Section 8 – Technical Support Appendices

Appendix 8.I **Intergovernmental Agreements**

There are currently no wastewater-related intergovernmental agreements for the City of Loveland.

Section 8 – Technical Support Appendices

Appendix 8.J **User Charge Study Analysis**

The City completed the Water and Wastewater Cost-of-Service Study and Rate Design, and Water and Wastewater Impact Fee Study in 2008. It is enclosed.

BROWN AND CALDWELL

BUSINESS CONSULTING PRACTICE

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Water and Wastewater Cost-of-Service Study and Rate Design, and Water and Wastewater Impact Fee Study

City of Loveland

200 N. Wilson Avenue

Loveland, CO 80537

February 29, 2008

Jim Lees

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Acronyms

AWWA	American Water Works Association
AWWARF	American Water Works Association Research Foundation
BOD	biochemical oxygen demand
City	City of Loveland
I&I	inflow and infiltration
lbs	pounds
MFE	multi-family equivalence
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
O&M	operations and maintenance
SFE	single-family equivalents
SIF	System Impact Fees
Study	cost-of-service and rate design study
T&D	transmission and distribution
TSS	total suspended solids
WEF	Water Environment Federation
WQC	Winter Quarter Consumption
WWTP	wastewater treatment plant

SECTION 1: EXECUTIVE SUMMARY

In June 2007, the City of Loveland (City) engaged Brown and Caldwell to study the City's water and wastewater utility costs and develop recommendations for adjusting the rates to reflect the City's costs of service and equitably allocate costs among the various classes of customers. This report summarizes the procedures utilized as well as the findings and recommendations of the cost-of-service and rate design study (Study), the results of which are summarized in Tables 1-1 and 1-2.

Brown and Caldwell used standard water and wastewater ratemaking practices to calculate the proposed rates as described by the American Water Works Association (AWWA) and the Water Environment Federation (WEF), respectively. The AWWA and WEF standards are very similar and include the following steps:

1. Determine the revenue requirements for a specified annual period referred to as a *test year*. Revenue requirements are defined as the amount of money the water and wastewater funds must recover from the rates charged to customers in order to meet all of the funds' operating and capital expenditures anticipated for the test year. The revenue requirements are described in more detail in Section 2 of this report.
2. Allocate the revenue requirements to water and wastewater customer classes. Following standard procedures, the revenue requirements of the water and wastewater systems are allocated to specific customer classes based on how the various classes actually use the water and wastewater systems. The customer classes and the demand characteristics of each class are described in Section 3 of the report; the allocation of the revenue requirements to those classes is described in Section 4.
3. Determine rates for service. The rates are based on the allocated costs of service for each customer class, meaning that the recommended rates for a given class reflect the cost of serving that class. The recommended rates are presented at Section 5 of the report.

In addition to the water and wastewater rates, the City also asked Brown and Caldwell to review its methodology for assessing System Impact Fees (SIFs) and to recommend a method for assessing those fees to "mixed-use" developments, such as the one currently contemplated for Grand Station.

Recommendations pertaining to the City's rates and SIFs are summarized in the following subsections.

1.1 Recommended Water and Wastewater Rates

The recommended water rates include new classes of service that are not technically part of the City's existing rate schedule. Although the City has many multi-family customers (e.g., condominiums, apartments), it currently charges those customers the same rate, for the most part, as residential customers. The recommended rates include a specific rate for multi-family customers. The City also does not currently have a rate specifically for irrigation customers (connections that are used only for the purposes of outdoor irrigation). The Study provides a recommended rate for irrigation connections and identifies irrigation as a separate customer class. In addition, Brown and Caldwell recommends separating the industrial customers from the rest of the existing commercial class and has provided a recommended rate that would apply to industrial customers.

In all, Brown and Caldwell identified five customer classes:

- Single-Family Residential
- Multi-Family Residential
- Commercial
- Industrial
- Irrigation

The City provides service both inside and outside of its corporate boundaries, with the rates for outside-city service assessed a 50 percent markup over the inside-city rates. The recommended rates for the City's water system are provided in Table 1-1.

Table 1-1.
Water Rates

Current Water Rates - Inside-City Customers								
	Base Monthly Meter Charge by Size							Use Fee Per
Customer Class	3/4"	1"	1 1/2"	2"	3"	4"	6"	1,000 Gallons
Single-Family Residential	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.60
Multi-Family Residential	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.60
Commercial	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.36
Irrigation	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.60
Industrial	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.21

Recommended Water Rates - Inside-City Customers								
	Base Monthly Meter Charge by Size							Use Fee Per
Customer Class	3/4"	1"	1 1/2"	2"	3"	4"	6"	1,000 Gallons
Single-Family Residential	$4.16	$4.90	$5.64	$7.68	$22.67	$28.22	$41.18	$1.55
Multi-Family Residential	$8.52	$9.26	$10.00	$12.04	$27.03	$32.58	$45.53	$1.44
Commercial	$4.16	$4.90	$5.64	$7.68	$22.67	$28.22	$41.18	$1.50
Irrigation	$4.16	$4.90	$5.64	$7.68	$22.67	$28.22	$41.18	$1.85
Industrial	$4.16	$4.90	$5.64	$7.68	$22.67	$28.22	$41.18	$1.53

Note:

1. The City's current water rate structure includes a 1 1/4" meter size category. Based on the most recent meter counts, one such meter exists within the Multi-Family class. Rates for this meter size were not included in this Study and therefore were not included in the current and proposed tables presented above.

2. Rates for outside-city customers, which are not shown here, are calculated at 150 percent of inside-city rates.

The wastewater rates include recommendations for additional customer classes, as well as a recommendation for changing the way in which extra-strength sewer customers are charged for contributions to the sewer system in excess of the normal domestic strength loads. As with the water rates, Brown and Caldwell recommends a specific multi-family class and an industrial class. The most significant recommendation for the wastewater rates, however, is the recommendation to assess extra-strength surcharges on a per-pound basis rather than as a function of estimated sewer flows. The wastewater rates include recommendations for five customer classes:

- Single-Family Residential
- Multi-Family Residential
- Commercial
- Industrial
- Extra-Strength

As with the water system, the City also provides some wastewater services outside of its corporate boundaries. The City charges a 50 percent markup of the inside-city rate for all wastewater service provided outside the City's limits. The recommended rates for the wastewater system are provided in Table 1-2.

Table 1-2.
Wastewater Rates

Customer Class and Description	Current Inside-City Rate	Recommended Inside-City Rate
Single-Family Residential (20245 customers)		
Monthly Flat Rate	$20.69	$17.67
Monthly Metered Rate		
Monthly Base Charge	$5.61	$5.63
Volume Charge per 1,000 Gallons	$2.71	$2.60
Multi-Family Residential (6503 customers)		
Monthly Flat Rate - Per Dwelling Unit	$19.53	$14.22
Monthly Metered Rate		
Monthly Base Charge - Per Dwelling Unit	$5.61	$4.83
Volume Charge per 1,000 Gallons	$2.71	$2.60
Commercial (1053 customers)		
Monthly Flat Rate	$113.59	$115.25
Monthly Metered Rate		
Monthly Base Charge	$5.61	$8.00
Volume Charge per 1,000 Gallons	$2.71	$3.21
Industrial (4 customers)		
Monthly Metered Rate		
Monthly Base Charge	$5.61	$8.00
Volume Charge per 1,000 Gallons	$2.71	$3.36
Extra-Strength Surcharge (approx. 275 customers)		
BOD Charge per 1,000 Gallons	$0.002002	n/a
TSS Charge per 1,000 Gallons	$0.001062	n/a
BOD Charge per Pound (In Excess of Domestic Load)	n/a	$0.32
TSS Charge per Pound (In Excess of Domestic Load)	n/a	$0.17

Note: Rates for outside-city customers, which are not shown here, are calculated at 150 percent of inside-city rates.

1.2 System Impact Fees

Brown and Caldwell reviewed the City's methodology for calculating SIFs and, as part of our review, developed a recommended approach for defining mixed-use development for the purposes of assessing the SIF to such developments in the future. Although the City's approach to calculating SIFs is generally sound, the City may wish to address some considerations to promote a more consistent approach in the future:

- It is appropriate to use an index of historical investment in utility plant as the basis for the plant-in-service. However, the City is using an index value in some cases (for some of the asset types listed) while using an engineer's estimate of replacement value in others. The two should produce consistent results, but that depends on the engineering approach to calculating replacement value. A more consistent approach would be to always use the index value.
- Including SIF cash as part of the basis for the fee is a technique that has been used in Colorado before, but is not one that Brown and Caldwell recommends. Under the equity approach, the rational nexus for recovering the SIF is to recover a proportionate share of the historical costs incurred by the City for the construction of a utility plant with sufficient capacity to serve new connections in the present. The SIF cash on hand is only an accounting of the City's collection of those payments and does not reflect investment in facilities directly (i.e., it is the accumulated recovery of past investments).
- The single-family equivalents (SFE) used in the City's calculation is the total existing SFE rather than the total SFE that could be served based on the investment in the utility plant-in-service. Using an SFE based on the total capacity of the plant-in-service will produce a more consistent SIF over time.

Brown and Caldwell recommends that mixed-use developments be assessed the SIF based on a fixture count methodology consistent with the AWWA standards for line and meter sizing. Under the recommended method, any master meters – situations where a single meter is shared – would be sized based on the number of plumbing fixtures present at the service location; all multi-family units would be charged based on the City's existing SIF schedule. The recommended approach also is consistent with the City's existing development standards. More details regarding the recommended method for assessing mixed-use development under the SIF schedule are provided in Section 6 of the report.

SECTION 2: REVENUE REQUIREMENTS

Revenue requirements are the total operating and capital costs the City must recuperate from its rates to properly operate, maintain, and develop the infrastructure for the water and wastewater systems. The first step in the ratemaking process is to determine the revenue requirements for a given year, called a *test year*. Both the determination of revenue requirements and the selection of the test year are important because the rates developed need to recover the revenue requirements in the year in which those costs are expected to occur (the test year). In addition, the method of calculating revenue requirements has bearing on the total revenue requirements and the subsequent rates.

2.1 Methodology for Determining Revenue Requirements

Under existing industry standards, there are two generally accepted approaches to projecting revenue requirements: the cash-needs approach and the utility approach. Under the cash-needs approach, total revenue requirements are the annual expenditures necessary to meet operating and maintenance costs, debt service requirements, and any cash-funded capital expenditures. Government-owned utilities, such as the City's, typically use the cash-needs approach to calculate revenue requirements since the approach lends itself to actual requirements for expenditures, which in turn supports the governmental budgeting process.

The utility approach is typically used by investor-owned/private utilities. The utility approach differs from the cash-needs approach in that debt service and cash-funded capital expenditures are removed from the total and replaced with depreciation expense as well as a component that allows the utility owners to earn a return on investment in the rate base. Under the utility approach, the "rate base" is essentially the used and useful utility plant-in-service net of accumulated depreciation, less allowances for contributed assets and other adjustments, and includes allowances for working capital. Used extensively by privately owned utilities, this approach also is used by government-owned utilities to calculate revenue requirements for customers outside of their jurisdictional boundaries.

The City provides water and wastewater utility services within and outside its corporate boundaries. Thus far, the City has not used the utility approach to calculate rates for outside-city customers and has instead charged outside-city customers the inside-city rate with a 50 percent markup (a philosophy that was adopted in the early 1980s). Given the City's history and objectives for this Study, Brown and Caldwell recommends using the cash-needs approach to calculate the revenue requirements.

2.2 Selection of the Test Year

The City's fiscal year runs from January 1st through December 31st. Brown and Caldwell began the Study in June 2007. It is the City's intent to propose any changes to the current water and wastewater rates in the fall of 2007 for implementation on January 1, 2008.

There are three typical approaches to selection of a test year: a historical test year, a historical test year with adjustments for known and measurable changes, and a projected test year. The City has begun, or will soon begin, a number of new services that were not included (or were only partially included) in the historical results for its 2006 fiscal year, or prior years. These additional services include the following:

- The addition of credit card processing fees as an added feature for bill payment
- A system-wide backflow prevention program
- A new "no fault" wastewater backup claim system (implemented 2nd quarter of 2006)

With the addition of these new programs, it was determined that use of a historical test year would not be appropriate. The City maintains a financial plan in which it has projected the costs of most of the new programs, making use of a projected test year more appropriate. Because the projection is for fiscal year 2008, there is little difference in this case between use of a projected test year and a historical test year with known and measurable changes. The only expected cost that was not accounted for in the City's financial plan for 2008 was the addition of the credit card processing fees. As such, the test year selected and used for this Study was the City's projected 2008 test year as adjusted to include the credit card processing fees.

2.3 Components of the Revenue Requirements

The cash-needs revenue requirements for the test year consist of the projected levels for operating and maintenance costs, debt service, and cash-funded capital expenditures. The rates, however, are based on the need for user charges, which include adjustments (deductions from the revenue requirements) for sources of income that are not derived from the rates. Such non-rate revenues include miscellaneous revenues (e.g., penalties and fees), tap fees, and interest earnings. Accordingly, there is a need to separate total revenue requirements from the user-charge revenue requirements. Both are defined as follows:

- **Total Revenue Requirements**: The total operating and maintenance, debt service, and cash-funded capital expenditures required to sustain operations in the test year. The City targets recovering total revenues from all sources equal to or exceeding the total revenue requirements in order to meet its financial goals, but is willing to draw down its unrestricted cash reserves in years of unusually high capital expenditures.
- **User-Charge Revenue Requirements**: The total revenue requirements less any income derived from sources other than the rates charged to the City's retail and wholesale customers. The City must recover the user-charge revenue requirements from the proposed rates.

The following sections summarize the various components of the revenue requirements.

2.3.1 Operating and Maintenance Costs

Operations and maintenance (O&M) expenses are those costs incurred to operate and maintain the water and wastewater systems, as well as fund administrative and general expenses. Table 2-1 and Table 2-2 are projections of the City's O&M expenses as of the date of the report. The tables separate O&M costs by utility function.

