BOZEMAN CLIMATE PROTECTION TASK FORCE

Bozeman Climate Action Plan

Municipal CAP

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Executive Summary

Climate Change has the potential to have devastating effects on the Bozeman community if immediate and aggressive policies are not taken to begin mitigating for anthropogenic (man-made) greenhouse gas (GHG) concentrations, the major cause of global warming. Urged by the efforts of the Citizens Concerned for Climate Change, the Bozeman City Commission signed onto the Mayors Climate Protection Agreement (MCPA) in November 2006. The MCPA, initiated in 2005 by Seattle's Mayor Nickel's, is a commitment to reduce greenhouse gas emissions to 12 percent below 1990 levels by 2012.

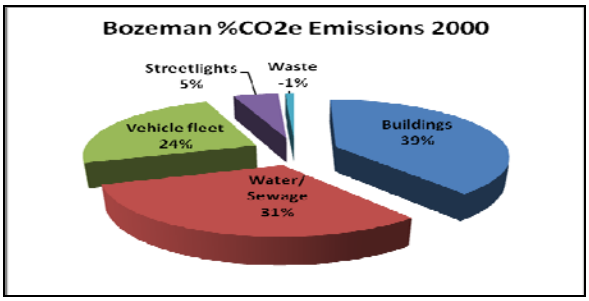
The City of Bozeman hired a Sustainability Coordinator for a one-year internship in May 2007 to begin developing the Bozeman Climate Action Plan (CAP). The CAP identifies ways in which the community can begin addressing Climate Change. Facilitated by the efforts of the Sustainability Coordinator, The Bozeman Climate Protection Task Force (CPTF) was appointed in July 2007 and given one year to identify a baseline emissions inventory of greenhouse gas emissions for the community and create benchmarks for reducing the community's emissions.

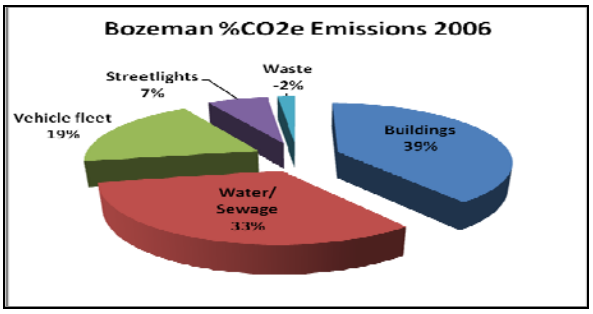
The CPTF met once a month to review, discuss, and understand the scope of the CAP. In October of 2007, the CPTF agreed to focus the first part of the CAP on municipal operations. The reasons are two- fold. First, the CPTF believes that the City should lead by example. This document represents the Municipal Climate Action Plan (Municipal CAP) which outlines the basis for each recommendation, the carbon reduction potential of that recommendation, and financial considerations associated with that recommendation. Second, the CPTF agreed that given the time constraints of ten months to produce a report, a meaningful and thoughtful approach to GHG mitigation recommendations could only begin with municipal operations. **It is important to stress that this plan is only a first part to a two-part plan, and the City must complete a Community Climate Action Plan to fulfill the requirements of the Mayors Climate Protection Agreement.**

The Task Force identified a baseline year of 2000 to measure Bozeman municipal emissions performance against. The year 2000 was selected because it was the first year with sufficient records available to calculate a baseline for City of Bozeman greenhouse gas emissions. An interim emissions inventory of 2006 was also performed.

The Task Force set a target of reducing municipal greenhouse gas emissions 15 percent below 2000 levels by 2020 as the City's reduction goal. The target year of 2020 was specifically identified to coincide with the efforts of the Bozeman 2020 Community Plan.

Based on the CACP analysis, Bozeman's total Municipal Operations CO_2e emissions for 2000 were 6,083 tons of CO_2e. Buildings were the leading source of emissions (all in tons CO_2e) with 2,384; Water/Sewage 1,958; Vehicle Fleet 1,487; Streetlights 326; and Waste -72 (see figure below). An interim year of 2006 was also measured to effectively gauge the City's most current emissions. Based on CACP analysis, Bozeman's Municipal Operations CO_2e emissions for 2006 were 7,866 tons of CO_2e. Buildings were the leading source





The figures above show emission levels for the City in 2000 and 2006. The City's goal is to reduce its greenhouse gas emissions to a level 15% below 2000 levels by 2020, or thus a numeric goal of 5,172 tons of CO_2e by the year 2020 (i.e., [1-0.15)]*6,083).

with 3,226; Water/Sewage 2,652; Vehicle Fleet 1543; Streetlights 564; and Waste -119 (note that a negative number signifies net carbon sequestered in the landfill). GHG reductions policies are far reaching and affect all sectors of society; for this reason, a holistic approach to GHG mitigation management must be used to effectively address climate change reduction strategies. The Climate Protection Task Force produced realistic and achievable goals balanced with innovative and progressive ideas to provide policies from which City officials can make effective decisions. Carbon reduction policies and fiscal responsibility are not mutually exclusive; for this reason, these recommendations will create a healthier community while most often saving taxpayer dollars.

The table that follows provides a summary of the 40 recommendations that the Task Force provided to the City Commission. All recommendations in the MCAP were agreed to by the CPTF through unanimous consent.

Summary of recommendations for the Bozeman Climate Protection Task Force to the City of Bozeman.

PBE-1. Manage Energy Usage	ED-4
PBE-2. Revise Building Codes to Include LEED	

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Chapter 1

Introduction

Climate Change is an issue which has the potential to have devastating effects on the Bozeman community if immediate and aggressive policies are not taken to begin mitigating for anthropogenic (man-made) greenhouse gas (GHG) concentrations which are a major cause of global warming. Urged by the efforts of the Citizens Concerned for Climate Change, the Bozeman City Commission signed onto the Mayor's Climate Protection Agreement (MCPA) in November 2006 (Appendix A). The MCPA, initiated in 2005 by Seattle's Mayor Nickel's, is a commitment to reduce greenhouse gas emissions to 12 percent below 1990 levels by 2012.

The City of Bozeman hired a Sustainability Coordinator for a one year internship in May 2007 to begin developing the Bozeman Climate Action Plan (CAP) (as described later, this was split into two efforts; this document, the Municipal CAP, and a Community CAP to be developed) . The CAP identifies ways in which the community can begin addressing Climate Change. Facilitated by the efforts of the Sustainability Coordinator, The Bozeman Climate Protection Task Force (CPTF) was appointed in July 2007 and given one year to identify a baseline emissions inventory of greenhouse gas emissions for the community and create benchmarks for reducing the community's emissions.

The CPTF met once a month to review, discuss, and understand the scope of the CAP. In October of 2006, the CPTF agreed to focus the first part of the CAP on Municipal operations. The reasons are two- fold. First, the CPTF believes that the city should lead by example. This document represents the Municipal Climate Action Plan (Municipal CAP) which outlines the basis for each recommendation, the carbon reduction potential of that recommendation, and financial considerations associated with that recommendation. Second, the CPTF agreed that given the time constraints of ten months to produce a report, a meaningful and thoughtful approach to GHG mitigation recommendations could only begin with municipal operations. **It is important to stress that this plan is only a first part to a two-part plan, and the city must complete a Community Climate Action Plan to fulfill the requirements of the Mayors Climate Protection Agreement.**

The recommendations provided in this Municipal CAP are divided into five sections: (1) Planning Building & Energy, (2) Transportation and Land Use; (3) Waste Water & Recycling, (4) Education & Outreach, and (5) Implementation. Realistic and achievable goals along with innovative and progressive ideas were balanced to provide policies from which city officials can make effective decisions. Carbon reduction policies and fiscal responsibility are not mutually exclusive; for this reason, these recommendations will create a healthier community while saving taxpayer dollars.

This report also includes several appendices for a future Community Climate Action Plan.

During the process, the CPTF found overlap between municipal and community operations. For this reason, the CPTF decided to append the recommendations to include possible community recommendations. These recommendations are only suggestions and intended to be used a tool to help guide the Community Climate Protection Task Force in their efforts (See Appendix B).

Global Warming: A Brief Summary

Scientific evidence clearly tells us that the Earth is warming, and that humans are influencing this trend. That was the conclusion of the second scientific assessment of the United Nation Intergovernmental Panel on Climate Change (IPCC) in 1988 and reinforced by the third and fourth scientific assessments by the IPCC submitted in 2001 and 2007. In 2007 the IPCC concluded, "The balance of evidence suggests a discernible human influence on global climate."

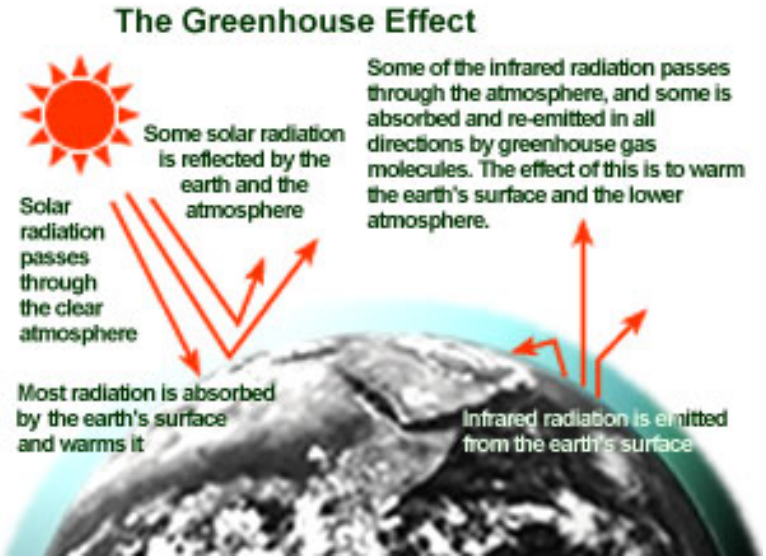

Figure 1. Graphical representation of the greenhouse effect (adapted from www.epa.gov/climatechange/kids/greenhouse.html)

The greenhouse effect (Figure 1) is the process whereby short wavelength energy from the sun hits the Earth and is re-radiated back toward space as long wavelength infra-red heat energy. Some of this heat energy passes into space but some is absorbed by the atmosphere, resulting in the retention of heat around the Earth. The natural greenhouse effect helps keep the Earth's average temperature at around 59 degrees Fahrenheit (F). Without the natural greenhouse effect, the Earth's average temperature would be around 0°F, and the planet would be largely uninhabitable.

Since industrialization, humankind has markedly increased the concentration of molecules in the atmosphere that absorb heat energy (known as "greenhouse gases"). These measurable concentration increases, along with upward trends in temperatures and rapid climate change around the globe, are the underlying basis for the current concerns of global warming.

A greenhouse gas is any gas in the atmosphere that adsorbs infra-red radiation and thereby contributes to the greenhouse effect. There are numerous greenhouse gases but the three of major concern to normal citizens and municipal operations—and thus the focus of this report—are carbon dioxide, methane, and nitrous oxide:

- *Carbon Dioxide (CO_2)* emissions result from the burning of fossil fuels (e.g., oil, coal, or natural gas) most often for transportation, industrial operations, or the heating of buildings.
- *Methane (CH_4)* emissions result from the anaerobic decay of organic materials in landfills and water treatment plants, as well as from fuel production, livestock production, and farming.
- *Nitrous Oxide (N_2O)* emissions result from agricultural and industrial activities, as well as during combustion of solid waste and fossil fuels.

These gases are also naturally occurring (e.g., plants "breathe" out carbon dioxide, and methane is a natural byproduct of decomposition). However, human activities such as those mentioned above have increased the concentration of these greenhouse gases in the atmosphere far beyond natural levels. That is why man-made GHG are the primary focus of efforts to reduce the impact that humans are having on the climate system.

For the first time, the IPCC is providing best estimates for the warming projected to result from particular increases in greenhouse gases that could occur after the 21st century, along with uncertainty ranges based on more comprehensive modeling. If atmospheric concentrations of greenhouse gases double compared to pre-industrial levels, this would "likely" cause an average warming of around 3°C (5.4°F), with a range of 2 - 4.5°C (3.6 - 8.1°F). A GHG level of 650 ppm (parts per million)would "likely" warm the global climate by around 3.6°C(6.5°F), while 750 ppm would lead to a 4.3°C(7.7°F) warming, 1,000 ppm to 5.5°C(9.9°F) and 1,200 ppm to 6.3°C(11.3°F).

Future GHG concentrations are difficult to predict and will depend on economic growth, new technologies, government policies and actions to stem GHG growth, and other factors. By signing on to the Mayors' Climate Protection Act, the City of Bozeman has declared its intention to take action to minimize its output of global warming gases.

Global Warming Potential and CO_2e

Each greenhouse gas differs in its ability to absorb heat in the atmosphere. The difference in absorption ability results from the different chemical bond characteristics for each molecule, as well as their expected lifetime in the atmosphere.

Scientists use the term "global warming potential" (or GWP) to describe how much a given mass of greenhouse gas will contribute to global warming. GWP is a relative scale that compares the gas in question to the same amount of CO_2 (i.e., $C0_2$ has a GWP of 1.0). CO_2 was chosen as the reference because it is the most prevalent of greenhouse gases in the atmosphere. As shown in Table 1, methane traps 21 times more heat per molecule than carbon dioxide and thus has a GWP of 21. Nitrous oxide absorbs 260 times more heat per molecule than carbon dioxide and thus has a GWP of 260.

Table 1. Relative global warming potential of the most common greenhouse gases. (Source EPA http://www.epa.gov/climatechange/emissions/downloads/ghg_gwp.pdf. Accessed 5/9/08).

Greenhouse gas	Chemical Symbol	Global warming potential	Expected lifetime (years) in the atmosphere
Carbon Dioxide	CO_2	1	50-150
Methane	CH_4	21	10.5
Nitrous Oxide	N_20	260	132

Global Warming Potential Units of Measure

When actual emissions are being discussed, global warming potentials allow policy makers to use one unit of measurement for comparing the various greenhouse gasses. That unit of measure is the known as "CO_2 equivalents" (or "CO_2e"). For instance, 1 ton of carbon dioxide emissions would equal 1 ton of CO_2e; 1 ton of methane would equally 21 tons of CO_2e. For the entirety of the Bozeman Municipal CAP estimates will be in terms of CO_2e .

Terminology: Weather, Climate, Climate Change, and Global Warming

Weather versus Climate

The terms weather and climate are often used interchangeably. In fact, they are different: weather is a condition of the atmosphere at one particular time and place, while climate is the average pattern of weather in a given place.

Measures of weather include wind speeds, temperature, humidity, atmospheric pressure, and precipitation. The weather often changes substantially from day to day. Weather patterns are a product of climate. Unlike weather, climate generally refers to large scales in time and space. Climate includes the broader overall relationships between the earth's atmosphere, oceans, land, and solar radiation.

Global Warming versus Climate Change

Global warming refers to the overall rise of the Earth's average temperature over time due to anthropogenic emissions of global warming gases. Climate change describes the potentially dramatic changes in such areas as sea level, weather patterns (storm events, flood, drought), and soil moisture *resulting from global warming*. It is important to note that wetter, cooler climates may result in some local areas even while *on average* the Earth is getting hotter.

Critical to current concerns about global warming is recognizing that human-induced climate change is occurring on time scales far faster than would be expected naturally. While humans are accustomed to living with daily and seasonal weather changes, we do not have experience adapting to *rapid* climate change. These changes are likely to have long-lasting and widespread adverse impacts on ecological systems, human health, and economies. Similarly, other species may be incapable of adapting to the changes resulting from rapid climate change.

The lag time between the emissions of greenhouse gases and their full impact on the climate can be decades or even centuries. The time required to reverse any effects is similarly long making it imperative to start activities such as outlined in the Municipal CAP now to best minimize global warming and the resulting climate changes.

Chapter 2

Climate Change and Bozeman

Climate Change Impacts to our Bozeman Community

While the global climate system is large, complex, and dynamic, evidence strongly suggests that human-caused emissions of greenhouse gases are directly tied to recent warming of the globe. Scientists are increasingly confident that the impacts of global warming over the next 50 to 100 years promise to be substantial. Anticipated climate-related challenges include rising sea levels, disrupted water resources, lessened food security, threats to human health, and disruptions to natural ecosystems. The frequency and severity of extreme weather events is also expected to increase.

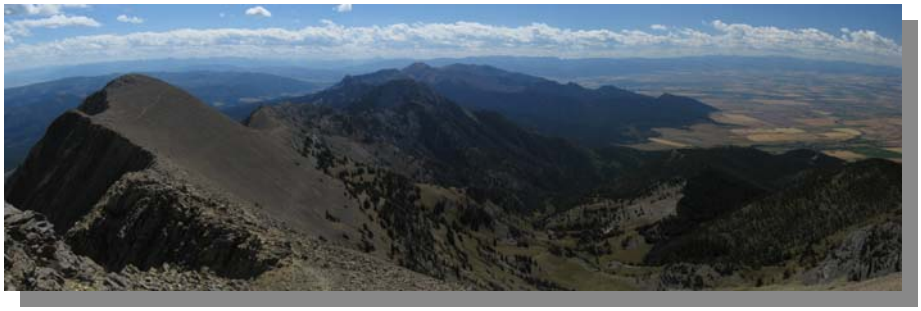

Figure 2. Bozeman and the Gallatin Valley as seen from the Bridger Crest.

Anticipating the impacts of climate change for a local area, such as Bozeman, is more difficult than predicting average change across the globe. However, for the Bozeman area, climate change may lead to such tangible, life-impacting alterations as increased catastrophic forest fires, shortened ski seasons, hotter summers, lower summer river flows, and drought.

Decreased tourism may result from shortened ski and fishing seasons, with a resulting decrease in business income and related tax income. Increased drought can have severe impacts on agri-business, as well as lead to increased property loss due to forest fires. Importantly, these impacts will stress municipal services such as fire prevention and clean and abundant water supply.

In addition to human-related concerns in the Bozeman area, local ecological diversity and our natural resources are likely to suffer a broad range of negative impacts and losses due to global

warming. These changes are intrinsically important, as well as with respect to their impact on tourism and other industries. Such changes might include disruption of native fisheries (e.g., west slope cutthroat trout populations), increased plant disease (e.g., blister rust), increased plant pathogens (e.g., bark beetles), and negative impacts on high elevation species (e.g., white bark pine).

What is Bozeman Doing About Climate Change?

Mayors Climate Protection Agreement

The Mayor of Bozeman signed on to the Mayors Climate Protection Agreement (MCPA) in November 2006. The purpose of this agreement is to engage US cities to decrease their output of gases known to cause global warming. As of 2008, 852 Mayors across the United States signed onto the MCPA, thereby committing their cities to attempt to meet measurable goals for greenhouse gas reductions.

The Mayors Climate Protection Agreement is at least in part tied to the federal government's decision not to sign the International Kyoto Protocol agreement. The Kyoto agreement commits nations to reduce their greenhouse gas emissions seven percent below 1990 levels by 2012. As of the writing of the Bozeman Municipal CAP, the United States has still not ratified the Kyoto protocol agreement.

The City of Bozeman should be commended for its leadership and progressive approach towards beginning to address climate change prior to this report. For instance, the City has the first silver rated LEED (Leadership in Environmental and Energy Design) public building in the state of Montana with its public library. The new City Hall is being renovated using LEED Existing Building designs. When possible, the City uses bio-diesel in its vehicle fleet, and the City has converted most of its traffic signals from incandescent light bulbs to Light Emitting Diodes (LED's). LED's are 80 percent more energy efficient than incandescent bulbs.

Climate Protection Task Force

The Bozeman City Commission appointed the Bozeman Climate Protection Task Force in July of 2007 to create a Bozeman Climate Action Plan (CAP). The Task Force is made up of diverse volunteers from the community, including people from the business, building, energy, science, engineering, and non-profit sectors, as well as citizen-at-large representatives. Over the course of the year the Task Force membership changed (losses and additions) due to members moving and changes in availability. Overall the group was relatively stable for the ~10 months required to create this Municipal CAP.

Bozeman Global Warming Gas Reduction Goal

The Task Force identified a baseline year of 2000 to measure Bozeman municipal emissions performance against. The year 2000 was selected because it was the first year with sufficient records available to calculate a baseline for City of Bozeman greenhouse gas emissions. An interim emissions inventory for 2006 was also performed.

The Task Force set a target of reducing municipal greenhouse gas emissions 15 percent below 2000 levels by 2020 as the City's reduction goal. The target year of 2020 was specifically identified to coincide with the efforts of the Bozeman 2020 Community Plan. GHG reductions

policies are far reaching and affect all sectors of society; for this reason, a holistic approach to GHG mitigation management must be used to effectively address climate change reduction strategies

Scope of this Municipal Climate Action Plan (MCAP)

This Municipal CAP serves as a guideline and tool for the Bozeman City government to decrease its greenhouse gas emissions. This document is not intended to drive change in businesses or individuals in the City of Bozeman, though it certainly will serve as a foundation for the Community Climate Action Plan to follow (see below). **The Task Force would like to stress to the Commission that to be in compliance with the MCPA the City of Bozeman must still complete a Community Climate Action Plan separate from the Municipal CAP.**

All the recommendations in the Municipal Climate Action Plan were achieved by unanimous consent of the CPTF.

This Municipal CAP should be used as a living document to be reviewed, monitored, and adjusted as necessary. It is important to note that further analysis of proposed changes might be required before action is taken. While the Task Force believes that all recommendations are warranted ecologically, in most cases a rigorous analysis of cost (or benefit) per unit of CO_2 reduced was beyond the Task Force's scope and/or knowledge and/or time availability. Thus we cannot present these recommendations as an ordered list of preferred actions (i.e., beginning with the most cost beneficial changes and running to most expensive changes per unit of CO_2 reduction).

The Task Force started with municipal operations rather than attempting a full blown private/public plan believing that in the end lessons learned in the Municipal plan would greatly inform the Community plan and, as a result, lead to higher likelihood of overall greenhouse gas reductions before the 2020 target year. The Task Force recognizes that municipal operations have far smaller potential reductions than those that will be available from a plan directed at the entire community including private businesses, Montana State University, and the general citizenry.

The Task Force unanimously agrees that a Community Climate Action Plan must be completed and adopted no later than 18 months from the adoption of the Municipal CAP. The Community CAP should incorporate this Municipal CAP, thus provide a complete private/public greenhouse gas reduction plan for the City of Bozeman. The Task Force believes that a facilitator/leader will be required to assist the current Climate Protection Coordinator to complete the Community CAP. We believe that the current Climate Protection Coordinator position does not have sufficient hours to *lead* the Community CAP, unless the position is re-scoped. A consultant or graduate student intern could also be considered to facilitate/lead the Community CAP.

Bozeman Municipal Emissions Inventory

The City of Bozeman hired a Sustainability Coordinator for a one-year internship to manage the Mayor's Climate Protection Agreement. The Sustainability Coordinator was charged with conducting a baseline emission inventory and facilitating the efforts of the Bozeman Climate Protection Task Force (CPTF).

The CPTF was given one year to examine emission reduction strategies and make recommendations for the City's CO_2 reduction policies. As previously noted, the CPTF unanimously agreed that the recommendations would focus solely on Municipal operations with a commitment to Community recommendations as a second phase of the Climate Action Plan.

Using the Clean Air Climate Protection (CACP) software version 1.1, June 2005 provided by ICLEI-Local Governments for Sustainability, a baseline emissions inventory was performed on the following municipal sectors: Buildings, Vehicle Fleet, Streetlights, Water/Sewage, and Waste (see Appendix C for data).

Based on the CACP analysis, Bozeman's total Municipal Operations CO_2e emissions for 2000 were 6,083 tons of CO2e. Buildings were the leading source of emissions (all in tons CO_2e) with 2,384 tons; Water/Sewage 1,958 tons; Vehicle Fleet 1,487 tons; Streetlights 326 tons; and Waste -72 tons (Figure 3).

