AN ANALYSIS OF THE PURCHASE OF THE PLUM CREEK WATER SYSTEM IN KYLE, TEXAS

By

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Abstract

The purpose of this research is to examine the possibility of the purchase of the Plum Creek water system by the City of Kyle, Texas. The initial purpose for this research was to perform cost-benefit analysis on the purchase of the Plum Creek water system by the City of Kyle; however the purchase price was not available. Without the initial cost of the water system it is impossible to calculate a single net present value to determine whether the purchase is economically efficient. Instead this analysis uses different population growth and discount rate assumptions to calculate potential purchase prices for the water system at approximate breakeven points (net present value equals zero), then uses the estimated purchase prices to discuss the feasibility of Kyle purchasing the Plum Creek water system. Since the actual purchase price is not available the results do not indicate whether or not the system should be purchased instead the results provide an estimate of the economic value of the water system under different growth assumptions and discount rate scenarios.

The least conservative estimate for the value of the Plum Creek water system $15,946,476, occurs at the growth assumption for the years 2002-06, with 2.78 persons per household discounted at 3%. The most conservative estimate for the value of the Plum Creek water system $7,637,335, occurs at the growth assumption for the years 2007-08 with 3.57 persons per household discounted at 7%. Given the location along the Interstate 35 corridor between Austin and San Antonio the City of Kyle is likely to grow faster that it did during 2007-2008.

The estimate for the value of the Plum Creek water system using the growth that occurred during the years 2005-2008 with 3.25 persons per household present a more likely scenario. The purchase prices for this growth scenario range from $9 million to $12 million. For a city size of Kyle that is just beginning to develop, the purchase of the Plum Creek water system under this assumption is feasible.

About the Author

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Chapter One: Introduction

Introduction

The City of Kyle, Texas is located between Austin and San Antonio along the Interstate 35 corridor. At the time of the 2000 census the population of Kyle was 5,314 residents. The population is now estimated to be near 30,000 residents (City of Kyle 2009). Over the past nine years one of the biggest challenges for city leaders is expanding city services and infrastructure to accommodate the rapid population growth.

Background

The City of Kyle currently provides water to 6,850 connections, approximately two thirds of the city's population (City of Kyle 2009, 161). The remaining connections receive water from the Plum Creek water system owned by Monarch Utilities. Monarch Utilities holds the "Certificate of Need and Necessity" to provide water to approximately 2,238 connections in the northern portion of the City of Kyle and a small portion of the neighboring city of Buda (TCEQ 2009, 2).

In 2007, Monarch Utilities applied to the Texas Commission on Environmental Quality to increase rates to be paid customers by 42 percent (Monarch Utilities 2007, 3). In September of 2007 the affected citizens approached the Kyle city council with their concerns about Monarch's service, water quality and increasing rates. Their complaints focused on increasing rates, water quality, service and insufficient water flow to fire hydrants (City of Kyle 2007, 4).

Residents requested that the city council deny the rate increase based on "Article XI section 11.01" of the Kyle city charter. The article states the city has the right to "Establish and enforce the rates to be paid by consumers of any utility or users of any service provided within the city, and, if provided by the city, outside of the city" (City of Kyle 2006, 32). The council agreed to deny the rate increase, and provide legal representation for the protest of the rate increase. Image 1.1 fire hydrant near Armando Chapa Middle School in Kyle, black paint indicates insufficient flow to support fire suppression.

Image 1.1 Fire Hydrant near Armando Chapa Middle School in Kyle, Texas.

In December 2008 the dispute was settled through mediation. The City of Kyle and Monarch Utilities agreed to a rate increase of 28 percent and Monarch Utilities agreed not to file for an additional rate increase before January 2011 (Monarch Utilities 2008, 3). Kyle residents that receive water from Monarch Utilities continue to pay higher water rates than those who receive water from the City of Kyle and face the possibility of increased homeowner's insurance rates and damages due to the insufficient water flow for fire protection. The affected residents fear that the City of Kyle will approve future rate increases due to the large amount of time and money used during the first rate protest. One solution proposed during the citizen comment period was for the City of Kyle to purchase the Plum Creek water system from Monarch Utilities (City of Kyle 2007, 4).

Local governments like the City of Kyle face limited resources. Meeting the citizen demand for services requires careful evaluation of all projects to ensure optimal use of resources. Cost-benefit analysis is a tool used to evaluate the efficiency of public projects. According to Fuguitt and Wilcox (1999) a properly conducted analyses includes all assumptions used in the study and carefully identifies and describes policy effects that are not quantifiable, but play a role in the overall decision.

Research Purpose

This research investigates the efficiency of the City of Kyle purchasing the Plum Creek water system from Monarch Utilities. One method used to evaluate this kind of decision is cost-benefit analysis. Initially this project planned to evaluate a switch from private to public distribution using cost-benefit analysis. Much of the paper examines the literature of cost-benefit analysis. Unfortunately a cornerstone of cost-benefit analysis, the initial purchase price estimate was not possible to obtain. As a result the focus of the study shifted to estimate potential purchase prices for the Plum Creek water system using different growth assumptions and discount rates.

This research accomplishes four things. First, this research discusses the history and theory of water distribution by the public and private sectors in order to identify costs and benefits associated with each type of distributor. Second, this research discusses cost-benefit analysis and the role of cost-benefit analysis in the decision making process.

Third, this research uses the tools of cost-benefit analysis as a heuristic device to identify costs, benefits and calculate net present values in order to estimate a range of purchase prices where net present value equal zero. The results show possible purchase prices the City of Kyle could pay for the water system that would be feasible and efficient.

The following chapter discusses the history and theory of municipal water policy. Chapter two begins with a review of the available literature on the history of water distribution in the United States followed by discussion about characteristics of the water distribution industry. The chapter concludes with an international perspective on water distribution.

Chapter three provides a discussion of cost-benefit analysis, the discussion includes (1) the role of cost-benefit analysis in the decision making process, (2) the steps involved in the analysis, and (3) cost-benefit analysis as a tool used by decision makers to evaluate projects based on the net present value of their social benefits.

Chapter four provides a short description of the City of Kyle, The Plum Creek water system, and the issues faced by Monarch Utilities customers in the city. The descriptions are followed by the application of the steps involved in cost-benefit analysis. A conceptual framework is developed to examine the efficiency of a switch from private to public water provision. The framework is used as a guide to generate the cost and benefit data for the case of Kyle, Texas. The chapter concludes with descriptions of the identified cost and benefits for the purchase of the Plum Creek water system.

Chapter five describes the methodology used to operationalize the cost and benefits identified in the conceptual framework. This chapter explains the methods used for data collection and the calculations used to determine the values of the identified costs and benefits. Chapter six presents the results of this analysis and chapter seven provides an analysis of purchase prices, conclusions and recommendations for future research.

Chapter Two: History and Theory of Municipal Water Policy

Introduction

Prior to the late 19th century the majority of the water delivered in the United States was provided by private firms (Melosi 2004, 211). In the late 19th century issues with private delivery created a shift to public delivery (Varghese 2007, 2). Today the majority of water delivered to homes and businesses in the United States is provided by municipalities (Wolff 2004, 1). According to Varghese (2007) provision of water has deteriorated because of a lack of federal funding and fiscal constraints on local governments. Private delivery of water is often one of the proposed solutions to budget shortfalls and infrastructure needs.

Proponents of water privatization suggest that privatization is a viable solution to the problem of raising capital and maintaining aging infrastructure (Wolff 2004, 1). Opponents of privatization fear that the main focus of private firms will be profit and issues related to water as a public good will be ignored (Melosi 2004, 218).