Table 2-1.
Test Year O&M Expenses – Water Fund

Function/Div. Code/Division Name:	2008 Projected Cost
Source of Supply	
4710 Water Resources	$975,140
Water Treatment	
4510 Executive	$8,600
4610 Engineering	24,150
4710 Water Resources	39,640
4720 Water Quality	370,140
4730 Water Treatment	1,213,420
4750 Technical Services	281,440
Total Water Treatment	$1,937,390
Transmission	
4510 Executive	$3,137
4530 Warehouse	12,129
4610 Engineering	22,846
4620 Engineering Support	23,165
4630 Inspections and Locates	16,322
4640 Water Operations	152,031
4710 Water Resources	7,532
Total Transmission	$237,162
Pumping	
4750 Technical Services	287,690
Total Pumping	$287,690
Meter Services	
4544 Water Meter Service	$497,410

Function/Div. Code/Division Name:	2008 Projected Cost
Distribution	
4510 Executive	$13,373
4530 Warehouse	51,711
4610 Engineering	97,394
4620 Engineering Support	98,755
4630 Inspections and Locates	69,588
4640 Water Operations	648,139
4710 Water Resources	32,108
4811 Dispatch	49,460
Total Distribution	$1,060,528
Billing	
4541 Utility Billing	$195,580
4542 Utility Billing - Meter Read	133,980
Total Billing	$329,560
Customer Service	
------ Credit Card Fees	$22,500
4540 Utility Billing - Cust. Svc.	48,200
Total Customer Service	$70,700
Admin. & General	
4510 Executive	$96,750
4520 Business and Finance	1,139,430
4551 Utility Cons.	136,510
4560 Administrative Support	54,480
4561 Administrative Support	68,390
Total Admin & General	$1,495,560
Grand Total Water Fund Operating Expenses	$6,891,140

Table 2-2.
Test Year O&M Expenses – Wastewater Fund

Function/Div. Code/Division Name:	2008 Projected Cost
Treatment	
4510 Executive	$9,500
4551 Utility Cons.	113,400
4610 Engineering	24,150
4710 Water Resources	39,640
4720 Water Quality	353,680
4740 Wastewater Treatment	1,484,450
4750 Technical Services	281,430
Total Treatment	$2,306,250
Wastewater Collection	
4510 Executive	$7,220
4610 Engineering	115,340
4620 Engineering Support	88,050
4630 Inspections and Locates	74,950
4640 Water Operations	734,830
4710 Water Resources	39,640
4811 Dispatch	21,220
Total WW Collection	$1,081,250
Pumping/Lift Stations	
4750 Technical Services	$300,180
Billing	
4541 Utility Billing	$78,230
4542 Utility Billing - Meter Read	23,300
Total Billing	$101,530
Customer Service	
--------- Credit Card Fees	$21,500
4540 Utility Billing - Cust. Svc.	48,200
Total Customer Service	$69,700
Admin. & General	
4510 Executive	$56,050
4520 Business & Finance	1,132,680
4551 Utility Cons.	27,690
4560 Administrative Support	32,130
4561 Administrative Support	40,160
Total Admin & General	$1,288,710
Grand Total Water Fund Operating Expenses	$5,147,620

2.3.2 Non-Rate Revenues

Non-rate revenues are those revenues generated by the City's water and wastewater funds that are not derived from the charging of water and wastewater rates. The purpose of this Study is to develop the water and wastewater rates that will be charged to the City's retail customers. As such, revenue generated from the sale of water and/or wastewater services for wholesale or contractual accounts are considered as non-rate revenues for the purposes of calculating the revenue requirements for the test year. Table 2-3 and Table 2-4 summarize the non-rate revenues for the water and wastewater funds.

Table 2-3.
2008 Test Year Non-Rate Revenues – Water Fund

Revenues and Sources	Note	Projected 2008
Wholesale Sales		$90,000
Meter Sales		60,000
Interest on Investments		128,500
Hydrant Rentals		325,000
Other Revenue		194,140
Wholesale Industrial - Discount	1	(12,141)
Outside City Surcharges		156,000
Total Non-Rate Revenues - Water Fund		$941,499

Notes:

1. Two industrial customers receive a wholesale rate of $1.03 per thousand gallons – the non-rate revenue shown (actually a cost) reflects the difference in revenue that would have been earned at the standard industrial rate vs. the contractual wholesale rate for the test year. This amount is an added cost to the other customer classes and increases their respective costs of service proportionately.

Table 2-4.
2008 Test Year Non-Rate Revenues – Wastewater Fund

Revenues and Sources	Projected 2008
Interest on Investments	$221,820
Other Revenues	6,550
Outside City Surcharges	40,787
Total Non-Rate Revenues - Wastewater Fund	$269,157

2.3.3 Capital Costs

Capital costs are driven by the City's plans for capital improvements. Under the cash-needs approach, capital costs fall into two categories: debt service and cash-funded capital expenditures. The City currently does not have any external outstanding debt in the water or wastewater utility funds and has no plans to issue any future external debt that might affect the test year. In the past, the City has made funds available to the water and/or wastewater fund by way of intra/inter-fund loans, each with interest and repayment terms. As of the date of the report, the wastewater fund had an outstanding balance due to the raw water fund in the amount of $1,500,000. According to the City's financial plan, repayment of this note is not expected to commence until fiscal year 2009; therefore, the debt service is not included in the test year revenue requirements.

As such, the City's cash-needs capital costs for both funds are cash-funded capital expenditures. The City has an existing budget in place for capital improvements spending, which includes net revenue from current operations and use of existing fund balances. The annual revenue requirement for cash-needs capital costs is included in the City's 10-year financial plan, and we used this number as the cash-needs capital costs for both the wastewater and water funds. In addition, the cash-needs capital requirements for the water fund include the annual transfer to the raw water fund. It should be noted that the financial plan submitted by the City includes increases in the transfer to the raw water fund of approximately 1 percent per year. The current year transfer is 3.03 percent of the estimated water sales for the test year (fiscal year 2008). Table 2-5 and Table 2-6 represent the cash-needs capital costs for both funds as of the report date.

Table 2-5.
2008 Test Year Cash-Needs Capital Requirements – Water Fund

Description	Projected 2008
Capital Expenditures	$1,744,785
Transfer to Raw Water Fund	226,330
Use of Fund Balance	(572,835)
Cash Funded Capital from Operations - Water Fund	$1,398,280

Table 2-6.
2008 Test Year Cash-Needs Capital Requirements – Wastewater Fund

Description	Projected 2008
Capital Expenditures	$3,435,360
Use of Fund Balance	(1,101,500)
Cash Funded Capital from Operations - Wastewater Fund	$2,333,860

2.4 Projected Revenue Requirements

The total revenue requirements for the City's water and wastewater utilities, as well as the user-charge revenue requirements, are shown on Table 2-7. The water and wastewater rates are designed to recover the user-charge revenue requirements.

Table 2-7.
2008 Test Year Revenue Requirements – Water and Wastewater Funds

Description	Projected 2008 Water Fund	Projected 2008 Wastewater Fund
O&M Expenses	$6,891,140	$5,147,620
Cash-Funded Capital Expenses	1,398,280	2,333,860
Annual Debt Service	0	0
Projected Revenue Requirements	8,289,420	7,481,480
(Less Non-Rate Revenues):		
Wholesale Sales	90,000	0
Meter Sales	60,000	0
Interest on Investments	128,500	221,820
Hydrant Rentals	325,000	0
Other Revenue	194,140	6,550
Wholesale Industrial - Discount	(12,141)	0
Outside City Surcharges	156,000	40,787
Projected Non-Rate Revenues	941,499	269,157
Required User-Charge Revenue	$7,347,921	$7,212,323

SECTION 3: CUSTOMER AND CLASS CHARACTERISTICS

Cost-of-service ratemaking is a process of allocating the utility system user-charge revenue requirements to customers based on their demands. Individual customer demands can vary depending on the nature of the water use at the location where service is provided. For example, water and sewer demand for a family residing in a typical single-family home is different than the water and sewer demand for a large industrial campus. As a practical matter, it is not feasible to allocate system revenue requirements to the individual account level. As such, the standard ratemaking practice is to group customers with similar demands into classes. Rates are then developed for each customer class with each individual customer paying the class' average allocated cost of service for each unit of specific usage.

Brown and Caldwell examined the City's existing customer classes and also developed recommendations for potentially new classes based on our analysis of water and sewer demands.

3.1 Water Utility Demands, Customers, and Classes

Water utility customers place various demands on a water system. The number of customers connected to a water system presents one level of demand that is typically related to the utility's need to provide for customer services such as bill processing, customer service support, meter reading, and other administrative services. Actual water demands are typically measured in terms of each class' average-day use, maximum-day use, and peak-hour use. In addition, reservation for fire flow capacity is another system demand that is applicable to a water system. In all, we included the following customer classes in the Study:

- **Single-Family Residential:** Residential customers include single-family homes used as domiciles. Multi-family customers are not included in this category.
- **Multi-Family Residential:** Multi-family service is characterized by multiple dwelling units at a single service location. Typical Multi-Family customers are apartment buildings, condominiums, and multi-plex (townhome) units. In some cases, multi-family units are individually metered, while in others there are a number of living units connected to a single water meter.
- **Commercial:** Commercial customers include all businesses from small retail shops to restaurants. The class also includes some of the City's Enterprise Fund accounts.
- **Industrial:** Industrial customers are businesses that meet certain criteria as defined by the City's rate schedule as modified from time to time. The class also includes some of the City's Enterprise Fund accounts.

- **Irrigation:** Irrigation customers are connections to the water system for the sole purpose of providing outdoor irrigation; these are separately metered connections used only for the purpose of irrigation. This class includes private irrigation connections as well as the City's own connections.
- **Special Classes**
  - **Fire Protection:** This customer class is included to account for the fire protection costs of the water system. The costs allocated to this class are eventually reallocated to all other customer classes as part of the cost-of-service allocation discussed in Section 4 of the report.
  - **City Government.** The City provides service to approximately 65 connections for municipal government buildings and irrigation connections. The City Government class does not include enterprise fund accounts.

3.1.1 Water Utility Cost Allocation Methodology

Costs in a water system are incurred as a result of customer demands. We measure customer demands on various levels based on the notion of cost causation. Essentially, *cost causation* means that the City incurs a cost of providing service as a result of a particular kind of demand. The AWWA describes two generally accepted methods for allocating costs: the base extra-capacity method, and the commodity demand method. Brown and Caldwell uses the base extra-capacity method under most municipal ratemaking circumstances, and has used this method to allocate costs in the Study. Under the base extra-capacity method, customer demands are measured and costs are allocated as one of the following:

- **Base Costs:** Costs that tend to vary with the total quantity of water used, plus the costs incurred to provide water under average daily demand conditions. Base demands for customer classes are measured as each class' average daily demand.
- **Extra-Capacity Costs:** Costs incurred as a result of having to meet rate of use requirements in excess of the average daily demands. Extra-capacity costs are measured as maximum-day (sometimes called "max-day") costs and peak-hour (sometimes called "max-hour") costs. Extra-capacity demands are measured as each class' maximum-day and peak-hour demands.

- **Customer Costs:** Costs incurred as a result of serving customers without regard for the amount of water used. Customer costs are incurred at the same level whether the utility provides any water or no water. These costs tend to include the costs of meter reading, billing, customer accounting, general and administrative costs, and other related costs. Measurements of demand for customer costs include measurements of meters in service, numbers of customer accounts, and numbers of customer service units.
- **Fire Protection Costs:** Direct costs of providing fire protection service.

The following sections describe the measurements of demand related to each of the above.

3.1.1.1 Average Daily Water Demands

The base costs of a water system are incurred as a result of providing water demands at an average daily rate. Unfortunately, customers' meters are not read on a daily basis, so we must estimate average daily demands by dividing total annual demand by 365 days. Of course, total annual demand can vary based on climate conditions and the amount and frequency of precipitation. In cost-of-service ratemaking, wide fluctuations in demand from year to year relative to other customer classes will cause the allocation of costs to fluctuate as well, potentially resulting in wide shifts in the rates charged to customers. Since wide fluctuations in rates are undesirable, it is best to normalize measures of demand based on historical data and to use the normal level of demand as the basis for any cost allocations. To normalize demands, Brown and Caldwell examined the water use patterns of the City of Loveland's water utility customers over a seven-year historical period from 2000 – 2006. Table 3-1 summarizes our findings; additional detail and data provided for use in the Study is provided in Appendix A.

Table 3-1.
Historical Water Demand by Customer Class (Millions of Gallons)
2000 – 2006

	Single-Family Residential		Multi-Family Residential		Commercial		Industrial		Irrigation		City Government		Total - All Classes	
Year	Total Demand	Avg. Month	Total Demand	Avg. Month	Total Demand	Avg. Month	Total Demand	Avg. Month	Total Demand	Avg. Month	Total Demand	Avg. Month	Total Demand	Avg. Month
2000	2,124.1	177.0	354.0	29.5	534.3	44.5	33.1	2.8	173.5	14.5	62.8	5.2	3,281.8	273.5
2001	2,092.3	174.4	350.5	29.2	509.3	42.4	57.8	4.8	177.0	14.7	57.8	4.8	3,244.7	270.4
2002	2,112.4	176.0	355.5	29.6	477.3	39.8	38.6	3.2	197.4	16.4	36.6	3.1	3,218.0	268.2
2003	1,890.6	157.6	326.9	27.2	476.9	39.7	39.2	3.3	233.5	19.5	50.2	4.2	3,017.3	251.4
2004	1,808.7	150.7	333.9	27.8	461.0	38.4	77.9	6.5	264.1	22.0	44.9	3.7	2,990.6	249.2
2005	2,039.7	170.0	352.6	29.4	498.7	41.6	93.2	7.8	335.1	27.9	53.5	4.5	3,372.9	281.1
2006	2,358.7	196.6	387.9	32.3	550.1	45.8	98.2	8.2	542.0	45.2	68.9	5.7	4,005.8	333.8

3.1.1.2 Maximum-Day and Peak-Hour Demands

One of the most important characteristics of customer demand is the maximum-day and peak-hour demands that customers place on the system. Since customers' meters are not read daily, let alone hourly, we can only estimate the class peaking requirements relative to the system peak (which actually is measured on a daily basis). We are able to estimate class peaks based on peak month (because we can only measure demands on a monthly basis, peak month is used as a proxy for maximum-day) as compared to the known system peak. The City's system maximum day is 2.4 times its average day, and the City estimates its peak hour at 1.74 times its maximum day; these amounts do not include fire flow demands. We estimated class maximum-day and peak-hour demands using the following procedures:

1. We assumed a system maximum-day factor of 2.4 times average day and a system peak-hour factor of 4.2 times average day for each of the years 2000-2006.

2. We divided total annual demand (see Table 3-1) by 365 days to determine the system average day and multiplied that value times the maximum-day (2.4) and peak-hour (4.2) factors to determine the system maximum day and peak hour, respectively.
3. To determine class maximum-day demands, each class' peak month was divided by the system peak month, and the resulting percentage was then multiplied by the estimate for the system maximum day (i.e., classes were allocated a proportion of the system maximum day based on their peak-month measured demands).
4. We multiplied each class's maximum-day demands by 1.74, a figure provided by the City and verified through the City's hydraulic modeling of the water system, to reach an estimated peak-hour demand by class.
5. We repeated this process for each year from 2000 through 2006. The results are summarized in Table 3-2.

Table 3-2
Estimated Historical Peaking Requirements by Customer Class
2000 – 2006

Year	Estimated System Peaks		Single-Family Residential		Multi-Family Residential		Commercial		Industrial		Irrigation		City Government	
	Factor	Demand (MG)	Factor	Demand (MG)	Factor	Demand (MG)	Factor	Demand (MG)	Factor	Demand (MG)	Factor	Demand (MG)	Factor	Demand (MG)
2000														
Max-Day	2.4	21.6	2.4	14.1	2.1	2.0	2.1	3.0	1.9	0.2	3.6	1.7	3.2	0.6
Peak-Hour	4.2	37.5	4.2	24.5	3.6	3.5	3.6	5.3	3.2	0.3	6.3	3.0	5.6	1.0
2001														
Max-Day	2.4	21.3	2.4	14.0	2.0	1.9	2.1	2.9	2.1	0.3	3.3	1.6	3.5	0.6
Peak-Hour	4.2	37.1	4.2	24.4	3.4	3.3	3.7	5.1	3.7	0.6	5.8	2.8	6.1	1.0
2002														
Max-Day	2.4	19.7	2.3	13.4	1.8	1.8	1.9	2.5	2.0	0.2	2.7	1.5	3.0	0.3
Peak-Hour	4.2	34.2	4.0	23.3	3.2	3.1	3.3	4.3	3.5	0.4	4.7	2.6	5.3	0.5
2003														
Max-Day	2.4	19.8	2.4	12.3	1.9	1.7	2.1	2.8	2.3	0.2	3.6	2.3	3.5	0.5
Peak-Hour	4.2	34.5	4.1	21.4	3.3	3.0	3.7	4.8	4.0	0.4	6.2	4.0	6.0	0.8
2004														
Max-Day	2.4	19.7	2.3	11.3	2.0	1.8	2.4	3.0	2.7	0.6	3.5	2.6	3.5	0.4
Peak-Hour	4.2	34.2	4.0	19.7	3.5	3.2	4.1	5.2	4.6	1.0	6.2	4.5	6.1	0.7
2005														
Max-Day	2.4	22.2	2.3	12.8	2.0	1.9	2.3	3.1	3.0	0.8	3.4	3.1	3.5	0.5
Peak-Hour	4.2	38.6	4.0	22.3	3.4	3.3	3.9	5.4	5.3	1.4	5.8	5.4	6.1	0.9
2006														
Max-Day	2.4	26.3	2.4	15.3	1.9	2.1	2.2	3.3	2.1	0.6	3.1	4.6	3.1	0.6
Peak-Hour	4.2	45.8	4.1	26.6	3.4	3.6	3.8	5.7	3.7	1.0	5.4	7.9	5.4	1.0

The maximum-day and peak-hour estimates provided in Table 3-2 are estimates of these demand measurements to be used for ratemaking purposes. They are meant to be reasonable approximations of maximum-day and peak-hour demand and should not be construed as actual measurements.