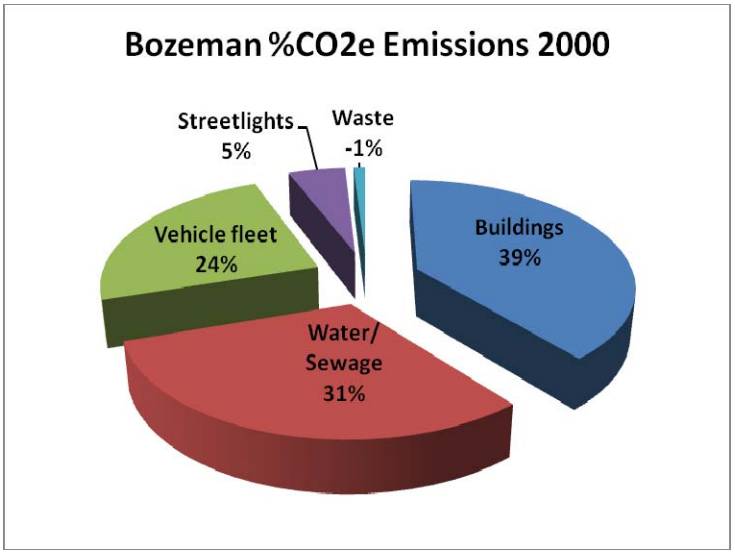

Figure 3. Percentage breakdown of Bozeman Municipal CO_2e emissions in the year 2000.

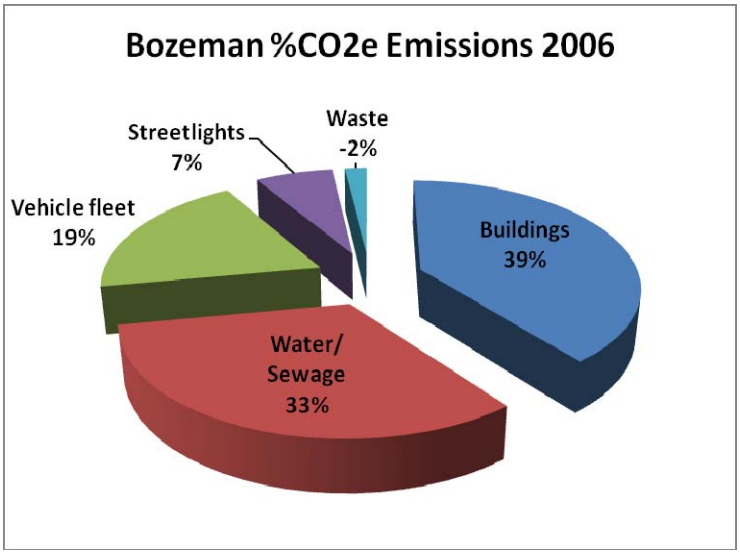

Figure 4. Percentage breakdown of Bozeman Municipal CO_2e emissions in the year 2006.

An interim year of 2006 was also measured to effectively gauge the city's most current emissions. Based on CACP analysis, Bozeman's Municipal Operations CO_2e emissions for 2006 were 7,866 tons of CO_2e. Buildings were the leading source with 3,226; Water/Sewage 2,652; Vehicle Fleet 1543; Streetlights 564; and Waste -119, all in tons of CO_2e (Figure 4).

The negative emissions from the Waste sector deserve comment. Greenhouse gas emissions generated from waste are dependent on the type of waste being disposed of and the configuration of the landfill where waste is disposed. Two processes generally occur in a typical landfill. First, the waste does not completely decompose causing some of the carbon that would have been released as CO_2 to be sequestered in the landfill. This process is representative of the current Bozeman Story Hill landfill resulting in a negative CO_2e inventory. In a second process, because of the lack of oxygen in the landfill decomposing organic matter is released as methane, a greenhouse gas 21 times more potent than CO_2. If methane is not captured or burned, landfills are usually net sources of greenhouse gas emissions (showing as positive emissions). In some cases, the methane released can be captured to produce energy or heat, which converts it back to the less potent CO_2 while at the same time displacing the need to supply new methane for energy or heat.

Bozeman Municipal CAP Process and Summary of Recommendations

To begin addressing global warming gas reductions, the Task Force divided into three subcommittees: (1) Planning, Building, and Energy (PBE); (2) Transportation and Land Use (TLU); and (3) Waste Water and Recycling (WWR). The CPTF did not explicitly state that each group must achieve the 15 percent reduction within its sector. Instead, the groups are tasked with determining baseline carbon footprint numbers and identifying greenhouse gas reduction opportunities within their sectors.

In the chapters that follow, we provide recommendations to the City from each of the three subcommittees. Table 2 provides a summary of those recommendations for easy reference. Note that in some instances recommendations from the three sub-committees overlapped; Table 2 shows those relationships.

The City's goal is to reduce its greenhouse gas emissions to a level 15% below 2000 levels by 2020, or thus a numeric goal of 5,172 tons of CO_2e by the year 2020 (i.e., [1-0.15)]*6,083)

Chapters 3-6 of this report provide recommendations on how Bozeman can reduce its greenhouse gas emissions to achieve this goal.

Table 2. Summary of recommendations from the Climate Protection Task Force to the City of Bozeman.

Climate Protection Task Force Recommendation	Closely Related To…
Planning, Building, and Energy	
PBE-1. Manage Energy Usage	ED-4
PBE-2. Revise Building Codes to Allow LEED	
PBE-3. Retrofit City Buildings to LEED Standards or Equivalent	
PBE-4. Create Sustainable Operations and Maintenance Manual for all Buildings	
PBE-5. Create Employee Conservation and Education Programs	
PBE-6. Purchase Green Tags	
PBE-7. Convert to Daylight Janitorial Services	
PBE-8. Create an Energy Fund	
Transportation and Land Use	
TLU-1. Improve Traffic Signal Operations	
TLU-2. Consider Roundabouts	
TLU-3. Modify Vehicle Purchasing Policies	WWR-8
TLU-4. Establish Vehicle Tracking Method for City Fleet	
TLU-5. Increase City Average Fuel Efficiency Standard	WWR-8
TLU-6. Create Transportation Demand Management Pilot Program	
TLU-7. Anti-idling ordinance	
TLU-8. Green Bike Program	
TLU-9. Fund LED Program	
TLU-10. Streamline Funding	
Waste Water and Recycling	
WWR-1. Install an Electricity-producing Turbine for the Sourdough Creek Plant	
WWR-2. Enforce LEED Building Standards for the Sourdough Treatment Plant Expansion	PBE-3, 4
WWR-3. Stop the Purchase of Bottled water with City of Bozeman Taxpayer Funds	PBE-5
WWR-4. Install a turbine for electrical generation at the City's Lyman Water Treatment Plant	
WWR-5. Set Goals for Water Conservation, then Measure, Monitor, Verify and Act on these Goals	PBE-1
WWR-6. Support Solid Waste Recycling in Municipal Buildings and Facilities, and in public spaces	
WWR-7. Explore Grant and Other Opportunities for Glass Recycling/Reuse	
WWR-8. Convert 100% of City Fleet of Solid Waste Collection Vehicles to the Use of Non-fossil Fuels	TLU-3,5
WWR-9. Produce an On-line Monthly Report of Municipal Recycling Activities	PBE-1, ED-4
WWR-10. Develop/continue Program for Solid Waste Co-use and Resale Opportunities incl. Compost	
WWR-11. Capture and Use Methane Gas Coming Off the Story Mill Landfill Site	
WWR-12. Install a Micro-turbine Power Generation System for Methane Capture and Use	
WWR-13. Secure Funding for Currently Unfunded Upgrades in Phase I of the WRF Upgrade Plan	
WWR-14. Commend City for Increases in Energy Efficiency Planned in Phase I of WRF Upgrade	
Education	
EDU-1. Create and Adapt Community Action Plan	
EDU-2. Participate in National Conversation on Climate Action, October 4th	
EDU-3. Participate in Gallatin Earth Celebration	
EDU-4. Create Office of Sustainability	PBE-1,8
EDU-5. Create a Tree Planting Program	
EDU-6. Create k-12 Education Program	
EDU-7. Create an Adaptation Plan	
Implementation	
IMP-1. Adapt Milestones for Reducing Bozeman's CO_2e Footprint	PBE-1, ED-4

Chapter 3

Planning, Building, and Energy (PBE) Sub-Committee Recommendations

Basis for Recommendations

The Planning Building & Energy (PBE) subcommittee was comprised of Peter Belschwender, Steve Burner, Mel Kotur, Matthew Madden, and Otto Pohl.

The PBE developed recommendations based on the baseline emissions inventory, their own knowledge, and recommendations proposed by various experts during committee meetings. Certain recommendations were removed from consideration based on feedback from these experts and information collected by the PBE. Local experts that the PBE met with included James Goehrung (Facilities Superintendant), Andy Epple (Planning Director), Kath William (LEED consultant), Linda Revenaugh (SWMBIA), Alice Meister (Library Director), Chuck Winn (Public Service Director), Gary Griffith (Bozeman Public School System Energy Director), and Ed Sondeno (Bozeman Public School System Energy Manager).

Table 3 provides a summary of actual energy used by City buildings, as well as the CO_2e resulting from that use. This information served as the basis for reduction planning and for the resulting recommendations provided below.

Table 3. City Building Energy Use for the years 2000 and 2006.

	2000	2006
Electricity (kWh)	1,474,535	3,514,933
Natural Gas (Dkt)	26,502	22,819
Total tons CO_2e resulting from City electricity and natural gas usage for the given years	2384	3226

PBE Recommendations

PBE-1. Manage Energy Usage

Description. Energy management is the systematic, on-going process of determining where and how energy is used, controlling energy use to optimize consumption and assessing opportunities. In order to succeed, an appropriate staff person must be assigned the ownership and overall responsibility for coordinating the implementation of the CAP. This staff person will provide the leadership and supervision necessary to the various departments to complete the following tasks:

- Track and monitor all energy use; electricity, natural gas, fleet and equipment fuel.
- Integrate the Climate Action Plan with Operations, Maintenance, and Administration staff.
- Arrange energy audits on all City facilities.
- Publicize the efforts and accomplishments of the City regarding implementation of the Plan.
- Arrange for or provide training to all City staff members involved with Plan implementation.

Carbon Footprint Reduction. Efficient use of resources will result in reduced carbon output. Demand Side Management strategies require staff support and necessary tools, and an established operations and maintenance manual (see recommendation PBE-4) to provide sound guidance in efficient use of energy and resources.

Financial considerations. There are no costs associated with this recommendation. However, demand side management strategies have shown to reduce energy usage and overall utility costs.

PBE-2. Revise Building Codes to Allow LEED

Description. In our growing City there is a considerable amount of new construction. As the City expands in every direction focus should be brought to projects and designers who are willing to take the next step in "green building." LEED certification of new buildings is a formidable task. This certification focuses on site development, water savings, energy savings, material selection, and indoor environment quality. The City should take steps to embrace this level of construction and the systems that make it effective. Some strategies used for LEED are non-conventional and may not be "how we have always done it". These approaches should be given due consideration and, if safe, code should be modified to allow for change.

Example: The new LEED Certified Silver Library has waterless urinals. During construction the code required that water be plumbed to all locations (just in case). This is an unnecessary use of resources and contrary to the intent of the waterless urinals.

Carbon Footprint Reduction. Easing the way for LEED certification will encourage designers and builders to push the envelope of efficiency and therefore reduce the CO_2 emissions of future buildings. According to a study by the New Building Institute, LEED certified buildings are 25 percent to 30% percent more energy efficient than their non-certified counterparts.

Financial Considerations. The Building Department, with the support of the City Commission, could easily make this step with a minimum amount of staff time. No initial investment is necessary.

PBE-3. Retrofit City Buildings to LEED Standards

Description. The City should lead by example and adopt the *LEED for Existing Buildings: Operations & Maintenance* (LEED-EB) standards or the energy efficiency equivalent, allowing it to measure operations, improvements, and maintenance of all City-owned buildings.

The City owns and operates 32 buildings. The facilities manager should be commended for efforts to maintain and upgrade these buildings. However, at this point there is no system in place to monitor energy performance or predict what affect any retrofit action will have on each building (see recommendation PBE-1).

Using LEED-EB guidelines during a regularly scheduled upgrade or retrofit creates a comprehensive approach to building performance. This system will take the guess work out of upgrades by providing tools to predict performance and reduce CO_2 output.

Carbon Footprint Reduction. By retrofitting buildings to LEED-EB standards the City can reduce its CO_2 output from buildings by 25 percent.

Financial Considerations. Retrofitting buildings to the LEED-EB standard will typically be more expensive than standard construction practices. However, many aspects of the retrofit will have long term paybacks in energy savings that need to be figured into the total cost. For instance, a 25 percent reduction in overall building energy usage would result in an annual savings of approximately $111,000. Administration of LEED certification is estimated to be only $1,200 per building.

PBE-4. Create Sustainable Operations and Maintenance Manual for all Buildings

Description. The creation of a documented Operations and Maintenance manual (O&M) will reduce the amount of energy consumed in all municipal buildings. Consulting LEED for existing buildings (see recommendation PBE-2) could be used as a guideline for developing a maintenance program. MSU has developed and currently uses a comprehensive O&M manual.

The O&M program should be implemented considering the following:

- A baseline energy usage measurement per building should be established as soon as possible.
- The manual should be used in conjunction with monthly and annual reports for energy use per building to both identify opportunities and measure the positive effects on energy usage per building.
- The O&M manual should be developed by documenting all current maintenance and operations practices and committing to continually updating this manual for new facilities and equipment.
- Set goals of reducing each City building to use at least 15 percent less British thermal units per square foot heating degree days (BTUs / SFHDD) of conditioned space.

Through energy usage tracking and prompt maintenance of buildings, the Bozeman School District has reduced the amount of energy use in all of buildings from 12 to 19 BTUs / SFHDD to less than 7 BTUs /SFHDD, or around 50 percent.

It is realized that the City buildings are used year-round and have a greater total energy load because of air conditioning in the summer. This must be considered when setting realistic goals for energy usage reductions.

Carbon Footprint Reduction. A reduction of 15 percent BTUs /SFHDD—achievable using a sustainable O&M manual—the City would reduce its CO_2 output by 484 tons of CO_2 annually.

Financial Considerations. The costs of writing the manual are relatively minimal. Energy savings will offset some or all investments in maintenance.

PBE-5. Create Employee Conservation and Education Programs

Description. Employee Conservation and Education Programs can help create more efficient practices among City employees. Such programs can also introduce employees to innovative efforts to reduce energy/resource consumption. This recommendation is intended to keep conservation in the forefront of City employees' minds. The following could be included in such a program:

- Ask City employees what ideas they have for reducing their own energy consumption at work and implement their ideas.
- Offer incentives for reducing consumption or penalties for wasteful practices.
- Keep employees informed about ongoing City efforts to reduce its carbon footprint by presenting results of energy monitoring and energy audits to all employees at regular meetings.
- "The last one to leave turns off the lights … and coffee maker … and copier … and air conditioners … and computers … and power strips…and other phantom loads…"
- Promote healthy competition between divisions or occupants of different buildings to win the race to a 15 percent reduction in energy consumption.

Carbon Footprint Reduction. According to ACC Environmental Consultants, "tenants control 70 percent of the energy used in office buildings." Significant reductions are possible simply by ensuring that computers are turned off at night. Using 2006 emissions data, a 5 percent reduction in energy usage would save 161 tons of CO_2e.

Financial Considerations. In 2006, the city spent $444,346 on utility costs for buildings. A 5 percent reduction in energy consumption would save approximately $22,000 a year. There is little, if any, expense associated with this recommendation.

PBE-6. Purchase Green Tags

Description. Green Tags represent the environmental attributes associated with electricity generated from renewable technologies like wind and solar energy. Each Green Tag represents the greenhouse gas reduction from 1,000 kilowatt-hours of electricity generated by a new renewable source. One of the "products" produced by renewable energy is the package of environmental benefits resulting from avoided greenhouse gases. Purchasing Green Tags can be a viable tool for the City of Bozeman in achieving the goal of reducing its carbon footprint.

Reducing energy usage is preferable to offsetting. However, offsetting is a valuable tool for achieving carbon reduction goals.

Carbon Footprint Reduction. In our region of the country, the average emission per megawatt-hour of electricity generated is approximately 1,107 lbs of CO_2. This means one Green Tag would represent the reduction of approximately 1,107 lbs of CO_2.

Financial Considerations. Investing in renewable energy is a large capital investment and initially increases electricity generation costs relative to established fossil fuel facilities. The purchase of Green Tags offsets this capital investment by helping existing renewable energy facilities expand, thus making affordable renewable energy more widely available.

Green Tags are not a small investment. For example, offsetting 10 percent of the City of Bozeman's entire annual carbon output from buildings [3,226 tons in 2006] would cost $12,000. However, the benefits of green tags are twofold because they reduce our environmental impact and expand

renewable energy capacity and associated technologies, which makes it more affordable in the long term. In our region, Green Tags can be purchased from the Bonneville Environmental Foundation www.GreenTagsUSA.org or through NorthWestern Energy www.northwesternenergy.com and these entities can be contacted for pricing information.

PBE-7. Convert to Daylight Janitorial Services

Description. Daylight cleaning can reduce the amount of energy consumed compared to night-time operations. Day cleaning has been commonplace in hospitals for years and is becoming more and more common in a variety of different private and municipal facilities.

Sampled companies and municipalities with varied operations like the City of Bozeman have documented an up to 8 percent reduction in utility costs.

Some other positive effects of day cleaning are:

- Less janitorial turnover with less supervision.
- Safer, more secure facilities for cleaners and occupants.
- Better social and family situations for janitorial staff.

Additional recommendations concerning janitorial operations:

- Use reduced or non-toxic cleaners.
- Use cleaners, materials, equipment, and practices that use less water.
- Implement a preferred purchasing program keeping the following sustainable questions in mind:
  - Toxicity concerns?
  - Sustainable raw materials?
  - Recycled content?
  - Transportation requirements?
  - Amount of packaging?
  - End life disposal options?

Carbon Footprint Reduction. A conservative estimate of 5 percent reduction in energy usage would save 161 tons of CO_2e annually.

Financial Considerations. A 5 percent reduction in energy consumption would save approximately $22,000 a year.

PBE-8. Create an Energy Fund

Description. It is important both on a political and community level that we draw attention to the tangible financial benefits generated by energy usage reduction and equipment investment. An energy fund allows this by placing the costs and benefits of the programs outlined in this document on the same balance sheet. For example, a new $50,000 high-efficiency boiler using this fund is not seen as just an expense, but rather as the investment necessary to produce the $20,000 of annual savings (i.e., profit) the boiler creates. This venture-capital mindset helps encourage the City to rigorously pursue the investments and upgrades that yield the greatest savings.

The energy fund should receive initial funding from two sources:

- Capital investments the City agrees to make under this plan.

- Savings resulting from the implementation of the recommendations in this plan.

It is critical that energy savings accrue to the balance sheet of the energy fund and be made available for further investment. PBE-1 could oversee these investments and the resulting savings. Lessons can be learned from Ann Arbor Michigan which has a successful Energy Fund program in place.

Benefits overview:

- Makes investment more politically palatable by framing the energy savings as profit
- Self-sustaining: makes additional investment the result of previous savings
- Encourages rigorous cost-benefit analysis to prioritize investments from a profit perspective

Carbon Footprint Reduction. This energy fund will not save carbon by itself but will encourage the City to pursue the highest "bang-for-the-buck" investments.

Financial Considerations. There is an initial capital cost associated with this recommendation, and a great opportunity for greater profit realization from the investments made by the fund.

Chapter 4

Transportation and Land Use (TLU) Sub-Committee Recommendations

Basis for Recommendations

The Transportation and Land Use (TLU) subcommittee was comprised of David Boggeman, Patrick McGowen, Martin Knight, and Greg Pederson. The TLU developed recommendations based on their own knowledge and based on those recommendations proposed by various experts who met with the TLU subcommittee. Local experts that the TLU met with included Lisa Ballard (Streamline Bus System), Jason Delmue (Bicycle Advisory Board), John Vandelinder (Streets Superintendent), Brian LaMeres (City Controller), Ron Gompertz (EcoAuto), Dan Alexander (Story Distributing), Ron Dingman (Park and Recreation Director), Chris Saunders (Assistant Planning Director), and Stephen Johnson (Gallatin Valley Land Trust).

Basic Data

When considering the annual transportation impacts on greenhouse emissions, it is convenient to consider the following relationships. Community green house gas emissions are a function of the number of people, how much each person drives, and the carbon efficiency of their vehicle.

$$GHG = Population * \frac{Miles\_Travelled}{Person} * \frac{CO_2\_Equiv.}{Mile}$$

The carbon efficiency of their vehicle is a function of how much carbon is released per gallon of fuel burned (alternative fuels may have lower impact), and the fuel efficiency of their vehicle.

$$\frac{CO_2\_Equiv.}{Mile} = \frac{CO_2\_Equiv. \,/\, Gallon}{Miles \,/\, Gallon}$$

Although simplified, this equation emphasizes individual impact and changes that can be made by personal choice such as reducing the miles travelled or by reducing the emissions per mile (purchasing a more fuel efficient car, less impacting mode such as bike or transit, etc).

When data are not available for analyzing a specific alternative the following basic values can be used.

- The National Personal Transportation Survey (NPTS) estimated that the vehicle miles traveled was 8200 miles per person in 2001.
- From the same survey (NPTS) the average fuel efficiency for passenger cars in 2001 is 22.1 mpg and 17.6 for SUVs and pickups. If the vehicle mix is unknown one could use an average of 20 miles per gallon.
- For regular unleaded gasoline the emissions are 21.4 pounds of CO_2 per gallon.
- There are 2000 lbs in one ton

From the above equations and basic values, the average person releases 4 tons of carbon per year from driving (8200 * 21.4 / 20 / 2000).

Alternative Fuels

The two most viable alternative fuels currently are biodiesel and ethanol. Research indicates the current production methods for ethanol result in only slight carbon savings over gasoline. However, cellulose based ethanol production, a developing technology, is estimated to produce about 1/10th the GHG of gasoline. If cellulose production technology becomes available, the switch to ethanol-fueled vehicles should become a top priority for the City. In the interim, the move to bio-fuel vehicles should still be implemented in order to realize the gains (though small) currently available and be prepared to take full advantage of the huge gains when cellulose production becomes available. There is consensus in the literature that biodiesel does reduce GHG emissions. Use of biodiesel should be a priority in the short and long term.

Magnitude of the Problem

From the CACP data the carbon emissions from the transportation related municipal operations are shown in Table 4. Note that the annual increase is calculated assuming a constant rate of increase.

Table 4. GHG from Transportation Related Municipal Operations

	2000 tons equiv. CO2	2006 tons equiv. CO2	Annual Increase
Vehicle Fleet	1487	1,543	0.6%
Streetlights	326	564	9.6%

TLU Recommendations for Reducing the City's Carbon Footprint

The primary sources of transportation carbon emissions from municipal operations come from street light/traffic signal operations and City-owned vehicle operations. Thus our recommendations focus on these two areas, as follows.

TLU-1. Improve Traffic Signal Operations

Description. Traffic signals are installed at intersections with high traffic flows and or safety issues. The traffic flows are dramatically less during late evening / early morning hours. Many municipalities change to a flashing operation during this time. Flashing operations gives a red flashing light to the minor street, and a flashing yellow light to the major street.