Although water distribution originally moved from the control of private companies to the control of the public sector, in some places it is still under the control of private companies, and some suggest that it might be cost effective if more delivery were returned to the private sector. This chapter examines the evolutionary processes, and arguments within the United States (and to a limited extent in Europe), while reviewing the available literature on the subject. It begins by examining the history of water delivery, then discusses issues in the water delivery industries past and present. Finally it presents the problems associated with each type of delivery.

History of Water Delivery in the United States

Before modern distribution and treatment facilities, individual farms and urban households were responsible for providing water and removing waste (Melosi 2004, 211). Households provided the services of water and sewage by digging wells and privies (Cutler and Miller 2005, 156). A privy is an underground vault, built separate from the main house, used to store waste. Privy vaults were generally lined with brick, stone or wood, and over time vaults would rot or disintegrate (Cutler and Miller 2005, 156). The simple design of these early waste facilities allowed wastewater to seep into the ground. The results were contamination of the nearby ground water (Cutler and Miller 2005, 156). Despite these issues, urban Americans continued to acquire water through private or public wells for much of the 18^{th} and early 19^{th} century (Melosi 2004, 211).

Philadelphia was the first city to complete a sophisticated water works and municipal distribution system in 1801 (Melosi 2004, 212). Large cities like Boston and New York continued to rely on individuals to provide their own water. Boston was reluctant to make the large initial investment to build a water system; it preferred that private investors lead the way (Cutler and Miller 2005, 160). Private water delivery in Boston began in 1794, when a group of entrepreneurs petitioned state legislature to be incorporated to deliver water to residents of Boston. The following year the legislature approved and incorporated the Aqueduct Corporation (Cutler and Miller 2005, 160).

The Aqueduct Corporation was authorized to deliver water to Boston with two stipulations: (1) water was to be provided free of charge to fight fires and, (2) water rates were subject to court regulations (Cutler and Miller 2005, 160).

In the mean time, New York City came to recognize the need for organized water delivery; some municipal reformers pointed to unsafe drinking water and unwashed streets as the cause of yellow fever outbreaks in the city (Reubens 1957, 583). The city was initially reluctant to allow a private water provider to deliver services to the city. Leaders felt that private enterprise would not be interested in the project unless there were profits to be made and feared those profits would come at the expense of the city and its citizens (Reubens 1957, 583). New York City first petitioned the state legislature for authority to construct a city owned system but was denied. A private corporation, The Manhattan Company, was formed in 1799 to supply the city with water (Cutler and Miller 2005, 165). The Manhattan Company, heavily influence by Republican Aaron Burr was created as an avenue for starting a bank that would increase the influence of the Republican Party, delivery of clean water was secondary (Reubens 1958, 102).

Following the Civil War, as the country dealt with immigration and rapid urbanization water systems increased dramatically in cities (Masten 2008, 6). The concentration of households and businesses in growing cities created a demand for the transportation of water and amplified issues of public health and the dangers of spreading fire (Masten 2008, 10).

As the water provision industry grew tensions between cities and private water providers increased. By this time the benefits of reliable delivery of clean water were evident, but for a number of reasons private water companies were either unwilling or unable to expand delivery to meet the needs of the cities they served. Fire protection gradually improved in population centers, but delivery to outlying areas remained sporadic. Private water systems water pressure to regions with high elevation was inadequate. Many of the poor and outlying areas were more vulnerable to destruction from fire and faced significantly higher insurance cost (Cutler and Miller 2005, 159).

Public health also created tension between private water providers and city leaders. In the late 19th and early 20th century, diseases such as diarrhea, dysentery, and typhoid were leading causes of death in American cities (Troesken 2001, 750). Disease was present in cities with public and private water delivery (Masten 2008, 10). Cities served by private firms suffered more deaths because private firms were less likely to install water mains in poor neighborhoods and outlying areas (Troesken 2001, 755). Since most residents could not afford to purchase bottled water, they resorted to private surface wells that presented greater health risk (Troesken 2001, 753).

City leaders recognized the social and political implications of effective water distribution. Large cities lead the way by expanding existing systems and supply (Melosi 2004, 213). By 1848, New York and Boston had already intervened to create municipal water services, and other U.S. cities began investigating the possibility of public water distribution (Cutler and Miller 2005, 160).

As a result there was a shift to public distribution. By the last decade of the 19th century, 43 percent of waterworks in the United States were publicly owned, and by the 1920s 70 percent of waterworks were publicly owned (Cutler and Miller 2005, 168).

Small and medium sized cities did not convert to public water delivery as rapidly, but they were able to convert. New Deal policies of the 1930s stimulated the move to public provision. These communities took advantage of federal subsidy during the New Deal (1930s). In 1932 the Federal Relief and Reconstruction Act authorized loans of 1.5 billion for state and local public works projects (Cutler and Miller 2005, 160). Smaller communities borrowed these funds and financed many public water systems (Melosi 2004, 215). Prior to the New Deal, smaller populations and rural areas did not receive the benefits of public delivery that larger cities enjoyed. From that time until the late 20th century, water was generally treated as a public good and its distribution regarded as a public responsibility. This was based on the assumption that market forces could not be depended upon to furnish services necessary to society (Melosi 2004, 211). By the middle of the 20th century, public provision was and remains the dominant form of delivery.

Although there is no consensus in the literature, there are several explanations why private firms were successful in the provision of other utilities but not able to maintain their market share in water delivery (Masten 2008, 2). Troesken and Geddes (2003) conclude that the shift to public delivery was due to contracting failure, fear of municipal acquisition prevented private water companies from making the necessary investments.

Cutler and Miller (2004) suggest that emergence of sophisticated municipal financing techniques gave cities an advantage in acquiring capital, but Masten (2008) argued that the timing of municipal financing made it a non factor during the majority of the public shift (Masten 2008, 9).

Melosi (2004) concluded that the push for municipal ownership had as much to do with desire to influence the growth of the city as to settle disputes with private companies over deficiencies in water provision and that public water supply could be profitable for city government keeping valuable resources out of the hands of business (Melosi 2004, 213). Beyond fire protection and public health, water delivery has unique characteristics that raise concern when it is controlled by private enterprise.

Characteristics of the Industry

Although water is similar to other products because it is bought and sold in the marketplace, the water delivery industry has several components that make it unique. Water provision provides the external benefits of fire suppression, public health, and environmental protection (Davis 2005, 147). Clean water is a finite resource necessary for survival of humans and the environment. Water distribution, as an industry, features all of the characteristics of a natural monopoly (Wolff 2004, 2). Combined, these factors create a complicated and sensitive operating environment.

Monopolies

A monopoly occurs when there is a single source of supply (Mansfield 1985, 276). Monopolies are characterized by large barriers to entry, capital intensity, high fixed cost, economies of scale, and inefficient competition (Mansfield and Behravesh 1995, 417).

According to Mansfield (1985), there are four conditions that cause monopolies. Two of these conditions directly apply to the provision of water. The first condition occurs when "the average cost of producing a product reaches a minimum at an output rate that is big enough to satisfy the entire market" (Mansfield 1985, 277). The cost structure of public utility provision is generally characterized by declining marginal cost (Cutler and Miller 2005, 178). This means that a large provider is able to service more customers for less cost than a small provider (Cutler and Miller 2005, 178). The second condition occurs when a firm is rewarded a market franchise by a government agency and that firm is granted exclusive privilege to produce the service in a particular area (Mansfield 1985, 277). Although technology and deregulation have increased competition for other utilities, market franchises are still common in water provision due to the large scale infrastructure and expensive treatment facilities that are required.