3.1.1.3 Customer Counts, Meters in Service, and Customer Service Units

The number of customers and meters in service is another measure of demand for certain kinds of water utility costs. Meter reading costs are related to the number and size of the meters in service, while other customer costs are related to the number of customers served. Brown and Caldwell determined equivalent meters (i.e. all meter sizes stated in terms of multiples of a single family meter), numbers of customer accounts, and numbers of customer service units. Customer service unit provides a measure of potential customer service demand; the number of units used included the total number of accounts for every class (assuming one customer for each account), but also included the total dwelling units in the Multi-Family Residential class. Table 3-3 summarizes the historical units for each.

Table 3-3.
Historical Customer Units – All Meter Sizes
2000 – 2006

Year	Single-Family Residential	Multi-Family Residential	Commercial	Industrial	Irrigation	City Government	Total - All Classes
2000	16,579	4,992	979	2	165	51	22,768
2001	17,295	5,172	987	4	162	56	23,676
2002	17,916	5,760	1,016	4	205	57	24,958
2003	18,830	5,936	1,057	4	218	58	26,103
2004	19,520	6,135	1,059	7	244	60	27,025
2005	20,205	6,323	1,078	7	259	62	27,934
2006	20,281	6,333	1,077	7	323	65	28,086

Notes:

1. Multi-Family units are listed here as numbers of dwelling units, which is the number of residential units connected to the water system. In some cases, a single connection (meter) can provide service to more than one residential unit.
2. See Appendix A for more detailed analysis and data.

In addition to the customer units shown in Table 3-3, we also determined meters in service by size for each year. These figures are available in Appendix A as they are too voluminous for inclusion here.

3.1.2 Water Utility Test Year Units of Service

We projected the units of service for average-day, maximum-day and peak-hour demands and for customer units to the test year using a projection of customer units provided by the City of Loveland (see Table 3-6) and the normalized water demands per customer unit developed in our analysis of the historical water use described in the preceding subsections. Total water demands for the test year were estimated based on the number of projected units times the average (normalized) water demands by month from the historical data as described above.

Multiplying the projected test year customer units by the average monthly usage results in a projected monthly water demand for each customer class. From that monthly information, we can then apply the same methodology for estimating maximum-day and peak-hour demand as was presented in Table 3-2. The calculations for determining average usage by month also took meter size into consideration, and the full tabulation is provided in Appendix A, as the volume of customers and meter sizes is too great for presentation here. Table 3-4 summarizes the findings.

Table 3-4.
Estimated Test Year Water Demand by Customer Class
(thousands of gallons)

Month	System Total	Single-Family Residential	Multi-Family Residential	Commercial	Irrigation	Industrial	City Government	Fire Protection
Jan	165,912.0	108,071.3	23,855.8	28,675.8	79.5	4,538.9	690.9	-
Feb	150,225.9	95,800.7	21,711.0	27,478.8	179.9	4,282.7	772.8	-
Mar	155,712.2	97,980.5	22,145.5	29,099.5	224.0	5,242.7	1,020.1	-
Apr	187,760.3	122,680.5	23,203.0	28,887.2	7,236.0	4,425.6	1,328.0	-
May	315,573.0	196,684.6	29,688.9	42,916.1	36,287.0	6,034.4	3,962.0	-
Jun	481,979.6	292,621.4	40,622.1	62,979.2	68,501.0	8,196.9	9,059.0	-
Jul	584,859.2	358,809.0	47,394.5	73,396.6	83,809.6	8,893.9	12,555.7	-
Aug	611,116.6	357,728.5	50,156.0	80,670.3	95,286.1	12,288.4	14,987.4	-
Sep	519,620.1	296,791.9	45,873.0	74,307.9	80,953.9	10,040.5	11,652.9	-
Oct	359,287.0	198,301.5	34,795.0	57,648.2	54,554.0	8,375.7	5,612.6	-
Nov	192,252.8	116,255.8	24,399.8	34,587.5	10,142.2	5,483.0	1,384.5	-
Dec	166,423.3	105,799.4	24,167.0	29,606.7	903.6	5,277.7	669.0	-
Total	3,890,721.9	2,347,524.9	388,011.5	570,253.7	438,156.6	83,080.3	63,694.9	-

Note:

1. It is normal for the Fire Protection class to have no average monthly or daily demands as fire demands are standby in nature.
2. The system average day is calculated by dividing the system total demands by 365 days (e.g. 3,890,721.9 divided by 365 or 10,659.5 gallons).

Maximum-day and peak-hour demands are estimated in the test year using the procedures outlined in Section 3.1.1.2. The system average day, based on Table 3-4, is 10,659.5 thousand gallons. The maximum-day factor, which does not include fire flow, is 2.4 times the average day based on input from the City's engineering staff, and the peak-hour is estimated at 1.74 times the maximum day, or 4.2 times the average day. The average day for each customer class can

be derived from Table 3-4 and the maximum-day and peak-hour demands are estimated as shown and summarized in Table 3-5 (note that Table 3-5 also shows the fire flow demands used in the Study).

Table 3-5.
Customer Class Average, Max-day and Peak-Hour Demands Projected for the Test Year
(thousands of gallons)

Customer Class	Average Day	Max-Day Factor	Max-Day Use	Peak-Hr. Factor	Peak-Hr. Use
Single-Family Residential	6,431.6	2.3	14,975.4	4.1	26,057.2
Multi-Family Residential	1,063.0	2.0	2,099.7	3.4	3,653.4
Commercial	1,562.3	2.2	3,377.1	3.8	5,876.1
Irrigation	1,200.4	3.3	3,988.9	5.8	6,940.7
Industrial	227.6	2.3	514.4	3.9	895.1
City Government	174.5	3.6	627.4	6.3	1,091.7
Fire Protection	-	-	1,440.0	-	8,640.0
Total	10,659.5	2.5	27,022.8	5.0	53,154.1

Notes:

1. Peaking factors are rounded to the nearest tenth.
2. Fire protection capacity has been added to reflect a primary fire flow requirement of 4,500 gpm for a 4-hour duration and a secondary fire flow of 1,500 gpm for a 4-hour duration. The total fire flow requirement is the sum of both the primary and secondary fire flow requirements. Maximum-day fire flow protection is calculated as 6,000 gpm x 4 hrs = 1,440 thousand gallons per day; the peak-hour fire flow equates to a daily load of 8,640 thousand gallons per day, both of which would not occur concurrently, but could occur within a 24-hour period. The rationale used for calculating fire protection demands and associated costs was obtained from the M1 Manual (Chapter 30), which is produced by the American Water Works Association.

In order to allocate customer costs in the Study, we also projected the total customer accounts, units of service, and number of customers by meter size for the test year. The City provided planning estimates for these projections, which are summarized at Table 3-6.

Table 3-6.
Estimated Test Year Customer Counts and Meter Sizes

Customer Class	Customers	Units	Customers by Meter Size						
			3/4"	1"	1 1/2"	2"	3"	4"	6"
Single-Family Residential	21,218	21,218	21,110	95	-	8	3	1	1
Multi-Family Residential	1,212	6,523	699	273	161	64	10	5	-
Commercial	1,129	1,129	697	204	101	96	19	9	3
Irrigation	312	312	105	96	59	42	8	2	-
Industrial	7	7	-	-	1	2	3	1	-
City Government	65	65	9	19	7	25	2	3	-
Fire Protection	-	-	-	-	-	-	-	-	-
Totals	23,943	29,254	22,620	687	329	237	45	21	4

Note:

1. Numbers of customers and numbers of units are different measures of customer counts; for the purposes of the Study, the "customers" are entities who actually receive bills from the City. "Units" are total dwelling units connected to the water system. Both measures are important for different reasons.

3.2 Wastewater Customers and Classes

Wastewater demands are somewhat more difficult to measure accurately since individual customer contributions to the sewer system are rarely, if ever, metered in the same way that water demand is measured. Single-Family Residential wastewater demands typically are estimated as the average winter water usage. Such estimates are based on the presumption that winter water demand is primarily non-consumptive, meaning that water used during these periods is eventually returned to the wastewater system, whereas water demand in summer months typically contains a large portion of consumptive usage (i.e., irrigation) that is not returned to the wastewater system. In most cases, commercial customers are billed based on actual monthly water use, and in still other cases residential customers are billed based on a presumed winter usage (in cases where the residential customer has no water meter data, they are identified as "flat rate sewer" customers in the City's billing system). The number of customers/connections is also a measure of wastewater demand for certain administrative costs.

Customer characteristics for wastewater systems are measured in terms of estimated sewer flows as discussed above, and also in terms of sewer loadings. Sewer loadings are measures of the concentrations and mass of wastes contributed to the wastewater system. Although the composition of the wastewater could be placed into numerous categories of wastes, the City, like most wastewater utilities, measures waste composition for just two such categories: biochemical oxygen demand (BOD), and total suspended solids (TSS). Customer classes contribute to the concentration and mass of wastes in the wastewater, which in turn must be treated in order for the water to be returned to the environment to required standards. Costs are allocated to customer classes based on estimations for billed sewer flows, estimated strength loadings, and the number of customer connections. We included the following classes in the Study:

- **Single-Family Residential:** Residential customers include single-family homes used as domiciles. Multi-family customers are not included in this category.
- **Multi-Family Residential:** Multi-family service is characterized by multiple dwelling units at a single service location. Typical Multi-Family customers are apartment buildings, condominiums, and multi-plex (townhome) units.
- **Commercial:** Commercial customers include all businesses from small retail shops to restaurants.
- **Industrial:** Industrial customers are businesses that use potable water as part of a production process; some of that water is returned to the sewer system while some is not.
- **City Government:** This class includes all of the City's non-irrigation accounts.
- **Extra-Strength:** This class includes all commercial/industrial customers who contribute excess BOD and TSS to the wastewater system (excess is defined as levels higher than the normal domestic level and will be described in detail later in this section of the report).
- **Inflow and Infiltration (I&I)/Unbilled:** Includes all unbilled sewer flows as measured as the difference between billed flows attributable to the customer classes and the total influent. I&I cannot be billed, so the costs associated with I&I/Unbilled are reallocated to the billable customer classes as part of the cost-of-service analysis.

There are two generally accepted methods for allocating the costs of wastewater treatment for the purposes of ratemaking: the surcharge method and the quantity-quality method. The City historically has used a surcharge method which is characterized by assigning standardized wastewater strength loadings for BOD and TSS to customer classes and assigning any additional wastewater loads to an "Extra-Strength surcharge." Under the surcharge method, residential and commercial customers are charged for contributions of normal domestic strength loads to the wastewater system; other customers, typically commercial and/or industrial customers, are required to pay a surcharge on wastewater

contributed to the system that is in excess of the normal domestic strength. This latter category of customers constitutes a surcharge class, or Extra-Strength class. The City currently manages approximately 275 such customers.

3.2.1 Analysis of Wastewater Flows by Class

Unlike water service, sewer service usually is not metered. As such, we can only estimate the amount of wastewater flow each customer class contributes to the wastewater system. The City, like many wastewater utilities, bills customers based on a measure of water demand. For some customers, the City calculates the average water demand during the winter months and uses that average monthly water demand as an estimate for wastewater flows (called *Winter Quarter Average* [WQA] in the City's rate schedule); other customers are billed for wastewater flows based on actual monthly water demand. Even for customers who are charged a flat monthly rate, the City imputes an estimated level of sewer flow. Table 3-7 summarizes the billed sewer flows for the City from 2000 – 2006.

Table 3-7.
Total Billed Sewer Flows by Class (MG)
2000 – 2006[1]

Customer Class	2000	2001	2002	2003	2004	2005	2006
Single- Family Residential	971.8	933.5	989.2	981.9	961.9	966.7	1025.1
Multi-Family Residential	235.2	238.9	250.0	252.0	246.9	253.9	255.9
Commercial	410.2	385.5	386.0	394.4	334.5	366.6	404.4
Industrial	0.3	0.3	0.3	0.3	21.0	19.0	19.4
City Government	29.3	24.8	20.0	21.5	21.2	20.6	20.0
Total	1,646.8	1,582.9	1,645.5	1,650.0	1,585.5	1,626.9	1,724.9

Note:

1. The Extra-Strength class is not assigned any values for flow because Extra-Strength is a surcharge class for extra BOD and TSS loadings only. Extra-Strength customers are actually commercial/industrial customers, and those customers' flows are billed as part of the regular rate for the Commercial/Industrial class – the Extra-Strength surcharge is additive.

3.2.1.1 Impact of Unbilled Flows – I&I

As with the water customer classes, we have considered additional customer classes for the purposes of cost allocation and in order to provide additional system cost information to the City. We established a customer class for I&I in order to collect specific cost information related to the I&I inherent in the City's wastewater system. The I&I costs were collected during the Study, with the costs ultimately allocated to billed customer accounts in proportion to total flow and/or numbers of customers in the class. For the purposes of the Study, I&I is quantified as all flows entering the wastewater treatment plant (WWTP) that are not accounted for as billed flows from the customer classes. We analyzed I&I (using this working definition) over the historical period 2000 – 2006, comparing the total billed flows to the total WWTP influent levels. Table 3-8 summarizes our findings.

Table 3-8.
I&I as a Portion of Total WWTP Inflow (MG)
2000 - 2006[1]

Customer Class	2000	2001	2002	2003	2004	2005	2006
Single-Family Residential	971.8	933.5	989.2	981.9	961.9	966.7	1025.1
Multi-Family Residential	235.2	238.9	250.0	252.0	246.9	253.9	255.9
Commercial	410.2	385.5	386.0	394.4	334.5	366.6	404.4
Industrial	0.3	0.3	0.3	0.3	21.0	19.0	19.4
City Government	29.3	24.8	20.0	21.5	21.2	20.6	20.0
Sum of Billed Flows	1,646.8	1,582.9	1,645.5	1,650.0	1,585.5	1,626.9	1,724.9
Total WWTP Inflow	2,042.3	2,031.1	1,863.2	2,090.9	2,076.9	2,157.2	2,025.6
I&I/Unbilled[2]	395.5	448.2	217.7	440.9	491.4	530.4	300.7
% Unbilled to Total	19%	22%	12%	21%	24%	25%	15%

Notes:

1. The Extra-Strength class is not assigned any values for flow because Extra-Strength is a surcharge class for extra BOD and TSS loadings only. Extra-strength customers are actually commercial/industrial customers, and those customers' flows are billed as part of the regular rate for the Commercial/Industrial class – the Extra-Strength surcharge as additive.
2. Unbilled flows are denoted as I&I for the purposes of the Study based on the working definition for I&I discussed in this report. Specifically, for the purposes of the report, I&I includes all unaccounted for flows. This definition is different from the technical definition of "inflow & infiltration" used for sewer system design.