Carbon Footprint Reduction. In 2006, the City of Bozeman used 234,000 kWh resulting in 128 tons CO_2e emissions (note that the 564 tons CO_2e in Table 4 represents traffic signals and street lighting). Flashing operations use slightly more than half the energy of regular operations. Assuming this operation would be for six hours per day, flashing operations would result in a one-eighth reduction in total energy use and CO_2 emissions.

Financial Considerations. In addition to the carbon savings, the reduction in energy would save the City approximately $2,340 per year (assuming 8 cents per kWh). The primary challenge is pedestrian safety.

TLU-2. Consider Roundabouts

Description. A roundabout is an intersection alternative that can provide higher traffic flow than an un-signaled intersection, yet in some cases can be a better option than a traffic signal. Under the right circumstances and when properly designed roundabouts can be a safer alternative. Currently roundabouts are often included as an option when considering improving an intersection. Carbon impacts should also be included when intersection upgrade options (i.e., signal verses roundabout) are considered.

Carbon Footprint Reduction. They do not require the electrical power a signal would. Currently signals at a single intersection in Bozeman use approximately 5-10,000 kWh per year. This results in several tons of CO_2e per year per intersection. There may be additional positive impact in vehicle emissions since vehicles can move through a roundabout without coming to a complete stop except under high traffic conditions.

Financial Considerations. Roundabouts do take more land area. They have generally proven to be safer. They may not be appropriate for extremely high volume intersections.

TLU-3. Modify Vehicle Purchasing Policy

Description. The goal of this effort is to increase the fuel efficiency and/or use of alternative fuels (primarily biodiesel) of the City vehicle fleet through purchasing of new vehicles. The following changes should be implemented in the vehicle requisition and purchasing process:

- If a department requests a vehicle that is not diesel or alternative fuel vehicle the department must write a justification for the reason as part of the requisition.
- When selecting the vehicle purchased based on the lowest bid, the estimate must include the fuel costs for the first 100,000 miles of operation based on EPA mileage rating and current fuel costs. There is precedence for this since the state vehicle procurement process utilizes this method.
- The vehicle purchased should be the smallest size needed for the job, including consideration for bicycles.

Electric vehicles are becoming a more viable option for smaller vehicles being purchased.

Carbon Footprint Reduction. The current average fuel efficiency for City cars and small trucks under three-quarter ton is estimated at 17 miles per gallon. The exact reduction is dependent on how many vehicles are replaced, and actual fuel efficiency of new vehicles.

Financial Considerations. The financial impact should be minimal. If a department can show that there is significantly higher cost for alternative fuel vehicles, the City can choose to waive this requirement as described in the first bullet above. Considering fuel costs along with the purchase price should result in a more economical choice over the life of the vehicle and actually reduce spending.

TLU-4. Establish Vehicle Tracking Method for City Fleet

Description. The estimates in this report are based on limited data. There is no centralized database of existing vehicles in the City fleet. This would not have a direct impact on carbon emissions, but is necessary for tracking the success of these impacts. Additionally, understanding the vehicle fleet could result in other ideas. The City should begin tracking fuel usage of all City vehicles starting August 2008 in order to get more accurate data of fleet efficiency.

Carbon Footprint Reduction. Accurate tracking of vehicle fuel usage will provide better estimates for future data on carbon emissions.

Financial Considerations. This measure would not add any additional costs to the City.

TLU-5. Increase City Average Fuel Efficiency Standard

Description. The vehicle tracking system will allow determination of baseline average fuel efficiency by department. Departments should be encouraged to increase their average fleet fuel efficiency. Each department should be encouraged to increase their average fuel efficiency according to the schedule in Table 5. The exact incentive to encourage departments to meet these goals is not specified. One possibility is to incorporate priority in approving vehicle requisitions based on a departments meeting these goals.

Carbon Footprint Reduction. If this is followed, by 2020 it would result in an annual reduction in carbon emissions of 416 tons of CO_2. Considering growth, this would have a net effect of 225 tons of CO_2e, or 15 percent below year 2000 baseline.

Financial Considerations. Including fuel efficiency as part of purchasing policy will provide a return on investment for future fuel usage.

Table 5. Fuel Efficiency Standard Goals

		Tons Equiv. CO_2		
Year	**Increase in MPG**	**No change**	**With Change**	**Net Impact**
2000	0%	1487	1487	0
2006	0% (assumed)	1543	1543	+4%
2010	5%	1580	1505	+1%
2015	20%	1628	1357	-9%
2020	33%	1678	1262	-15%

*** assumes 0.6% growth per year in vehicle fleet based on 2000 to 2006 data*

TLU-6. Create Transportation Demand Management Pilot Program

Description. This program does not impact City operations directly, but could have an impact on City employee's personal choices about transportation to and from work. The program would provide incentives for employees to use alternative modes to get to and from work. Alternative modes could include carpooling, bicycling, walking, and public transit. Incentives could include such things as gift certificates, or better parking spots (for carpoolers). Additionally, this would allow a chance to pilot the program before implementing it on community scale.

Carbon Footprint Reduction. Again this would not have an impact on the carbon emissions from municipal operations. The impact to the community would be dependent on the success of the program. Each participant could result in one ton of carbon reduction annually.

Financial Considerations. The program would cost money to provide appropriate incentives. However, with innovative incentives and donations, the cost could be cut considerably. For example, local businesses could donate gift certificates that could be given to those employees who use alternative modes. Increasing biking and walking modes of travel could have benefits to the wellness of employees. These programs are typically implemented for congestion and parking management, so these benefits would also be realized.

TLU-7. Anti-idling ordinance

Description: The city should be commended for instating an informal anti-idling policy and should further its efforts by creating an official anti-idling policy for all City fleet vehicles unless it is deemed unsafe.

Carbon Footprint Reduction: According to the EPA, anti-idling measures can help reduce air pollution and wear-and-tear on engines.

Financial Considerations. Significant reductions in fuel costs are associated with anti-idling poilicies.

TLU-8. Green Bike Program

Description. Buy two bicycles per building for employees use. Encouraging the use of bicycles for in town use can help avoid employee emissions and also increase healthy activity.

Carbon Footprint Reduction. 3 tons of CO_2e could be reduced per year if 10 employees used the Green Bike program to travel 2 miles once a day. (20 miles x 260 days= 5200 miles, 5200 miles /20MPG= 260 Gallons, 260 gallons= 3 tons of CO_2e)

Financial Considerations: There are upfront and maintenance costs associated with this program. A potential savings of $910/year (if gas prices remain constant) is associated with fuel usage avoided by biking.

TLU-9. Fund LED Program

Description. Light Emitting Diodes (LED) use 10-20 percent of the energy used by incandescent light bulbs. The City has started converting all of its traffic signals to LED's and should be commended for its efforts. Continued funding should support expanding this effort to changing the City's street lighting to LED's.

Carbon Footprint Reduction. A significant carbon reduction is associated with this recommendation.

Financial Considerations. The true savings from LEDs are found not only in the amount of money saved on electricity, but also money saved on labor and the cost of replacement over time. Labor and replacement cost is substantial when you are looking at a large building with many lights. If you use LEDs, maintenance costs will be much less than if you used traditional incandescent bulbs. The other major variable in savings is the amount of power used compared to the power used for an incandescent bulb. LEDs use only 10-20% of the electricity used by incandescent bulbs. As you can see, LEDs save much more money and energy in the long run. (D:\LED traffic light FAQ - Appropedia The sustainability wiki.htm)

TLU-10. Streamline Funding

Description. Streamline transit service began in August 2006. Operation of the Streamline buses results in carbon emissions, and a single bus is much less fuel efficient than a passenger car. Yet one bus with 20 passengers is far more carbon efficient than 20 passenger cars. The CAP encourages continued, and if possible increased Streamline funding. The net carbon impact of additional funding for Streamline, however, will likely not provide as significant a reduction in CO2 emissions as other recommendations. Additional Streamline funding, purely for carbon reduction purposes, should be a lower priority.

Carbon Reduction. Based on data collected by the TLU a very rough estimate of the current Streamline operation saves approximately 20 tons of CO2 per year in reduced community vehicle travel. This same data shows Streamline operating at about $1/4^{th}$ its capacity (although some lines on some days are nearly at capacity). Each new citizen that rides Streamline under current operations is a net carbon savings. One can assume that increase funding for streamline would result in increased service which would result in increased ridership similar to current operations.

Financial Considerations: The city currently provides $33,000 a year to fund the Streamline bus system. To increase ridership and routes, funding should be increased as soon as possible, but no later than, fiscal year 2009. This figure should be arrived upon through discussion with the Transportation board, city officials, and Streamline representatives and approved by the City commission.

Waste, Water & Recycling Sub-Committee Recommendations

Basis for Recommendation

The Waste, Water & Recycling subcommittee (WWR) was comprised of Scott Bischke, Molly Cross, Mark Johnson, and Collin Moore. The WWR developed recommendations based on the baseline emissions inventory, their own knowledge, interactions with citizens in the community, and recommendations proposed by various experts during committee meetings. Local experts that the WWR met with included Paul Layton (Water Reclamation Facility Assistant Superintendent), Dan Harmon (HDR/Morrison Maierle Engineering), Mitch Mihalovich (National Center for Appropriate Technology), Dave Ryan (NorthWestern Energy), Marc Gaines (City employee), Herb Bartle (City employee), Steven Johnson (Solid Waste Superintendent for the City of Bozeman), Rick Moroney (Water Treatment Plant Superintendant for the City of Bozeman), Rick Hixson (City engineer), Brian Heaston (City Water Conservation Manager).

Basic Data

An initial energy usage inventory associated with the City's energy usage was completed by Hattie Baker, Sustainability Coordinator for the Mayors' Climate Protection Agreement. Non-transportation energy usage was tabulated by data collection from all City accounts with North Western Energy, City supplier of both electricity and natural gas (Table 6).

Table 6. Energy use and resulting CO_2e output from City wastewater and solid waste operations.

Energy	2000	2006
Electricity(kWh)	3,310,671	4,186,384
Natural Gas (Dkt)	4,248	5,870
Tons of CO_2e	1958	2652

WWR Recommendations: Incoming Water Treatment

Basis for recommendation

On February 21st, 2008, the Waste Water and Recycling subcommittee met with Rick Hixson, Rick Moroney, and Brian Heaston of the City Engineering office. The meeting focused on potential changes to the City's incoming water supply and treatment system that would help decrease Bozeman's municipal carbon footprint.

Current operation overview

Bozeman citizens currently receive their water supply from two incoming water treatment plants: one on Sourdough Creek as it emerges from the Gallatin Range south of town, one on Lyman Creek as it comes out of the Bridger Range north of town. The Sourdough plant is the City's primary source of water. It is fed by Sourdough Creek, as well as a large pipe that runs across the front of the Gallatin Range from Hyalite Creek several miles and several drainages west of Sourdough Creek. Hyalite Creek is supplied by Hyalite Reservoir, ~ten miles up the Hyalite Creek drainage above the water outtake pipe for the Sourdough plant. Water runs from the outtake facilities to the Sourdough Treatment Plant via gravity.

Based on those discussions, the Task Force developed a list of five recommendations for the City to undertake with respect to reducing the carbon footprint of its incoming water treatment facilities. A rigorous calculation of cost per pound of CO_2 reduced was beyond the scope of the Task Force. We do, however, provide our best guess at the order of preference for carrying out these recommendations based on our perception of greatest carbon footprint reduction per dollar of taxpayer expenditure.

WWR-1. Install an Electricity-producing Turbine for the Sourdough Creek Plant

Description. Several hundred feet of head (vertical distance) are available between the Hyalite Creek outtake and the Sourdough Creek Treatment Plant. Given this untapped hydraulic pressure and the high volumetric flow rates (~4M gal/day in the winter, ~13M gal/day in the summer), potential exists for creating a water treatment plant that is fully (or at least partially) self-sustaining from an energy usage standpoint.

Carbon footprint reduction. In 2006, the Water Treatment Plant currently used 364,166 kWh of electricity and 4058 Dkt of natural gas, and emitted 450 tons of CO2e. Energy derived from the turbine will emit no carbon (beyond turbine manufacture and transport to point of installation). Additionally, the electrical energy produced will directly replace current electricity usage, which is generated by coal combustion.

Financial considerations. The Water Treatment Plant spent $73,560 in utility costs for 2006. A breakeven point for turbine purchase will be most strongly determined by four items: (a) cost per kWh that the City is paying for electricity, which is expected to go up; (b) cost of purchase and installation of the turbine (note that a preliminary study is available from the City engineer); (c) final design—and hence overall power needs—of the upcoming expansion of the Sourdough plant, to be completed in 2013; and (d) possible future charges for carbon emissions (rate is unknown, though current carbon markets in Europe have hovered in the $20-40/metric ton CO_2).

WWR-2. Enforce LEED Building Standards for the Sourdough Treatment Plant Expansion

Description. Design goals for the expansion of the Sourdough Treatment plant, slated for completion in 2013, should follow LEED standards. Given the current treatment plant has little or

no insulation, a large carbon footprint reduction opportunity exists. Additional design goals should include energy efficient operation of chemical processes (e.g., microfiltration, chlorination, fluoridation), which might include such items as replacing inefficient pumps, stirrers, and motors. Note that this recommendation is a specific implementation of PBE-3.

Carbon footprint reduction. LEED design principles specifically (among many areas) address minimizing energy usage and thus will drive carbon footprint reduction.

Financial considerations. Cost for LEED certification is unknown, though from a carbon footprint reduction standpoint the Task Force recommends that energy-associated LEED (or similar) principles be followed, not that LEED certification be sought. Currently energy usage (electricity and gas heating) at the Sourdough Plant costs $73,560/yr. Task Force calculations provide an estimate that the Sourdough Plant emits 437 tons of CO_2/yr. Carbon footprint reduction for the electrical portion of energy usage will be addressed by the recommended new turbine power (see #1); the natural gas load will be reduced by the redesign of the new Sourdough Plant.

WWR-3. Stop the Purchase of Bottled water with City of Bozeman Taxpayer Funds

Description. Declare official City policy to be that no bottled water can be purchased with City of Bozeman taxpayer funds. The consumption of bottled water causes millions of pounds of CO_2 emissions each year. Additionally, plastic bottles associated with bottled water have become a large volume waste stream. The Task Force recognizes that the recommended action will have real consequences for carbon footprint reduction, plus be a symbolic statement to Bozeman citizens (a) about the environmental issues associated with drinking bottled water, and (b) that the water supplied through the City's water plants is of exceptional quality. The Task Force recognizes the potential need for exceptions in times of emergency when bottled water could be the most convenient method of water distribution.

Carbon Footprint Reduction. The consumption of bottled water causes millions of pounds of CO_2 emissions each year due to energy consumption in plastic bottle creation and in long distance shipping of a locally available resource (of, almost certainly, superior quality to what can be purchased). By stopping the purchase of bottled water with City funds, the City will no longer be participating in the CO_2 emissions associated with this inefficient use of resources.

Financial Considerations. This change will provide a net savings if City employees are required to drink City-produced water.

WWR-4. Install a turbine for electrical generation at the City's Lyman Water Treatment Plant

Description. Following the installation and beginning operation of the Hyalite/Sourdough turbine, budget funds for the study of a similar turbine to be placed into operation at the Lyman plant. Successful carbon footprint reduction may additionally be available at the City's smaller Lyman plant. The Task Force recommends basing the decision for installation of a turbine at the Lyman Plant on the successful operation of the Hyalite/Sourdough turbine.

Carbon Footprint Reduction. In 2006, Lyman Creek reservoir used 84,817 kWh and emitted 46 tons of CO2e. A carbon footprint reduction could again be possible based on capturing energy from the head of water available leading to the Lyman plant.

Financial Consideration. The Lyman Creek Plan paid $8,100 in utility costs. Project financial viability will be driven by the same metrics listed under WWR-1. The break-even point should be readily

calculated based on performance (energy production performance, low maintenance and down time) of the Hyalite/Sourdough turbine.

WWR-5. Set Goals for Water Conservation, then Measure, Monitor, Verify and Act on these Goals

Description. Declare water conservation a Commission goal and request quarterly reports from the City engineer on water usage per capita. With the aid of the City Engineering department, set firm goals for water usage, beginning with City facilities and grounds (e.g., parks). The Task Force recognizes that in our dry western climate, water quality and quantity have a huge influence on development, lifestyle, and quality of life. The Task Force recommends that the City Commission support such water conservation programs such as low water use landscaping and incentives for high volume toilet replacement.

Carbon footprint reduction. Water conservation leads to decreased carbon footprint through reduced need for (a) future incoming water treatment plant capacity and (b) future waste water treatment plant capacity (and coincident energy usage at both).

Financial Considerations. Similarly, water conservation leads to decreased use of taxpayer funds through reduced need for (a) future incoming water treatment plant capacity and (b) future waste water treatment plant capacity.

WWR Recommendations: Solid Waste and Recycling

Basis for recommendations

The following recommendations result in part from multiple meetings by the Waste Water and Recycling subcommittee with City staff. Those meetings include Solid Waste Superintendant Steve Johnson's (a) recycling presentation to the City Commissioners in January 2008 (with follow-up questions from the subcommittee via e-mail), and (b) a presentation to a Citizens Concerned for Climate Change meeting in September 2007. We also received information on landfill methane recapture options from the U.S. EPA's Landfill Methane Outreach Program and discussed them with Steve Johnson and City Engineer Dustin Johnson.

Current operation overview

The Bozeman City landfill (Story Mill landfill) is closing in June 2008. At that time all solid waste will be diverted to the Gallatin County landfill at Logan. City dump truck and recycling truck operations will continue to be housed at Story Mill landfill, and there will be an expansion of administrative offices associated with solid waste at the Story Mill site. Even though the City's Story Mill landfill will be closed, the site will continue to produce methane far into the future, leading to opportunities for carbon footprint reduction.

WWR-6. Support Solid Waste Recycling in Municipal Buildings, at Municipal Facilities, and in public spaces

Description. Immediately follow through on the plan to support solid waste recycling in municipal buildings and at municipal facilities, and expand that plan to include facilitating recycling and composting during all events held in public spaces. Bozeman has approved a municipal recycling program, but not all City offices and building are equipped and participating. We recommend that the City take immediate steps to ensure that all municipal facilities have the necessary collection bins and other infrastructure to facilitate recycling. Further, we recommend that City employees

be educated about the City recycling program and be encouraged to recycle. Materials to be collected should be at a minimum cardboard, aluminum, newspapers, mixed paper/magazine, and plastic bottles. The City should also adopt practices for events that occur in public places to foster recycling and composting of waste.

Carbon footprint reduction. Globally, recycling decreases carbon footprint by capturing embodied energy in an object (for example, recycling an aluminum can eliminates mining bauxite as the first step in creating a new can). Locally recycling reduces the volume of solid waste, thereby reducing the number of ~60 mile round trips to Logan landfill and thus the carbon emissions related to solid waste transportation.

Financial Considerations. The Task Force believes that the City's recycling program will be, at a minimum, cost neutral depending on the volume of materials recycled and current markets for recyclable materials. Mandatory recycling will avoid certain materials from being included in the waste stream. Thus, a potential for reducing waste and costs of tipping fees would be probable.

Existing Measures. The City started recycling cardboard and office paper in 2005. In 2006, the City avoided dumping 12 tons of office paper and 15 tons of cardboard in the landfill. This reduced the City's carbon footprint by 40 tons of CO_2e and 30 tons of CO_2e, respectively.

WWR-7. Explore Grant and Other Opportunities for Waste Glass Recycling/Reuse

Description. For the citizens of Bozeman, glass is a highly visible part of the waste stream that most people recognize as recyclable throughout the US. As part of its municipal operations, the Task Force recommends that the City begin now to explore funding opportunities for a glass grinding machine that would allows for reuse of waste glass as a sand adjunct in local roadway construction. Separately, a discussion should be undertaken with local vendors regarding the possibility of grinding glass at facilities outside the City's Solid Waste Department. We recommend that the City talk with Allied Waste Systems and TMC Sand and Gravel who recently ground toilets into gravel for use as road bed material during the Great Gallatin Toilet Tradeout program.

Carbon footprint reduction. The Task Force is not aware of any large scale, local program to wash and reuse glass containers. Currently the closest point of recycle for Bozeman glass is Spokane, Washington. It is not economically nor carbon-wise to ship trucks filled with heavy glass to the Pacific Northwest for recycle. A glass grinding program would help reduce the need for sand and gravel extraction and transportation, thus helping reduce the carbon footprint associated with new road building in the Gallatin Valley. This carbon reduction should be traded off against the power required to run the glass grinder before proceeding with the project.

Financial considerations. A combination of cheap competing material (i.e., locally mined sand) and high cost of the grinder make purchase of a glass grinder financially difficult. Thus the Task Force believes that either (a) procuring a federal grant for purchase of a grinding machine or (b) partnering with private industry may be the only current realistic opportunities to return glass recycling to Bozeman.

WWR-8. Convert 100 percent of the City Fleet of Solid Waste Collection Vehicles to the Use of Non-fossil Fuels

Description. Convert or replace 100 percent of the fleet of City-owned solid waste collection vehicles to the use of non-fossil fuels. Biofuels selected should be derived from Montana sources if at all possible. By 1 January 2014 the Task Force recommends that 100 percent of all City-owned solid waste collection vehicles be powered by alternatives to fossil fuels. Given a most likely

scenario of the continued us of diesel fuel, the Task Force further recommends a minimum of B20 biodiesel be employed, or whatever the maximum biodiesel blend available during any year. Finally, the Task Force wants to be clear that its goal focuses on the use of non-fossil fuels not simply on the conversion of vehicles (i.e., that might be biofuel compliant but continue to use regular fossil fuels). Note that this recommendation is closely related to TLU-3 and 5.

Carbon footprint reduction. Solid Waste collection and disposal operations emitted 444 tons of CO_2e in 2006. By converting to Montana based biofuels (likely biodiesel), the City will reduce its carbon footprint in two major ways: (1) Transportation associated with fuel shipment to Bozeman will be reduced dramatically over petroleum-based products. (2) Biofuels reduce dependence on fossil fuels and cycles carbon currently in the terrestrial carbon cycle. In contrast, fossil fuel extraction releases stable sub-surface carbon that would otherwise remain sequestered underground. Thus biofuels are carbon neutral as the plants from which they are produced can be grown again while fossil fuels pull ancient carbon from the ground non-sustainably, at least relative to any time-frame meaningful to current climate change concerns

Financial Considerations. The City spent $45,823 in fuel costs for Solid Waste operations. Relative market value of petroleum-based diesel and biodiesel will determine the payback on the fleet conversion.

Existing Measures. The City currently has a biodiesel tank and used 10,000 gallons of biodiesel in 2007 which avoided 24 tons of CO_2e from being emitted into the atmosphere. Roughly 50 percent of the City's trucks already run on biodiesel.

WWR-9. Produce an On-line Monthly Report of Municipal Recycling Activities

Description. Beginning January 2009, produce a monthly report of municipal recycling operations that can be accessed online by City employees and Bozeman citizens alike. The report should include data on the pounds of recycling separated by type. The monthly report can be used to monitor and drive municipal recycling rates and goals, educate the public and City employees on recycling progress at municipal facilities, and provide a foundation for building a similar reporting infrastructure for reporting of community-wide recycling efforts.

Carbon Footprint Reduction. The report alone would not reduce carbon footprint but would act as an on-going highlight to performance of carbon footprint reduction efforts, thereby helping the City modify its activities as needed.

Financial Considerations. The Solid Waste division should produce reports for the effort defined in PBE-1.

