "benefit" is not applied to net operational emissions.

- **Soil Carbon Sequestration (2010: -598 MT CO_2e, 2012: -525 MT CO_2e)**
  When biosolids are applied to existing soil they store a portion of the organic carbon and increase the health and sequestration potential of the existing soil.

ALLOCATION OF MWMC FACILITIES' GHG EMISSIONS TO EUGENE AND SPRINGFIELD

One of the drivers for conducting this GHG inventory is to allocate GHG emissions to the cities served by MWMC (Eugene and Springfield) per their request. Both cities have conducted their own GHG inventories but did not include wastewater operations due to the complexities associated with calculating emissions from a regional wastewater treatment facility. To date, wastewater process emissions have been a known Scope 3 emissions source gap in both cities' GHG inventories.

There are various factors which contribute to GHG emissions at a wastewater treatment facility that could be used to allocate emissions to the cities. These factors include:

- the volume of wastewater treated (i.e., flow)
- the population being served
- the amount of nitrogen or biochemical oxygen demand in the wastewater

Additional discussion with both cities' staff still needs to occur to determine emissions allocations and boundaries (e.g., accountability of electricity consumption from local and regional pump stations).

SUSTAINABILITY EFFORTS AND CLIMATE ACTION

As an ISO 14001 EMS certified organization, the Wastewater Division staff is committed to climate action strategies that reduce GHG emissions as part of the EMS continuous improvement model. The GHG inventory provides a baseline that allows for strategic planning that focuses on areas with the greatest potential for reduction in GHG emissions. Several measures have already been implemented that correlate to GHG reduction, including reduction in energy consumption, solid waste, and use of natural resources.

The EMS model emphasizes incremental change over time that results in large positive change. The Wastewater staff will align its strategies with the City of Eugene's Climate Action Plan, as well as the EMS continuous improvement model, by establishing annual objectives and targets aimed at GHG emission reduction efforts. Table 3 highlights past efforts and future opportunities for improvement.

Table 3: Past Efforts (Since 1996) and Future Opportunities

Objective	Action Items
Past Efforts	
Reduce Energy Consumption	Total Energy Saving:7.9 million kWh annually • Replaced multi-state blower with turbo blower. • Replaced coarse diffusers with fine bubble. • Upgraded Cogeneration engine. • Added Variable Frequency Drives (VFDs), dampers, and pressure sensors on odorous air fans. • Replaced gas mixing with mechanical mixers on digesters. • Improved primary solids. • Rehabilitated Willakenzie pump station and force main. • Installed stacked tray technology for grit removal process. • Installed Variable Frequency Drives (VFD) for Recycled Water within the Plant (W2) and the Return Activated Sludge (RAS) pump. • Retrofitted lights with motion sensors. • Installed LED street lights. • Upgraded a significant number of indoor light fixtures.
Natural Resources Reduction	• Began using recycled water at the BMF. • Increased the amount of non-petroleum based fuels (biodiesel and E10) consumed by vehicles.
Reduce Air Emissions	• Reduced carbon monoxide emissions from the engine generator.
Reduce Solid Waste	• Implemented an extensive recycling/reuse/reduce program.
Future Opportunities for Improvement	
Reduce Energy Consumption	• Assess/Improve energy use from smaller equipment at MWMC Facilities such as air compressors, lab hoods and vacuum pumps. • Study Biogas Utilization and explore renewable energy options such as solar and micro-hydro on site.
Reduce Consumption of	• Increase the use of alternative fuels (e.g., 50% Biodiesel). • Consider new commute options/incentives for employees.

Objective	Action Items
Natural Resources	• Continue electronic control for documents.
Reduce Consumption of Chemicals	• Research/adopt alternatives and management methods to pesticide application.

CONTACT INFORMATION AND ADDITIONAL RESOURCES

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