3.2.2 Analysis of Wastewater Strengths

Establishing a normal domestic loading assumption is important for the purposes of ratemaking because the purpose of the Study is to allocate costs, including the costs of wastewater treatment, to the various customer classes. A normal domestic strength load – a concentration measured in mass per volume – is assigned to each customer class; when

multiplied by each class' billed sewer flow, the result is an estimate of total BOD and TSS for each class (measured in pounds). Any BOD and TSS not accounted for through these calculations is assumed to be contributed by the Extra-Strength customers, and the cost of treating those excess amounts is charged through the Extra-Strength surcharge. It follows that establishing a normal domestic strength that is too low will result in an over allocation of treatment costs to the customers who pay the Extra-Strength surcharge; a normal domestic strength level that is too high results in increased charges to the other customer classes and a lower Extra-Strength surcharge.

Brown and Caldwell analyzed data provided by the City to determine an appropriate level of normal domestic strength for use in the Study.

Data provided by the City suggests that Extra-Strength customers have contributed approximately 9.3 percent of the BOD and 9.8 percent of the TSS at the WWTP (these levels were determined by analyzing wastewater contributions of the 275 current surcharge customers as compared to total WWTP BOD and TSS levels). Based on these percentages, we analyzed the Extra-Strength contributions to the WWTP and estimated BOD and TSS contributions from Extra-Strength loadings versus contributions at normal domestic strength levels. Table 3-9 summarizes our analysis of the BOD levels; Table 3-10 summarizes our analysis of the TSS levels.

Table 3-9.
Estimated Domestic and Extra-Strength BOD
2000 – 2006

	(a)	(b)	(c) = (a) x (b)	(d) = (a) - (c)	(e)	(f) = (d)/[(e) x 8.34]	
	Total WWTP BOD (lbs)	Avg. % Extra-Strength to Total BOD	Estimated Extra-Strength BOD (lbs)	Estimated Domestic BOD (lbs)	Actual WWTP Inflow (MG)	Estimated Avg. Domestic Load (mg/L)	3-Yr Moving Avg.
2000	4,432,468	9.3%	412,835	4,019,633	2,042	236	n/a
2001	4,445,298	9.3%	414,030	4,031,269	2,031	238	n/a
2002	4,474,320	9.3%	416,733	4,057,587	1,863	261	245
2003	4,715,709	9.3%	439,215	4,276,494	2,091	245	248
2004	4,608,577	9.3%	429,237	4,179,340	2,077	241	249
2005	4,730,609	9.3%	440,603	4,290,006	2,157	238	241
2006	4,829,767	9.3%	449,839	4,379,929	2,026	259	246
Average	4,605,250	9.3%	428,927	4,176,322	2,041	245	

Table 3-10.
Estimated Domestic and Extra-Strength TSS
2000 – 2006

	(a)	(b)	(c) = (a) x (b)	(d) = (a) - (c)	(e)	(f) = (d)/[(e) x 8.34]	
	Total WWTP TSS (lbs)	Avg. % Extra-Strength to Total TSS	Estimated Extra-Strength TSS (lbs)	Estimated Domestic TSS (lbs)	Actual WWTP Inflow (MG)	Estimated Avg. Domestic Load (mg/L)	3-Yr Moving Avg.
2000	3,861,713	9.8%	377,700	3,484,012	2,042	204	n/a
2001	3,879,049	9.8%	379,396	3,499,653	2,031	206	n/a
2002	3,783,633	9.8%	370,064	3,413,570	1,863	220	210
2003	4,634,559	9.8%	453,290	4,181,270	2,091	240	222
2004	4,137,567	9.8%	404,681	3,732,887	2,077	215	225
2005	5,163,340	9.8%	505,008	4,658,332	2,157	259	238
2006	5,139,336	9.8%	502,660	4,636,676	2,026	274	249
Average	4,371,314	9.8%	427,543	3,943,771	2,041	232	

Our analyses have not been verified by independent laboratory testing and are heavily dependent on the assumptions of WWTP BOD and TSS contributed by the Extra-Strength customers. As such, these analyses are not relevant for decisions regarding WWTP design or for operating purposes. However, the analyses do provide adequate inputs for use in ratemaking and, based on our professional judgment, reflect levels of BOD and TSS that should result in an equitable allocation of wastewater treatment costs among the various customer classes while producing an appropriate basis for the Extra-Strength surcharge.

Based on the above analyses, Brown and Caldwell recommends that the City base its normal domestic strength loads, for the purposes of ratemaking, on the three-year moving average identified in the above tables. For the test year, those values are 246 mg/L for BOD and 249 mg/L for TSS. Currently the City uses 200 mg/L BOD and 250 mg/L for TSS.

The remainder of this section describes how the wastewater strengths apply to the customer classes and the various characteristics of each of the classes used in the Study.

3.2.2.1 Extra-Strength Customers and the Extra-Strength Surcharge

Extra-Strength customers are those customers who contribute surplus BOD and/or TSS to the wastewater system. Customers exhibiting wastewater concentrations in excess of the normal domestic levels are considered Extra-Strength customers. For example, a customer with a BOD concentration of 650 mg/L exceeds the normal domestic load of 246 mg/L (estimated for 2006) by 404 mg/L; this Extra-Strength customer contributes 64 percent more BOD to the wastewater system than customers contributing at a normal level, resulting in almost 1½ tons (approximately 3,400 lbs) of additional BOD for every million gallons of wastewater flow. The additional costs for treating these surplus flows are appropriately assigned to Extra-Strength customers.

As mentioned in Section 3.2, the City has identified 275 current Extra-Strength customers, and all fall within the definition of the Commercial class. Under the surcharge method of cost allocation, it is customary to establish a secondary customer class called an "Extra-Strength" or "Surcharge" class. The Extra-Strength class accounts for the excess BOD and TSS and allows for the calculation of the Extra-Strength surcharge. As such, customers identified as Extra-Strength contributors are billed once for their normal domestic loads and also are billed the surcharge for the Extra-Strength contributions above and beyond the normal domestic level. The purpose of the Extra-Strength surcharge is to recover the costs of treating excess BOD and TSS. Table 3-9 and Table 3-10 show the total BOD and TSS, respectively, for the Extra-Strength customers – this is the amount of BOD and TSS these customers contribute to the wastewater system in excess of the domestic level. Figure 3-1 and Figure 3-2 (both based on data shown on Table 3-9 and Table 3-10, respectively) also show the BOD and TSS levels for Extra-Strength customers over time.

Figure 3-1.
Extra-Strength BOD Levels
2000 - 2006

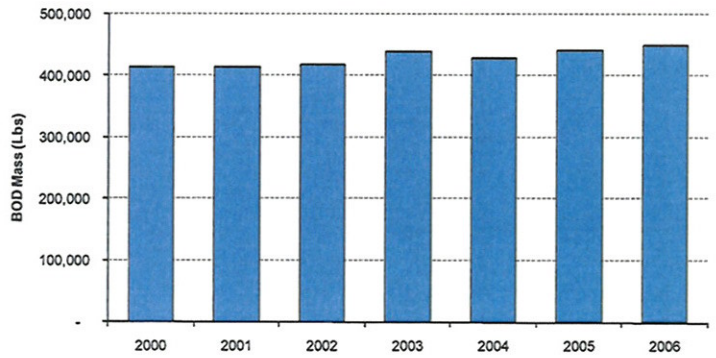
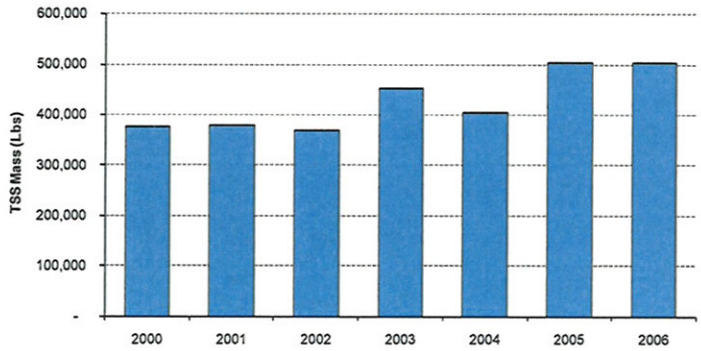


Figure 3-2.
Extra-Strength TSS Levels
2000 - 2006



Extra-strength surcharges apply only to excess BOD and TSS levels and do not apply to the flows contributed by these customers. The surcharge is additive, meaning that the customers subject to the surcharge would be billed for their flows (and the normal portion of their sewer strength) as members of either the Commercial or Industrial classes. The surcharge is added to these amounts. As such, the surcharge class is not assigned a flow value for the purposes of the Study.

3.2.2.2 Strength and Loadings for All Other Customer Classes

Loadings for all other classes can be determined by multiplying the billed flows by the normal domestic strength loading and a constant of 8.34 to convert mg/L to pounds. Table 3-9 and Table 3-10 summarize our analysis of the normal domestic strength loads for the City's WWTP, and those normal loads include allowances for the I&I as discussed in Section 3.2.1.1. In order to fully account for the total WWTP flows and loads, we must account for the I&I appropriately.

In Table 3-9 and Table 3-10, the normal domestic strength shown is calculated based on total WWTP inflow – this amount includes any I&I in the system. As such, to account for the total BOD and TSS mass at the WWTP, the I&I flow must also be assigned a normal domestic strength. Table 3-11 summarizes the total BOD loads from 2000 – 2006, and Table 3-12 summarizes the TSS loads. The amounts shown in the tables are based on the findings for normal domestic strength as already discussed and from actual data provided by the City (total WWTP BOD).

Table 3-11.
BOD Per Year (lbs)
2000 - 2006

Customer Class	2000	2001	2002	2003	2004	2005	2006
Single-Family Residential	1,912,645.6	1,852,747.8	2,154,232.0	2,008,178.4	1,935,548.5	1,922,510.5	2,216,595.4
Multi-Family Residential	462,875.8	474,189.2	544,432.9	515,499.3	496,799.4	505,006.3	553,411.0
Commercial	807,333.0	765,046.4	840,681.3	806,556.7	673,096.6	728,976.9	874,510.7
Industrial	643.6	555.7	594.5	562.5	42,310.7	37,725.1	41,970.7
City Government	57,725.9	49,142.5	43,649.5	43,945.4	42,702.0	41,053.8	43,229.7
Extra-Strength	412,834.7	414,029.7	416,732.8	439,215.5	429,237.4	440,603.2	449,838.7
Sum of Billed Loads[1]	3,654,058.6	3,555,711.3	4,000,323.0	3,813,957.7	3,619,694.6	3,675,875.9	4,179,556.1
Total WWTP BOD	4,432,467.9	4,445,298.4	4,474,320.2	4,715,709.2	4,608,577.5	4,730,608.9	4,829,767.2
I&I/Unbilled Loads[2]	778,409.3	889,587.0	473,997.2	901,751.5	988,882.8	1,054,733.0	650,211.1
% I&I Loads to Total	18%	20%	11%	19%	21%	22%	13%

Notes:

1. Loads are calculated at the average domestic strength load identified for each year as shown in Table 3-9 x 8.34 x the billed flows for each class as shown in Table 3-8.
2. I&I/Unbilled is assigned a normal domestic strength.

Table 3-12.
TSS Per Year (lbs)
2000 - 2006

Customer Class	2000	2001	2002	2003	2004	2005	2006
Single-Family Residential	1,657,783.4	1,608,420.2	1,812,313.8	1,963,462.6	1,728,785.6	2,087,571.4	2,346,530.4
Multi-Family Residential	401,197.1	411,656.4	458,020.9	504,020.8	443,729.3	548,364.6	585,851.5
Commercial	699,755.0	664,157.4	707,248.9	788,597.2	601,193.8	791,564.6	925,773.8
Industrial	557.8	482.5	500.2	549.9	37,790.9	40,964.0	44,431.0
City Government	50,033.9	42,661.9	36,721.4	42,966.9	38,140.4	44,578.6	45,763.7
Extra-Strength	412,834.7	414,029.7	416,732.8	439,215.5	429,237.4	440,603.2	449,838.7
Sum of Billed Loads[1]	3,222,161.8	3,141,408.1	3,431,538.0	3,738,812.9	3,278,877.4	3,953,646.5	4,398,189.1
Total WWTP TSS	3,861,712.7	3,879,048.6	3,783,633.5	4,634,559.5	4,137,567.2	5,163,340.2	5,139,336.5
I&I/Unbilled Loads[2]	639,550.9	737,640.6	352,095.5	895,746.5	858,689.7	1,209,693.8	741,147.4
% I&I Loads to Total	17%	19%	9%	19%	21%	23%	14%

Notes:

1. Loads are calculated at the average domestic strength load identified for each year as shown in Table 3-10 x 8.34 x the billed flows for each class as shown in Table 3-8.
2. I&I /Unbilled is assigned a normal domestic strength.

3.2.3 Wastewater Utility Test Year Units of Service

We projected the units of service for wastewater demand the same way we did for the water utility demands. For the test year, we used a projection of customer units provided by the City and the normalized flows per customer unit developed in

our analysis of the historical flows described above. Total flows for the test year were estimated based on the number of projected units times the average (normalized) flows from the historical data. Table 3-13 summarizes our calculation of test year flows and provides the estimated customer units for the test year as well. More detailed information related to the historical flow and customer unit data is provided in Appendix B.

Table 3-13.
Estimated Test Year Wastewater Flows by Customer Class
(thousands of gallons)

	2000 - 2006			Test Year		
Customer Class	Avg. Daily Flow (mgd) *(a)*	Avg. Annual Flow (MG) *(b)*	Avg. Annual. Flow/Cust. (gal) *(c)*	Proj. Test Yr. Units *(d)*	Proj. Annual Flow (MG)[1] *(e)*	Proj. Avg. Daily Flow (mgd)[2] *(f)*
Single-Family Residential	2.67	975.71	55,512.0	20,245	1,123.84	3.08
Multi-Family Residential	0.68	247.55	43,311.4	6,503	281.65	0.77
Commercial	1.05	383.07	400,932.0	1,053	422.18	1.16
Industrial	0.02	8.65	2,286,642.9	4	9.15	0.03
City Government	0.06	22.50	709,902.9	32	22.72	0.06
Sum of Billed Classes	4.49	1,637.49	n/a	27,837	1,859.54	5.09
I&I/Unbilled[3]	1.25	403.55	1,246,445	n/a	458.28	1.26
Total[4]	5.59	2,041.04	n/a	27,837	2,317.81	6.35

Notes:

1. Column *(e)* = *(d)* x *(c)* / 1,000,000
2. Column *(f)* = *(e)* / 365 days
3. I&I/Unbilled flow = Total WWTP flow – Billed Flow.
4. Total WWTP flow projected as 5.59 mgd (historical average WWTP inflow) / 4.49 mgd (historical average billed flows) x 5.09 mgd (test year estimate for billed flow).

Brown and Caldwell also estimated the BOD and TSS loads for each customer class for the test year. The estimates for domestic strength customers, which include all of the non-surcharge classes (including the I&I/Unbilled flows) are based on the three-year rolling average strength loadings as shown in Table 3-9 (BOD) and Table 3-10 (TSS). Table 3-14 summarizes the calculation of test year loadings for non-surcharge customer classes.