WWR-10. Develop/continue a Program for Solid Waste Co-use and Resale Opportunities, Including Compost

Description. Develop/continue a program for solid waste co-use and resale opportunities, including composting and resale of organic materials. The Task Force recommends that the City begin a program focused on treating segment of the solid waste stream as reusable resource rather than as waste. The Task Force recognizes that some of this work is underway—for example combustibles are now regularly separated and sold as hog fuel. However, we believe further opportunities exist, such as the sale to citizens of compost derived from City landscaping and mowing operations. The Task Force recommends that the potential for composting facilities at the Mandeville farm be explored. Similarly we recommend that any and all materials segregated for exchange be

publicized on a regularly updated website called the "Bozeman Landfill Exchange" that citizens can access in their search for materials.

Carbon footprint reduction. Leaving some materials (for example wooden pallets) in the landfill might be considered a form of carbon sequestration, at least for many years. The Task Force, however, believes that a true life cycle analysis would show that reuse of almost any collected material will result in a net carbon decrease due to capturing the embodied energy in a material for a new use, and because a new material for that use will not have to be produced and transported to Bozeman. Also, creation of a composting facility would result in a great carbon footprint reduction—organic materials make up a great percentage of landfill (25 percent by one estimate; for the City this would include mowing and similar waste from City parks), that would no longer need to be trucked ~60 miles round trip to the County Landfill.

Financial considerations. Money must be budgeted to provide for materials segregation, and for website posting for citizen review of materials available at the Bozeman Landfill Exchange.

WWR-11. Capture and Use Methane Gas Coming Off the Story Mill Landfill Site

Description. The soon-to-be-closed Story Mill landfill site generates considerable methane (CH_4) from rotting organic material. This methane production will continue, even after landfill closure. The Task Force recommends that the City capture this gas and use it for heating or electrical generation.

Carbon footprint reduction. Methane has a global warming potential 21 times as great as CO_2. By capturing the methane the City will eliminate a potent global warming gas that is currently being vented directly to the atmosphere. By using the methane a heat source or for electrical generation in micro-turbines, the City will additionally eliminate the need to buy methane (i.e. natural gas) for these operations, or similarly electricity generated by coal-fired power plants.

Financial considerations. Several financial studies have been undertaken by the U.S. EPA's Landfill Methane Outreach Program. These options, including capture of the methane for resale, for heating or powering the new landfill administrative building should be strongly reviewed for payback viability. If viability is not proven, the Task Force recommends that the City review methane capture once yearly as increasing energy prices are likely to make the program financially viable in the near future.

WWR Recommendations: Water Reclamation Facility

Basis for Recommendations

In November 2007, the Waste Water and Recycling subcommittee met with Mitch Mihailovich (NorthWestern Energy (NWE) E+ Efficiency Contractor), Dave Ryan (Energy Conservation Program, National Center for Appropriate Technology (NCAT)), Dan Harmon (HDR/Morrison *Mairle* Engineering consultant), Paul Layton (Water Reclamation Facility Assistant Superintendent), Marc Gaines (City employee), and Herb Bartle (City employee). Each party's main goals were identified: Water Reclamation Facility (WRF)—increase capacity with new technology; NWE/NCAT—reduce gas and electrical energy usage; WWR—reduce carbon footprint. The meeting focused on potential changes to the City's WRF that would help decrease Bozeman's Municipal carbon footprint while also satisfying the other identified goals.

Current Operation Overview

All waste water from the City of Bozeman is treated at a single Water Reclamation Facility (WRF) on the northern edge of the City. The current facility treats an average of 5.8 MGD (million gallons per day), but the WRF is in the process of upgrading its capacity to an average of 8.5 MGD. Included in the first phase of the upgrade plan are several advanced treatment technologies and improved energy efficiency measures that will serve to increase the WRF's overall energy efficiency (i.e., energy per gallon of waste treated). The design for the first phase of WRF upgrades will be completed in March/April 2008, and the job will be advertised for bids around August 2008. The first phase of the planned upgrade to the Bozeman WRF is expected to be completed in October 2011.

Based on the November 2007 discussion and a site visit to the WRF, the Task Force developed a list of three recommendations for the City to undertake with respect to reducing the carbon footprint of its waste water treatment plant. Some of the recommendations have been translated into a calculation of cost per pound CO_2 reduced by HDR/Morrison Maierle Engineering, although for some recommendations we can only roughly estimate the cost-benefit calculation. Some of the recommendations are already included in the budget for the first phase of the WRF upgrade plan, some recommendations represent unfunded upgrades included in the first phase of the WRF upgrade plan, and some recommendations go beyond the first phase of the WRF upgrade plan.

The ability of these recommendations to decrease absolute CO_2e emissions is dampened by the increase in emissions that will result from increased waste water generation from a growing population. Recommendation 12 is the main option that has great potential to decrease absolute emissions from the WRF. Recommendations 13 and 14 will decrease the amount of CO_2e produced per gallon of waste water treated, but given the planned WRF capacity expansion absolute amount of CO_2e produced relative to 2000 are expected to increase.

WWR-12. Install a Micro-turbine Power Generation System for Methane Capture and Use

Description. A micro-turbine system would allow the WRF to turn biogas waste from the anaerobic digesters (75 percent of which would otherwise be flared) into power that can be used by the WRF to heat, cool, and light its buildings. At this time, there is insufficient biogas production to operate the smallest available micro-turbine (approximately 230 kW). Therefore, the micro-turbine operation would need to be augmented by natural gas until approximately 2020. To reduce the need for supplemental natural gas and maximize the utility of the micro-turbines, the anaerobic digesters could be turned into "cash cows" by accepting high strength waste directly into the digesters. The higher levels of biogas produced from this high strength waste would off-set the need for added natural gas, and increase the cost effectiveness of the micro-turbines. High strength waste streams in Bozeman that could be directly fed into the digesters include waste from the Darigold Milk Plant, and the grease traps at Montana State University's cafeteria and other food facilities. A receiving facility would need to be built to accommodate the extra inputs, adding to the cost of this option, but the potential for power generation would be significant. Also, with high strength waste being directly input into digesters, the efficiency of the current system that treats all influent prior to the digesters would be increased (using less energy in the absence of the high strength waste). Additional analyses would need to be done to determine how much of the WRF's power needs could be met by directly feeding the anaerobic digesters with high strength waste.

Carbon footprint. Installing a micro-turbine would have a significant impact on reducing the Municipal carbon footprint by turning waste into energy. According to HDR/Morrison Mairle

Engineering, we can reasonably estimate that the micro-turbine would lead to a reduction of 225 - 250 kW of electrical load at the WRF. A more accurate estimate of the carbon footprint reduction for the micro-turbine will only be possible once they know the efficiency of the micro-turbine machine they would like to install (research into which machine will be best is still on-going). It will also depend on whether the Darigold Milk Plant will be included in the high strength waste collection program. Given the fact that increasing demand on the WRF due to a growing population in Bozeman will result in an absolute increase in CO_2eq emissions from the WRF, a micro-turbine linked to a digester that accepts high strength waste is the only way to reduce the absolute amount of emissions produced by operations at the WRF. Although there is a high cost to installing a micro-turbine (see below), the Task Force recommends that the City seek funding to support the installment of such a micro-turbine as a means of significantly reducing the Municipal carbon footprint.

Financial Considerations. A ~230kW micro-turbine would cost approximately $1.8 million, so the Task Force recommends that the City seek financial assistance from the electrical utility (NorthWestern Energy) to balance out the costs of purchasing and operating a micro-turbine.

WWR-13. Secure Funding for Currently Unfunded Upgrades in Phase I of the WRF Upgrade Plan

Description. Funding should be secured for upgrades that are part of the WRF's first phase, but for which there are currently insufficient funds. The WRF design team has proposed to replace the existing conventional blowers with new blowers with 40 percent greater efficiency. Also, funds for extending waste biogas use as an energy source for heating and cooling all new or existing buildings (not just some) if at all practical should be secured.

Carbon footprint reduction. It is unknown how much the carbon footprint would be reduced by heating and cooling all existing and new WRF buildings using waste biogas. A preliminary analysis by HDR/Morrison Mairle suggests that replacing the existing blowers with high efficiency blowers would reduce the WRF carbon footprint by roughly 1,000 tons CO2/year, *relative to a facility with expanded capacity that has less efficient blowers*. It is important to note that the absolute carbon footprint of the WRF will increase relative to the existing (2008) facility due to a growing population in Bozeman, no matter whether conventional or more efficient approaches are employed. Therefore, the Task Force strongly recommends that the City adopt the most efficient proposed upgrades to minimize emissions from the WRF, and consider the installment of a micro-turbine as mentioned in Recommendation WWR-12 to reduce absolute carbon emissions.

Financial Considerations. The Task Force strongly recommends that the City find sufficient funds to supply the necessary WRF upgrades. Financial assistance through NWE, including the motor rebate program, should be pursued. These upgrades are critical to minimize global warming gas output, plus protect the Gallatin River and the air quality of the Gallatin Valley.

WWR-14. Commend the City for Increases in Energy Efficiency Planned in Phase I of WRF Upgrade Plan

Description. The City should be commended for increases in energy efficiency already budgeted for in the first phase of the WRF upgrade plan. Several of the proposed upgrades will increase the efficiency of the operation in terms of the number of gallons of water treated per ton of CO_2 emitted. These include: (1) a requirement that new and replacement motors be of "premium" efficiency (92 percent) rather than "standard efficiency (88 percent); (2) the inclusion of an improved dewatering facility that will reduce the amount of biosolids hauled to land application sites; (3) new administration/laboratory buildings will have improved energy performance by

following the LEED initiatives for a silver rating; and (4) waste biogas from the anaerobic digester will be reused to heat and cool several of the facility's existing buildings.

Carbon footprint reduction. A preliminary analysis by HDR/Morrison Mairle suggests that: (1) requiring new process equipment to be of premium efficiency rather than standard efficiency will lead to a decrease of roughly 75 tons CO_2/year; (2) including an improved dewatering facility will reduce the amount of biosolids transported to land application sites which will lead to a decrease of roughly 10 tons CO_2/year; and (3) using waste biogas to heat the new administration and laboratory buildings will lead to a decrease of roughly 57 tons CO_2/year, *relative to a facility with expanded capacity that uses less efficient upgrade technologies*. It is important to note that the absolute carbon footprint of the WRF will increase relative to the existing facility due to a growing population in Bozeman, no matter whether conventional or more efficient approaches are employed. Therefore, the Task Force strongly recommends that the City adopt the most efficient proposed upgrades to minimize emissions from the WRF, and consider the installment of a micro-turbine as mentioned in Recommendation WWR-12 to reduce absolute carbon emissions.

Financial considerations. The City has already budgeted for the changes described and the work to accomplish these goals is in progress or completed.

Chapter 6

Education and Outreach

Basis for Recommendation

Awareness is essential to the success of Climate Protection in Bozeman. The Task Force proposes several outreach events as part of the City budget and ongoing efforts to keep the public informed.

EDU-1. Create and Adopt Community Action Plan

Description. The recommendations in the municipal CAP are only a first step in reducing the community's carbon footprint. The Municipal CAP is a leadership tool for the community and is intended to help guide future carbon reduction strategies. To make a significant reduction in Bozeman greenhouse gas emissions a Community Climate Action Plan *must* be adopted. The City should appoint a Community Climate Protection Task Force from a list of stakeholders created by CPTF no later than six months from adoption of the Municipal CAP and complete a Community Climate Action Plan no later than 18 months from adoption of Municipal CAP. A facilitator will be required to assist the current Climate Protection Coordinator to complete the Community CAP. We believe that the current Climate Protection Coordinator position does not have sufficient hours to *lead* the Community CAP, unless the position is re-scoped. A consultant or graduate student intern could also be considered to lead the Community CAP.

EDU-2. Participate in National Conversation on Climate Action

Description. The first annual National Conversation on Climate Action was held in Bozeman on October 4th, 2007. Seventy cities around the country held national conversations at the same time. One hundred people from the community attended the conversation and speakers in the community discussed ways to reduce greenhouse gas emissions. The purpose of the event was to engage citizens to find ways they can take action in reducing emissions in Bozeman. It is recommended that Bozeman participate in similar events in the future.

EDU-3. Participate in Gallatin Earth Celebration

Description. Building on the successful work of the Bozeman Beautification Board's Clean-up Day, the first annual Gallatin Earth Celebration brings together the community to clean up our neighborhoods, learn what the City is doing to confront climate change, and enjoy a picnic, music,

and vendor exhibits related to green products or services. The City should budget appropriately every year for the Gallatin Earth Celebration held the weekend after Earth Day.

EDU-4. Create an Office of Sustainability

Description. The city should investigate opportunities for creating an Office of Sustainability and hiring a full-time Sustainability Director to lead the efforts of the Climate Action Plan. The Sustainability Director should work under the office of the City Manager and provide information to the various departments on climate reduction strategies. The Office of Sustainability is responsible for monitoring the success of the Climate Action Plan, outreach and education in the community, and implementing the Community/Municipal Climate Acton Plan. The position can be justified through the energy savings achieved from emissions reduction policies enacted.

EDU-5. Create a Tree Planting Program

Description. The Task Force commends the current tree planting program and supports continued outreach for tree planting programs. The tree planting would be done with a goal of promoting the importance of trees in removing carbon dioxide from the atmosphere. This effort could take place on Gallatin Earth Celebration Day, Arbor Day, Earth Day, or a day selected by the City Forester as optimal for tree planting. We envision this program growing to include Community involvement in the Community CAP.

EDU-6. Create k-12 Education Program

Description. The Sustainability Director should be responsible for coordinating with the Bozeman Public School System and Montana State University to create k-12 student education programs to teach students concepts such as the importance and methods of recycling; the value of alternative modes of transport (walk, bike, bus); and simplified concepts about global warming;

EDU-7. Create an Adaptation Plan

Description. The consensus among climate experts is that climate change is happening now and is likely to increase. Average global surface temperatures rose 1.1 degrees Fahrenheit during the 20th century. Northwest winters have warmed 2.7 degrees since 1950, in part because of cycles in ocean conditions. Global sea levels have risen around four to eight inches. Even if the world was to stop burning fossil fuels tomorrow, existing levels of atmospheric CO_2 would continue to contribute to warming temperatures, melting sea ice, disappearing glaciers and the myriad other climate changes and impacts already being observed. Our approach is that we can and must reduce our levels of climate pollution to slow the rate of climate change. But we must also plan for and adapt to the climate change that is inevitable here in the Northwest. The City should create an adaptation plan to deal with the impacts due to already occurring climate change.

Chapter 7

Implementation

The Task Force recognizes that with the current level of information on City operations it is not in the position to declare an implementation plan, nor define for the City which of its recommendations should be implemented first or second, done in parallel, etc. However, we do feel strongly, that the City must have tangible milestones to achieve the desired goal of reducing municipal greenhouse gas emissions 15 percent below 2000 levels by 2020 as the City's reduction goal.

IMP-1. Adapt Milestones for Reducing Bozeman's CO_2e Footprint

Description. The Task Force recommends that the City adapt a yearly inventory of its greenhouse gas emissions, measured as CO_2e to begin no later than January 2010. The City should seek to achieve a yearly milestone of CO_2e emissions that meet, at a minimum, a linear decrease from 2006 levels to desired 2020 level (Figure 5**Error! Reference source not found.**). In other words, the City's goal is to reduce municipal greenhouse gas emissions 15 percent below 2000 levels by 2020. However, given that our most recent data is 2006, the Task Force recommends a linear decrease from 2006 levels to 2020 levels.

Given the adaption of the Energy Fund (PBE-8), we further recommend that this yearly measure be used to determine financial input (i.e., budgeting) to the Energy Fund. More funds will be budgeted to the fund for the subsequent year if the year under review did not meet its CO_2e emission milestone.

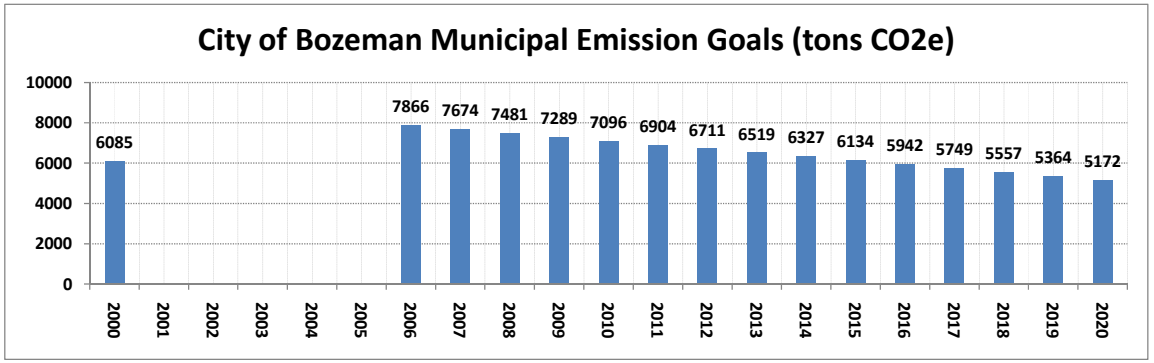

Figure 5. Recommended CO_2e emission goals for the City of Bozeman to meet overall Task Force goal by 2020.

Acknowledgements

Many thanks to all who helped in developing and writing Bozeman's Municipal Climate Action Plan. It was a collaborative effort, which makes it all the more likely to succeed!

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Appendix A: **Mayors' Climate Protection Agreement**

ENDORSING THE US MAYORS' CLIMATE PROTECTION AGREEMENT

(Endorsed Language)

ENDORSING THE U.S. MAYORS CLIMATE PROTECTION AGREEMENT

WHEREAS, the U.S. Conference of Mayors has previously adopted strong policy resolutions calling for cities, communities and the federal government to take actions to reduce global warming pollution; and

WHEREAS, the Inter-Governmental Panel on Climate Change (IPCC), the international community's most respected assemblage of scientists, has found that climate disruption is a reality and that human activities are largely responsible for increasing concentrations of global warming pollution; and

WHEREAS, recent, well-documented impacts of climate disruption include average global sea level increases of four to eight inches during the 20th century; a 40 percent decline in Arctic sea-ice thickness; and nine of the ten hottest years on record occurring in the past decade; and

WHEREAS, climate disruption of the magnitude now predicted by the scientific community will cause extremely costly disruption of human and natural systems throughout the world including: increased risk of floods or droughts; sea-level rises that interact with coastal storms to erode beaches, inundate land, and damage structures; more frequent and extreme heat waves; more frequent and greater concentrations of smog; and

WHEREAS, on February 16, 2005, the Kyoto Protocol, an international agreement to address climate disruption, went into effect in the 141 countries that have ratified it to date; 38 of those countries are now legally required to reduce greenhouse gas emissions on average 5.2 percent below 1990 levels by 2012; and

WHEREAS, the United States of America, with less than five percent of the world's population, is responsible for producing approximately 25 percent of the world's global warming pollutants; and

WHEREAS, the Kyoto Protocol emissions reduction target for the U.S. would have been 7 percent below 1990 levels by 2012; and

WHEREAS, many leading US companies that have adopted greenhouse gas reduction programs to demonstrate corporate social responsibility have also publicly expressed preference for the US to adopt precise and mandatory emissions targets and timetables as a means by which to remain competitive in the international marketplace, to mitigate financial risk and to promote sound investment decisions; and

WHEREAS, state and local governments throughout the United States are adopting emission reduction targets and programs and that this leadership is bipartisan, coming from Republican and Democratic governors and mayors alike; and

WHEREAS, many cities throughout the nation, both large and small, are reducing global warming pollutants through programs that provide economic and quality of life benefits such as reduced energy bills, green space preservation, air quality improvements, reduced traffic congestion, improved transportation choices, and economic development and job creation through energy conservation and new energy technologies; and

WHEREAS, mayors from around the nation have signed the U.S. Mayors Climate Protection Agreement which, as amended at the 73rd Annual U.S. Conference of Mayors meeting, reads:

The U.S. Mayors Climate Protection Agreement

a. We urge the federal government and state governments to enact policies and programs to meet or beat the target of reducing global warming pollution levels to 7 percent below 1990 levels by 2012, including efforts to: reduce the United States' dependence on fossil fuels and accelerate the development of clean, economical energy resources and fuel-efficient technologies such as conservation, methane recovery for energy generation, waste to energy, wind and solar energy, fuel cells, efficient motor vehicles, and biofuels;
b. We urge the U.S. Congress to pass bipartisan greenhouse gas reduction legislation that includes 1) clear timetables and emissions limits and 2) a flexible, market-based system of tradable allowances among emitting industries; and
c. We will strive to meet or exceed Kyoto Protocol targets for reducing global warming pollution by taking actions in our own operations and communities such as:

1. Inventory global warming emissions in City operations and in the community, set reduction targets and create an action plan.
2. Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities;
3. Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car pooling and public transit;
4. Increase the use of clean, alternative energy by, for example, investing in "green tags", advocating for the development of renewable energy resources, recovering landfill methane for energy production, and supporting the use of waste to energy technology;
5. Make energy efficiency a priority through building code improvements, retrofitting city facilities with energy efficient lighting and urging employees to conserve energy and save money;
6. Purchase only Energy Star equipment and appliances for City use;
7. Practice and promote sustainable building practices using the U.S. Green Building Council's LEED program or a similar system;
8. Increase the average fuel efficiency of municipal fleet vehicles; reduce the number of vehicles; launch an employee education program including anti-idling messages; convert diesel vehicles to bio-diesel;
9. Evaluate opportunities to increase pump efficiency in water and wastewater systems; recover wastewater treatment methane for energy production;
10. Increase recycling rates in City operations and in the community;
11. Maintain healthy urban forests; promote tree planting to increase shading and to absorb CO2; and
12. Help educate the public, schools, other jurisdictions, professional associations, business and industry about reducing global warming pollution.

NOW, THEREFORE, BE IT RESOLVED that The U.S. Conference of Mayors endorses the U.S. Mayors Climate Protection Agreement as amended by the 73rd annual U.S. Conference of Mayors meeting and urges mayors from around the nation to join this effort.

BE IT FURTHER RESOLVED, The U.S. Conference of Mayors will work in conjunction with ICLEI Local Governments for Sustainability and other appropriate organizations to track progress and implementation of the U.S. Mayors Climate Protection Agreement as amended by the 73rd annual U.S. Conference of Mayors meeting.

Appendix B: Suggestions for Future Community Plan

Citizens Concerned for Climate Change Recommendations

Ideas for Possible Bozeman Climate Protection Action Plan
March 2007, second draft

(The bolded actions 1-12 below come from the Mayors' Climate Protection Agreement, with local examples listed with each. An [F] indicates a recommended first step.)