Regulation of Monopolies

Unregulated monopolistic provision allows too much control over the level of service, quality, and rates delivered by single firm. Musgrave (1959) identifies four situations where public regulation is necessary. Three of these situations relate directly to the provision of water they are: (1) the demand for the product is inelastic, (2) the product is a merit want so that satisfaction is encouraged by public policy, and (3) the purchase price of the product weighs heavily on the budgets of low income families (Musgrave 1959, 45). State regulatory commissions that grant market franchises are usually responsible for regulating prices charged by monopolies (Mansfield 1985, 302). These commissions set a maximum price that includes the average total cost and a fair rate of return (Mansfield 1985, 303). Even though regulation is present, Mansfield (1985) maintains there is often controversy over what constitutes "a fair rate of return" and what investments should be included in the calculation that produces the fair rate of return. In addition to rate regulation from state commissions, water is regulated at the federal level by the Environmental Protection Agency.

Federal Regulation

The Safe Drinking Water Act was passed in 1974, amended in 1986, and again in 1996 to protect public health by regulating public drinking water supply (EPA 2009, 1). The Act applies to all public water systems in the United States (EPA 2009, 1). The Act is implemented by the Environmental Protection Agency, who evaluates quality standards, sets policy and enforces the Act. The Safe Drinking Water Act of 1996 calls for more stringent water quality standards. These standards require upgrades and improvements beyond routine maintenance of water systems. The implementation of tougher standards adds additional fiscal stress to smaller water systems reducing competition even further. The Act includes specific provisions for those smaller systems that "require consideration of structural alternatives that involve fundamental changes to the organization, ownership or management of a water system including regionalization and consolidation" (Varghese 2007, 1).

Public Distribution

The complex operating environment of the industry and sensitivity of water as a basic resource allowed municipalities to dominate the market in the United States. Private provision accounts for only fifteen percent of water services in the U.S. (Varghese 2007, 4). Although distribution of water remains largely in the hands of public providers, public distribution is not immune to problems. Varghese (2007) estimated an annual shortfall of 11 billion dollars to replace aging water facilities. The Environmental Protection Agency estimated in February 2001, that 151 billion dollars in investments would be needed over 20 years for new infrastructure (Varghese 2007, 4).

The decline in infrastructure investment for some public water providers can be attributed to the decrease of federal assistance, tightened municipal budgets, and increased regulation by the Safe Drinking Water Act of 1996. According to Varghese (2007) the federal government is not providing as much assistance for maintenance as it did for construction during the New Deal. Congress appropriates between $700-850 million annually to the Safe Drinking Water Act revolving loan fund which accounts for less than 10 percent of the nation's requirements (Varghese 2007, 4).

Beyond water provision, municipalities have other objectives such as public safety and transportation that compete for limited resources. Projects like transportation and water infrastructure usually require borrowing through the issuance of bonds. When communities are facing budget constraints borrowing is not a popular option.

Communities who are experiencing growth may see borrowing as a more popular option, but those funds compete with other needs in the growing community. Some community leaders look to privatization as an option. Proponents believe that privatization can furnish the capital, expand services and manage infrastructure more efficiently (Davis 2005, 146).

Ownership Differences

Capital

One difference between public and private water distribution is found in the methods of obtaining capital. The public sector has the advantage of lower cost through the issuance of tax exempt financial instruments and exemption from certain taxes (Laurer 2001, 122). Although federal assistance is not as abundant as it has been in the past, it can still provide an advantage when it is available. Public organizations can also take advantage of competitive prices through pooled public acquisitions or government discounts given by manufacturers (Laurer 2001, 122). Private organizations do not enjoy a tax exempt status. Cost of capital is generally higher in the private sector, but there are more options available to balance capital needs (Laurer 2001, 138).

Performance

Studies examining performance differences between public and private water distribution mostly propose informal hypotheses, and few studies test the hypotheses or use rigorous empirical examination (Laurer 2001, 137). Evidence about performance is inadequate.

There is literature examining differences in management between public and private distributors. These studies reveal the public sector brings local control to facilities and local water resources. Further citizens have more local input in keeping management accountable. Furthermore, public sector firms do not have to return a profit to share holders, they have the ability to reduce rates by lowering profits or keeping profits for use on other community projects (Laurer 2001, 156). Public sector organizations do not have to return a profit to share holders and are generally more responsive to community concerns (Laurer 2001, 122). In contrast, private firms claim that profit motive encourages efficiency and innovation to achieve goals (Laurer 2001, 122).

Employment in the public sector is generally more secure. Employment related regulations reduce management flexibility in personnel decisions. Private firms have fewer regulations giving firms more freedom and flexibility to re-organize, act and be responsive to customer needs and changing market conditions. (Laurer 2001, 123) According to Renzetti and DuPont (2003) there are no recent large scale studies examining water utility performance and ownership in the United States. Recent examples of privatization in practice are more prevalent in the international community.

International Perspective

In 1989 The United Kingdom sold all water and sewer infrastructure in England and Wales to private providers (Davis 2005, 150). The British government argued that a change in ownership would increase performance, results of studies produced after privatizations have been inconclusive (Renzetti and DuPont 2003, 42). Private distribution in developing countries produced less favorable outcomes (Melosi 2004, 220).

In an attempt to provide clean drinking water to developing nations, The United Nations Decade of Drinking Water proposed to expand water delivery to reach even rural areas of developing nations (Varghese 2007, 4). The United Nations plan saw little success. During this period, countries investment in water distribution infrastructure went down while demand increased due to population growth, urbanization, and economic growth (Varghese 2007, 4). The International Monetary Fund and World Bank recognized that developing countries did not have sufficient capital to supply water to their growing populations. They suggested that private capital could provide a solution (Varghese 2007, 5). By 1998 private water providers were in full operation in many developing countries in areas of Latin America, East Asia, South Asia and Africa. The people in these countries then began to recognize the cost associated with private water. The kinds of investments expected from the private investors were not realized, water quality and service declined and prices climbed which resulted in highly publicized protest (Varghese 2007, 5).

Overall there is no conclusive evidence that one sector provides an advantage over the other in terms of efficiency (Renzetti and DuPont 2003, 42). Management practices can be changed shared or adapted to either public or private settings. The core issue that has led to some resistance toward privatization is the issue of water as a public good versus a commodity. If there is no evidence of improved performance, should a basic resource like water be in private hands?

Conclusion

It is reasonable to believe water distribution needs to be equitable, meaning everyone has access to clean water at an affordable rate. Clean water is necessary for health. Water sources should be monitored to protect the environment and ensure sustainability. Once those basic levels are met water is more like a commodity. Beyond permitting our survival, water is critical for industry, farming and our favorite leisure activities.

Because water is necessary for survival, the decision to privatize is more complicated than a decision about road repair or refuses collection. These industries generally have a lower barrier to entry and more competition. Water distribution is a natural monopoly and opponents of private distribution fear once citizens have lost direct control, profit motive and loyalty to shareholders will take precedence over equity, health and the environment.

Wolff (2004, 1) concludes that the decision to distribute publicly or privately should center on the following questions: How do we provide safe water for all people? How can we better involve the community in decisions? How can we ensure economic incentives can be aligned with social goals? An honest approach to these questions could relieve fears related to private water delivery.

The issue of ownership is not resolved. It is clear that private companies and investors are not the panacea some advocates for privatization claim (Wolff 2004, 1). Governments in the United States and abroad continue to face fiscal challenges and the infrastructure and development issues continue. Private capital can provide an answer but when implemented in developing countries private businesses were less likely to recognize that water is more than just a commodity, it is a necessary resource. For privatization to work, the public sector needs to provide effective oversight, monitoring and regulation of the private operator (Wolff 2004, 2).

It is clear that neither public nor private distributors have a comprehensive solution for issues related to water distribution. Areas that are well serviced by responsible public and private providers can be expected to continue their mutually beneficial relationship. Customers in areas that are not well served by private providers, however, will likely demand public provision when private business fails.