Table 3-14.
Estimated Test Year Wastewater Loadings for Non-Surcharge Customer Classes

Customer Class	Test Year Annual Flow (MG) *(a)*	3-Yr. Rolling Avg BOD Load (mg/L) *(b)*	3-Yr. Rolling Avg TSS Load (mg/L) *(c)*	Test Year BOD (lbs) *(d)*	Test Year TSS (lbs) *(e)*
Single-Family Residential	1,123.84	246	249	2,307,285	2,335,423
Multi-Family Residential	281.65	246	249	578,246	585,298
Commercial	422.18	246	249	866,754	877,324
Industrial	9.15	246	249	18,778	19,007
City Government	22.72	246	249	46,639	47,207
Sum of Billed Classes	1,859.54	n/a	n/a	3,817,702	3,864,260
I&I/Unbilled	458.28	246	249	940,855	952,329
Total	2,317.81			4,758,558	4,816,589

Notes:

1. Column (*d*) = (*a*) x (*b*) x 8.3456765 (a constant to convert mg/L to lbs)
2. Column (*e*) = (*a*) x (*c*) x 8.3456765

Extra-strength loadings were estimated based on available data that indicate that approximately 9.3 percent of the total BOD mass at the WWTP is attributable to the surcharge customers, as is 9.8 percent of the TSS. By adding these

additional loads to the total, we were able to estimate WWTP BOD and TSS levels for the test year. Table 3-15 summarizes the calculations for the Extra-Strength customers. Table 3-16 summarizes the test year loads for all customer classes. Brown and Caldwell used the values shown in Table 3-16 for the purposes of calculating rates for the test year.

Table 3-15.
Test Year Loads for Extra-Strength Customers

Description	BOD (lbs)	TSS (lbs)
Total Domestic Load	4,758,558	4,816,589
Percentage Domestic	90.7%	90.2%
Total Extra-Strength Load	487,923	523,310
Percentage Extra-Strength	9.3%	9.8%
Total WWTP Load	5,246,480	5,339,899

Table 3-16.
Test Year Loads for All Customers

Customer Class	BOD (lbs)	TSS (lbs)
Singe-Family Residential	2,307,285	2,335,423
Multi-Family Residential	578,246	585,298
Commercial	866,754	877,324
Industrial	18,778	19,007
City Government	46,639	47,207
I&I/Unbilled	940,855	952,329
Extra-Strength	487,923	523,310
Total	5,246,480	5,339,899

SECTION 4: COST-OF-SERVICE ALLOCATIONS

System cost allocations are determined for the various customer classes, as defined in the previous sections of this report, based on each class' service requirements. This is a primary step in any cost-of-service study, and in order to accomplish it one must first determine and analyze the system revenue requirements and customer characteristics. As a result of the findings, O&M and capital costs are allocated to the appropriate customer classes.

To determine the revenue requirements, Brown and Caldwell and City staff utilized the City's 2008 financial plans, with slight modifications as described in Section 2 of the report, for the water and wastewater systems as well as year-end 2006 capital asset information for both systems. Once the revenue requirements and customer characteristics (as described in Section 3 of the report) were determined, the procedures described below were completed:

- Procedure 1: Functionalize Costs
- Procedure 2: Assign Functionalized Costs to Groups
- Procedure 3: Allocate Costs Based on Customer Service Characteristics
- Procedure 4: Allocate Non-Rate Revenues to Customer Classes
- Procedure 5: Distribute Total Costs to Specific Customer Classes

Because the water and wastewater cost allocations were developed independently, the procedures and methodologies used will be discussed for each.

4.1 Allocation of O&M and Capital Costs – Water System

4.1.1 Procedure 1: Functionalize Costs

In this procedure, the O&M costs of water service were analyzed and segregated by system function. The functional categories and their associated values were instrumental in determining the proper allocation of the O&M costs to the various classes of customers based on their characteristics. Brown and Caldwell and City staff determined that the major functions to be included in the cost-of-service study would be as follows:

- **Source of Supply:** Costs associated with storing and conveying raw water to the water treatment plant

- **Treatment:** Costs associated with treatment of raw water to be conveyed to the transmission and distribution (T&D) system
- **Transmission:** Costs associated with conveying treated water to the distribution system
- **Storage:** Costs associated with storing treated water in the T&D system
- **Distribution:** Costs associated with conveying treated water to customers
- **Transmission & Distribution Pumping:** Costs associated with pumping or maintaining adequate pressure in the T&D system
- **Meter Services:** Costs associated with implementing and maintaining meter reading hardware/software
- **Billing:** Costs associated with collecting usage data from customers via the meter reading hardware and billing customers based on the data
- **Customer Service:** Costs associated with maintaining customer satisfaction
- **Fire Protection:** Direct costs associated with providing adequate fire flow pressures and volumes for all customer classes
- **General/Administrative:** Shared costs which are allocated among those listed above based on the percentage of their costs to total costs

4.1.1.1 O&M

The City maintains a functionalized operating budget that identifies costs as one or more of the functions listed above. A summary of the 2008 test year O&M expenses by function can be found in Table 4-1.

Table 4-1.
2008 Test Year O&M Expenses by Function

Function	(a) Direct Expenses		(d) = (a) / (b) % of Total Functional	(e) = (d) x (c) General/ Administrative Allocation	(a) + (e) Total O&M Expenses by Function
Source of Supply	$975,140		18%	$270,292	$1,245,432
Treatment	1,937,390		36%	537,010	2,474,400
Transmission	237,162		4%	65,737	302,899
Distribution	1,060,528		20%	293,960	1,354,488
T&D Pumping	287,690		5%	79,743	367,433
Meter Services	497,410		9%	137,873	635,283
Billing	329,560		6%	91,348	420,908
Customer Service	70,700		1%	19,597	90,297
Fire Protection	0		0%	0	0
Total Functional Expenses	$5,395,580	*(b)*	100%	$1,495,560	$6,891,140
General/Administrative - Indirect Expenses	$1,495,560	*(c)*			
Total Test Year 2008 O&M Expenses	$6,891,140				

Notes:

1. Storage O&M costs have been included in the distribution costs for the purposes of the Study.
2. No direct fire protection costs were identified in the Study; any direct fire protection costs have been included in the distribution function for the purposes of the Study. Indirect fire protection costs are accounted for elsewhere in the Study (see Table 4-4).

4.1.1.2 Capital Costs

Similar to the O&M procedure discussed above, the capital costs of the water utility were analyzed and segregated by system function. Again, as noted above, the functional categories, and their associated values, were instrumental in determining the proper allocation of the capital costs to the various classes of customers based on their characteristics. In order to accomplish this, Brown and Caldwell and City staff determined that the O&M functional categories, with the exceptions of Billing, Meter Service, and Customer Service, also would be utilized for capital costs. For the Water Storage function, the capital costs were identified specifically rather than included in the Distribution function as they were for the O&M costs.

The functions were determined by reviewing the City's capital assets listing for the water utility as of December 31, 2006 and functionalizing those assets, net of depreciation, in the established categories. The functionalized asset listing was prepared by City staff and was utilized, in large part, to determine the test year capital costs attributable to each function. In order to accomplish this, the 2008 test year capital costs were multiplied by the percentage of fixed assets by function based on the December 31, 2006 functionalized assets listing. The total test year cash-needs capital costs for the water system are $1,398,280 as discussed in Section 2 of the report. A summary of the 2006 net capital assets by function and the breakdown of anticipated capital costs by function can be found in Table 4-2 and Table 4-3, respectively.

Table 4-2.
Net Assets by Function
12/31/2006

Function Description	(a) Net Assets		(d) = (a) / (b) % of Total Net Assets	(e) = (d) x (c) General/ Administrative Allocation	(a) + (e) Total Net Assets by Function
Source of Supply	$73,018,904		51%	$539,923	$73,558,827
Treatment	15,688,310		11%	116,004	15,804,314
Transmission	8,847,473		6%	65,421	8,912,894
Distribution	37,718,173		26%	278,899	37,997,072
T&D Pumping	162,304		0%	1,200	163,504
Water Storage	7,818,153		5%	57,810	7,875,963
Fire Protection	0		0%	0	0
Total Net Assets by Function	$143,253,317	*(b)*	100%	$1,059,257	$144,312,574
General/Administrative - Indirect Net Assets	$1,059,257	*(c)*			
Total Test Year Net Assets	$144,312,574				

Table 4-3.
Capital Costs Allocated by Function
2008 Test Year

Function Description	(a) Net Assets		(d) = (a) / (b) % of Total Net Assets	(c) x (d) Total Net Assets by Function
Source of Supply	$73,558,827		51%	$712,730
Treatment	15,804,314		11%	153,132
Transmission	8,912,894		6%	86,359
Distribution	37,997,072		26%	368,163
T&D Pumping	163,504		0%	1,584
Water Storage	7,875,963		5%	76,312
Fire Protection	0		0%	0
Totals	$144,312,574	*(b)*	100%	$1,398,280
Total Test Year Capital Costs	$1,398,280	*(c)*		

4.1.2 Procedure 2: Assign Functionalized Costs to Groups

4.1.2.1 O&M/Capital Costs

In this procedure the functionalized O&M and capital costs are assigned to specific customer groups or jointly to all customer classes. A customer group consists of one or more customer classes that would share responsibility for certain costs incurred by the utility. Joint costs are shared among all customers in the system proportionately based on their characteristics; specific costs are shared among specific classes based on the characteristics of that group alone. We did not identify any specific customer groupings and have included all costs as joint costs for the purposes of Study.

4.1.3 Procedure 3: Allocate Costs Based on Customer Service Characteristics

4.1.3.1 O&M/Capital Costs

After functionalizing the O&M and capital costs and determining that the costs would be jointly shared by all customer classes, the costs of the water service were analyzed by system function. At that point the costs were allocated to the various classes of customers, based on their demand/usage characteristics. In this analysis, costs were assigned to the basic functional components of Base, Extra Capacity, Customer (Meters and Services, Billing), and Fire Protection. The functional components utilized for this study and their basic definitions are as follows:

- **Base:** Costs that vary directly with the total quantity of water used, as well as those costs associated with serving customers under average load conditions. These costs were assigned to the customer classes based on each class' demand characteristics.
- **Extra Capacity:** Costs incurred due to demands in excess of average load conditions. Extra capacity demand is measured by determining the maximum-day and peak-hour demands for each customer class. These costs were assigned to the customer classes based on each class' demand characteristics.
- **Customer:** Costs associated with meter related expenses and billing, collections and accounting expenses. Customer costs were allocated to classes based on different measurements, including numbers of accounts, number of meters by size, and number of service units (a measure that takes into account the dwelling units connected to the system in the Multi-Family Residential class).
- **Fire Protection:** Costs associated with providing and maintaining public fire protection service. These costs were assigned to the customer classes based on the number of accounts served.

Based on the customer characteristics discussed in Section 3 of this report and the use of the functional components listed in the above bullets, O&M and capital costs were assigned to the customer classes. A summary of the 2008 test year assignment of O&M and capital costs to each of the customer classes can be found in Table 4-4 and Table 4-5.

Table 4-4.
Summary Allocation of Functional Costs to Joint Cost Responsibility Group by Class
2008 Test Year – O&M Costs

Class Description	Base	Max Day	Peak Hr	Meter	Billing	Customer Service Units	Total
Single-Family Residential	$1,620,812	$1,227,282	$415,499	$526,661	$373,004	$65,492	$4,228,750
Multi-Family Residential	267,896	171,555	58,080	42,870	21,306	20,134	581,843
Commercial	393,723	275,927	93,416	45,442	19,847	3,485	831,840
Irrigation	302,518	325,920	110,341	14,402	5,485	963	759,629
Industrial	57,361	42,031	14,230	1,348	123	22	115,115
City Government	43,977	51,263	17,355	4,560	1,143	201	118,499
Fire Protection	0	117,865	137,599	0	0	0	255,464
Totals	$2,686,288	$2,211,844	$846,520	$635,283	$420,908	$90,297	$6,891,140

Table 4-5.
Summary Allocation of Functional Costs to Joint Cost Responsibility Group by Class
2008 Test Year – Capital Costs

Class Description	Base	Max Day	Peak Hr	Meter	Billing	Customer Service Units	Total
Single-Family Residential	$578,019	$143,675	$89,251	$0	$0	$0	$810,946
Multi-Family Residential	95,461	20,067	12,466	0	0	0	127,994
Commercial	140,259	32,267	20,044	0	0	0	192,570
Irrigation	107,789	38,121	23,681	0	0	0	169,590
Industrial	20,428	4,914	3,052	0	0	0	28,394
City Government	15,673	5,997	3,726	0	0	0	25,396
Fire Protection	0	13,810	29,581	0	0	0	43,390
Totals	$957,629	$258,851	$181,800	$0	$0	$0	$1,398,280

4.1.4 Procedure 4: Allocate Non-Rate Revenues to Customer Classes

4.1.4.1 O&M/Capital Costs

After completing the procedures above, non-rate revenues are allocated to specific customer classes. The method for allocation is identical to that described for Procedure 3. Non-rate revenues are applied as credits for each of the customer classes based on those allocations. While reviewing non-rate revenues, one must also determine the source of the revenue and apply the credits to either O&M or capital costs. In addition, it is necessary on occasion to allocate certain non-rate revenues to specific classes or groups of classes. Total 2008 test year non-rate revenue credits by class are shown in Table 4-6. Again, these credits will reduce the total revenue requirements for each class.

Table 4-6.
Summary Allocation of Operating, Capital and Specific Non-Rate Revenues by Class by Functional Cost
2008 Test Year – Non-Rate Revenue Credits

Class Description	Base	Max Day	Peak Hr	Meter	Billing	Customer Service Units	Total Credit By Class
Single-Family Residential	$240,652	$142,604	$53,753	$52,887	$37,457	$6,577	$533,930
Multi-Family Residential	39,776	19,934	7,514	4,305	2,140	2,022	75,690
Commercial	58,458	32,061	12,085	4,563	1,993	350	109,511
Irrigation	44,917	37,870	14,275	1,446	551	97	99,156
Industrial	8,517	4,884	1,841	135	12	2	15,391
City Government	29,168	32,346	11,179	2,805	703	123	76,324
Fire Protection	0	13,695	17,801	0	0	0	31,497
Totals	$421,488	$283,395	$118,449	$66,141	$42,855	$9,171	$941,499

Note:

1. Total O&M credits are equal to $752,999. Total capital credits are equal to $188,500.

4.1.5 Procedure 5: Distribute Total Costs to Specific Customer Classes

4.1.5.1 O&M/Capital Costs

In Procedure 5 the revenue requirement for each of the classes is determined by adding the total O&M and capital costs for each class and subtracting the credits for non-rate revenues for each class. The total revenue requirement calculated for each class, along with each class' customer characteristics, was utilized to determine the rate structure necessary to meet the individual class and overall revenue requirement for the utility. Total revenue requirements by class can be found in Table 4-7.