1. **Inventory global warming emissions in City operations and in the community, set reduction targets, and create an action plan**
   a. **(F)** Establish a Climate Protection Advisory Committee to advise staff on changes each department can make, prepare an action plan for the City, assess short-term and long-term costs and benefits of implementing/not implementing various recommendations, advise Commission on policy changes, answer questions, help with outreach;
   b. **(F)** Have department heads read the Mayor's Climate Action Handbook, which describes how to get started; ask each department to identify a first step they can take in 2007–2008 and begin working on a departmental action plan, with advisory committee help;
   c. **(F)** Join ICLEI, Local Governments for Sustainability, to take advantage of their technical assistance regarding climate protection; ICLEI provides experienced staff, software tools, a toolkit, programs, and technical assistance to help local governments reduce greenhouse gas emissions in a cost-effective, efficient manner; their website is http://www.iclei.org; ICLEI can assist the city in inventorying global warming emissions, setting targets for each year, and creating an action plan to meet those targets;
   d. **(F)** During the 2007–2008 fiscal year, conduct a baseline inventory of global warming pollutants (recommended first step in the U.S. Mayors' Climate Action Handbook and also by Rocky Mountain Institute);
   e. **(F)** Adopt a long-term, overarching commitment covering all City departments, programs, and policies to consider the impact of actions on global warming and to adopt more climate-friendly practices, including reduction of greenhouse gas emissions, minimizing waste through reuse and purchase of recycled supplies, and maximizing energy efficiency;
   f. **(F)** Set deadlines for key actions (the baseline inventory, development of the action plan, departmental first steps, and so forth);
   g. **(F)** Ask all relevant City advisory boards to submit recommendations for addressing global warming;
2. **Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities**
   a. During the 2020 Community Growth Plan Update, consider any objectives and policies not already in place that would help reduce carbon emissions as the community grows;
   b. Promote mixed use;
3. **Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car pooling and public transit**
   a. During the Transportation Plan Update, consider any objectives not already in place to help reduce carbon emissions as the community grows;
   b. Expand Streamline bus routes for greater convenience and use;
   c. Continue improving walkability and bikability of community through completing networks of walking and biking lanes/routes/paths, completing safe routes for children to walk and bike to all schools, and improve intersection and arterial crossing safety for pedestrians;
   d. Install more energy-efficient traffic lights;
   e. Favor roundabouts for intersections, which reduce idling (and thus emissions);
   f. Ask Bike Board, Pedestrian Traffic Safety Committee, Transportation Coordinating Committee, and interested community groups to help develop recommendations;
4. **Increase the use of clean, alternative energy by, for example, investing in "green tags," advocating for the development of renewable energy resources, recovering**

landfill methane for energy production, and supporting the use of waste to energy technology

5. **Make energy efficiency a priority through building code improvements, retrofitting city facilities with energy efficient lighting, and urging employees to conserve energy and save money**
   a. Include reducing emissions and maximizing energy efficiency as goals for all capital improvements/facilities planning;
   b. encourage retrofitting of existing homes for reduced energy use, perhaps through rebate program; work with power company to build on its existing programs;
   c. revise Building Code to promote construction of more energy-efficient buildings;
   d. consider other policy changes to promote less energy use and create a more climate-friendly built environment, including lighting, heating/cooling, fans, and load reduction;
6. **Purchase only Energy Star equipment and appliances for City use**
   a. Encourage local businesses to promote Energy Start appliances to customers
7. **Practice and promote sustainable building practices using the U.S. Green Building Council's LEED program or a similar system**
   a. The new library is an excellent example of what's possible; post data on website to make information easily accessible on its sustainable building features;
8. **Increase the average fuel efficiency of municipal fleet vehicles; reduce the number of vehicles; launch an employee education program including anti-idling messages; convert diesel vehicles to bio-diesel**
   a. Build on the great start the City has already made regarding biodiesel vehicles, and the Planning Department's bicycle program for staff use during the workday; purchase hybrid vehicles when appropriate;
   b. Ask police and other departments to develop appropriate policies regarding idling;
9. **Evaluate opportunities to increase pump efficiency in water and wastewater systems recover wastewater treatment methane for energy production**
10. **Increase recycling rates in City operations and in the community**
    a. Set targets and publicize availability to all households and businesses;
    b. Adopt practices for events that occur in public places (Sweet Pea, Christmas Stroll, etc.) to foster recycling and less waste;
11. **Maintain healthy urban forests; promote tree planting to increase shading and to absorb CO_2**
    a. Ask Tree Board and City forestry staff to work together to create a plan to dramatically increase tree planting program in parks and on boulevards;
12. **Help educate the public, schools, other jurisdictions, professional associations, business and industry about reducing global warming pollution**
13. **With reduced snowpack and water supply predicted as one regional impact of climate change, adopt and fully implement the already studied and proposed water conservation plan for Bozeman and consider additional measures**
    a. Implement the recommended rebate program for individuals (and maybe businesses and nonprofits) to retrofit homes with water-conserving devices and appliances;
    b. Revise Building Code to require (or encourage) installation of optimally water-conserving devices and appliances in new homes and workplaces;
    c. Consider other policy changes to promote water conservation;
    d. Retrofit City buildings for better water conservation;
14. **(F) Revise Economic Development Revolving Loan standards to promote investment in businesses pursuing clean energy alternatives or with climate-friendly business practices**
15. **Support legislative bills to help Montana respond to climate change**

Transportation and Land Use Community Suggestions

While collecting information about municipal operations, the TLU committee also collected information about numerous community options. These options are included here to provide a foundation for the community action plan, to be developed later, and to bring to light some potential alternatives.

Basis for Recommendations

The transportation land use (TLU) subcommittee was comprised of David Boggeman, Patrick McGowen, Martin Knight, and Greg Pederson. The TLU developed recommendations based on their own knowledge and based on those recommendations proposed by various experts who met with the committee (see Chapter 4).

Background

The Bozeman Sewer Facilities Plan estimated that annual vehicle miles travelled in Bozeman was 111,000,000. Considering the average estimates and relationships discussed previously (20 mpg fuel efficiency, and 21.4 pounds of CO2 per gallon) car travel in Bozeman currently results in 59,000 tons of CO2 annually. By another estimate, the 2000 population of Bozeman was 27,509 and the typical person averaging 4.4 tons of CO2 per year from driving. The community carbon impact is 121,040 tons of CO2 from transportation. The first estimate is probably too low because it does not include vehicle miles travelled on local streets (just arterials and highways). The second estimate is of total travel of Bozeman's citizens. It does not include travel of Bozeman citizens outside of Bozeman, or travel of non-citizens in Bozeman.

This is not an exact representation of total transportation emissions in Bozeman. For example it does not include transportation emissions in Bozeman that are caused by non-residents such as tourists or those living in outside areas that come to Bozeman to work, shop and recreate. However, it is a good estimate and allows for easy comparison.

The bad news is that not only is the population increasing, but people are travelling more. Figure 6 shows how the miles driven per person have increased on average 1.4 percent per year.

Projecting this to the forecast year of 2020 means travel per person will increase 30 percent from 2001 values. Combine that with a 47 percent yearly increase in population from 2000 to 2020, means the total vehicle miles travelled will nearly double the likely carbon produced by the same amount. This means that a significant reduction need take place just to maintain the current output.

Reducing Community Carbon Footprint

Considering the continued increase in both population and miles driven per person, a significant reduction in the carbon impact of transportation can only result from individual choices of Bozeman citizens. The recommendations presented attempt to influence this choice by:

- providing incentives or disincentives
- improving the feasibility of alternative modes (primarily walking, biking and transit), and
- public education
- community supported agriculture

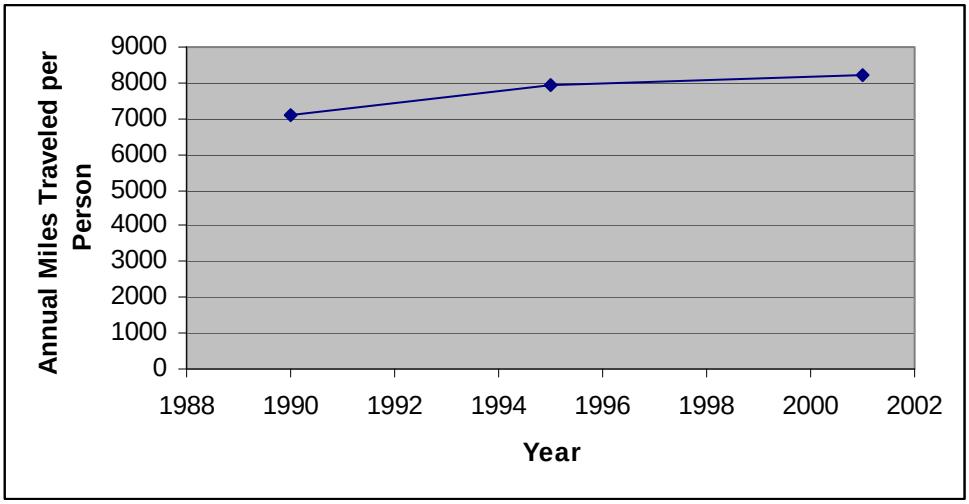

Figure 6. Miles Driven Per Person Nationally (Source: NPTS)

Incentives

APP-1. Local Incentives for Hybrid / Alternative Fuel Vehicles

Description. The City could provide incentives for locals to purchase high efficiency or alternative fuel vehicles. The exact nature of the incentives is not defined.

APP-2. Local Gas Tax

Description. A local gas tax has the potential to reduce transportation caused carbon for two reasons, first the slight increase in fuel costs may motivate individuals to choose more carbon friendly alternatives. Second the gas tax could be used primarily support carbon friendly options (alternative fuel vehicles, improved bicycle and pedestrian facilities, and better public transit).

Carbon Reduction. Small increases in fuel prices have proven to be mostly inelastic. The demand for fuel does not decrease with small increases in fuel cost, so the reduction caused by the increase in cost will likely be minimal. Most of the mitigations mentioned in this report have a real cost associated with them, with no identified source of funding. This could be a source of funding for a carbon reduction program.

Consequences/Discussion. It is the author's understanding according to state law, that the city could not pass such a tax; this would have to be passed by the Gallatin County Commission and possibly approved by voters. The tax could not exceed 2 cents per gallon. The City should encourage the county to implement this tax and encourage the use go to GHG reduction.

App-3. Transportation Demand Management

Description. If the pilot transportation demand management (TDM) program works well, it could be implemented community wide. Often this is done by requiring employers over a certain size to implement a TDM plan. More information on implementing TDM including case studies can be found at http://www.ops.fhwa.dot.gov/tdm/toolbox.htm. These are primarily implemented in more urban areas in an attempt to reduce congestion. The gains in congestion reduction in a City

the size of Bozeman is likely to be minimal. This does not rule out, however, the potential of using the same strategies to reduce community carbon emissions.

Carbon Reduction. Many employee based programs have resulted in 10-20 percent of employees utilizing alternative modes (carpooling, biking, transit, or telecommuting). This is of course only the work trips, which accounts for only a portion of the travel (commonly in the range of 20 percent). Also, this is only for the largest employers. A successful program could result in a 1-2 percent reduction in total community vehicle travel.

Improving the Feasibility of Carbon Friendly Transportation Modes

App-4. Improved Connectivity through Land Use / Development Policies

Description. Many developers will plan communities with cul-de-sacs and dead end streets. This can increase the number of lots in a development and have a traffic calming impact. However, these practices are not beneficial to bicycling and walking. For example, an individual could live right next to a transit stop, but have to walk several blocks to get to it because of lack of connectivity of streets. Developers should be required to connect streets at least with multiuse (i.e., bicycle and pedestrian) pathways.

Encourage Pedestrian and Bicycle Facilities for new/reconstructed Roadways and Developments

App-5. Bicycle / Walking Pathway Policy and Design Considerations

Description. The City of Bozeman has made a concerted effort to become a bicycle and pedestrian friendly city. The City was chosen as the best bike/ped city in the state of Montana by (Sunset Magazine). The current design standards for bicycle pedestrian facilities are good but some improvements could be made. These include:

- Sidewalks next to curbs should be outlawed these get covered by snow plowed from the street in winter and the rest of the year dirt and gravel from the road are thrown there. Sidewalks with landscape buffers are safer, more appealing and more likely to be utilized.
- Shaded paths (e.g., trees) are better for several reasons they are cooler both for users and the atmosphere. They last longer solar radiation is hard on concrete and asphalt. They are more pleasant to use people have a greater sense of wellbeing when surrounded by plants.
- The bike/ped trails that are not on surface streets should have maps and/or path signs to enable users not familiar with the system to navigate throughout the city without having to use surface streets. A common standard for path-finding signs should be investigated.
- The ribbon racks in the current code are an outdated design. These racks do not hold bikes up causing the bikes fall and potentially become damaged, not to mention this may also be viewed as aesthetically unpleasing. How much would people use parking lots that had a strong likelihood of damaging their cars? There are several available designs that resolve these problems. Examples include Welles or Bullard style racks. The design of these racks is superior since it ensures two points of contact with each bike (not including wheels).
- City code also needs to be modified to place bike racks near the main entrance to buildings. Pedestrians and cyclists should be rewarded with 'premium parking' for choosing to commute using carbon free transportation
- The uniform development code requires these paths to be concrete. There should be flexibility for use of asphalt or alternative materials surfaces where appropriate. Alternative paving techniques can reduce amounts of materials needed and provide

permeable surfaces for the infiltration of water. Asphalt surface are less then optimal since they generate green house gasses in the production processes and are a derivitive of petroleum products. In addition, the black surface has a low albedo wich causes retention of heat and increases in long-wave radiation; thus adding to the urban heat island effect. However, the lower cost of asphalt could result in more pathways and thus more bicycle users. Landscaping the trails with mature trees, as mentioned above, can serve to reduce the local heating effects and improve the overall enjoyabilty of the trail.

- Revisit the "Sidewalk Program." This program is currently on the books and requires homeowners to pay for sidewalks to provide connectivity in the pedestrian system. This program has been put on hold because of public backlash, but there is still the need for a connected, usable pedestrian facility. A potential county wide gas tax could pay for the sidewalks or developers could cover the sidewalk program during the initial construction phase.

App-6. Designated City Funding for Bike Lane Construction and Maintenance

Description. There exist gaps in the bicycle/pedestrian system. Efforts need to be made to address these gaps. If the City of Bozeman considers a core responsibility to be the provision of a *'transportation system',* then transportation in Bozeman needs to be treated as such. With the intention of providing connectivity and encouraging alternative forms of transportation the City should not allow partial completion of road building projects such that significant connectivity gaps develop. We urge the City to find or leverage the money to complete roads that are only partially constructed at the cost of developers. This has the effect of increasing connectivity and making cycling and walking more viable forms of transportation, and additionally it will reduce traffic from new developments from being pushed out onto the few and already crowded main roads. As stated before, connectivity of cities combined with the use of bicycle and pedestrian routes results in fewer cars on the roads. Suggestions of this nature should not be considered as added expenditures but as cheaper than building more, or maintaining larger roads to accommodate more cars.

Since the primary method for construction of bike lanes is to add them into new developments, and road reconstruction projects, the network is constructed in an ad-hoc method with no maintenance funds. The City has done a good job of establishing a connected system in a piecemeal fashion, but critical gaps still exist. A small fund should be created for maintenance of bike lanes (primarily sweeping and plowing) and for construction of new bike lanes for the highest priority segments in the road and trail network that would not otherwise be improved with new construction of roadways or developments. A modest fund to improve the most critical gaps could have huge potential benefits.

App-7. Hire a Permanent Bike/Ped Coordinator

Description. The City of Bozeman is now large enough that it needs a fulltime Bicycle Pedestrian (Bike/Ped) Coordinator. The City has very dedicated and hard working Bicycle and Pedestrian Boards but the workload of reviewing all new developments within the City and monitoring construction for compliance is more time consuming than it is fair to expect volunteer boards to accomplish. There may be an opportunity to share the cost by hiring a joint city / county coordinator. This person could have a more comprehensive view of City County connectivity issues and work toward an integrated system. Federal funding for such a position is not available until Bozeman reaches a population of 50,000. However, the impact this position could have on

connectivity and coordination of the bike/ped trails is much greater now than when the City is developed to a size of 50,000

Carbon Reduction. There would be no way to directly quantify carbon reduction for the City, but US government studies have shown that up to 20 percent of people would travel by walking or bicycle if facilities existed. If this were the case the City could save a substantial amount of money and carbon in construction costs for new roads and streets as the City grows.

App-8. Plan for Light Rail

Description. Light rail can be environmentally friendly transportation option for several reasons. First the system is run on electricity instead of gasoline or diesel. Electricity is not always cleaner energy, but it can be. Second the energy loss from rolling resistance between steel wheel - steel rail is about $1/10^{th}$ that of rubber tire – pavement. Unfortunately much of these gains are usually lost because of heavier vehicles and faster acceleration/deceleration used in light rail. The other negative is that light rail requires designated right of way (as opposed to bus transit that can share the road with passenger cars) and has huge infrastructure cost. A comparision of different modes of public transportation by Vuchic (enter web link here) suggest that light rail becomes competitive with bus transit or private auto somewhere between 5,000-10,000 riders per hour. For comparison, the maximum capacity of a single lane on a high-speed freeway is a little over 2000 vehicles per hour. It will be some time before Bozeman is of the size and density for light rail, well beyond the 2020 target of this plan. However, light rail should be kept in mind for long range planning horizons.

Other

App-9. Public Education

Description. In order to reduce community carbon emissions, it must come down to personal choice. Educating the public on their carbon impact and how they can reduce this could have a huge impact. Based on the average values discussed at the introduction of this section, the average person uses 8 gallons of gas per week, 34 gallons per month, and 410 gallons per year. To be a carbon friendly citizen one would use 15 percent less meaning 7 gallons per week. The target percentage could be increased in order to make up for increased population. There could also be publically recognized targets, and suggested attainment levels, similar to green building programs (certified by the LEED) designed to reduce individual fuel consumption (e.g., bronze is < 8 gallons per week, silver < 6 gallons, gold < 4 gallons). Conversions could also be provided for alternative fuels. Such goals may also serve to increase community cohesiveness around a common goal if promoted properly. People could be rewarded with bus passes, free bike repairs at a local shop, compact florescent light bulbs, a t-shirt, button, or poster if they state and provide minimal evidence (e.g. a monthly credit card statement showing fuel purchases) showing that they have met these goals for a certain period of time. This could be combined with the other areas including home energy use.

App-10. Community Supported Agriculture

Description. Aside from personal choice, improving other efficiencies in the system such as food production and distribution, or local renewable energy production, could result in a greatly reduced carbon footprint for the City of Bozeman.

From a land use planning perspective, the TLU felt they could not add anything to the current City land use planning efforts, with one exception. The City should consider incentives for community supported farms. This provides local produce for citizens and a viable business plan for small scale farmers. Growing food locally saves the shipping costs for produce and also helps preserve open space. Further information can be found at:

- General resources: USDA http://www.nal.usda.gov/afsic/pubs/csa/csa.shtml and University of MA http://www.umassvegetable.org/food_farming_systems/csa/
- Right here in Bozeman is Towne Harvest at MSU http://www.newwest.net/city/article/urban_agriculture_creating_an_alternative_to_traditional_methods/C396/L396/
- A great example of an incubator farm is Intervale Center http://www.intervale.org/
- Also interesting is the role of the Vermont Land Trust in helping secure the land http://www.vlt.org/PR/062907newsrel.html

Appendix C: **Supporting Data from ICLEI CACP Software**

CACP Data 2000 and 2006 Summaries

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Bozeman Government Greenhouse Gas Emissions in **2000**
Summary Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Buildings	2,384	39.2	31,366	114
Vehicle Fleet	1,487	24.4	17,457	207,383
Streetlights	326	5.4	2,174	138,747
Water/Sewage	1,958	32.2	15,547	0
Waste	-72	-1.2		11,039
Total	6,084	100.0	66,544	357,283

This report has been generated for Bozeman, Montana using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

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Bozeman Government Greenhouse Gas Emissions in **2006**
Summary Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Buildings	3,226	41.0	37,559	513,517
Vehicle Fleet	1,543	19.6	18,278	408,656
Streetlights	564	7.2	3,525	343,570
Water/Sewage	2,652	33.7	20,189	388,231
Waste	-119	-1.5		20,187
Total	7,866	100.0	79,551	1,674,160

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CACP Data 2000 and 2006 Details

Year 2000

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Government Greenhouse Gas Emissions in 2000
Detailed Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Bozeman, Montana				
800 N Grand Ball Park				
Electricity	1	0.0	7	0
Subtotal 800 N Grand Ball Park	1	0.0	7	0
Bealle				
Electricity	1	0.0	6	0
Subtotal Bealle	1	0.0	6	0
Bogart Pool Building				
Electricity	15	0.2	101	0
Subtotal Bogart Pool Building	15	0.2	101	0
Bogert Park				
Electricity	20	0.3	135	0
Subtotal Bogert Park	20	0.3	135	0
Bozeman Pond Restroom				
Electricity	3	0.0	19	0
Natural Gas	4	0.1	67	0
Subtotal Bozeman Pond Restroom	7	0.1	86	0

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Government Greenhouse Gas Emissions in 2000
Detailed Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Cemetary Operations				
Electricity	4	0.1	26	0
Natural Gas	9	0.1	147	0
Subtotal Cemetary Operations	13	0.2	173	0
Cemetary Shed				
Electricity	0	0.0	0	0
Subtotal Cemetary Shed	0	0.0	0	0
Centennial Park				
Electricity	1	0.0	4	0
Subtotal Centennial Park	1	0.0	4	0
City Hall/ Fire Station 1				
Electricity	146	2.4	971	0
Natural Gas	785	12.9	12,713	0
Subtotal City Hall/ Fire Station 1	931	15.3	13,684	0
City Landfill Cinderblock Pump Lights				
Electricity	0	0.0	3	114
Subtotal City Landfill Cinderblock Pump Lights		0.0	3	114
Cooper Park				
Electricity	1	0.0	6	0
Subtotal Cooper Park	1	0.0	6	0

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Government Greenhouse Gas Emissions in 2000
Detailed Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
East Gallatin Park				

Electricity	1	0.0	6	0
Subtotal East Gallatin Park	1	0.0	6	0
Equipment Shack				
Electricity	2	0.0	13	0
Subtotal Equipment Shack	2	0.0	13	0
Fire Station 2				
Electricity	20	0.3	131	0
Natural Gas	29	0.5	468	0
Subtotal Fire Station 2	49	0.8	599	0
Haggerty Lane Ball Fields				
Electricity	25	0.4	169	0
Subtotal Haggerty Lane Ball Fields	25	0.4	169	0
Jarrett Park				
Electricity	0	0.0	3	0
Subtotal Jarrett Park	0	0.0	3	0
Josephine Park				
Electricity	1	0.0	8	0
Subtotal Josephine Park	1	0.0	8	0

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Kirk Park				
Electricity	0	0.0	0	0
Subtotal Kirk Park	0	0.0	0	0
Kirk Park Restroom				
Electricity	4	0.1	26	0
Subtotal Kirk Park Restroom	4	0.1	26	0
Lindley Park				
Electricity	2	0.0	10	0
Subtotal Lindley Park	2	0.0	10	0
Lindley Park Bowl				
Electricity	1	0.0	4	0
Subtotal Lindley Park Bowl	1	0.0	4	0
Lindley Park Rec				
Electricity	5	0.1	33	0
Natural Gas	14	0.2	224	0
Subtotal Lindley Park Rec	19	0.3	257	0
Lower Yard				
Electricity	3	0.0	20	0

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Natural Gas	30	0.5	479	0
Subtotal Lower Yard	33	0.5	499	0
Old Library				
Electricity	118	1.9	785	0
Natural Gas	39	0.6	623	0
Subtotal Old Library	156	2.6	1,408	0
Park Operation Toole Street				
Electricity	2	0.0	15	0
Subtotal Park Operation Toole Street	2	0.0	15	0
Senior Center				
Electricity	124	2.0	823	0
Natural Gas	93	1.5	1,503	0

Subtotal Senior Center	216	3.6	2,326	0
Shops Complex				
Electricity	112	1.8	745	0
Natural Gas	215	3.5	3,476	0
Subtotal Shops Complex	327	5.4	4,221	0
Solid Waste Disposal				
Electricity	8	0.1	52	0
Subtotal Solid Waste Disposal	8	0.1	52	0

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Government Greenhouse Gas Emissions in 2000
Detailed Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Southside Park				
Electricity	14	0.2	93	0
Subtotal Southside Park	14	0.2	93	0
Stiff Professional Building				
Electricity	123	2.0	820	0
Natural Gas	84	1.4	1,366	0
Subtotal Stiff Professional Building	207	3.4	2,186	0
Swim Center				
Natural Gas	324	5.3	5,243	0
Subtotal Swim Center	324	5.3	5,243	0
W Babcock Park				
Electricity	3	0.1	21	0
Subtotal W Babcock Park	3	0.1	21	0
Subtotal Buildings	2,384	39.2	31,366	114
Vehicle Fleet				
Bozeman, Montana				
Building Inspection				
Gasoline	23	0.4	263	3,124
Subtotal Building Inspection	23	0.4	263	3,124