When citizens demand public provision of water, local governments have five options: (1) the outright purchase of existing private system, (2) introduction of municipal provision in the same area as the private company, (3) petition the state legislature to revoke the private water company charter, (4) regulation, or (5) do nothing (Cutler and Miller 2005, 159). The second and third options are not usually viable. Regulations generally prohibit introduction of competing water providers and revocation of the private charter would still require the purchase of the existing system. The outright purchase of the water system is a viable option. In this case a careful investigation of the cost and benefits of a public purchase of a private facility has merit. The next chapter introduces cost-benefit analysis a technique of operations research used to evaluate policy options such as the purchase of a water utility[1].

[1] For more Texas State Applied Research Projects that deal with water see Thompson (2009) Gillfillan (2008) and Albright (2006)

Chapter Three: Cost-Benefit Analysis

Introduction

This chapter provides a discussion of cost-benefit analysis, the discussion includes (1) the role of cost-benefit analysis in the decision making process, (2) the steps involved in the analysis, and (3) cost-benefit analysis as a tool used by decision makers to evaluate projects based on the net present value of their social benefits.

Cost-Benefit Analysis

According to Galambos and Schreiber (1978, 62) if optimum use is to be made of limited revenues, local governments must spend them in ways that are acceptable for society, generating the most benefits for the community relative to the cost incurred. Cost-benefit analysis is a tool used by decision makers in government to evaluate projects based on the optimal use of limited resources. The results of the analysis inform the decision making process, but do not dictate the final decision. The overall decision should consider factors like the project’s affect on equity in the community, community goals and the political climate. According to Litchfield (1960) the results of cost-benefit analysis focus on optimization, but the analysis provides a framework where all relevant arguments for or against a project can be organized.

Decision Making

Cost-benefit analysis is based on rational decision choice theory. The theory states that in a transaction there are two rational decision makers, consumers and firms, and they will choose alternatives that best meet the goal given the cost. In the public sector, the government is the decision maker that allocates the scarce public sector resources. The goal of government is to maximize society's welfare. A decision is rational if the social benefits outweigh the social cost (Fuguitt and Wilcox 1999, 36).

In public decision making the social and political issues may have the potential to outweigh economic considerations; therefore a decision should not be made solely on the results of cost-benefit analysis (Zerbe and Bellas 2006, 2). Mikesell (1986) maintains that public sector resource allocation decisions are made by political bargaining, and not by rational consideration of administrators. While many decisions may be made by political bargaining, cost-benefit analysis can add at least three things to the bargaining process: (1) consideration for the underrepresented potential beneficiaries or cost bearers, (2) information about economic efficiency, and (3) focus public decisions on the value of competing alternatives (Mikesell 1986, 193).

Steps Involved In Cost-Benefit Analysis

The steps of a cost-benefit analysis are (1) identify the benefits and cost of the project, (2) assign dollar values to cost and benefits so that they are comparable, (3) incorporate a time dimension that considers values over the life of the project, and (4) decide whether the project yields a large enough social benefit to justify the expense (Galambos and Schreiber 1978, 62).

Identifying Costs and Benefits

The first step for the analyst is to identify all consequences either directly or indirectly involved with the project. Costs and benefits that are measurable are considered tangible. Tangibles should be included in the calculations of the analysis. Costs and benefits that cannot be measured in monetary terms are called intangibles (Thompson 1999, 154), and intangibles should be included in the cost benefit presentation (Galambos and Schreiber 1978, 73).

Costs

Costs are categorized as direct or indirect. Direct costs include the cost in goods and services used to construct, operate and maintain the project (Thompson 1999, 163). Direct costs break down further into initial and recurring costs. Initial cost includes the labor, materials for the construction of a project or initial purchase price of an existing facility. Recurring costs are the costs that continue throughout the life of the project. Some examples of recurring cost are personnel, maintenance, and materials (Ascott 2006, 13).

Indirect costs are costs the community pays for the project; these costs are not incurred by the local government (Galambos and Schreiber 1978, 64). Examples of indirect costs are environmental effects or cost imposed on households that are dislocated by the project (Galambos and Schreiber 1978, 64)[2].

[2] For more information on identifying costs see Tanous (2007), Fuguitt and Wilcox (1999), Mikesell (1986) and Zerbe (2006)

Benefits

Benefits are increase in value that results from the project (Mikesell 1986, 194). Like cost, benefits also break down into direct and indirect categories. Direct benefits are gains for people who make direct use of the goods and services provided by the project (Thompson 1999, 163). Indirect benefits are received by those who do not have direct involvement with the project. Examples of indirect benefits might be greater access to alternative resources or increased property values. For example a widened road through a neighborhood might reduce traffic in an adjacent neighborhood.[3]

One important consideration when identifying benefits is a transfer. A transfer is an offset of benefits, or a transfer of activity from one place to another (Galambos and Schreiber 1978, 70). One example of a transfer is an increase in sales along a new highway that result from the loss of sales along the original highway (Galambos and Schreiber 1978, 70). Transfers should be addressed because they are an affect of the project, but are not considered as a benefit in the analysis.

Assigning Value to Cost and Benefits

Cost and benefits should be measured in monetary value. Measuring in dollars creates a common denominator that can be used for comparing (Tanous 2007, 20). Because all benefits and costs are not valued by the market, those values must be estimated. The analyst cannot be paralyzed by lack of complete information because complete information is only available when it is too late to make the decision (Mikesell 1986, 194).

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[3] For more information on identifying benefits see Tanous (2007), Fuguitt and Wilcox (1999), Ascott (2006), Dorfman (1965) and Stott (2009)

Once values are assigned to costs and benefits they must be converted to reflect their present value. The present value formula is demonstrated below in figure 3.1.

Figure 3.1 Present Value Formula

$$\boldsymbol{PV = \frac{FV_n}{(1+r)^n}}$$

PV=Present Value

FV_n = a value received in the future

r = discount rate

n = number of years into the future that sum is received

(Mikesell 1986, 202)

The present value formula calculates the value of sums to be received in the future into values that are understood and compared in today's dollars (Zerbe and Bellas 2006, 6). Because money can be invested to earn interest, one dollar today is worth more than one dollar in the future (Mansfield and Behravesh 1998, 510).

"For example if the interest rate is 6 percent, \$1 received now is equivalent to \$1.06 received one year from now." (Mansfield and Behravesh 1998, 510) In this scenario the future value is \$1.06, the present value is \$1, the discount rate is the interest rate of 6 percent and n=1 year.

Discount Rate

Finding present values requires the use of a discount rate. Discounting adjusts sums to be received in the future to their present value equivalent (Mikesell 1986, 202). Because government entities pay lower interest rates on debt than private businesses, there is no consensus on which discount rate should be used.

Some argue that the rate at which governments borrow money is too low and does not reflect the true opportunity cost of a project. Galambos and Schreiber (1978) state that the discount rate for a city should be the rate paid by the city on general obligation bonds in recent months. The discount rate that the Office of Management and Budget instructs most executive agencies to use is 3 percent and 7 percent (Ascott 2006, 19). Objectivity is important when selecting a discount rate. Choosing a rate that is too high will artificially inflate the cost of a project, while choosing a rate that is too low underestimates the cost of a project.

Since values chosen for discount rate are subject to error and disagreement, a range of values can be used as a sensitivity analysis (Zerbe and Bellas 2006, 6). The use of multiple discount rates allow for an evaluation of the project at each rate. Tanous proposes that the use of "multiple discount rates allows the analyst to objectively determine the rate that works best for the entity" (Tanous 2007, 26).

Time Horizon

Once discount rates are selected the next step involved in a cost-benefit analysis is choosing a time horizon. The time horizon for a project is the useful life of that project or the number of years that benefits can be expected. When choosing an acceptable time horizon, the useful life of the project should be carefully selected to ensure that the benefits of the project have been exhausted and costs are not over estimated (Tanous 2007, 27). If the time horizon is too short it can lower the net present value of the project by reducing the benefit stream. If the time horizon is too long the benefit stream will be increased and can skew the decision criterion (Ascott 2006, 17).