Table 4-7.
Summary of Water Revenue Requirements by Class
2008 Test Year

Class Description	(a) Total O&M O&M Costs Requirement	(b) Total Capital Costs Requirement	(c) Total Non-Rate Revenue Credits	(a) + (b) - (c) Total Revenue Requirement By Class
Single-Family Residential	$4,228,750	$810,946	$533,930	$4,505,766
Multi-Family Residential	581,843	127,994	75,690	634,146
Commercial	831,840	192,570	109,511	914,899
Irrigation	759,629	169,590	99,156	830,063
Industrial	115,115	28,394	15,391	128,118
City Government	118,499	25,396	76,324	67,570
Fire Protection	255,464	43,390	31,497	267,358
Totals	$6,891,140	$1,398,280	$941,499	$7,347,921

4.2 Allocation of O&M and Capital Costs – Wastewater System

4.2.1 Procedure 1: Functionalize Costs

4.2.1.1 O&M

In this procedure, the O&M costs of wastewater service were analyzed and segregated by system function. The functional categories, and their associated values, were instrumental in determining the proper allocation of the O&M costs to the various classes of customers based on their characteristics. In order to accomplish this, Brown and Caldwell and City staff determined that the major functions to be included in the cost-of-service study would be as follows:

- **Treatment:** Costs associated with treatment of sewage
- **Collection:** Costs associated with conveying sewage from the customer site to the treatment plant
- **Collection Pumping/Lifting:** Costs associated with lifting sewage within the collection system
- **Billing:** Costs associated with billing customers for wastewater services
- **Customer Service:** Costs associated with maintaining customer satisfaction
- **General/Administrative:** Shared costs which are allocated among those listed above based on the percentage of their costs to total costs

The functions listed above were developed by reviewing the City's division level subschedules utilized to prepare the 2008 Wastewater Financial Plan. As noted above, the 2008 Wastewater Financial Plan is the basis for the O&M revenue requirements to be funded via rates. Functionalizing the costs in this manner enhances the accuracy and equity of the wastewater system cost allocations which will be discussed in more detail in the following paragraphs. A summary of the 2008 test year O&M expenses by function can be found in Table 4-8.

Table 4-8.
2008 Wastewater Test Year O&M Expenses by Function

Function	(a) Direct Expenses		(d) = (a) / (b) % of Total Functional	(e) = (d) x (c) General/ Administrative Allocation	(a) + (e) Total O&M Expenses by Function
Treatment	$2,306,250		60%	$770,188	$3,076,438
Collection	1,081,250		28%	361,091	1,442,341
Collection Pumping/Lifting	300,180		8%	100,247	400,427
Billing	101,530		3%	33,907	135,437
Customer Service	69,700		2%	23,277	92,977
Total Functional Expenses	$3,858,910	*(b)*	100%	$1,288,710	$5,147,620
General/Administrative - Indirect Expenses	$1,288,710	*(c)*			
Total Test Year 2008 O&M Expenses	$5,147,620				

4.2.1.2 Capital Costs

Similar to the O&M procedure discussed above, the capital costs of the wastewater utility were analyzed and segregated by system function. Again, as noted above, the functional categories, and their associated values, were instrumental in determining the proper allocation of the capital costs to the various classes of customers based on their characteristics. In order to accomplish this, Brown and Caldwell and City staff determined that the O&M functional categories, with the exception of Billing and Customer Service, also would be utilized for capital costs.

The functions were determined by reviewing the City's capital assets listing for the wastewater utility as of December 31, 2006 and functionalizing those assets, net of depreciation, in the established categories. The functionalized asset listing was prepared by City staff and was utilized, in large part, to determine the test year capital

costs attributable to each function. In order to accomplish this, the 2008 test year capital costs were multiplied by the percentage of fixed assets by function based on the December 31, 2006 functionalized assets listing. The total test year capital costs for the wastewater system is $2,333,860, as discussed in more detail in Section 2 of the report. A summary of the 2006 net assets by function and the breakdown of anticipated capital costs by function can be found in Table 4-9 and Table 4-10, respectively.

Table 4-9.
Net Assets by Function
12/31/2006

Net Assets by Function as of 12/31/2006	(a) Net Assets		(d) = (a) / (b) % of Total Net Assets	(e) = (d) x (c) General/ Administrative Allocation	(a) + (e) Total Net Assets by Function
Treatment	$20,934,190		39%	$273,172	$21,207,362
Collection	29,530,816		55%	385,350	29,916,166
Collection Pumping/Lifting	2,852,086		5%	37,217	2,889,303
Total Net Assets by Function	$53,317,092	*(b)*	100%	$695,739	$54,012,831
General/Administrative - Indirect Net Assets	$695,739	*(c)*			
Total Test Year Net Assets	$54,012,831				

Table 4-10.
Wastewater Capital Costs Allocated by Function
12/31/2006

Function Description	(a) Net Assets		(d) = (a) / (b) % of Total Net Assets	(c) x (d) Total Net Assets by Function
Treatment	$21,207,362		39%	$916,357
Collection	$29,916,166		55%	1,292,658
Collection Pumping/Lifting	$2,889,303		5%	124,845
Totals	$54,012,831	*(b)*	100%	$2,333,860
Total Test Year Capital Costs	$2,333,860	*(c)*		

4.2.2 Procedure 2: Assign Functionalized Costs to Groups

4.2.2.1 O&M/Capital Costs

In this procedure the functionalized O&M and capital costs were assigned to specific customer groups or jointly to all customer classes. A customer group consists of one or more customer classes that would share responsibility for certain costs incurred by the utility. Joint costs are shared among all customers in the system proportionately based on their characteristics; specific costs are shared among specific classes based on the characteristics of that group alone. We did not identify any specific customer groupings and have included all costs as joint costs for the purposes of the Study.

4.2.3 Procedure 3: Allocate Costs Based on Customer Service Characteristics

4.2.3.1 O&M/Capital Costs

After functionalizing the O&M and capital costs and determining that the costs would be jointly shared by all customer classes, the costs of the wastewater service were analyzed by system function in order to properly allocate the costs to the various classes of customers, based on their demand/usage characteristics. In this analysis, costs were assigned to the basic functional components of Flows, Loadings (BOD/TSS), and Customer (Services and Billing). The functional components utilized for this study, and their basic definitions, are as follows:

- **Flows:** Costs that vary with the hydraulic flow of sewage. Flow costs typically include the operating and capital costs associated with treatment, collection lines and lift stations, which are typically designed to accommodate maximum hydraulic flow rates. These costs were assigned to the customer classes based on each class' demand characteristics.
- **Loadings:** Costs associated with sewer loadings. Loadings are measures of the concentrations and mass of wastes contributed to the wastewater system. Although the composition of the wastewater could be placed into numerous categories of wastes, the City, like most wastewater utilities, measures waste composition for just two such categories: BOD and TSS. Customer classes contribute to the concentration and mass of wastes in the wastewater, which in turn must be treated in order for the water to be returned to the environment to required standards. These costs were assigned to the customer classes based on each class' demand characteristics.
- **Customer (Services and Billing):** Costs associated with billing, collections and accounting expenses. These costs were assigned to the customer classes based on the number of accounts served.

Based on the customer characteristics described in Section 3 of this report and the use of the functional components listed in the above bullets, O&M and capital costs were assigned to the customer classes. A summary of the 2008 test year assignment of O&M and capital costs to each of the customer classes can be found in Table 4-11 and Table 4-12.

Table 4-11.
Summary Allocation of Functional Costs to Joint Cost Responsibility Group by Class
2008 Test Year – O&M Costs

Class Description	Flows	BOD	TSS	Customer	Billing	Customer Service Units	Total
Single-Family Residential	$1,087,422	$771,181	$403,647	$0	$0	$166,118	$2,428,368
Multi-Family Residential	272,527	193,272	101,161	0	0	53,360	620,319
Commercial	408,501	289,702	151,634	0	0	8,640	858,476
Industrial	8,850	6,276	3,285	0	0	33	18,445
City Government	21,981	15,588	8,159	0	0	263	45,991
I&I/Unbilled	443,425	314,469	164,598	0	0	0	922,491
Extra-Strength Loadings	0	163,082	90,447	0	0	0	253,529
Totals	$2,242,705	$1,753,570	$922,931	$0	$0	$228,413	$5,147,620

Table 4-12.
Summary Allocation of Functional Costs to Joint Cost Responsibility Group by Class
2008 Test Year – Capital Costs

Class Description	Flows	BOD	TSS	Customer	Billing	Customer Service Units	Total
Single-Family Residential	$1,076,643	$231,659	$102,392	$0	$0	$0	$1,410,695
Multi-Family Residential	269,887	58,071	25,667	0	0	0	353,625
Commercial	404,172	86,965	38,438	0	0	0	529,574
Industrial	8,756	1,884	833	0	0	0	11,472
City Government	21,747	4,679	2,068	0	0	0	28,494
I&I/Unbilled	0	0	0	0	0	0	0
Extra-Strength Loadings	0	0	0	0	0	0	0
Totals	$1,781,204	$383,258	$169,398	$0	$0	$0	$2,333,860

4.2.4 Procedure 4: Allocate Non-Rate Revenues to Customer Classes

4.2.4.1 O&M/Capital Costs

After completing the procedures above, non-rate revenues are allocated to specific customer classes. The method for allocation is identical to that described for Procedure 3. Non-rate revenues are applied as credits for each of the customer classes based on those allocations. While reviewing non-rate revenues, one must also determine the source of the revenue and apply the credits to either O&M or capital costs. In addition, it is necessary on occasion to allocate certain non-rate revenues to specific classes or groups of classes. Total 2008 test year non-rate revenue credits by class are listed in Table 4-13. Again, these credits will reduce the revenue requirement shown above for each class.

Table 4-13.
Summary Allocation of Operating, Capital and Specific Non-Rate Revenues by Class by Functional Cost
2008 Test Year – Non-Rate Revenue Credits[1]

Class Description	Flows	BOD	TSS	Customer	Billing	Customer Service Units	Total Credit By Class
Single-Family Residential	$92,085	$23,111	$10,753	$0	$0	$1,528	$127,478
Multi-Family Residential	23,078	5,792	2,695	0	0	491	32,056
Commercial	34,593	8,682	4,040	0	0	79	47,394
Industrial	749	188	88	0	0	0	1,025
City Government	1,861	467	217	0	0	2	2,548
I&I/Unbilled	37,550	9,424	4,385	0	0	0	51,359
Extra-Strength Loadings	0	4,887	2,410	0	0	0	7,297
Totals	$189,917	$52,552	$24,588	$0	$0	$2,100	$269,157

Note:
1. Total O&M credits are equal to $47,337. Total capital credits are equal to $221,820.

4.2.5 Procedure 5: Distribute Total Costs to Specific Customer Classes

4.2.5.1 O&M/Capital Costs

In Procedure 5 the revenue requirement for each of the classes is determined by adding the total O&M and capital costs for each class and subtracting the credits for non-rate revenues for each class. The total revenue requirement calculated for each class, along with each class' customer characteristics, was utilized to determine the rate structure necessary to meet the individual class and overall revenue requirement for the utility. Total revenue requirements by class can be found in Table 4-14.

Table 4-14.
Summary of Revenue Requirements by Class
2008 Test Year

Class Description	(a) Total O&M Costs Requirement	(b) Total Capital Costs Requirement	(c) Total Non-Rate Revenue Credits	(a) + (b) - (c) Total Revenue Requirement By Class
Single-Family Residential	$2,428,368	$1,410,695	$127,478	$3,711,585
Multi-Family Residential	620,319	353,625	32,056	941,888
Commercial	858,476	529,574	47,394	1,340,657
Industrial	18,445	11,472	1,025	28,891
City Government	45,991	28,494	2,548	71,937
I&I/Unbilled	922,491	0	51,359	871,132
Extra-Strength Loadings	253,529	0	7,297	246,232
Totals	$5,147,620	$2,333,860	$269,157	$7,212,323

SECTION 5: RECOMMENDED RATES

The recommended rates are based on the allocated cost of service for each customer class as described in Sections 2 through 4 of the report. In all cases, the proposed rates are designed to recover the revenue requirement particular to a customer class such that each class pays its own fair share of the water and wastewater system costs.

5.1 Recommended Water Rates

Unit costs per thousand gallons of water usage and base monthly service charges were developed for each class (classes developed were described in earlier sections of this report) based on the class' revenue requirement and characteristics. Costs included in the unit cost per thousand gallons of water usage include base costs and the costs of extra capacity (maximum day and peak hour). Costs included in the base monthly charge for each class include all customer costs, meter costs, and charges for public fire protection. This process was done for each of the classes, and the results are shown in the recommended water rates schedule, located in Table 5-1.

Table 5-1.
Current and Recommended Rates
Water Utility

Current Water Rates - Inside-City Customers								
	Base Monthly Meter Charge by Size							Use Fee Per
Customer Class	3/4"	1"	1 1/2"	2"	3"	4"	6"	1,000 Gallons
Single-Family Residential	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.60
Multi-Family Residential	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.60
Commercial	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.36
Irrigation	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.60
Industrial	$5.75	$7.72	$9.68	$15.09	$54.91	$69.66	$104.48	$1.21

Recommended Water Rates - Inside-City Customers								
	Base Monthly Meter Charge by Size							Use Fee Per
Customer Class	3/4"	1"	1 1/2"	2"	3"	4"	6"	1,000 Gallons
Single-Family Residential	$4.16	$4.90	$5.64	$7.68	$22.67	$28.22	$41.18	$1.55
Multi-Family Residential	$8.52	$9.26	$10.00	$12.04	$27.03	$32.58	$45.53	$1.44
Commercial	$4.16	$4.90	$5.64	$7.68	$22.67	$28.22	$41.18	$1.50
Irrigation	$4.16	$4.90	$5.64	$7.68	$22.67	$28.22	$41.18	$1.85
Industrial	$4.16	$4.90	$5.64	$7.68	$22.67	$28.22	$41.18	$1.53

Note:

1. The City's current water rate structure includes a 1 1/4" meter size category. Based on the most recent meter counts, one such meters exists within the Multi-Family class. Rates for this meter size were not included in this Study and therefore were not included in the current and proposed tables presented above.

2. Rates for outside-city customers, which are not shown here, are calculated at 150 percent of inside-city rates.

5.1.1 Comparison of Existing and Recommended Water Rates

The recommended rate schedule shown in Table 5-1 is directly related to the revenue requirements and customer service characteristics found during the cost-of-service study for each class. Table 5-2 (Single-Family), Table 5-3 (Multi-Family), Table 5-4 (Commercial), Table 5-5 (Irrigation) and Table 5-6 (Industrial) provide monthly rate comparisons between the current and recommended rates at various usage levels for each of the classes shown in Table 5-1.

Table 5-2.
Single-Family Residential Class – Rate Comparison
Current versus Recommended Rates

(a)	Current Rates			Recommended Rates			*(g) / [(d) - 1]*
Gallons Consumed (in Thousands)	*(b)* **Monthly Base Charge**	*(c)* **Use Fee Per 1,000 Gallons**	*(d)* **b + (a x c) Monthly Fee**	*(e)* **Monthly Base Charge**	*(f)* **Use Fee Per 1,000 Gallons**	*(g)* **e + (a x f) Monthly Fee**	**% Change from Current Monthly Fee**
5	$5.75	$1.60	$13.75	$4.16	$1.55	$11.91	-13%
10	$5.75	$1.60	$21.75	$4.16	$1.55	$19.66	-10%
15	$5.75	$1.60	$29.75	$4.16	$1.55	$27.41	-8%
20	$5.75	$1.60	$37.75	$4.16	$1.55	$35.15	-7%
25	$5.75	$1.60	$45.75	$4.16	$1.55	$42.90	-6%
30	$5.75	$1.60	$53.75	$4.16	$1.55	$50.65	-6%
50	$5.75	$1.60	$85.75	$4.16	$1.55	$81.64	-5%

Note: The rate comparisons shown above are for 3/4", inside-city, single-family meters.