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Government Greenhouse Gas Emissions in 2000
Detailed Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Cemetary				
Gasoline	25	0.4	295	3,497
Subtotal Cemetary	25	0.4	295	3,497
City Attorney				
Gasoline	1	0.0	14	161
Subtotal City Attorney	1	0.0	14	161
City Manager				
Gasoline	7	0.1	81	955
Subtotal City Manager	7	0.1	81	955
Facilites Managment				
Gasoline	0	0.0	1	13
Subtotal Facilites Managment	0	0.0	1	13

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Government Greenhouse Gas Emissions in 2000
Detailed Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Finance IT Administration				
Gasoline	1	0.0	13	156

Subtotal Finance IT Administration	1	0.0	13	156
Fire				
Gasoline	37	0.6	433	5,137
Diesel	37	0.6	426	5,347
Subtotal Fire	74	1.2	859	10,485
Forestry/Tree Maintenance				
Gasoline	115	1.9	1,338	15,873
Subtotal Forestry/Tree Maintenance	115	1.9	1,338	15,873
Parking				
Gasoline	10	0.2	119	1,412
Subtotal Parking	10	0.2	119	1,412

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Government Greenhouse Gas Emissions in 2000
Detailed Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Parks				
Gasoline	85	1.4	997	11,830
Subtotal Parks	85	1.4	997	11,830
Planning				
Gasoline	1	0.0	13	148
Subtotal Planning	1	0.0	13	148
Police				
Gasoline	203	3.3	2,368	28,096
Subtotal Police	203	3.3	2,368	28,096
Public Service				
Gasoline	58	1.0	680	8,062
Subtotal Public Service	58	1.0	680	8,062

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Government Greenhouse Gas Emissions in 2000
Detailed Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Recreation				
Gasoline	1	0.0	9	103
Subtotal Recreation	1	0.0	9	103
Solid Waste Collection				
Gasoline	148	2.4	1,751	20,769
Subtotal Solid Waste Collection	148	2.4	1,751	20,769
Solid Waste Disposal				
Gasoline	233	3.8	2,744	32,548
Subtotal Solid Waste Disposal	233	3.8	2,744	32,548
Streets				
Gasoline	261	4.3	3,071	36,433
Subtotal Streets	261	4.3	3,071	36,433

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Government Greenhouse Gas Emissions in 2000
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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Vehicle Maintenance				
Gasoline	5	0.1	54	636
Subtotal Vehicle Maintenance	5	0.1	54	636
Waste Water Operations				
Gasoline	34	0.6	402	4,768
Subtotal Waste Water Operations	34	0.6	402	4,768

Waste Water Plant				
Gasoline	30	0.5	352	4,179
Subtotal Waste Water Plant	30	0.5	352	4,179
Water Operations				
Gasoline	154	2.5	1,801	21,360
Subtotal Water Operations	154	2.5	1,801	21,360

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Government Greenhouse Gas Emissions in 2000
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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Water Plant				
Gasoline	18	0.3	208	2,471
Subtotal Water Plant	18	0.3	208	2,471
Zoning				
Gasoline	2	0.0	26	305
Subtotal Zoning	2	0.0	26	305
Subtotal Vehicle Fleet	1,487	24.4	17,457	207,383
Streetlights				
Bozeman, Montana				
11th and Mendenhall Bouncing Ball Light				
Electricity	0	0.0	1	0
Subtotal 11th and Mendenhall Bouncing Ball Light	0.0		1	0
15th-18th Main-Durston				
Electricity	11	0.2	71	10,572
Subtotal 15th-18th Main-Durston	11	0.2	71	10,572

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
1802 N Rouse				
Electricity	0	0.0	3	0
Subtotal 1802 N Rouse	0	0.0	3	0
7th Main-Oak				
Electricity	17	0.3	113	6,262
Subtotal 7th Main-Oak	17	0.3	113	6,262
7th-11th-Main-Durston				
Electricity	23	0.4	155	14,122
Subtotal 7th-11th-Main-Durston	23	0.4	155	14,122
8th West City Limits				
Electricity	20	0.3	136	5,673
Subtotal 8th West City Limits	20	0.3	136	5,673
Alley Lamme-Villard				
Electricity	1	0.0	5	236
Subtotal Alley Lamme-Villard	1	0.0	5	236
Babcock Caution Light				
Electricity	0	0.0	1	0
Subtotal Babcock Caution Light	0	0.0	1	0

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Babcock S3rd-S5th				
Electricity	2	0.0	12	545

Subtotal Babcock S3rd-S5th	2	0.0	12	545
Beall/Durston Rd				
Electricity	3	0.0	20	1,735
Subtotal Beall/Durston Rd	3	0.0	20	1,735
Blackmore Terrace/17th -Durston				
Electricity	3	0.0	17	2,518
Subtotal Blackmore Terrace/17th -Durston		0.0	17	2,518
Bozeman Chronicle Rouse and Babcock				
Electricity	0	0.0	2	0
Subtotal Bozeman Chronicle Rouse and Babcock		0.0	2	0
Cleveland St				
Electricity	4	0.1	27	4,744
Subtotal Cleveland St	4	0.1	27	4,744
Cleveland-Lincoln Grand-6th				
Electricity	28	0.5	190	17,722
Subtotal Cleveland-Lincoln Grand-6th	28	0.5	190	17,722

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Cooper/Bogert/Kirk/Lindley/				
Electricity	5	0.1	32	4,076
Subtotal Cooper/Bogert/Kirk/Lindley/	5	0.1	32	4,076
Corner E Babcock and S Rouse				
Electricity	5	0.1	30	0
Subtotal Corner E Babcock and S Rouse	5	0.1	30	0
Corner S 15th / Babcock				
Electricity	0	0.0	2	0
Subtotal Corner S 15th / Babcock	0	0.0	2	0
Durston-Villard & 10-11th				
Electricity	1	0.0	7	354
Subtotal Durston-Villard & 10-11th	1	0.0	7	354
E Bozeman Interchange				
Electricity	1	0.0	7	294
Subtotal E Bozeman Interchange	1	0.0	7	294
Greekway				
Electricity	2	0.0	10	941
Subtotal Greekway	2	0.0	10	941
Highland and Main				
Electricity	5	0.1	35	0
Subtotal Highland and Main	5	0.1	35	0

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Kagy Blvd				
Electricity	21	0.4	142	2,218
Subtotal Kagy Blvd	21	0.4	142	2,218
Main 4th S 8th Ave				
Electricity	10	0.2	66	3,566
Subtotal Main 4th S 8th Ave	10	0.2	66	3,566
Main-Mendenhall				
Electricity	0	0.0	3	265
Subtotal Main-Mendenhall	0	0.0	3	265
Main/Harrison				
Electricity	31	0.5	208	11,099
Subtotal Main/Harrison	31	0.5	208	11,099

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Main/N Bozeman				
Electricity	20	0.3	133	6,664
Subtotal Main/N Bozeman	20	0.3	133	6,664
Mendenhall-Church-3rd				
Electricity	12	0.2	79	5,353
Subtotal Mendenhall-Church-3rd	12	0.2	79	5,353
Mendenhall/Tracy/ Black				
Electricity	0	0.0	0	0
Subtotal Mendenhall/Tracy/ Black	0	0.0	0	0

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Morwyn Add #2				
Electricity	0	0.0	2	1,136
Subtotal Morwyn Add #2	0	0.0	2	1,136
Morwyn Add# 1				
Electricity	3	0.0	17	1,005
Subtotal Morwyn Add# 1	3	0.0	17	1,005
N 19th to Main				
Electricity	13	0.2	89	1,554
Subtotal N 19th to Main	13	0.2	89	1,554
N Ida-NChurch				
Electricity	18	0.3	118	6,418
Subtotal N Ida-NChurch	18	0.3	118	6,418
N Main Alley				
Electricity	3	0.1	23	1,121
Subtotal N Main Alley	3	0.1	23	1,121
N Willson Main-Mendenhall				
Electricity	1	0.0	3	313
Subtotal N Willson Main-Mendenhall	1	0.0	3	313

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
NW Corner S19th/Koch				
Electricity	0	0.0	3	87
Subtotal NW Corner S19th/Koch	0	0.0	3	87
Parking Lots				
Electricity	2	0.0	12	411
Subtotal Parking Lots	2	0.0	12	411
S Black-College-Railway				
Electricity	3	0.0	17	865
Subtotal S Black-College-Railway	3	0.0	17	865
S Willson Main-Cleveland				
Electricity	9	0.2	62	10,068
Subtotal S Willson Main-Cleveland	9	0.2	62	10,068
Scoreboard Softball Complex				
Electricity	0	0.0	0	0
Subtotal Scoreboard Softball Complex	0	0.0	0	0
SE Corner Kagy/S 19th				
Electricity	0	0.0	3	87
Subtotal SE Corner Kagy/S 19th	0	0.0	3	87
SE Corner W Lincoln S 19th				
Electricity	0	0.0	3	122
Subtotal SE Corner W Lincoln S 19th	0	0.0	3	122

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Thompson Addition #1				
Electricity	2	0.0	11	2,767
Subtotal Thompson Addition #1	2	0.0	11	2,767
Traffic Light 19th/Durston				
Electricity	7	0.1	50	0
Subtotal Traffic Light 19th/Durston	7	0.1	50	0
Traffic Sginal Willson/Babcock				
Electricity	7	0.1	47	0
Subtotal Traffic Sginal Willson/Babcock		0.1	47	0
Traffic Signal Kagy/S 3rd				
Electricity	4	0.1	26	0
Subtotal Traffic Signal Kagy/S 3rd	4	0.1	26	0
United Commercials Travelers Building				
Electricity	0	0.0	2	0
Subtotal United Commercials Travelers Building		0.0	2	0
Valley Unit Subdivision				
Electricity	10	0.2	67	10,070
Subtotal Valley Unit Subdivision	10	0.2	67	10,070
Villard/N7th Flashing Light				
Electricity	0	0.0	1	0
Subtotal Villard/N7th Flashing Light	0	0.0	1	0

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
W Babcock Park Lights				
Electricity	2	0.0	13	0
Subtotal W Babcock Park Lights	2	0.0	13	0
W Bozeman Interchange Trilateral Cnt				
Electricity	3	0.1	23	0
Subtotal W Bozeman Interchange Trilateral Cnt		0.1	23	0
West Park Manor 1				
Electricity	6	0.1	40	3,764
Subtotal West Park Manor 1	6	0.1	40	3,764
Willson/Mendenhall Lights				
Electricity	5	0.1	36	0
Subtotal Willson/Mendenhall Lights	5	0.1	36	0
Subtotal Streetlights	326	5.4	2,174	138,747
Water/Sewage				
Bozeman, Montana				
Bonner Lane Water Well				
Electricity	2	0.0	14	0
Subtotal Bonner Lane Water Well	2	0.0	14	0
Cambridge Drive Pump				
Electricity	1	0.0	7	0
Subtotal Cambridge Drive Pump	1	0.0	7	0

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	Equiv CO 2	Equiv CO 2	Energy	Cost

	(tons)	(%)	(MMBtu)	($)
City Landfill Cinderblock Pond Pump				
Electricity	14	0.2	91	0
Subtotal City Landfill Cinderblock Pond Pump		0.2	91	0
City Water Well				
Electricity	3	0.1	22	0
Subtotal City Water Well	3	0.1	22	0
Landfill New Pump				
Electricity	12	0.2	80	0
Subtotal Landfill New Pump	12	0.2	80	0
Lindley Park Pump				
Electricity	5	0.1	36	0
Subtotal Lindley Park Pump	5	0.1	36	0
Lyman Creek Resevoir Cinderblock Bldg				
Electricity	12	0.2	78	0
Subtotal Lyman Creek Resevoir Cinderblock Bldg		0.2	78	0
Pear Street Booster Station				
Electricity	9	0.1	60	0
Subtotal Pear Street Booster Station	9	0.1	60	0

Government Greenhouse Gas Emissions in 2000
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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Perkins Place Pump				
Electricity	7	0.1	44	0
Subtotal Perkins Place Pump	7	0.1	44	0
Rouse and Tamarack Pump				
Electricity	4	0.1	27	0
Subtotal Rouse and Tamarack Pump	4	0.1	27	0
Sprinkler System 11th/Main				
Electricity	0	0.0	0	0
Subtotal Sprinkler System 11th/Main	0	0.0	0	0
Waste Water lift station				
Electricity	2	0.0	15	0
Subtotal Waste Water lift station	2	0.0	15	0
Waste Water Treatment Plant (WWTP)				
Electricity	1,443	23.7	9,616	0
Subtotal Waste Water Treatment Plant (WWTP)		23.7	9,616	0
Water Treatment Plant				
Electricity	173	2.8	1,151	0
Natural Gas	198	3.3	3,209	0
Subtotal Water Treatment Plant	371	6.1	4,360	0

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Water Treatment Plant Cholrinator				
Electricity	4	0.1	29	0
Subtotal Water Treatment Plant Cholrinator		0.1	29	0
WWTP Admin Building				
Natural Gas	30	0.5	484	0
Subtotal WWTP Admin Building	30	0.5	484	0
WWTP Maintenance Bldg				
Natural Gas	18	0.3	293	0
Subtotal WWTP Maintenance Bldg	18	0.3	293	0
WWTP Primary Treatment Bldg				

Natural Gas	15	0.2	235	0
Subtotal WWTP Primary Treatment Bldg	15	0.2	235	0
Yard Light and Power Pole				
Electricity	4	0.1	27	0
Natural Gas	2	0.0	27	0
Subtotal Yard Light and Power Pole	6	0.1	54	0
Yard Light Sediment Basin House				
Electricity	0	0.0	3	0
Subtotal Yard Light Sediment Basin House		0.0	3	0

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Subtotal Water/Sewage	1,958	32.2	15,547	0
Waste				
Bozeman, Montana				
Bozeman Landfill		Disposal Method - Managed Landfill		
Paper Products	-50	-0.8	4,195	
Food Waste	10	0.2	1,435	
Plant Debris	-23	-0.4	1,104	
Wood/Textiles	-9	-0.2	442	
All Other Waste	0	0.0	3,864	
Subtotal Bozeman Landfill	-72	-1.2	11,039	
Subtotal Waste	-72	-1.2	11,039	
Total	6,084	100.0	66,544	357,283

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Year 2006

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Bozeman, Montana				
Adam Bronken Complex				
Electricity	6	0.1	39	1,430
Subtotal Adam Bronken Complex	6	0.1	39	1,430
Ball Park				
Electricity	2	0.0	11	373
Subtotal Ball Park	2	0.0	11	373
Bealle Park				
Electricity	1	0.0	6	245
Subtotal Bealle Park	1	0.0	6	245
Bogert Park				
Electricity	10	0.1	61	1,751
Subtotal Bogert Park	10	0.1	61	1,751
Bogert Park Pavillion & Bandstand				
Electricity	14	0.2	86	2,912
Subtotal Bogert Park Pavillion & Bandstand		0.2	86	2,912
Bogert Park Pool				
Electricity	6	0.1	38	1,052
Natural Gas	35	0.4	567	5,640
Subtotal Bogert Park Pool	41	0.5	605	6,692

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Bozeman Pond Restroom				
Electricity	3	0.0	17	542
Natural Gas	4	0.1	68	862
Subtotal Bozeman Pond Restroom	7	0.1	85	1,404
Bronken Memorial Park				
Electricity	1	0.0	7	311
Subtotal Bronken Memorial Park	1	0.0	7	311
Cemetary Operations				
Electricity	1	0.0	7	286
Subtotal Cemetary Operations	1	0.0	7	286
Cemetary Operations 2				
Electricity	3	0.0	21	664
Natural Gas	10	0.1	168	1,836
Subtotal Cemetary Operations 2	14	0.2	189	2,500
Centennial Park				
Electricity	1	0.0	9	313
Subtotal Centennial Park	1	0.0	9	313
City Hall/ Fire Station 1				
Electricity	170	2.2	1,061	25,389

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Natural Gas	450	5.7	7,285	16,924
Subtotal City Hall/ Fire Station 1	620	7.9	8,346	42,313
Cooper Park				
Electricity	1	0.0	8	180
Subtotal Cooper Park	1	0.0	8	180
East Gallatin Park				
Electricity	2	0.0	10	428
Subtotal East Gallatin Park	2	0.0	10	428
Equipment Shack				
Electricity	2	0.0	12	423
Subtotal Equipment Shack	2	0.0	12	423
Fire Station 2				
Electricity	28	0.4	173	5,008
Natural Gas	24	0.3	392	3,464
Subtotal Fire Station 2	52	0.7	565	8,472
Haggerty Lane Ball Fields				
Electricity	28	0.4	177	17,099
Natural Gas	7	0.1	113	1,291
Subtotal Haggerty Lane Ball Fields	35	0.4	290	18,390

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Jarrett Park				
Electricity	1	0.0	5	214
Subtotal Jarrett Park	1	0.0	5	214
Josephine park				
Electricity	10	0.1	60	1,723
Subtotal Josephine park	10	0.1	60	1,723
Kirkpark Restroom				

Electricity	4	0.1	26	1,393
Subtotal Kirkpark Restroom	4	0.1	26	1,393
Landfill shop				
Electricity	0	0.0	2	133
Subtotal Landfill shop	0	0.0	2	133
Lindely Park W of Picnic				
Electricity	2	0.0	14	458
Subtotal Lindely Park W of Picnic	2	0.0	14	458
Lindley Park Bowl SweetPea				
Electricity	1	0.0	3	472
Subtotal Lindley Park Bowl SweetPea	1	0.0	3	472
Lindley Park Rec				
Electricity	3	0.0	19	605
Natural Gas	11	0.1	184	2,016
Subtotal Lindley Park Rec	14	0.2	203	2,621

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Lower Yard				
Electricity	23	0.3	145	3,154
Natural Gas	31	0.4	499	4,794
Subtotal Lower Yard	54	0.7	644	7,948
Multi Family Dwelling 1				
Electricity	3	0.0	20	0
Natural Gas	7	0.1	106	0
Subtotal Multi Family Dwelling 1	10	0.1	126	0
Multi Family Dwelling 2				
Electricity	3	0.0	16	0
Natural Gas	9	0.1	140	0
Subtotal Multi Family Dwelling 2	11	0.1	156	0
New Library				
Natural Gas	103	1.3	1,674	16,740
Green Electricity	0	0.0	1,700	67,583
Subtotal New Library	103	1.3	3,374	84,323

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Old Library				
Electricity	97	1.2	606	14,080
Natural Gas	83	1.1	1,342	13,748
Subtotal Old Library	180	2.3	1,948	27,828
Park Operations 1				
Electricity	0	0.0	3	107
Subtotal Park Operations 1	0	0.0	3	107
Park Operations 2				
Electricity	3	0.0	17	552
Subtotal Park Operations 2	3	0.0	17	552
Police Law & Justice Center				
Electricity	419	5.3	2,621	58,323
Natural Gas	134	1.7	2,176	22,895
Subtotal Police Law & Justice Center	554	7.0	4,797	81,218
Senior Center				
Electricity	131	1.7	820	21,954

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Natural Gas	55	0.7	890	8,962
Subtotal Senior Center	186	2.4	1,710	30,916
Shops Complex				
Electricity	157	2.0	984	25,485
Natural Gas	215	2.7	3,475	22,247
Subtotal Shops Complex	372	4.7	4,459	47,732
Solid Waste Diposal				
Electricity	31	0.4	195	5,955
Subtotal Solid Waste Diposal	31	0.4	195	5,955
Southside Park				
Electricity	13	0.2	84	2,406
Subtotal Southside Park	13	0.2	84	2,406
Stiff Professional Building				
Electricity	221	2.8	1,383	29,386
Natural Gas	43	0.5	691	7,422
Subtotal Stiff Professional Building	264	3.4	2,074	36,808

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Story Mansion				
Electricity	0	0.0	2	105
Natural Gas	34	0.4	549	5,424
Subtotal Story Mansion	34	0.4	551	5,529
Swim Center				
Electricity	245	3.1	1,530	34,328
Natural Gas	324	4.1	5,243	52,430
Subtotal Swim Center	569	7.2	6,773	86,758
Subtotal Buildings	3,226	41.0	37,559	513,517
Vehicle Fleet				
Bozeman, Montana				
ANIMAL CONTROL				
Gasoline	5	0.1	55	1,209
Subtotal ANIMAL CONTROL	5	0.1	55	1,209
BLDG INSPECTION OPERATION				
Gasoline	67	0.9	791	17,515
Diesel	0	0.0	2	56
Subtotal BLDG INSPECTION OPERATION	68	0.9	794	17,571
CEMETERY OPERATIONS				
Gasoline	13	0.2	149	3,304
Diesel	5	0.1	60	1,373
Subtotal CEMETERY OPERATIONS	18	0.2	209	4,677
CITY ADMINISTRATION				
Gasoline	1	0.0	12	267
Subtotal CITY ADMINISTRATION	1	0.0	12	267

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
CITY HALL				
Gasoline	0	0.0	4	96

Subtotal CITY HALL	0	0.0	4	96
CODE ENFORCEMENT				
Gasoline	0	0.0	1	21
Subtotal CODE ENFORCEMENT	0	0.0	1	21
CRIME CTRL & INVESTIGATE				
Gasoline	17	0.2	201	4,441
Subtotal CRIME CTRL & INVESTIGATE	17	0.2	201	4,441
DARE				
Gasoline	4	0.1	51	1,124
Subtotal DARE	4	0.1	51	1,124
DRUG FORFEITURE				
Gasoline	9	0.1	110	2,444
Subtotal DRUG FORFEITURE	9	0.1	110	2,444
ENGINEERING				
Gasoline	8	0.1	94	2,091
Subtotal ENGINEERING	8	0.1	94	2,091
FIRE ADMINISTRATION				
Gasoline	15	0.2	172	3,800
Diesel	0	0.0	1	22
Subtotal FIRE ADMINISTRATION	15	0.2	173	3,822
FIRE HAZARDOUS MATERIALS				
Gasoline	0	0.0	0	8
Diesel	2	0.0	28	642
Subtotal FIRE HAZARDOUS MATERIALS	2	0.0	28	650
FIRE OPERATIONS				
Diesel	38	0.5	435	9,985
Subtotal FIRE OPERATIONS	38	0.5	435	9,985

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
FORESTRY/TREE MAINTENANCE				
Gasoline	20	0.3	239	5,290
Diesel	7	0.1	76	1,753
Subtotal FORESTRY/TREE MAINTENANCE	27	0.3	315	7,043
I.T. - ADMINISTRATION				
Gasoline	7	0.1	77	1,708
Subtotal I.T. - ADMINISTRATION	7	0.1	77	1,708
LIBRARY OPERATIONS				
Gasoline	0	0.0	4	87
Subtotal LIBRARY OPERATIONS	0	0.0	4	87
PARK OPERATIONS				
Gasoline	95	1.2	1,116	24,693
Diesel	13	0.2	154	3,527
Subtotal PARK OPERATIONS	108	1.4	1,269	28,220
PARKING OPERATIONS 1				
Gasoline	2	0.0	29	633
Subtotal PARKING OPERATIONS 1	2	0.0	29	633
PARKING OPERATIONS 2				
Gasoline	3	0.0	36	802
Subtotal PARKING OPERATIONS 2	3	0.0	36	802
PLANNING OPERATIONS				
Gasoline	3	0.0	32	702
Subtotal PLANNING OPERATIONS	3	0.0	32	702
POLICE OPERATIONS				
Gasoline	193	2.4	2,261	50,044
Subtotal POLICE OPERATIONS	193	2.4	2,261	50,044
PUBLIC SERVICES ADMIN				
Gasoline	1	0.0	16	349
Subtotal PUBLIC SERVICES ADMIN	1	0.0	16	349