Decision Criterion

When the cost, benefits, discount rate and time horizon have been identified, the analyst can determine the present value of the project and apply a decision criterion. The most common decision criterions used are the Pareto criterion, payback period, net present value, and benefit cost ratio (Tanous 2007, 31). Pareto criterion states that “a project is economically feasible if no one is worse off and at least someone is better off” (Ascott 2006, 21). Pareto criterion is rarely used in cost-benefit analysis because it is considered to be too conservative.

Payback period is similar to a break even analysis used in the private sector. Payback period considers how long it will take for the net benefits to pay back the initial cost of a project. Payback period can be found by dividing the net annual benefits by the initial capital outlay (Ascott 2006, 21). Payback period is not as strong as net present value or benefit cost ratio because it does not consider the time value of money (Ascott 2006, 21).

Net present value compares the present value of the costs to the present value of the benefits. If the benefits are greater than the cost, the project is efficient. Benefit cost ratio is calculated by dividing the present value of the project by the initial capital outlay. If the ratio is greater than one, the project should be considered (Tanous 2007, 34) When the analysis is complete and the decision criterion has been applied, the findings should be reported in a clear and objective report. The report should describe the project, discuss all intangible cost and benefits, and provide support for the estimates used in the analysis.

Applications

The role of cost-benefit analysis is to provide better quality information to aid in decision making (Galambos and Schreiber 1978, 70). Cost-benefit analysis can be used at all levels of government to evaluate projects. The analysis can be performed on a project of any size; however the project should be large enough to justify the time and resources involved in the analysis (Dorfman 1965, 8). When discussing the use of cost benefit-analysis Fuguitt and Wilcox conclude that cost-benefit analysis is applicable anytime a decision requires the use of resources (Fuguitt and Wilcox 1999, 36).

Limitations of Cost-Benefit Analysis

Cost-benefit analysis has limitations that must be pointed out by the analyst and understood by the decision maker. First it must be clear that cost-benefit analysis deals only with the efficient use of resources which is only one part of the decision. Decision makers should consider the other aspects of a project before making a choice. One limitation with this method is correctly identifying all benefits and cost associated with a particular project.

Whether positive or negative the implications of a policy do not always present themselves at the time of the study. A second limitation is the need to assume a time stream of benefits and cost into an uncertain future (Thompson 1999, 165). This is especially true with resources, like water, that are finite. Future benefits and some cost depend upon availability, which is uncertain because of natural fluctuations in the hydrologic cycle (Thompson 1999, 165). A third limitation of cost-benefit analysis is in the selection of the discount rate, choosing an inappropriate discount can unfairly enhance the benefits or the cost of a project.

This limitation can be addressed with a comparison of multiple discount rates, but it is not always clear which rate is appropriate. A fourth limitation is that cost-benefit analysis gives the assumption of analytical precision when in fact it is based on many assumptions and estimates (Thompson 1999, 165). Despite these limitations cost benefit can provide useful insight into a project's worthiness.

Addressing Missing Variables

Cost-benefit analysis cannot be paralyzed by a lack of complete information (Mikesell 1986, 194). In most cases missing costs and benefit values are estimated. When estimating the value of existing water system there are three values to consider. First is the value of the actual plant and equipment. Because the physical life of water supply assets vary considerably by the type of asset and length of time in service this value is difficult to estimate without a complete inventory of the systems assets (Warford and Williams 1971, 298). Second is the perceived value of the system by the seller. This value would include the value of the plant, equipment, future revenues and the value associated with holding a monopoly. If this information is not supplied it is difficult to estimate the sellers perceived value. The third value is the value of the water system to the purchaser; this value can be estimated based on the costs and benefits that the water system will provide to the buyer. Because this value does not consider the actual purchase price it does not conclude whether or not the water system should be purchased. The estimated value to the buyer does however provide decision makers with a maximum price where the system could be purchased and remain an efficient use of the buyer's resources.

If the initial purchase price is missing the steps of cost-benefit analysis can be used to identify the costs and benefits of purchasing a water system and determine the value of the system where net present value equals zero. The purchase price where net present value equals zero represents the maximum efficient purchase price. In this situation the present value of the benefits and the present value of the operating cost will remain the same whether or not the purchase price is available. The cost for debt service does rely on the initial purchase price and must be recalculated each time the purchase price changes.

Net present value is calculated by subtracting the present value of the costs from the present value of the benefits. The present value of the benefits and the present value of the operating cost are known. To find where net present value equals zero the debt service cost for a particular purchase price is added to the operating cost to find the total cost for the system at the chosen purchase price. The net present value for the purchase of the water system can then be calculated for that purchase price. This calculation is used to generate several present values at different purchase prices. The resulting net present values and corresponding purchase prices can then be used along with the two point equation of a line to solve for the purchase price where net present value equals zero.

The following chapter provides a short description of the City of Kyle, The Plum Creek water system, and the issues faced by customers of Monarch Utilities. The descriptions are followed by the application of the steps in cost-benefit analysis developed by Galambos and Schreiber. The steps are used to develop a framework that examines the efficiency of a switch from private to public water provision.

This framework is used as a guide to generate the cost and benefit data for the case of Kyle, Texas. Descriptions of the identified costs and benefits for the purchase of the Plum Creek water system follow the conceptual framework.

Chapter Four: Setting

The purpose of this chapter is to provide descriptions of the City of Kyle, the Plum Creek water system and issues faced by residents of Kyle who receive water from the Plum Creek water system. This chapter concludes with a detailed description of the costs and benefits involved in the switch from private to public water distribution in the case of Kyle.

The City of Kyle, Texas is located in central Texas between Austin and San Antonio along the Interstate 35 corridor. At the time of the 2000 census the population of Kyle was 5,314 residents. The population is now estimated to be near 30,000 residents (City of Kyle 2009).In addition to the growing number of residents; Kyle is currently experiencing rapid economic development. In 2009 construction was completed on a new Seton Hospital and two shopping centers that include a Target, Lowes Home Improvement and other retail outlets. Jobs created by these recent developments will ensure that the city continues to grow in population. Image 4.1 depicts the location of the City of Kyle in relation to other Texas cities.

Image 4.1 Texas Map (city-data.com, 2009)

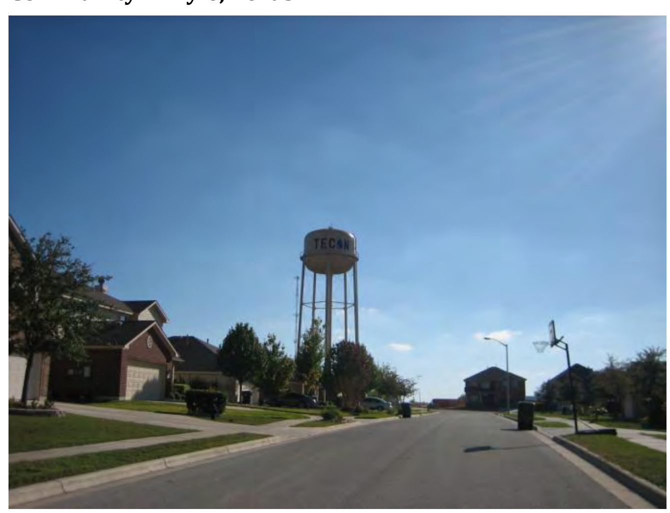
The City of Kyle currently provides water to 6,850 connections, approximately two thirds of the city's population (City of Kyle 2009, 161). The remaining connections receive water from the Plum Creek water system owned by Monarch Utilities. Image 4.2 Kyle City Hall and Historic Water Tower.