Table 5-3.
Multi-Family Residential Class – Rate Comparison
Current versus Recommended Rates

(a)	Current Rates			Recommended Rates			(g) / [(d) - 1]
Gallons Consumed (in Thousands)	(b) Monthly Base Charge	(c) Use Fee Per 1,000 Gallons	(d) b + (a x c) Monthly Fee	(e) Monthly Base Charge	(f) Use Fee Per 1,000 Gallons	(g) e + (a x f) Monthly Fee	% Change from Current Monthly Fee
10	$7.72	$1.60	$23.72	$9.26	$1.44	$23.65	0%
20	$7.72	$1.60	$39.72	$9.26	$1.44	$38.04	-4%
30	$7.72	$1.60	$55.72	$9.26	$1.44	$52.43	-6%
40	$7.72	$1.60	$71.72	$9.26	$1.44	$66.82	-7%
50	$7.72	$1.60	$87.72	$9.26	$1.44	$81.21	-7%
75	$7.72	$1.60	$127.72	$9.26	$1.44	$117.18	-8%
100	$7.72	$1.60	$167.72	$9.26	$1.44	$153.15	-9%

Note: The rate comparisons shown above are for 1", inside-city, multi-family meters.

Table 5-4.
Commercial Class – Rate Comparison
Current versus Recommended Rates

(a) Gallons Consumed (in Thousands)	Current Rates			Recommended Rates			(g) / [(d) - 1]
	(b) Monthly Base Charge	(c) Use Fee Per 1,000 Gallons	(d) b + (a x c) Monthly Fee	(e) Monthly Base Charge	(f) Use Fee Per 1,000 Gallons	(g) e + (a x f) Monthly Fee	% Change from Current Monthly Fee
20	$7.72	$1.36	$34.92	$4.90	$1.50	$34.82	0%
40	$7.72	$1.36	$62.12	$4.90	$1.50	$64.74	4%
60	$7.72	$1.36	$89.32	$4.90	$1.50	$94.66	6%
80	$7.72	$1.36	$116.52	$4.90	$1.50	$124.57	7%
100	$7.72	$1.36	$143.72	$4.90	$1.50	$154.49	7%
120	$7.72	$1.36	$170.92	$4.90	$1.50	$184.41	8%
150	$7.72	$1.36	$211.72	$4.90	$1.50	$229.29	8%

Note: The rate comparisons shown above are for 1", inside-city, commercial meters.

Table 5-5.
Irrigation Class – Rate Comparison
Current versus Recommended Rates

(a) Gallons Consumed (in Thousands)	Current Rates			Recommended Rates			(g) / [(d) - 1] % Change from Current Monthly Fee
	(b) Monthly Base Charge	(c) Use Fee Per 1,000 Gallons	(d) b + (a x c) Monthly Fee	(e) Monthly Base Charge	(f) Use Fee Per 1,000 Gallons	(g) e + (a x f) Monthly Fee	
80	$9.68	$1.60	$137.68	$5.64	$1.85	$153.77	12%
100	$9.68	$1.60	$169.68	$5.64	$1.85	$190.81	12%
125	$9.68	$1.60	$209.68	$5.64	$1.85	$237.10	13%
150	$9.68	$1.60	$249.68	$5.64	$1.85	$283.39	14%
175	$9.68	$1.60	$289.68	$5.64	$1.85	$329.68	14%
200	$9.68	$1.60	$329.68	$5.64	$1.85	$375.97	14%
250	$9.68	$1.60	$409.68	$5.64	$1.85	$468.55	14%

Note: The rate comparisons shown above are for 1½", inside-city, irrigation meters.

Table 5-6.
Industrial Class – Rate Comparison
Current versus Recommended Rates

(a) Gallons Consumed (in Thousands)	Current Rates			Recommended Rates			(g) / [(d) - 1]
	(b) Monthly Base Charge	(c) Use Fee Per 1,000 Gallons	(d) b + (a x c) Monthly Fee	(e) Monthly Base Charge	(f) Use Fee Per 1,000 Gallons	(g) e + (a x f) Monthly Fee	% Change from Current Monthly Fee
80	$15.09	$1.21	$111.89	$7.68	$1.53	$129.75	16%
100	$15.09	$1.21	$136.09	$7.68	$1.53	$160.27	18%
125	$15.09	$1.21	$166.34	$7.68	$1.53	$198.42	19%
150	$15.09	$1.21	$196.59	$7.68	$1.53	$236.57	20%
175	$15.09	$1.21	$226.84	$7.68	$1.53	$274.72	21%
200	$15.09	$1.21	$257.09	$7.68	$1.53	$312.87	22%
250	$15.09	$1.21	$317.59	$7.68	$1.53	$389.16	23%

Note: The rate comparisons shown above are for 2", inside-city, industrial meters.

5.2 Proposed Wastewater Rates

Unit costs per thousand gallons of sewage generated and base monthly service charges were developed for each class (classes developed were described in earlier sections of this report) based on the class' revenue requirement and characteristics. The majority of costs included in the unit cost per thousand gallons of sewage generated include flow and normal strength loadings costs. The costs associated with extra-strength loadings were considered independently as discussed in Section 3 of this report. Costs included in the base monthly charge for each class include a portion of the flow and normal strength loadings costs as well as all customer service related costs.

While reviewing the study results and recommended rates with the Loveland Utilities Commission (LUC) on September 18th, 2007, Brown and Caldwell was directed by the LUC to develop an alternative wastewater rate for the Commercial and Industrial classes. In addition, the LUC requested that Brown and Caldwell present the originally recommended and alternative rates for the two classes to the Loveland City Council for consideration at the October 16th, 2007, City Council meeting. The originally recommended rate for the Commercial class was $2.60 per one thousand gallons with a base charge of $28.34 per month, and the originally recommended rate for the Industrial class was $2.60 per one thousand gallons with a base charge of $152.29 per month. The LUC had concerns about the large increase in the base charge, particularly for the impact on small businesses. As such, the LUC directed Brown and Caldwell to develop alternative rates for both classes that feature lower monthly base charges and higher rates per thousand gallons. The alternative rates for the Commercial and Industrial classes were approved by the Loveland City Council on October 16th, 2007. The rates approved are shown below in the recommended wastewater rates schedule, located in Table 5-7.

Table 5-7.
Current and Recommended Wastewater Rates

Customer Class and Description	Current Inside-City Rate	Recommended Inside-City Rate
Single-Family Residential (20245 customers)		
Monthly Flat Rate	$20.69	$17.67
Monthly Metered Rate		
Monthly Base Charge	$5.61	$5.63
Volume Charge per 1,000 Gallons	$2.71	$2.60
Multi-Family Residential (6503 customers)		
Monthly Flat Rate - Per Dwelling Unit	$19.53	$14.22
Monthly Metered Rate		
Monthly Base Charge - Per Dwelling Unit	$5.61	$4.83
Volume Charge per 1,000 Gallons	$2.71	$2.60
Commercial (1053 customers)		
Monthly Flat Rate	$113.59	$115.25
Monthly Metered Rate		
Monthly Base Charge	$5.61	$8.00
Volume Charge per 1,000 Gallons	$2.71	$3.21
Industrial (4 customers)		
Monthly Metered Rate		
Monthly Base Charge	$5.61	$8.00
Volume Charge per 1,000 Gallons	$2.71	$3.36
Extra-Strength Surcharge (approx. 275 customers)		
BOD Charge per 1,000 Gallons	$0.002002	n/a
TSS Charge per 1,000 Gallons	$0.001062	n/a
BOD Charge per Pound (In Excess of Domestic Load)	n/a	$0.32
TSS Charge per Pound (In Excess of Domestic Load)	n/a	$0.17

Note: Rates for outside-city customers, which are not shown here, are calculated at 150 percent of inside-city rates.

5.2.1 Current and Recommended Rate Comparisons – Wastewater Utility

The recommended rate schedule shown in Table 5-7 is directly related to the revenue requirements and customer service characteristics found during the cost-of-service study for each class. Table 5-8 (Single-Family), Table 5-9 (Multi-Family), Table 5-10 (Commercial), Table 5-11 (Industrial), and Table 5-12 (Extra-Strength Customers) provide monthly rate comparisons between the current and proposed rates at various usage levels for each of the classes shown in Table 5-1.

Table 5-8.
Single-Family Residential Class – Rate Comparison
Current versus Recommended Rates

(a)	Current Rates			Recommended Rates			(g) / [(d) - 1]
Winter Quarter Average (in Thousands)	(b) Monthly Base Charge	(c) Use Fee Per 1,000 Gallons	(d) b + (a x c) Monthly Fee	(e) Monthly Base Charge	(f) Use Fee Per 1,000 Gallons	(g) e + (a x f) Monthly Fee	% Change from Current Monthly Fee
3	$5.61	$2.71	$13.74	$5.63	$2.60	$13.44	-2%
5	$5.61	$2.71	$19.16	$5.63	$2.60	$18.64	-3%
10	$5.61	$2.71	$32.71	$5.63	$2.60	$31.64	-3%
15	$5.61	$2.71	$46.26	$5.63	$2.60	$44.65	-3%

Note: The rate comparisons shown above are for inside-city, monthly metered rate customers in the Single-Family Residential class.

Table 5-9.
Multi-Family Residential Class – Rate Comparison
Current versus Recommended Rates

(a)	Current Rates			Recommended Rates			(g) / [(d) - 1]
Winter Quarter Average (in Thousands)	(b) Monthly Base Charge	(c) Use Fee Per 1,000 Gallons	(d) b + (a x c) Monthly Fee	(e) Monthly Base Charge	(f) Use Fee Per 1,000 Gallons	(g) e + (a x f) Monthly Fee	% Change from Current Monthly Fee
5	$5.61	$2.71	$19.16	$4.83	$2.60	$17.84	-7%
10	$5.61	$2.71	$32.71	$4.83	$2.60	$30.85	-6%
15	$5.61	$2.71	$46.26	$4.83	$2.60	$43.85	-5%
20	$5.61	$2.71	$59.81	$4.83	$2.60	$56.86	-5%

Note: The rate comparisons shown above are for inside-city, monthly metered rate customers in the Multi-Family Residential class.

Table 5-10.
Commercial Class – Rate Comparison
Current versus Recommended Rates

(a) Billed Flow (in Thousands)	Current Rates			Recommended Rates			(g) / [(d) - 1] % Change from Current Monthly Fee
	(b) Monthly Base Charge	(c) Use Fee Per 1,000 Gallons	(d) b + (a x c) Monthly Fee	(e) Monthly Base Charge	(f) Use Fee Per 1,000 Gallons	(g) e + (a x f) Monthly Fee	
10	$5.61	$2.71	$32.71	$8.00	$3.21	$40.10	23%
15	$5.61	$2.71	$46.26	$8.00	$3.21	$56.15	21%
20	$5.61	$2.71	$59.81	$8.00	$3.21	$72.20	21%
30	$5.61	$2.71	$86.91	$8.00	$3.21	$104.30	20%

Note: The rate comparisons shown above are for inside-city, monthly metered rate customers in the Commercial class.

Table 5-11.
Industrial Class – Rate Comparison
Current versus Recommended Rates

(a)	Current Rates			Recommended Rates			(g) / [(d) - 1]
Billed Flow (in Thousands)	(b) Monthly Base Charge	(c) Use Fee Per 1,000 Gallons	(d) b + (a x c) Monthly Fee	(e) Monthly Base Charge	(f) Use Fee Per 1,000 Gallons	(g) e + (a x f) Monthly Fee	% Change from Current Monthly Fee
1,700	$5.61	$2.71	$4,612.61	$8.00	$3.36	$5,720.00	24%
1,800	$5.61	$2.71	$4,883.61	$8.00	$3.36	$6,056.00	24%
1,900	$5.61	$2.71	$5,154.61	$8.00	$3.36	$6,392.00	24%
2,000	$5.61	$2.71	$5,425.61	$8.00	$3.36	$6,728.00	24%

Note: The rate comparisons shown above are for inside-city, monthly metered rate customers in the Industrial class.

Table 5-12.
Extra-Strength Class – Rate Comparison
Current versus Recommended Rates

(a) Billed Flow (in Thousands)[1]	Excess Loadings[2]		Current Rates			Recommended Rates			(i) / [(f) - 1] % Change from Current Fee
			Fee Per Thousand Gallons		(f) Total Extra-Strength Fee[3]	Fee Per Pound		(i) Total Extra-Strength Fee[4]	
	(b) BOD mg/L	(c) TSS mg/L	(d) BOD	(e) TSS		(g) BOD	(h) TSS		
50	139	1	$0.002002	$0.001062	$13.97	$0.32	$0.17	$18.62	33%
50	442	371	$0.002002	$0.001062	$63.94	$0.32	$0.17	$85.28	33%
50	574	656	$0.002002	$0.001062	$92.29	$0.32	$0.17	$123.10	33%

Notes:

1. The above examples were used for demonstration purposes only. Assumed 50,000 gallons in monthly consumption and included three levels of Extra-Strength customers as presented by City staff.

2. Extra-Strength customers will pay the above rates in addition to their normal class rates. The excess loadings shown above are loadings above normal strength.

3. The total Extra-Strength fee under the current methodology is calculated as follows:
   BOD *(b)* x *(d)* = rate per thousand gallons, rate per thousand gallons x *(a)* = BOD rate
   TSS *(c)* x *(e)* = rate per thousand gallons, rate per thousand gallons x *(a)* = TSS rate

4. The total Extra-Strength fee under the proposed methodology is calculated as follows:
   BOD [*(a)* x *(b)* x 8.34 x (g)] / 1,000
   TSS [*(a)* x *(b)* x 8.34 x *(h)*] / 1,000

SECTION 6: SYSTEM IMPACT FEES

The City charges an SIF as a condition of receiving service for any new connection to the water and/or wastewater systems. New connections include connections to new structures (e.g., new homes) as well as installation of new connections at an existing service address where the use of the water and wastewater system has changed substantially. This latter event can and does occur whenever a change in meter size is needed.

The SIF is a particular utility fee that falls under the category of *impact fees* as described in the Colorado Revised Statutes, CRS 29-20-104.5. The Colorado law describes such fees as ones that fund ". . .expenditures by. . .local government on capital facilities needed to serve new development." The law further requires that local governments – which generally include all cities, towns, and counties in Colorado – may not impose an impact fee unless the fee is (1) legislatively adopted, (2) generally applicable to a broad class of property, and (3) intended to defray the projected impacts on capital facilities caused by proposed development. The level of the fee, under the statute, is bound to the quantifiable and reasonable impacts of proposed development and cannot be set at a level greater than what is necessary to defray those impacts. An important attribute of the Colorado law is that the impact fee may not be imposed to remedy deficiencies in the utility systems, meaning that impact fees are not to be imposed for renewal and replacements, repairs, or any other reason other than expansion of the system to accommodate new development.

The Colorado statute is consistent with the 2001 Colorado Supreme Court decision in *Krupp v. Breckenridge Sanitation District* even though the statute contains some additional constraints that were not discussed in the Court's ruling. Specifically, the Krupp decision provides guidelines in establishing impact fees which, when followed, distinguish the fees from other types of development contributions known as *takings*. Those guidelines state that the impact fee must be:

- Reasonably related to the cost of service
- Rationally based
- Fairly calculated
- Applied in a rational and consistent manner
- Applicable to all similarly situated applicants

6.1 Generally Accepted Approaches for Calculating Impact Fees

Brown and Caldwell reviewed the City's current SIF under the guidelines and constraints of both the Colorado law (CRS 29-20-104.5) as well as the *Krupp v. Breckenridge case*. There are three generally accepted approaches to establishing an impact fee like the City's SIF. Any of the three approaches, if applied correctly, will result in an impact fee that can meet the Colorado requirements.