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RECREATION PROGRAMS				
Gasoline	1	0.0	14	310
Subtotal RECREATION PROGRAMS	1	0.0	14	310
RECYCLING				
Gasoline	55	0.7	641	14,195
Diesel	29	0.4	330	7,573
LPG	0	0.0	5	139
Subtotal RECYCLING	84	1.1	977	21,907
SHOP COMPLEX				
Gasoline	4	0.1	48	1,054
Diesel	0	0.0	1	29
Subtotal SHOP COMPLEX	4	0.1	49	1,083
SLUDGE INJECTION				
Gasoline	10	0.1	115	2,539
Diesel	49	0.6	565	12,971
Subtotal SLUDGE INJECTION	59	0.7	680	15,510
SOLID WASTE DISPOLSAL OPERATIONS				
Gasoline	25	0.3	291	6,435
Diesel	90	1.1	1,035	23,760
LPG	0	0.0	4	118
Subtotal SOLID WASTE DISPOLSAL OPERATIONS	1.5		1,331	30,313
SOLIDWASTE COLL OPERATION				
Gasoline	309	3.9	3,632	80,396
Diesel	19	0.2	216	4,966
LPG	0	0.0	6	163
Subtotal SOLIDWASTE COLL OPERATION	329	4.2	3,855	85,525
STREET OPERATIONS				
Gasoline	143	1.8	1,699	37,594
Biodiesel (B-20)	73	0.9	1,047	24,314
LPG	5	0.1	73	1,945
Subtotal STREET OPERATIONS	221	2.8	2,818	63,853

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TRAFFIC SIGNS AND MARKERS				
Gasoline	12	0.2	139	3,068
Biodiesel (B-20)	1	0.0	16	367
LPG	0	0.0	3	92
Subtotal TRAFFIC SIGNS AND MARKERS	13	0.2	158	3,526
VEHICLE MAINTENANCE OPERATIONS				
Gasoline	5	0.1	59	1,316
Diesel	2	0.0	21	489
LPG	0	0.0	5	124
Subtotal VEHICLE MAINTENANCE OPERATIONS	0.1		85	1,929
WASTEWATER OPERATIONS				
Gasoline	42	0.5	497	11,008
Diesel	0	0.0	1	29
LPG	0	0.0	1	23
Subtotal WASTEWATER OPERATIONS	43	0.5	499	11,060
WASTEWATER PLANT OPERATE				
Gasoline	26	0.3	303	6,713
Diesel	3	0.0	34	789

LPG	0	0.0	0	12
Subtotal WASTEWATER PLANT OPERATE	29	0.4	338	7,514
WATER OPERATIONS				
Gasoline	80	1.0	936	20,712
Diesel	5	0.1	57	1,319
LPG	0	0.0	1	18
Subtotal WATER OPERATIONS	85	1.1	994	22,049
WATER TREATMNT PLANT OPER				
Gasoline	20	0.3	234	5,176
Diesel	3	0.0	40	914
Subtotal WATER TREATMNT PLANT OPER	23	0.3	274	6,091
Subtotal Vehicle Fleet	1,543	19.6	18,278	408,656

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Streetlights				
Bozeman, Montana				
7th-11th Main-Durston-Vill				
Electricity	25	0.3	155	17,067
Subtotal 7th-11th Main-Durston-Vill	25	0.3	155	17,067
8th- West City Limits				
Electricity	22	0.3	136	7,689
Subtotal 8th- West City Limits	22	0.3	136	7,689
Alley Lamme-Villard				
Electricity	1	0.0	7	361
Subtotal Alley Lamme-Villard	1	0.0	7	361
Babcock S 3rd-S5th				
Electricity	2	0.0	12	722
Subtotal Babcock S 3rd-S5th	2	0.0	12	722
Beall/Durston Rds				
Electricity	3	0.0	20	2,108
Subtotal Beall/Durston Rds	3	0.0	20	2,108
Blackmore Terrace/17th.Durston				
Electricity	3	0.0	17	2,919
Subtotal Blackmore Terrace/17th.Durston		0.0	17	2,919
Cattail 2 Light				
Electricity	8	0.1	48	7,476
Subtotal Cattail 2 Light	8	0.1	48	7,476

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Cattail Creek Lights				
Electricity	8	0.1	48	14,175
Subtotal Cattail Creek Lights	8	0.1	48	14,175
Cleveland St				
Electricity	4	0.1	27	5,446
Subtotal Cleveland St	4	0.1	27	5,446
Cleveland-Lincoln Grand-6th				
Electricity	30	0.4	190	21,359
Subtotal Cleveland-Lincoln Grand-6th	30	0.4	190	21,359
Durston- Vill & 10-11th				
Electricity	2	0.0	10	541
Subtotal Durston- Vill & 10-11th	2	0.0	10	541
Greekway				
Electricity	2	0.0	10	541

Subtotal Greekway	2	0.0	10	541
Harvest Creek Lights Ph6-11				
Electricity	16	0.2	102	16,122
Subtotal Harvest Creek Lights Ph6-1116		0.2	102	16,122
Laurel Glen Street Lights Ph1				
Electricity	8	0.1	48	8,469
Subtotal Laurel Glen Street Lights Ph1		0.1	48	8,469

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Main - N Ida- N Church				
Electricity	14	0.2	85	5,998
Subtotal Main - N Ida- N Church	14	0.2	85	5,998
Main- 4th S 8th Ave				
Electricity	10	0.1	66	4,614
Subtotal Main- 4th S 8th Ave	10	0.1	66	4,614
Mendenhall- Church- 3rd				
Electricity	13	0.2	79	6,699
Subtotal Mendenhall- Church- 3rd	13	0.2	79	6,699
Morwyn Add # 2				
Electricity	1	0.0	3	1,458
Subtotal Morwyn Add # 2	1	0.0	3	1,458
Morwyn Addition #1				
Electricity	3	0.0	17	1,284
Subtotal Morwyn Addition #1	3	0.0	17	1,284
N 7th Main-Oak				
Electricity	18	0.2	113	8,081
Subtotal N 7th Main-Oak	18	0.2	113	8,081
N Wilson Main to Mendenhall				
Electricity	1	0.0	3	378
Subtotal N Wilson Main to Mendenhall	1	0.0	3	378

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
S Wilson Main-Cleveland				
Electricity	10	0.1	60	11,412
Subtotal S Wilson Main-Cleveland	10	0.1	60	11,412
Valley Unit Sundivision				
Electricity	11	0.1	67	11,674
Subtotal Valley Unit Sundivision	11	0.1	67	11,674
West Park Manor 1				
Electricity	6	0.1	40	4,545
Subtotal West Park Manor 1	6	0.1	40	4,545
11th/Mendenhall Bouncing Ball Light				
Electricity	0	0.0	1	115
Subtotal 11th/Mendenhall Bouncing Ball Light		0.0	1	115
1802 N Rouse				
Electricity	1	0.0	3	169
Subtotal 1802 N Rouse	1	0.0	3	169
3925 W Babcock Street Lights				
Electricity	5	0.1	29	484
Subtotal 3925 W Babcock Street Lights	5	0.1	29	484
Alder Creek				
Electricity	6	0.1	35	7,452
Subtotal Alder Creek	6	0.1	35	7,452

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Alley off N Tracy				
Electricity	5	0.1	28	860
Subtotal Alley off N Tracy	5	0.1	28	860
Alley off S Bozeman				
Electricity	3	0.0	20	630
Subtotal Alley off S Bozeman	3	0.0	20	630
Alley off Tracy next to S 23				
Electricity	5	0.1	32	893
Subtotal Alley off Tracy next to S 23	5	0.1	32	893
Allison subdivision				
Electricity	9	0.1	57	3,920
Subtotal Allison subdivision	9	0.1	57	3,920
Babcock Caution Light				
Electricity	0	0.0	1	115
Subtotal Babcock Caution Light	0	0.0	1	115
Baxter Meadows Phase 1				
Electricity	7	0.1	44	12,934
Subtotal Baxter Meadows Phase 1	7	0.1	44	12,934
Baxter Meadows Phase 2				
Electricity	3	0.0	21	5,525
Subtotal Baxter Meadows Phase 2	3	0.0	21	5,525

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Boz Cronicle Rouse/Babcock				
Electricity	0	0.0	2	90
Subtotal Boz Cronicle Rouse/Babcock	0	0.0	2	90
Cattail 3 Light				
Electricity	5	0.1	28	4,966
Subtotal Cattail 3 Light	5	0.1	28	4,966
Cooper/Bogert/Kirk/Lindley				
Electricity	5	0.1	32	4,778
Subtotal Cooper/Bogert/Kirk/Lindley	5	0.1	32	4,778
Corner E Babcock/ S Rouse				
Electricity	3	0.0	18	579
Subtotal Corner E Babcock/ S Rouse	3	0.0	18	579
Corner So15/Babcock				
Electricity	0	0.0	2	90
Subtotal Corner So15/Babcock	0	0.0	2	90
Durston Road				
Electricity	1	0.0	3	127
Subtotal Durston Road	1	0.0	3	127
E Boz Intrchng Trilat Cnt				
Electricity	3	0.0	20	548
Subtotal E Boz Intrchng Trilat Cnt	3	0.0	20	548

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	Equiv CO 2	Equiv CO 2	Energy	Cost

	(tons)	(%)	(MMBtu)	($)
Ferguson Meadows Lighting Distrcit #671				
Electricity	26	0.3	162	12,434
Subtotal Ferguson Meadows Lighting Distrcit #671	0.3	162	12,434	
Harvest Creek Phase 5 lights				
Electricity	2	0.0	13	2,327
Subtotal Harvest Creek Phase 5 lights	2	0.0	13	2,327
Highland/Main Traffic Signal				
Electricity	5	0.1	32	793
Subtotal Highland/Main Traffic Signal	5	0.1	32	793
Kagy Blvd				
Electricity	23	0.3	142	4,039
Subtotal Kagy Blvd	23	0.3	142	4,039
Main/Harrison				
Electricity	33	0.4	208	14,380
Subtotal Main/Harrison	33	0.4	208	14,380
Main/N Bozeman				
Electricity	21	0.3	133	8,731
Subtotal Main/N Bozeman	21	0.3	133	8,731
Meagher/Babcock				
Electricity	2	0.0	12	0
Subtotal Meagher/Babcock	2	0.0	12	0

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Mendenhall Tracy Parking Lot				
Electricity	0	0.0	0	84
Subtotal Mendenhall Tracy Parking Lot	0	0.0	0	84
Mendenhall/Tracy/Black Prking				
Electricity	0	0.0	0	94
Subtotal Mendenhall/Tracy/Black Prking	0	0.0	0	94
Michael Grove & Villard				
Electricity	0	0.0	0	0
Subtotal Michael Grove & Villard	0	0.0	0	0
N 15th & Durston Traffic Signal				
Electricity	7	0.1	43	1,282
Subtotal N 15th & Durston Traffic Signal	0.1	43	1,282	
N 19th/Main- S side Durston City Owned				
Electricity	14	0.2	89	2,716
Subtotal N 19th/Main- S side Durston City Owned	0.2	89	2,716	
N 27 & Oak				
Electricity	1	0.0	8	524
Subtotal N 27 & Oak	1	0.0	8	524
N Alley Bozeman Btwn Main & Mendenhall				
Electricity	4	0.1	26	806
Subtotal N Alley Bozeman Btwn Main & Mendenhall	0.1	26	806	

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
N Main Alley Grand/Rouse				
Electricity	4	0.0	23	1,469
Subtotal N Main Alley Grand/Rouse	4	0.0	23	1,469
NW Corner So 19/Koch				
Electricity	1	0.0	3	132
Subtotal NW Corner So 19/Koch	1	0.0	3	132

Parking Lots				
Electricity	2	0.0	12	578
Subtotal Parking Lots	2	0.0	12	578
S 3rd & Graf St Light				
Electricity	1	0.0	3	448
Subtotal S 3rd & Graf St Light	1	0.0	3	448
S Black-College-Railway				
Electricity	3	0.0	17	1,128
Subtotal S Black-College-Railway	3	0.0	17	1,128
Scoreboard Softball Complex				
Electricity	0	0.0	1	113
Subtotal Scoreboard Softball Complex	0	0.0	1	113
SE Cor Kagy/So 19th				
Electricity	1	0.0	3	132
Subtotal SE Cor Kagy/So 19th	1	0.0	3	132

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
SE corner W Lincoln/So 19th				
Electricity	1	0.0	3	169
Subtotal SE corner W Lincoln/So 19th	1	0.0	3	169
SE Side of Intersection Durston/23rd				
Electricity	13	0.2	81	0
Subtotal SE Side of Intersection Durston/23rd	0.2		81	0
SID 15th/18th Main-Durston				
Electricity	11	0.1	71	12,558
Subtotal SID 15th/18th Main-Durston	11	0.1	71	12,558
St Light Main/Mendenhall				
Electricity	1	0.0	4	0
Subtotal St Light Main/Mendenhall	1	0.0	4	0
Thompson Addition #1				
Electricity	3	0.0	22	6,396
Subtotal Thompson Addition #1	3	0.0	22	6,396
Traffic Light 19th/Durston				
Electricity	6	0.1	40	1,173
Subtotal Traffic Light 19th/Durston	6	0.1	40	1,173
Traffic Signal 19th & Kagy				
Electricity	5	0.1	31	939
Subtotal Traffic Signal 19th & Kagy	5	0.1	31	939

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Traffic Signal Kagy/ S 3rd				
Electricity	5	0.1	32	776
Subtotal Traffic Signal Kagy/ S 3rd	5	0.1	32	776
Traffic Signal Wilson/Babcock				
Electricity	8	0.1	53	1,530
Subtotal Traffic Signal Wilson/Babcock	8	0.1	53	1,530
United Commercial Travelers Bldg				
Electricity	0	0.0	2	128
Subtotal United Commercial Travelers Bldg		0.0	2	128
Valley West Lights PH 1-3				
Electricity	17	0.2	105	19,509
Subtotal Valley West Lights PH 1-3	17	0.2	105	19,509
Valley West Ph 2 Street Lighting				

Electricity	5	0.1	30	5,322
Subtotal Valley West Ph 2 Street Lighting		0.1	30	5,322
Valley West Subdivision Lighting				
Electricity	7	0.1	45	6,160
Subtotal Valley West Subdivision Lighting		0.1	45	6,160
Villard/N 7th flashing light				
Electricity	0	0.0	1	113
Subtotal Villard/N 7th flashing light	0	0.0	1	113

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W Babcock Park Lights				
Electricity	2	0.0	13	1,207
Subtotal W Babcock Park Lights	2	0.0	13	1,207
W Boz Interchng Trilat Cnt				
Electricity	4	0.0	23	666
Subtotal W Boz Interchng Trilat Cnt	4	0.0	23	666
Walton Homestead Streetlights				
Electricity	8	0.1	49	9,307
Subtotal Walton Homestead Streetlights	8	0.1	49	9,307
West Durston Rd Lights				
Electricity	12	0.1	73	3,440
Subtotal West Durston Rd Lights	12	0.1	73	3,440
West Winds Subdivision Lighting				
Electricity	13	0.2	82	15,380
Subtotal West Winds Subdivision Lighting		0.2	82	15,380
White Oak & Babcock Lights				
Electricity	8	0.1	48	0
Subtotal White Oak & Babcock Lights	8	0.1	48	0
Wilson & Olive Traffic Signal				
Electricity	1	0.0	7	288
Subtotal Wilson & Olive Traffic Signal	1	0.0	7	288

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Wilson/Mendenhall Lights				
Electricity	6	0.1	36	886
Subtotal Wilson/Mendenhall Lights	6	0.1	36	886
Subtotal Streetlights	564	7.2	3,525	343,570
Water/Sewage				
Bozeman, Montana				
Baxter Meadow Lift Station				
Electricity	9	0.1	56	1,596
Natural Gas	1	0.0	19	613
Subtotal Baxter Meadow Lift Station	10	0.1	75	2,209
Bonner Ln Water Well				
Electricity	2	0.0	14	470
Subtotal Bonner Ln Water Well	2	0.0	14	470
Bridger Lift Station				
Electricity	1	0.0	7	277
Subtotal Bridger Lift Station	1	0.0	7	277
Cambridge Dr Pump				
Electricity	2	0.0	14	451
Subtotal Cambridge Dr Pump	2	0.0	14	451

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City Landfill Cinderblock Pump				
Electricity	6	0.1	35	1,133
Subtotal City Landfill Cinderblock Pump		0.1	35	1,133
City Water Well				
Electricity	4	0.0	24	0
Subtotal City Water Well	4	0.0	24	0
Landfill New Pump				
Electricity	15	0.2	91	2,218
Subtotal Landfill New Pump	15	0.2	91	2,218
Laurel Glenn Lift Station				
Electricity	0	0.0	0	45
Natural Gas	0	0.0	0	0
Subtotal Laurel Glenn Lift Station	0	0.0	0	45
Lindley Park Pump				
Electricity	9	0.1	54	2,169
Subtotal Lindley Park Pump	9	0.1	54	2,169
Lyman Creek Resevoir				
Electricity	46	0.6	289	8,100
Subtotal Lyman Creek Resevoir	46	0.6	289	8,100
Pear Street Booster Station				
Electricity	65	0.8	409	11,281
Subtotal Pear Street Booster Station	65	0.8	409	11,281

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Perkins Place Pump				
Electricity	8	0.1	48	1,420
Subtotal Perkins Place Pump	8	0.1	48	1,420
Rouse & Tamarak Pump				
Electricity	5	0.1	30	909
Subtotal Rouse & Tamarak Pump	5	0.1	30	909
Sprinkler Sys 11th/Main				
Electricity	0	0.0	0	10
Subtotal Sprinkler Sys 11th/Main	0	0.0	0	10
Waste Water Lift station				
Electricity	3	0.0	20	684
Subtotal Waste Water Lift station	3	0.0	20	684
Water Treatment Plant				
Electricity	199	2.5	1,243	33,355
Natural Gas	251	3.2	4,058	40,205
Subtotal Water Treatment Plant	450	5.7	5,301	73,560
Water Treatment Plant 2				
Electricity	22	0.3	135	3,831
Subtotal Water Treatment Plant 2	22	0.3	135	3,831

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	Equiv CO 2	Equiv CO 2	Energy	Cost

	(tons)	(%)	(MMBtu)	($)
Water Treatment Plant chlorinator bldg				
Electricity	0	0.0	2	142
Subtotal Water Treatment Plant chlorinator bldg		0.0	2	142
WTR Building				
Electricity	16	0.2	102	0
Subtotal WTR Building	16	0.2	102	0
WWTP				
Electricity	1,872	23.8	11,703	258,571
Subtotal WWTP	1,872	23.8	11,703	258,571
WWTP Admin Building				
Electricity	1	0.0	4	0
Natural Gas	73	0.9	1,183	13,530
Subtotal WWTP Admin Building	74	0.9	1,187	13,530
WWTP Longbow Lane Lift Station				
Electricity	3	0.0	17	35
Natural Gas	1	0.0	14	268
Subtotal WWTP Longbow Lane Lift Station		0.0	31	303
WWTP Maintenance Building				
Natural Gas	18	0.2	295	3,280
Subtotal WWTP Maintenance Building	18	0.2	295	3,280

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	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
WWTP Primary Treatment Building				
Natural Gas	19	0.2	315	3,332
Subtotal WWTP Primary Treatment Building		0.2	315	3,332
WWTP Yard Light Power Pole				
Electricity	0	0.0	3	145
Subtotal WWTP Yard Light Power Pole	0	0.0	3	145
Yard Light Sediment Basin House				
Electricity	0	0.0	3	161
Subtotal Yard Light Sediment Basin House		0.0	3	161
Subtotal Water/Sewage	2,652	33.7	20,189	388,231
Waste				
Bozeman, Montana				
Untitled		Disposal Method - Managed Landfill		
Paper Products	-82	-1.0	7,671	
Food Waste	16	0.2	2,624	
Plant Debris	-37	-0.5	2,019	
Wood/Textiles	-15	-0.2	807	
All Other Waste	0	0.0	7,065	
Subtotal Untitled	-119	-1.5	20,187	

This report has been generated for Bozeman, Montana using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

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Government Greenhouse Gas Emissions in 2006

Detailed Report

	Equiv CO 2 (tons)	Equiv CO 2 (%)	Energy (MMBtu)	Cost ($)
Subtotal Waste	-119	-1.5		20,187
Total	7,866	100.0	79,551	1,674,160

This report has been generated for Bozeman, Montana using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Raw Data: Energy Usage for City of Bozeman Municipal Operations for the 2000 and 2006

	Northwestern Energy Account Numbers 2007 Pulled from online accounts Used this sheet for inputting data					Montana Power 2000 Pulled from AP Claims 1/2/01- 1/23/01 Warrant #/19957/20067/20068/20076/20247/20260/20452/20458/20471/20471/20580//20625/20638/20766/20774							
	Account Number		Dept	Building	Address	KWH Usage 2006	KWH Usage 2000	Cost 2006	Cost 2000	DKT 2006	DKT 2000	Cost 2006	Cost 2000
1	1494317-9	w	#	Water Treatment Plant Operations	10825 Hyalite Canyon Rd WTR Bldg	29,857.00							
2	1136433-8	b	#	Story Mansion Apartments	111 W Harrison	2,517.00		$ 273.00		76.00		$ 819.00	
3	0725388-3	b	#	Cemetary Operations	1110 E Curtiss St Shed	2,136.00	7.00	$ 286.00				$ -	
4	0725433-7	l	#	Street Lighting	11th/Mendenhall Bouncing Ball Light	300.00	223.00	$ 115.00				$ -	
5	0100410-0	w	#	Water Operations	1202 Pear Street	119,920.00	17,491.00	$ 11,281.00				$ -	
6	0100529-7	b	#	Swim Center	1211 W Main	448,160.00		$ 34,328.00			5,243.00	$ -	
7	1337778-3	l	#	Street Lighting	1215 Durston Rd Light	960.00		$ 126.50					
8	1433945-1	l	#	Street Lighting	150 W of Meagher & Babcock Lights	3,399.00							
9	0724953-5	b	#	Josephine Park	1630 Kenyon Dr Water	17,470.00	2,202.00	$ 1,723.00				$ -	
10	0725516-9	l	#	Street Lighting	1802 N Rouse	960.00	960.00	$ 169.00	$ 122.00			$ -	
11	0723351-3	b	#	Lower Yard Water Operations	1812 N Rouse	8,627.00	5,405.00	$ 888.00		487.40	474.40	$ 4,441.00	
12	0723351-3	b	#	Lower Yard Unmetered Lights	1812 N Rouse		492.00		$ 102.00				
13	1074157-7	b	#	Lower Yard Wastewater Operations	1812 N Rouse	23,577.00		$ 2,266.00				$ -	