Image 4.2 Kyle City Hall and Historic Water Tower (city-data.com, 2009)

Plum Creek Water System

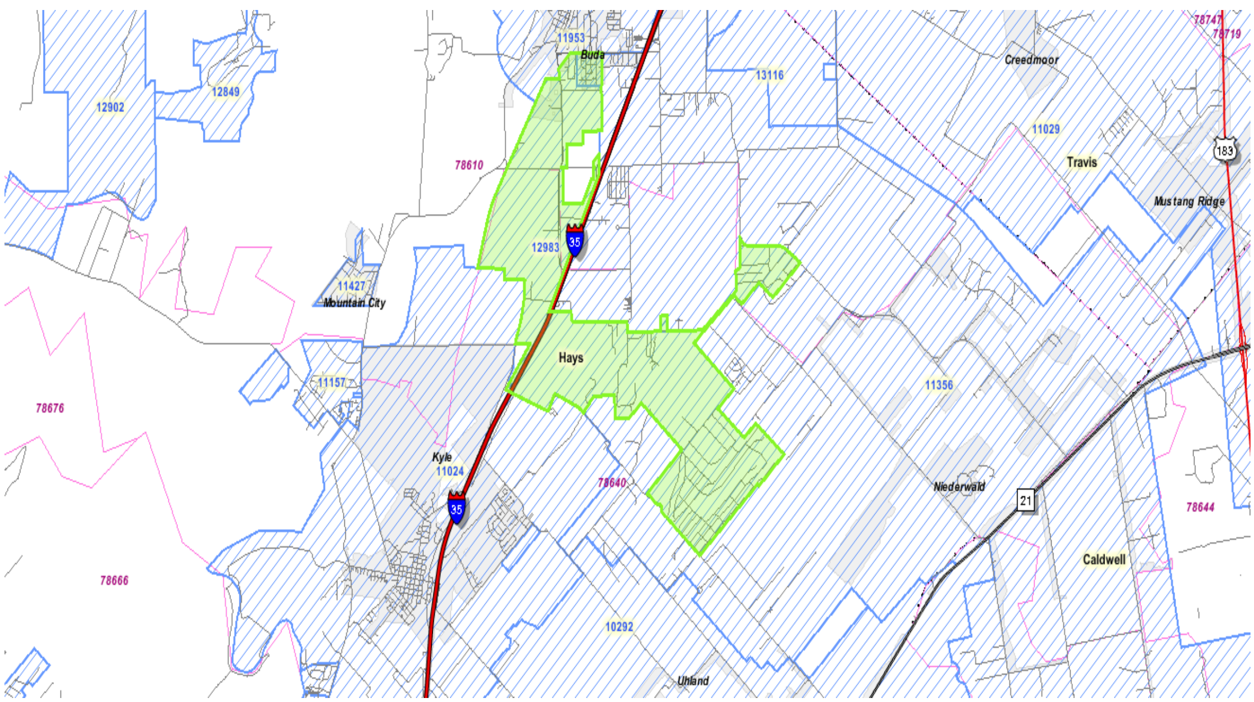
In May 2004, South West Water Company, parent company to Monarch Utilities purchased 87 water utilities and 12 wastewater utilities in Texas from Tecon Utilities. The purchase price was $63 million. At the time of purchase the systems served 21,000 water connections and 4,000 wastewater connections (South West Water Company 2004, 1). The Plum Creek water system located in Kyle, Texas was included in this purchase. Image 4.3 Monarch Utilities water tower in the Amberwood community in Kyle, Texas.

Image 4.3 Private Water Tower Located in the Amberwood Community in Kyle, Texas



The Plum Creek water system serves approximately 6,714 residents through 2,238 connections (TCEQ 2009, 2). The system consists of a network of underground infrastructure used to distribute water from four wells and three storage tanks with the capacity to store 1.065 million gallons of water (TCEQ 2009, 2). The total production capacity of the system is 2.657 million gallons daily (TCEQ 2009, 2). Since the purchase of Tecon Utilities, South West Water Company estimates $34 million were invested to improve systems in Texas (Monarch Utilities 2009, 2). Image 4.4 highlights the area served by the Plum Creek water system.

Image 4.4 Map of Plum Creek Water System Service Area (TCEQ 2009)



In 2007, Monarch Utilities applied to the Texas Commission on Environmental Quality to increase water rates residential customers by 42 percent (Monarch Utilities 2007, 3). The proposed rate increase included systems in Texas towns (Blue Mound, Flower Mound, Granbury, Sothmayd, Aurora, Kyle), and areas of Henderson County.

In September of 2007 citizens of the City of Kyle approached the city council with their concerns about Monarch Utilities. Complaints focused on increasing rates, water quality, service and insufficient water flow to fire hydrants (City of Kyle 2007, 4). The council agreed to deny the rate increase, and to provide the legal representation to join other communities in the protest (City of Kyle 2007, 4).

In December 2008 the dispute was settled through mediation. The City of Kyle and Monarch Utilities agreed to a rate increase of 28 percent and Monarch Utilities agreed not to file for an additional rate increase before January 2011 (Monarch Utilities 2008, 3). Kyle residents that receive water from Monarch Utilities continue to pay higher water rates than those who receive water from the City of Kyle in addition, they face the possibility of increased homeowner's insurance rates and damages due to the insufficient water flow for fire protection. The affected residents are concerned that the City of Kyle will approve future rate increases to avoid the large amount of time and money spent during the first rate protest (Amberwood Neighborhood Meeting Minutes, 2010). One solution proposed during the citizen comment period was for the City of Kyle to purchase the Plum Creek water system from Monarch Utilities (City of Kyle 2007, 4). Cost-Benefit analysis is a tool designed to evaluate proposals like this.

Conceptual Framework

The steps involved in cost-benefit analysis, the issues involved in the distribution of water identified from the literature and the circumstances in the case of Kyle are combined to construct a conceptual framework. The framework is used to organize data for the analysis of an outright purchase of the Plum Creek water system by the City of Kyle. This framework provides a starting point for a cost-benefit analysis[4].

The conceptual framework includes the, (1) identified costs and benefits, (2) chosen discount rates, and (3) growth assumptions throughout the life of the project. The elements identified in the purchase of the Plum Creek water system by the City of Kyle are described in Table 4.1.

[4] For more information on constructing conceptual framework tables see Shields (1998) and Shields and Tajalli (2006)

Table 4.1 Conceptual Framework Table

Conceptual Framework Table	
Research Purpose: To evaluate the purchase of Monarch Water Utility by the City of Kyle, Texas	
Missing Variable	**Scholarly Support:**
Initial Purchase Price	(Ascott 2006, 13), (Thompson 1999, 163), Tanous (2007), Fuguitt and Wilcox (1999), Mikesell, (1986), Zerbe and Bellas (2006),
Cost: **Operating Cost**	**Scholarly Support**
1. Debt Service **2. Employee Services** **3. Supplies & Materials** **4. Facility Operations** **5. Equipment Operations** **6. Service Fees & Contracts** **7. Capital Expenditure** **8. Water Supply**	Ascott (2006), Tanous (2007), Galambos & Schreiber (1978), Fuguitt and Wilcox (1999), Mikesell, (1986), Zerbe and Bellas (2006), Thompson (1999)
Benefits:	**Scholarly Support:**
1. Additional Revenue from Added Connections **2. Savings on Insurance Premiums (Fire/Homeowner)**	Galambos & Schreiber (1978), Dorfman (1965), Fuguitt and Wilcox (1999), Mikesell (1986), Ascott (2006), Tanous (2007),
Discount Rates	**Scholarly Support:**
1. 4.8%, **2. 3%,** **3. 7%**	Ascott (2006), Tanous (2007), Galambos & Schreiber (1978), Mikesell (1986) First Southwest Company (2009) Zerbe and Bellas (2006)
Growth Assumptions	**Scholarly Support**
1. 2002-06 (3,181 persons per year), 2007-08 (1,667 persons per year), 2005-08 (2,369 persons per year) **2. Persons Per Household 2.78, 3.25, 3.57**	Smith and Lewis (1980), Smith (1986), Starsinic and Zitter (1968) City of Kyle (2008)

Missing Variable

The literature on cost-benefit analysis identifies the initial purchase price as an essential component of cost-benefit analysis. Because the initial purchase price is not available this research uses the tools of cost-benefit analysis to calculate the net present value of the Plum Creek water system at different purchase prices. The analysis then uses the net present values and the corresponding purchase prices to solve for the purchase price where net present value equals zero. The equations below demonstrate the calculations used to solve for the purchase price where net present value equals zero.