6.1.1 The Equity Method

The first approach is called the *equity method*. Under the equity method, new connections are charged a proportional fee based on the total ratepayer equity in the utility system. To properly apply the equity method, one must know the total value of the plant-in-service, the total debt obligations pledged against the system, the available capacity in the plant-in-service, and the number of equivalent units connected to the system. Generally, the equity method states ratepayer equity as the value of the plant-in-service less accumulated depreciation and long-term debt. Dividing the ratepayer equity by the total number of existing equivalent units gives an average equity value per equivalent customer that is then charged to new connections accordingly.

The equity method quantifies historical investment in the utility system, and it is presumed that capacity is available in the system to provide new customers with service. The rational basis for charging customers based on the level of historical investment exists so long as the system has the capacity to provide service; once the capacity in the system is fully subscribed, however, there is no rational basis for charging customers a proportion of the historical investment. As such, the equity method is best suited for utilities that have existing facilities in place with the capacity to provide for anticipated growth.

6.1.2 The Incremental Cost Method

The second approach for calculating impact fees is the *incremental cost method*. Under this approach, new connections are charged a proportionate share of the anticipated costs that the utility will incur in order to provide capacity for new service. To apply the incremental cost method, the utility must be able to quantify the expected investment in facilities over a number of future periods and must identify those investments as related to increases in capacity versus investments that do not increase capacity. To assess the fee, the utility also will need to know the total capacity provided by the proposed investments and approximately how many equivalent units can be served with that capacity. The impact fee under the incremental cost method is the total cost of the capacity-related investments divided by the total equivalent units that those investments ultimately will serve.

The incremental cost method quantifies future investment in the utility system and is more closely aligned with facility planning. Unlike the equity method, the incremental cost method presumes that the existing facilities are inadequate to provide new customers with service and that new investment is required in order to make service available. The fee is meant to defray a proportionate cost of those future investments. There is a rational basis for charging customers a fee based on the incremental cost method so long as there is a need for future investment to provide capacity for new connections. There is a distinction between added capacity and added capacity for new customers because the rational basis for an impact fee in Colorado must relate to the impact of proposed development (i.e., new customers) on facilities. It follows that additions to capacity that are not required to provide service for new customers are not investments that should be included in the basis for the impact fee.

6.1.3 Combined Approach

In many cases, new connections will at one time use capacity in the existing system and also will require additional capacity (e.g., new source of water supply) requiring future investments. In these cases, combining the equity method and incremental cost method may be appropriate. When using a combined approach, it is important to fully account for available capacity and expected capacity and to understand those capacities based on functional distinctions of the utility system (e.g., source of supply, transmission, storage) so as to properly account for both the historical investments as well as the future investments in the system. If applied properly, the combined approach can be calculated with the following formula:

$$\text{Impact Fee} = \frac{\text{Historical Investment} + \text{Planned Investment}}{\text{Available Equivalent Units} + \text{Planned Equivalent Units}}$$

6.2 The City of Loveland's System Impact Fee

Our review of the City's SIF indicates that it is based on the equity method as described in Section 6.1.1. As such, the fee is a proportionate share of the historical investment in the utility systems. In addition to the SIF, the City requires new connections to dedicate sufficient water rights to provide service based on equivalent units of demand. For a new water connection, then, the total impact includes both the SIF and the dedication of water rights.

Table 6-1 is a summary of the City's water SIF (excluding the water rights dedication). The calculation includes a value of the entire utility plant-in-service expressed either as the historical cost as indexed to present value based on an inflation index or as current market value based on engineer estimates. In addition to the current plant values, the SIF includes in its basis the accumulated SIF funds ("SIF Cash" in Table 6-1). Liabilities, including outstanding debt and oversize agreements, are then subtracted from the total of the plant-in-service and SIF cash to reach a net asset value. The net asset value is the total ratepayer equity under the City's impact fee approach; the net asset value is divided by the number of equivalent units to reach an SIF of $4,340 per unit.

Table 6-2 is a summary of the City's wastewater SIF, and it is calculated in the same way as the water fee. The most significant difference between the two is that the amount of SIF cash on hand for the wastewater fund is substantially less than what is on hand for the water fund.

Table 6-1.
2007 Water System Impact Fee Calculation

Description	Value
Land	$509,000
Trunk Mains	55,030,562
Treatment Plant	42,000,000
Equipment	1,653,569
Storage	19,500,000
Pump Stations	1,670,000
Work in Progress	129,152
Total Plant-In-Service	$120,492,283
SIF Cash	$12,391,598
(Less)	
Outstanding Long-Term Debt	$0
Oversize Agreements	(483,859)
Net Asset Value	$132,400,022
Total Single-Family Equivalents	30,514
SIF per Equivalent Unit	$4,340

6.2.1 Findings Related to the City's SIF

The City's approach to calculating its SIFs is reasonable and, in our opinion, is generally consistent with the guidelines provided by CRS 29-20-104.5 and the *Krupp v. Breckenridge* decision. There are some areas, though, that the City may wish to address at some point in the future:

- It is appropriate to use an index of historical investment in utility plant as the basis for the plant-in-service. However, the City is using an index value in some cases (for some of the asset types listed) while using an engineer's estimate of replacement value in others. The two should produce consistent results, but that depends on the engineering approach to calculating replacement value. A more consistent approach would be to always use the index value.
- Including SIF cash as part of the basis for the fee is a technique that has been used in Colorado before, but not one that Brown and Caldwell recommends. Under the equity approach, the rational nexus for recovering the SIF is to recover a proportionate share of the historical costs incurred by the City for the construction of a utility plant with sufficient capacity to serve new connections in the present. The SIF cash on hand is only an accounting of the City's collection of those payments and does not reflect investment in facilities directly (i.e., it is the accumulated recovery of past investments).
- The SFE used in the City's calculation is the total existing SFE rather than the total SFE that could be served based on the investment in the utility plant-in-service. Using an SFE based on the total capacity of the plant in service will produce a more consistent SIF over time.

Table 6-2.
2007 Wastewater System Impact Fee Calculation

Description	Value
Land	$342,933
Trunk Mains	17,041,665
Treatment Plant	50,000,000
Equipment	1,057,644
Lift Stations	0
Work in Progress	8,997
Total Plant-In-Service	$68,451,239
SIF Cash	$4,282,126
(Less)	
Outstanding Long-Term Debt	$0
Oversize Agreements	(131,949)
Net Asset Value	$72,601,416
Total Single-Family Equivalents	30,816
SIF per Equivalent Unit	$2,360

6.3 Mixed-Use Customer Types

An important change facing the City of Loveland in the short-term is the pending addition of a new type of development where a number of activity types will be present at a single service address. Mixed-use development is a relatively new concept in Colorado and includes construction of larger buildings that house residential units (either apartments or condominiums), as well as commercial interests (e.g., restaurants). In many cases, there is a single water or sewer connection to one such building, which in turn is shared by the various tenants. Problems arise with respect to utility ratemaking with these types of developments because the water and sewer usage can vary greatly from one building (i.e., connection) to the next depending on the mix of residential to commercial activities at each location.

The City has asked Brown and Caldwell to recommend a methodology for assessing the SIF for mixed-use developments. A proposed definition is discussed in the following paragraphs, as well as two alternative methods to assess SIF and rates for the mixed-use class.

6.3.1 Mixed-Use Definition

Mixed-use customers are defined as properties with a mix of multi-family residential and commercial uses. Metrics such as occupants, fixture counts, dwelling units or square footage can be used to calculate the split between these categories.

6.3.2 Alternative 1: Square Footage/Primary Use Approach

6.3.2.1 Assessing a Fee

Once the split between multi-family and commercial has been determined, an appropriate fee can be calculated by applying the rate schedule for the primary use on the property. For most multi-use properties, the square footage proposed for multi-family units is greater than that proposed for commercial usage; therefore, the primary usage would be multi-family. According to the City's 2007 SIF schedule, multi-family properties with 9 or more dwelling units per building are assessed a fee of $1,690 per unit. For a multi-use development with a predominance of multi-family usage, the rates can be applied directly from the existing rate structure. To assess a fee for the remaining commercial property, an equivalent multi-family unit can be calculated by taking the average square footage per multi-family dwelling unit and dividing it into the commercial property square footage. In the event that a property's primary usage is commercial, the non-residential SIF schedule would be used, and the tap would be sized to include the residential usage.

For example, a multi-use property has 15 dwelling units with an average of 1,000 square feet per dwelling unit and a designated commercial space of 5,000 square feet. The SIF would be assessed as follows:

> The primary usage is multi-family, so the multi-family fee schedule would be used. All fifteen units would be assessed a fee of $1,690 for a total of $25,350. The remaining commercial usage would be converted into a multi-family equivalence (MFE) by dividing the square footage by the average multi-family dwelling unit size, or 5,000/1,000 = 5 MFE. The fee would be assessed by treating these five MFEs as additional dwelling units at $1,690 each, for a total fee of $8,450. The total fee of $33,800 for this property would be obtained by adding these results ($25,350 + $8,450 = $33,800).

6.3.2.2 Assuring an Adequate Tap Size

Under the square footage approach, the City should ensure that an adequate tap size is installed for the customer. The tap size required by a new customer can be estimated by performing a fixture count. Studies, such as the End Use Studies funded by the American Water Work Association Research Foundation (AWWARF), can be used to calculate a rough usage number.

Note: The examples above are not all inclusive and only include the impact of this approach on the impact fees collected for the water fund. Monthly fees were not calculated under this approach. Alternative 2 provides a greater level of detail.

6.3.3 Alternative 2: Fixture Value Approach

6.3.3.1 Assessing a Fee

Similar to the City's existing process, when plans are received from the developer for the mixed-use development, the master meter will be sized based on total fixture counts. The design engineer for the developer will be required to submit calculations for the developed unit based on the current version of either AWWA M-22 or International Plumbing Code standards. The impact fee can be based on either the meter size (in total) or by utilizing the existing impact fee schedule for each of the units separated by class. Examples of the two approaches are discussed below:

Example 1 – Impact/Monthly Fee Based on Ultimate Tap Size

Assumptions: A six-story mixed unit development is built in the city limits. The top 4 floors consist of a total of 16 multi-family units, the second floor consists of 6 office units and the main floor consist of 2 restaurants. For illustration purposes, the restaurants are considered Extra-Strength customers and represent 20 percent of the demand based on the fixture value count. Irrigation demands will be handled through a separate 1-inch irrigation tap, and a 3-inch water/sewer tap is required based on the overall fixture value counts.

Impact Fee Based on Ultimate Tap Size:

Wastewater Impact Fee – 3-inch – Billed via Capital Recovery Surcharge in lieu of impact fee ($0.701 Inside and $1.051 Outside per thousand gallons of sewer billed)

Water Impact Fee – 3-inch – Billed via Capital Recovery Surcharge in lieu of impact fee ($0.671 Inside and $1.006 Outside per thousand gallons of consumed water)

Raw Water Development Fee – Billed via Raw Water Capital Surcharge in lieu of impact fee ($0.15 per thousand gallons of consumed water).

Irrigation Tap Fee – 1-inch	$26.410
Total Impact Fee Based on Ultimate Sizing	$26.410

Monthly Fees Based on Ultimate Tap Size:

Water rates would include the following:

1. A base charge for the 3-inch tap of $54.91.
2. A charge for each thousand gallons of usage times the rate per thousand for each category type based on original fixture value count (i.e., if in the assumptions above multi-family fixture values represented 60 percent of demand, office space fixture values represented 20 percent and the restaurants represented 20 percent, then the rates associated with those categories would be used – in this case 60 percent of usage times $1.60 and 40 percent of usage times $1.36).
3. The Capital Recovery Surcharge per thousand ($0.671) times usage.

4. The Raw Water Surcharge per thousand ($0.15) times usage.
5. Applicable fees for the stand-alone irrigation tap.
6. Applicable excess water use, fire hydrant, fire protection tap service and tank and hydrant fees.

Wastewater rates would include the following:

1. A base charge for the metered water service of $5.61.
2. $2.71 per thousand gallons of consumption.
3. Inside-City Extra-Strength Surcharge (the surcharge will be billed based on total consumption billed times the percent applicable to Extra-Strength based on fixture values – in this case 20 percent – times the rate per thousand).

Example 2 – Impact/Monthly Fee Based on Tap Sizes for Unit Classes

Assumptions: A six-story mixed unit development is built in the city limits. The top 4 floors consist of a total of 16 multi-family units, the second floor consists of 6 office units and the main floor consist of 2 restaurants (considered Extra-Strength customers for illustration purposes). Irrigation demands will be handled through a separate 1-inch irrigation tap. Three taps are purchased and constructed in a vault to provide service to each of the customer types (top four floors requires a 1-inch tap, second floor office space requires a 1-inch tap, and the first floor Extra-Strength customers require a joint 1-inch tap based on fixture value counts).

Note: The above assumptions are in no way consistent with Example 1 above, as far as sizing requirements. This is for illustration purposes only. In addition, it may be beneficial to provide/require separate taps to the Extra-Strength users for tracking and operational purposes (i.e., increased backflow prevention requirements, needed grease traps and surcharge calculations).

In addition, one tap can be utilized in this approach as well. If one tap is utilized, the percentage of use can still be broken down as noted below. The monthly billing breakdown would, however, be determined by either original fixture value counts for each class or by utilizing the demand characteristics for the City's active accounts for each of the classes.

Impact Fee Based on Separate Taps for Unit Classes:

Wastewater Impact Fees – Include the top four floors of multi-family (all sixteen units at $1,730 or $27,680); the second floor office space units would be calculated at the 1-inch impact fee rate (or $13,550), and the first floor high strength customers would also be calculated at the 1-inch impact fee rate (or $13,550).

Total wastewater impact fees:	$ 54,780

Water Impact Fees – Include the top four floors of multi-family (all sixteen at $1,690 or $27,040); the second floor office space units would be calculated at the 1-inch impact fee rate (or $15,310), and the first floor Extra-Strength customers would also be calculated at the 1-inch impact fee rate (or $15,310).

Total water impact fees	$ 57,660
Raw Water Development Fee – (16 at $626 and 3 at $1,700)	$ 15,116
Irrigation Tap Fee – 1-inch	$ 26,410
Total Impact Fee Based on Separate Taps for Unit Classes	$153,966

Monthly Fees Based on Separate Taps for Unit Classes

Water and wastewater fees under this example would be billed in the same fashion as existing customers in each of the classes (Multi-Family, Commercial, Extra-Strength).

6.4 Brown and Caldwell Recommendation

Brown and Caldwell recommends that the Alternative 2, Example 2 methodology be utilized for mixed-use development within the City. This opinion is based, in large part, on the criteria evaluation of alternative approaches developed as part of this Study. In addition, research suggests that the most widely used approach for tap sizing is the fixture value count approach, which is also consistent with the City's current method of tap sizing. Furthermore, if separate taps are required for the classes, usage data for the mixed-use developments would be consistent with existing data maintained by the City, and the classes included can readily be accounted for under the City's existing schedules for rates and charges.

Table 6-3 is a decision matrix which was developed and utilized by Brown and Caldwell to assist in our recommendation to the City on how to approach mixed-use development.

Table 6-3.
Criteria Evaluation of Alternative Approaches

Criteria	Alt. 1	Alt. 2
Ease of Operations (1=most difficult, 5=easiest)	3	5
Cost Recovery (1=always under-recovers, 5=rarely under-recovers)	2	4
Consistency of Application to All Mixed-Use Developments (1=would not apply to any other mixed-use development, 5=could apply to any mixed-use development)	3	4
Consistency with City Development Standards (1=requires all new procedures, 5=can be used with existing procedures in all cases)	2	4
Fairness / Equity (1=lacks rational basis, 5=clear rational basis)	2	5
Total	12	22