14	1316061-9	b	#	Lower Yard Shops Complex	1812 N Rouse	10,135.00							
15	0721640-1	b	#	Lower Yard Fire Operational Readiness	1812 N Rouse Fire Dept Training Bldg					12.00	4.40	$ 353.00	
	Total					42,339.00	5,897.00	3,154.00	102.00	499.40	478.80	4,794.00	
16	0711528-0	b	#	Professional Building	20 E Olive St	405,280.00	239,800.00	$ 29,386.00		691.00	1,366.00	$ 7,422.00	
17	0711528-0	b	#	Unmetered Lights	20 E Olive St		492.00		$ 98.00				
						405,280.00	240,292.00	29,386.00	98.00	691.00	1,366.00	7,422.00	-
18	1564375-2	b	#	Multi-Family Dwelling	214 E Lamme	5,920.00				105.90			
19	1564377-8	b	#	Multi-Family Dwelling	214 E Lamme St #1	4,683.00				140.00			
20	0709659-7	b	#	Solid Waste Diposal Operations	2143 S Story Mill Rd	57,120.00	15,131.00	$ 5,955.00				$ -	
21	0100399-5	b	#	Old Library	220 E Lamme	177,480.00	230,040.00	$ 14,080.00				$ -	
22	0722065-0	b	#	Old Library	220 E Lamme					1,342.00	623.20	$ 13,748.00	
						177,480.00	230,040.00	14,080.00	-	1,342.00	623.20	13,748.00	-
23	0724445-2	w	#	WWTP Yard Light & Power Pole	2245 Springhill Rd	864.00	7,036.00	$ 145.00			27.20	$ -	
24	0724445-2	w	#	WWTP Yard Light & Power Pole	2245 Springhill Rd Unmetered Lights		864.00		$ 119.00				
						864.00	7,900.00	145.00	119.00	-	27.20	-	-
25	0724448-6	w	#	WWTP Admin Bldg	255 Moss Bridge Road	1,298.70		$ -		1,183.20	483.80	$ 13,530.00	

26	0100527-1	w	#	WWTP	255 Moss Bridge Road	3,429,120.00	2,817,560.00	$ 258,571.00				$ -	
27	0724446-0	w	#	WWTP PRIMARY TRTMT BLDG	255 Moss Bridge Road					315.00	235.30	$ 3,332.00	
28	0724447-8	w	#	WWTP MAINTENANCE BLDG	255 Moss Bridge Road					295.00	292.80	$ 3,280.00	
						3,430,418.70	2,817,560.00	258,571.00	-	1,793.20	1,011.90	20,142.00	-
29	0724290-2	b	#	Jarrett Park	2708 Westridge Dr	1,434.00	942.00	$ 214.00				$ -	
30	0722821-6	b	#	Park	325 S Church	17,774.00	29,520.00	$ 1,751.00					
31	0722822-4	b	#	Park	325 S Church Pool	11,009.00		$ 1,052.00		567.00		$ 5,640.00	
32	0725312-3	b	#	Cemetary Operations	340 Golf Way	6,164.00	7,708.00	$ 664.00		168.00	146.80	$ 1,836.00	
33	0720914-1	b	#	Park Operations	3626 Toole Street	5,122.00	4,497.00	$ 552.00				$ -	
34	1168745-6	w	#	Baxter Meadows Lift Station	3698 Cattail St	16,356.00		$ 1,596.00		19.00		$ 613.00	
35	1461275-5	l	#	Street Lighting	3925 W Babcock St # Lights	3,290.00							
36	1461275-8	l	#	Street Lighting	3925 W Babcock St # Lights	3,290.00							
37	1461275-8	l	#	Street Lighting	3925 W Babcock St # Lights Unmetered	1,920.00		$ 484.00					
	Total					8,500.00	-	484.00	-	-	-	-	-
38	0100526-3	b	#	Fire Station 2	410 S 19th Ave	50,816.00	38,318.00	$ 5,008.00				$ -	
39	0722091-6	b	#	Fire Station 2	410 S 19th Ave					392.00	468.30	$ 3,464.00	
						50,816.00	38,318.00	5,008.00	-	392.00	468.30	3,464.00	-
40	0100528-9	b	#	City Hall/ Fire Station 1	411 E Main	311,000.00	284,420.00	$ 25,389.00				$ -	

41	0722066-8	b	#	City Hall/ Fire Station 1	411 E Main					7,285.00	12,713.00	$ 16,924.00	
						311,000.00	284,420.00	25,389.00	-	7,285.00	12,713.00	16,924.00	-
42	1234518-7	w	#	Water Treatment Plant	4330 Sourdough Rd ByPass	39,643.00		$ 3,831.00				$ -	
	0724804-0	w	#	Water Plant	Chlorinator Bldg Sourdough Goldstein	603.00	8,506.00	$ 142.00				$ -	
43	0778556-1	w	#	Laurel Glen Lift Station	5485 Saxon Way	-	-	$ 45.00				$ -	
44	0720977-8	w	#	Park Operations	502 Cambridge Dr #Pump	4,060.00	2,152.00	$ 451.00				$ -	
45	0725787-6	w	#	Street Operations	541 Perkins Place Pump	14,197.00	12,804.00	$ 1,420.00				$ -	
46	1456520-4	b	#	New Library	626 E Main	498,080.00		$ 67,582.52		1,674.90			
47	0765348-8	b	#	Bozeman Pond Restroom	670 Fowler Ave	4,987.00	5,658.00	$ 542.00		68.00	67.00	$ 862.00	
48	0100462-1	w	#	Water Treatment Plant	7022 Sourdough Cyn Rd	363,280.00	337,000.00	$ 33,187.00				$ -	
49	0724805-7	w	#	WTP Operations	7022 Sourdough Cyn Rd			$ -		3,970.00	3,157.40	$ 39,274.00	
50	0724806-5	w	#	WTP Operations	7022 Sourdough Cyn Rd			$ -		88.00	51.98	$ 931.00	
51	0724808-1	w	#	WTP Operations	7022 Sourdough Cyn Rd	886.00	103.00	$ 168.00				$ -	
						364,166.00	337,103.00	33,355.00	-	4,058.00	3,209.38	40,205.00	-
52	0724288-6	b	#	Southside Park	706 S 5th	24,661.00	27,265.00	$ 2,406.00				$ -	
53	1258429-8	b	#	Park Operations	720 N 5th St #IRR	786.00		$ 107.00					
54	0724341-3	b	#	Park Operations	800 N Grand BallPk	3,217.00	2,176.00	$ 373.00				$ -	
55	0100400-1	b	#	Senior Center	807 N Tracy	240,120.00	240,760.00	$ 21,954.00				$ -	

56	0722067-6	b	#	Senior Center	807 N Tracy		492.00		$ 135.00	890.00	1,502.70	$ 8,962.00	
						240,120.00	241,252.00	21,954.00	135.00	890.00	1,502.70	8,962.00	-
57	0724387-6	b	#	Park Operations	807 N Tracy Centennial Park	2,554.00	1,309.00	$ 313.00				$ -	
58	1136409-8	b	#	Story Mansion	811 S Wilson	520.00		$ 105.00		549.00		$ 5,424.00	
59	0100395-3	b	#	Shop Complex	814 N Bozeman	109,800.00	73,560.00	$ 8,852.00				$ -	
60	0723345-5	b	#	Wastewater Operations	814 N Bozeman	23,837.00	14,201.00	$ 2,312.00		17.00	33.90	$ 417.00	
61	0723347-1	b	#	Water Operations	814 N Bozeman Copper Shed	106.00	57.00	$ 95.00				$ -	
62	0723344-8	b	#	Shops Complex	814 N Bozeman Green Storage Bldg					638.00	744.20	$ 6,447.00	
63	0723346-3	b	#	Wastewater Operations	814 N Bozeman		3,648.00	$ -	$ 472.00	5,319.00	2,697.80	$ 15,383.00	
64	0100393-8	b	#	Parks Operation	814 N Bozeman	154,480.00	126,720.00	$ 14,226.00		-		$ -	
	Total			Shops Complex		288,223.00	218,186.00	25,485.00	472.00	5,974.00	3,475.90	22,247.00	
65	1328956-6	w	#	Bridger Lift Station	99 Commercial Drive	2,037.00		$ 277.00				$ -	
	1343390-9	l	#	Street Lighting	Alder Creek PH 2& 2 Lighting SILD #681	10,332.00		$ 7,452.00					
66	0994100-6	l	#	Street Lighting	Alley off N Tracy next to MTR for E Main St	8,295.00		$ 860.00				$ -	
67	1051725-8	l	#	Street Lighting	Alley off S Bozeman btwn Main & Babcock	5,829.00		$ 630.00				$ -	
68	0993949-7	l	#	Street Lighting	Alley off Tracy next to S 23	9,418.00		$ 893.00				$ -	
69	0974264-4	l	#	Street Lighting	Allison Subd Dist 670	16,632.00		$ 3,920.00				$ -	
70	0725432-9	l	#	Traffic Signal	Babcock Caution Light Behind Wilson School	309.00	303.00	$ 115.00				$ -	
71	1553135-3	l	#	Street Lighting	Baxter Meadows Subd Ph2 Streetlights SILD 685	6,060.00		$ 5,525.00					
72	1553155-1	l	#	Street Lighting	Baxter Meadows Subdivision Ph 1 ST Lites 680	12,900.00		$ 12,934.00					

73	0724022-9	b	#	Park Operations	Bealle Park 409 N Bozeman Ave	1,812.00	1,812.00	$ 245.00	$ 161.00			$ -	
74	0100460-5	b	#	Park Operations	Bogert Park Pavillion & Bandstand	25,147.00	39,596.00	$ 2,912.00				$ -	
75	0721447-1	w	#	Street Operations	Bonner Ln Water Well	4,090.00	4,121.00	$ 470.00		-		$ -	
76	0725523-5	l	#	Street Lighting	Boz Cronicle Rouse/Babcock	492.00	492.00	$ 90.00	$ 66.00			$ -	
77	1334448-6	b	#	Park Operations	Bronken Memorial Park	2,064.00		$ 311.14					
78	1592431-9	b	#	Cemetary Operations	Buttonwood & Ellis Veterans Wall								
80	0724289-4	b	#	Park Operations	Cinderblock Bldg Kirkpark restroom	7,580.00	7,674.00	$ 1,393.00				$ -	
81	0725194-5	b	#	Operations	City Landfill Cinderblock Pond Pump	10,240.00	26,731.00	$ 1,133.00				$ -	
82	0725194-5	b	#	Operations	City Landfill Cinderblock Pond Pump Unmetered Lights		864.00		$ 114.00				
										-	-	-	-
83	0724021-1	b	#	Park Operations	Cooper Park	2,312.00	1,685.00	$ 180.00				$ -	
84	0725514-4	l	#	Street Lighting	Cooper/Bogert/Kirk/Lindley	9,300.00	9,300.00	$ 4,778.00	$ 4,076.00			$ -	
85	0725536-7	l	#	Street Lighting	Corner E Babcock/ S Rouse	5,317.00	8,913.00	$ 579.00				$ -	
86	0725531-8	l	#	Street Lighting	Corner So15/Babcock	492.00	492.00	$ 90.00	$ 66.00			$ -	
87	0937862-1	b	#	Parks Operations Adam Bronken Complex	Cottonwood & Durston	11,524.00		$ 1,430.00				$ -	
88	0725434-5	l	#	Street Lighting	E Boz Intrchng Trilat Cnt	5,832.00	1,944.00	$ 548.00	$ 294.00			$ -	
89	0724322-3	b	#	Park Operations	East Gallatin Park Manley Rd	2,891.00	1,878.00	$ 428.00				$ -	
90	0724337-1	b	#	Park Operations	Equip Shack Crnr Mason/Black	3,596.00	3,788.00	$ 423.00				$ -	
91	0985747-5	l	#	Street Lighting	Ferguson Meadows Lighting Distrcit #671	47,520.00		$ 12,434.00				$ -	
92	0724036-9	b	#	Park Operations	Haggerty Lane Ball Fields	51,893.00	49,399.00	$ 17,099.00		113.00	193.50	$ 1,291.00	

93	0723092-3	l	#	Street Lighting	Highland/Main Traffic Signal	9,494.00	10,173.00	$ 793.00				$ -	
94	0725436-0	l	#	Street Lighting	Kagy Blvd	41,580.00	41,580.00	$ 4,039.00	$ 2,218.00			$ -	
95	0725250-5	w	#	Operations	Landfill New Pump Storymill Rd	26,800.00	23,380.00	$ 2,218.00				$ -	
96	0725227-3	b	#	Operations	Landfill Shop 2143 Story Mill Rd	517.00	-	$ 133.00				$ -	
									-	-	-	-	-
97	1566670-4	w	#	WWTP Longbow Lane Lift Station	Laurel Glen/5485 Saxon Way	4,912.00		$ 35.00		14.00		$ 268.00	
98	0724037-7	b	#	Park Operations	Lindely Park W of Picnic	3,980.00	2,960.00	$ 458.00				$ -	
99	0724338-9	b	#	Park Operations	Lindley Park Bowl SweetPea	960.00	1,240.00	$ 472.00				$ -	
100	0724281-1	w	#	Park Operations	Lindley Park Pump	15,927.00	10,688.00	$ 2,169.00				$ -	
101	0722092-4	b	#	Lindley	Lindley Park Rec1106 E Curtiss St	5,566.00	9,683.00	$ 605.00		184.00	224.00	$ 2,016.00	
102	1113063-0	w	#	Water Treatment Plant	Lyman Creek Resevoir	84,817.00		$ 8,100.00				$ -	
103	0724858-6	w	#	Water Treatment Plant	Lyman Creek Resevoir chlorinator house		-						
104	0724857-8	w	#	Water Treatment Plant	Lyman Creek resevoir, Cinder Blk Bldg		22,906.00						
105	0725519-3	l	#	Street Lighting	Main/Harrison	61,008.00	61,008.00	$ 14,380.00	$ 11,099.00			$ -	
106	0725520-1	l	#	Street Lighting	Main/N Bozeman	39,072.00	39,072.00	$ 8,731.00	$ 6,664.00			$ -	
107	0704423-3	w	#	Water operations	Manley Rd	-		$ -				$ -	
108	0725431-1	l	#	Street Lighting	Mendenhall Tracy Parking Lot	-	-	$ 84.00				$ -	
109	0725430-3	l	#	Street Lighting	Mendenhall/Tracy/Black Prking	58.00	58.00	$ 94.00				$ -	
110	1205402-9	b	#	Park Operations	Michael Grove & Villard	24.00							
111	1216846-4	l	#	Traffic Signal	N 15th & Durston Traffic Signal	12,720.00		$ 1,282.00				$ -	
112	0725731-4	l	#	Street Lighting	N 19th/Main- S side Durston City Owned	26,196.00	26,196.00	$ 2,716.00	$ 1,554.00			$ -	

113	1174308-5	l	#	Street Lighting	N 27 & Oak	2,376.00		$ 524.00				$ -	
114	1051695-3	l	#	Street Lighting	N Alley Bozeman Btwn Main & Mendenhall	7,708.00		$ 806.00				$ -	
115	0725518-5	l	#	Street Lighting	N Main Alley Grand/Rouse	6,612.00	6,612.00	$ 1,469.00	$ 1,121.00			$ -	
116	0724987-3	w	#	Street Operations	Near 410 E Aspen City Water Well	7,090.00	6,322.00						
117	0725532-6	l	#	Street Lighting	NW Corner So 19/Koch	960.00	960.00	$ 132.00	$ 87.00			$ -	
118	0725521-9	l	#	Street Lighting	Parking Lots	3,396.00	3,396.00	$ 578.00	$ 411.00			$ -	
119	0725786-8	w	#	Street Operations	Rouse & Tamarak Pump	8,755.00	7,823.00	$ 909.00				$ -	
120	1454143-7	l	#	Street Lighting	S 3rd & Graf St Light	960.00		$ 448.00					
121	0851549-6	l	#	Parks Operations	Scoreboard Softball Complex	300.00	35.00	$ 113.00				$ -	
122	0725539-1	l	#	Street Lighting	SE Cor Kagy/So 19th	960.00	960.00	$ 132.00	$ 87.00			$ -	
123	0725528-4	l	#	Street Lighting	SE corner W Lincoln/So 19th	960.00	960.00	$ 169.00	$ 122.00			$ -	
124	1544263-5	l	#	Street Lighting	SE Side of Intersection Durston/23rd	23,731.00							
125	1119793-6	l	#	Street Lighting	SID # 673 Oliver St-Harvest Creek Phase 5 lights	3,936.00		$ 2,327.00				$ -	
126	0725697-7	l	#	Street Lighting	SID 15th/18th Main-Durston	20,664.00	20,664.00	$ 12,558.00	$ 10,572.00			$ -	
127	0725700-9	l	#	Street Lighting	SID 28 Cleveland St	8,004.00	8,004.00	$ 5,446.00	$ 4,744.00			$ -	
128	0725525-0	l	#	Street Lighting	SID 300 N Wilson Main to Mendenhall	984.00	984.00	$ 378.00	$ 313.00			$ -	
129	0725707-4	l	#	Street Lighting	SID 338 Mendenhall-Church- 3rd	23,040.00	23,040.00	$ 6,699.00	$ 5,353.00			$ -	
130	0725706-6	l	#	Street Lighting	SID 361 Main - N Ida- N Church	24,960.00	34,560.00	$ 5,998.00	$ 6,418.00			$ -	
131	0725713-2	l	#	Street Lighting	SID 362 Main- 4th S 8th Ave	19,200.00	19,200.00	$ 4,614.00	$ 3,566.00			$ -	
132	0725708-2	l	#	Street Lighting	SID 400 Morwyn Add # 2	984.00	492.00	$ 1,458.00	$ 1,136.00			$ -	
133	0725714-0	l	#	Street Lighting	SID 420 Morwyn Addition #1	4,920.00	4,920.00	$ 1,284.00	$ 1,005.00			$ -	
134	0725709-0	l	#	Street Lighting	SID 423 S Black-College-Railway	4,920.00	4,920.00	$ 1,128.00	$ 865.00			$ -	
135	0725698-5	l	#	Street Lighting	SID 453 West Park Manor 1	11,808.00	11,808.00	$ 4,545.00	$ 3,764.00			$ -	
136	0725710-8	l	#	Street Lighting	SID 459 7th-11th Main-Durston-Vill	45,492.00	45,492.00	$ 17,067.00	$ 14,122.00			$ -	
137	0725711-6	l	#	Street Lighting	SID 460 N 7th Main-Oak	33,156.00	33,156.00	$ 8,081.00	$ 6,262.00			$ -	

138	0725695-1	l	#	Street Lighting	SID 461 Blackmore Terrace/17th.Durston	4,920.00	4,920.00	$ 2,919.00	$ 2,518.00			$ -	
139	0725696-9	l	#	Street Lighting	Sid 462 Beall/Durston Rds	5,904.00	5,904.00	$ 2,108.00	$ 1,735.00			$ -	
140	0725704-1	l	#	Street Lighting	SID 473 8th- West City Limits	39,888.00	39,888.00	$ 7,689.00	$ 5,673.00			$ -	
141	0725712-4	l	#	Street Lighting	SID 480 Cleveland-Lincoln Grand-6th	55,596.00	55,596.00	$ 21,359.00	$ 17,722.00			$ -	
142	0725691-0	l	#	Street Lighting	SID 484 Greekway	2,952.00	2,952.00	$ 1,134.00	$ 941.00			$ -	
143	0725575-5	l	#	Street Lighting	SID 556 Durston- Vill & 10-11th	2,952.00	2,088.00	$ 541.00	$ 354.00			$ -	
144	0725715-7	l	#	Street Lighting	SID 572 Alley Lamme-Villard	1,968.00	1,392.00	$ 361.00	$ 236.00			$ -	
145	0725702-5	l	#	Street Lighting	SID 618 Babcock S 3rd-S5th	3,396.00	3,396.00	$ 722.00	$ 545.00			$ -	
146	0725688-6	l	#	Street Lighting	SID 637 Valley Unit Sundivision	19,680.00	19,680.00	$ 11,674.00	$ 10,070.00			$ -	
147	0725701-7	l	#	Street Lighting	SID S Wilson Main-Cleveland	17,628.00	18,120.00	$ 11,412.00	$ 10,068.00			$ -	
148	1359359-5	l	#	Street Lighting	SID682 Laurel Glen Street Lights Ph1	14,184.00		$ 8,469.00					
149	0724292-8	l	#	Park Operations	Signal Lights Main & 19th	-	1.00	$ 54.58				$ -	
150	1590758-7	l	#	Street Lighting	SILD #690 Cattail 2 Light	14,088.00		$ 7,476.00					
151	1590751-2	l	#	Street Lighting	SILD #690 Cattail 3 Light	8,280.00		$ 4,966.00					
152	1534671-1	l	#	Street Lighting	SILD 687 Harvest Creek Lights Ph6-11	29,988.00		$ 16,122.00					
153	1110754-7	l	#	Street Lighting	SLD #672 Cattail Creek Lights	14,150.00		$ 14,175.00				$ -	
154	0724035-1	w	#	Park Operations	Sprinkler Sys 11th/Main	1.00	1.00	$ 9.55				$ -	
155	0721071-9	l	#	Street Lighting	St Light Main/Mendenhall	1,040.00	960.00		$ 265.00			$ -	
156	0724327-2		#	Park Operations	Kirk Park 1 Minof Gibsons	-	28.00	$ 84.00				$ -	
157	0725007-9	w	#	Waste water operations lift stations	SW of sunrise campground 439 hospitality way	5,678.00	4,319.00	$ 684.00				$ -	
158	0725526-8	l	#	Street Lighting	Thompson Addition #1	6,396.00	3,245.00	$ 6,396.00	$ 2,767.00			$ -	
159	0725541-7	l	#	Traffic Signal	Traffic Light 19th/Durston	11,754.00	14,593.00	$ 1,173.00				$ -	
160	1013266-0	l	#	Traffic Signal	Traffic Signal 19th & Kagy	9,099.00		$ 939.00				$ -	
161	0725542-5	l	#	Traffic Signal	Traffic Signal Kagy/ S 3rd	9,300.00	7,543.00	$ 776.00				$ -	
162	0725513-6	l	#	Traffic Signal	Traffic Signal Wilson/Babcock	15,425.00	13,879.00	$ 1,530.00				$ -	

163	0725522-7	l	#	Street Lighting	United Commercial Travelers Bldg	492.00	492.00	$ 128.00	$ 101.00			$ -	
164	1553102-3	l	#	Street Lighting	Valley West Lights PH 1-3 SILD #688	30,864.00		$ 19,509.00					
165	1549671-4	l	#	Street Lighting	Valley West Ph 2 Street Lighting	8,880.00		$ 5,322.00					
166	1549660-7	l	#	Street Lighting	Valley West Subdivision Lighting	13,320.00		$ 6,160.00					
167	0721193-1	l	#	Street Lighting	Villard/N 7th flashing light	293.00	306.00	$ 113.00				$ -	
168	0724363-7		#	Park Operations	W Babcock Park		6,248.00						
169	0724364-5	l	#	Park Operations	W Babcock Park Lights	3,936.00	3,938.00	$ 1,207.00	$ 991.00			$ -	
170	0725435-2	l	#	Street Lighting	W Boz Interchng Trilat Cnt	6,720.00	6,720.00	$ 666.00	$ 370.00			$ -	
171	1351629-9	l	#	Street Lighting	Walton Homestead Streetlights SILD 679	14,268.00		$ 9,307.00					
172	1540737-2	l	#	Street Lighting	West Durston Rd Lights	21,248.00		$ 3,440.00					
173	1520018-1	l	#	Street Lighting	West Winds Subdivision Lighting SILD 691	24,168.00		$ 15,380.00					
174	1433980-8	l	#	Street Lighting	White Oak & Babcock Lights	14,144.00							
175	1265338-2	l	#	Traffic Signal	Wilson & Olive Traffic Signal	2,140.00		$ 288.00				$ -	
176	0723091-5	l	#	Street Lighting	Wilson/Mendenhall Lights	10,653.00	10,633.00	$ 886.00				$ -	
177	0724801-6	w	#	WTP Operations	Yard Light Sediment Basin House	864.00	864.00	$ 161.00	$ 118.00			$ -	
	Totals					13,292,660.40	9,850,437.00	$ 1,357,086.29	$ 142,708.00	49,528.00	55,627.06	$ 294,585.00	-