(PVC) Debt service cost depends on the amount borrowed for the initial purchase price. The present value of the costs is calculated by adding the net present value of operating costs **(PVOC)** and the net present value of debt service cost **(PVDS)** for a chosen purchase price.

PVC = PVOC + PVDS

PVB = Present Value of Benefits

NPV = Net Present Value of project at chosen purchase price

NPV=PVB – PVC

(NPV=0) To find where Net Present Value equals zero, Net Present Value is calculated for four different purchase price scenarios. The resulting Net Present Values and their corresponding purchase prices are used to solve for the purchase price where **NPV=0** using the two point equation of a line.

Two Point Equation of a Line:

X_1=Purchase Price

Y_1=NPV of Purchase Price X_1

X_2=Purchase Price

Y_2=NPV of Purchase Price X_2

$$\boldsymbol{y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}\ (x - x_1)}$$

In this analysis, x represents the initial purchase price, and y represents the net present value. The values of (x_1, y_1) and (x_2, y_2) are known. For example, for the population growth during 2002-2006 with 2.78 residents per household and a discount rate of 3%, x_1 = \$15,000,000, y_1 = \$2,052,989, x_2 = \$16,500,000 and y_2 = -\$1,200,640. The above equation is solve for x when y = 0 (net present value is zero).

Costs

The costs listed in this framework represent the costs involved the purchase and operation of the Plum Creek water system in Kyle, Texas. The identified cost are debt service, employee services, supplies and materials, facility operations, equipment operations, capital expenditure, service fees and contracts and water supply.

Benefits

The benefits listed in this framework represent the benefits that would result from the purchase of the Plum Creek water system. The benefits were identified from the discussions on water distribution and the City of Kyle. The measurable benefits are additional revenue from added water connections, and lower household insurance rates.

Benefits that were identified but were not quantifiable are local input for citizens and accountability to residents, greater control over environmental resources and increased influence on future development inside the city.

Discount Rate

The discount rates chosen for this project are those used by the Office of Management and Budget for evaluating federal projects, they are 3 percent and 7 percent. The 4.8 percent rate represents the estimated rates for 2009 general obligation bonds provided by First Southwest Company to the City of Kyle.

Growth Assumptions

Planning to meet demand for services at the local level requires knowledge of population trends that occur between census counts. Local governments rely on population estimates to keep pace with the future needs of a city.

One technique for estimating populations between census measurements is the housing unit method. The housing unit method assumes that everyone lives in some type of housing structure, and that the population of an area can be found by multiplying the number of housing units by the average number of persons per household (Smith 2008, 287).

A variation of the housing unit method uses public utility information to adjust estimates to exclude vacancies (Starsinic and Zitter 1968, 477). In this variation the number of electric or water connections are multiplied by the average person per household to estimate population. In both cases, the average person per household estimate can be found by in the most recent census results.

Estimates based on the most recent census become less accurate over time (Smith and Lewis 1980, 327). Using multiple persons per household estimates and different growth trends in the years following the census can provide a useful range of population estimates.

The growth assumptions in this framework represent the population growth for the City of Kyle during three different time periods they are 2002-2006, 2007-2008 and 2005-2008 (City of Kyle 2008). A variation of the housing unit method for estimating city population is used to estimate future growth. The housing unit method used by the City of Kyle estimates population based the number of residential water customers in the city multiplied by an estimated number of persons per household. The persons per household estimates used in this analysis are 2.78, 3.25 and 3.57.

Conclusions

This chapter applies the steps of cost-benefit analysis to the issues involved in water distribution. A conceptual framework is created to evaluate the switch from private to public water provision. This framework is used as a guide to generate the cost and benefit data for the case of Kyle, Texas.

Chapter Five: Methodology

Introduction

Chapter five describes the methodology used to estimate the costs and benefits identified in the conceptual framework in order to find the highest efficient purchase price of the water system using different growth assumptions. The methods for collecting data and estimating costs, benefits and population growth for the case of Kyle are explained. Table 5.1 outlines the method used to measure each category identified in the conceptual framework. Table 5.1 is followed by a discussion of the methodology.

Table 5.1 Operationalization of Conceptual Framework Table

Operationalization of Conceptual Framework Table	
Cost:	**Measurement:**
Initial Purchase Price	**(PVC)** Debt service cost depends on the amount borrowed for the initial purchase price. The present value of the costs is calculated by adding the net present value of operating costs **(PVOC)** and the net present value of debt service cost **(PVDS)** for a chosen purchase price. **PVC = PVOC + PVDS** **PVB** = Present Value of Benefits **NPV** = Net Present Value of project at chosen purchase price **NPV=PVB – PVC** **(NPV=0)** To find where Net Present Value equals zero, Net Present Value is calculated for four different purchase price scenarios. The resulting Net Present Values and their corresponding purchase prices are used to solve for the purchase price where **NPV=0** using the two point equation of a line.

	Two Point Equation of a Line: X_1=Purchase Price Y_1=NPV of Purchase Price X1 X_2=Purchase Price Y_2=NPV of Purchase Price X2 $$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}\ (x - x_1)$$ In this analysis, x represents the initial purchase price, and y represents the net present value. The values of (x_1, y_1) and (x_2, y_2) are known. For example, for the population growth during 2002-2006 with 2.78 residents per household and a discount rate of 3%, x_1 = \$15,000,000, y_1 = \$2,052,989, x_2 = \$16,500,000 and y_2 = -\$1,200,640. The above equation is solve for x when y = 0 (net present value is zero).
Debt Retirement	Debt retirement costs equal the principle and interest paid throughout life of general obligation bonds issued for purchase. Four different debt service schedules for varying amounts were provided by the City of Kyle. The linear relationship that exist between the four known debt service schedules was used to interpolate new debt service schedules that fall between the known values and extrapolate new schedules that fall outside the known values. The result is a series of debt service schedules from five million to thirty million dollars in half million dollar increments. So that a range of net benefits can be calculated at different debt service costs. See Tables in Appendix A for yearly figures.
Employee Services	Employee Services cost is calculated using the most current cost estimates based on the 2008-09 re-estimated budgets divided by the number of connections to find the yearly cost per connection. The cost per connection is

	then multiplied by the number of connections at three different growth projections. The current estimated cost for the 2008-09 year is $261,262. The number of connections is calculated using current housing unit estimates.
Supplies and Materials	Supplies and Materials costs are calculated using the most current cost estimates based on the 2008-09 re-estimated budgets to find the yearly cost per connection. The cost per connection is then applied to three different growth projections. Current estimated cost for the 2008-09 year is $71,390. The number of connections is calculated using current housing unit estimates.
Facility Operations	Facility Operations costs are calculated using the most current cost estimates based on the 2008-09 re-estimated budgets to find the yearly cost per connection. The cost per connection is then applied to three different growth projections. Current estimated cost for the 2008-09 year is $12,110. The number of connections is calculated using current housing unit estimates.
Equipment Operations	Equipment Operations costs are calculated using the most current cost estimates based on the 2008-09 re-estimated budgets to find the yearly cost per connection. The cost per connection is then applied to three different growth projections. Current estimated cost for the 2008-09 year is $16,860. The number of connections is calculated using current housing unit estimates.
Service Fees & Contracts	Service Fees & Contracts costs are calculated using the most current cost estimates based on the 2008-09 re-estimated budgets to find the yearly cost per connection. The cost per connection is then applied to three different growth projections. Current estimated cost for the 2008-09 year is $47,181. The number of connections is calculated using current housing unit estimates.
Water Supply	Water Supply cost is calculated using the most current cost estimates based on the 2008-09 re-estimated budgets to find the yearly cost per connection. The cost per connection is then applied to three different growth projections. Current estimated cost for the 2008-09 year is $1,437,353. The number of connections is calculated using current housing unit estimates.

Capital Expenditure	Capital Expenditures are calculated based on Estimates provided by the EPA Community Water System Survey (2000). Publicly owned systems with 501-3,300 connections average expense is $48,000 per year. Systems with 3,301-10,000 connections average expense was $199,000 per year and Systems with 10,001-100,000 connections average expense was $1,114,000 per year. Capital expenditure was calculated based on the number of connections using different growth assumptions.
Benefits:	**Measurement:**
Additional Water Revenue	Additional water revenue is calculated using the number of new connections multiplied by the average water bill inside the City of Kyle. The average bill is based on average household consumption of 325 gallons per day. Monthly consumption is then applied to the City of Kyle rate scale. Revenue estimates are calculated according to three different growth projections to determine future revenues.
Savings on Insurance	Savings on Insurance is estimated based on average savings for homeowners Insurance with a Property Protection Class rating change from 9 to 6. The change in rating would result in an 11.8% decrease on insurance premiums. The average homeowner premium in Texas is $1,280. The $151.04 decrease in premiums is multiplied by 871, the number of homes that are currently in neighborhoods with insufficient water flow to fire hydrants. Savings calculations are applied to three different growth projections to determine future savings.
Growth	Population Growth is estimated by using the number of water connections and a multiplier. This study uses the growth from the years 2002-2006, 2007-2008 and 2005-2008. Three multipliers are used 2.78, 3.25 and 3.57. The multiplier represents the number of residents per household. The estimated population is calculated using three growth trends. The population is then divided by the person per household to calculate future water connections.
Discount Rate	Three discount rates are used to provide a sensitivity analysis. The rates used are 3% and 7% provided by the Office of Management and Budget and 4.8% the most current rate paid by the City of Kyle on General Obligation

	Bonds,
Decision Criteria	Net Present Value $(NPV = PVB - PVC)$ is used as a decision criterion; it is calculated as the difference between the net present value of the cost and the net present value of the benefits. Since the purchase price is not available the exact net present value for the purchase could not be calculated instead a maximum purchase price is calculated where the net present value equals zero. If the system is purchased for less than the maximum purchase price the purchase would be considered efficient.

Methodology

Cost-benefit analysis is a method used in decision making to organize the positive and negative consequences of a project (Schmid 1989, 1). The results of the analysis are used to determine the social value of a project for the purpose of comparing alternatives (Schmid 1989, 1). This analysis uses the elements of cost-benefit analysis to calculate net present values under different discount rates and growth assumptions for the purchase of the Plum Creek water system. The steps of cost-benefit analysis require that all costs and benefits are identified and the measurable costs and benefits are assigned a value.

A major component of cost-benefit analysis, the initial purchase price is not available. This analysis compensates for the initial purchase price by substituting different purchase prices and the corresponding debt service cost to generate net present values at different purchase prices. The present value of the operating cost and the present value of the benefits remain constant in their respective scenarios. The cost for debt service depends on the amount borrowed for the initial purchase price. The present value of the total cost is calculated by adding the present value of operating costs **(PVOC)** and the present value of debt service cost **(PVDS)** for the chosen purchase price.

PVC = PVOC + PVDS

PVB = Present Value of Benefits

NPV = Net Present Value of project at chosen purchase price

NPV=PVB – PVC

(NPV=0) To find where Net Present Value equals zero, Net Present Value is calculated for four different purchase price scenarios. The resulting Net Present Values and their corresponding purchase prices are used to solve for the purchase price where **NPV=0** using the two point equation of a line.

If the water system is purchased at or below the price where net present value equals zero, the purchase would be considered rational. This analysis uses existing data to estimate the costs and benefits involved in the purchase and operation of the Plum Creek water system.

Data Sources

The data used to operationalize this analysis was collected from the City of Kyle, The Environmental Protection Agency, First Southwest Company, Texas Commission on Environmental Quality and the Texas Department of Insurance. All information concerning operating expenses of the water system except capital expenditure was collected from the City of Kyle. Data on water rates and population growth were also collected from existing information made available by the City of Kyle. Information on capital expenditure and average household water use was collected from the Environmental Protection Agency. Debt service and bond information was created by The First Southwest Company and made available by the City of Kyle.

Estimated savings on homeowner insurance is based on information collected from the Texas Department of Insurance and Information about Monarch Water Utilities was collected from Texas Commission on Environmental Quality and South West Water Company.

Growth

The City of Kyle estimates population between census measurements by multiplying the number of water connections by the number of persons per household (City of Kyle, 2008). Three different growth estimates are used in this analysis. The growth estimates are based on the average yearly increase in population for each period of time. The time periods are 2002-2006, 2007-2008 and 2005-2008 (City of Kyle, 2008).

The average increase in population for Kyle during the years 2002-2006 was 3,181 persons per year. The average increase in population for Kyle during the years 2007-2008 was 1,667 persons per year. The average increase in population for Kyle during the years 2005-2008 was 2,369 persons per year (City of Kyle 2008). Growth estimates for this analysis are calculated by adding the average increase in population to the previous year's total. The population estimates are then divided by number of persons per household to determine the number of water connections.

This analysis uses three persons per household estimates 2.78, 3.25 and 3.57 to determine the number of water connections for the entire city. Because the initial purchase of the Plum Creek water system would increase the number of connections for the City of Kyle water system by 32.5 percent, this analysis assumes that 32.5 percent of the total future water connections will be to the new system (City of Kyle 2009) (TCEQ 2009).

The following tables demonstrate how population and future connections were calculated using the 2.78 persons per household estimate. Calculations were repeated to find the number of connections for 3.25 and 3.57 persons per household.

Table 5.2 demonstrates growth in population, total water connections, and new connections for the Plum Creek water system. The calculations in the table assume that the population will continue to grow as it did in the years 2002-2006 with an average of 2.78 persons per household. Original population estimates were obtained from the City of Kyle "Building Activity Report 2008".

The increase in population for the years 2002-2006 is approximately **3,181** persons per year, the future population is estimated by adding **3,181** each year. The total number of connections in the City of Kyle is calculated by dividing population estimates in column A. by **2.78**. Future connections for the Plum Creek water system are calculated by multiplying the total number of connections in column B. by **32.5 percent.**

Table 5.2 City of Kyle Growth Assuming Growth from the Years 2002-2006

City of Kyle Growth: Assuming Growth from the Years 2002-2006				
Year	**A** **Population of City** **2002-2006 Average = Additional 3,181 persons per year**	**B** **Persons Per Household**	**C** **Total Connections For City** $\frac{A}{B} = C$	**D** **Connections for Plum Creek Water System** $C * 32.5\% = D$
2008	23,360	2.78	8,403	2,731
2009	26,541	2.78	9,547	3,103
2010	29,722	2.78	10,691	3,475
2011	32,903	2.78	11,836	3,847
2012	36,084	2.78	12,980	4,218
2013	39,265	2.78	14,124	4,590
2014	42,446	2.78	15,268	4,962
2015	45,627	2.78	16,413	5,334
2016	48,808	2.78	17,557	5,706
2017	51,989	2.78	18,701	6,078
2018	55,170	2.78	19,845	6,450
2019	58,351	2.78	20,990	6,822
2020	61,532	2.78	22,134	7,193
2021	64,713	2.78	23,278	7,565
2022	67,894	2.78	24,422	7,937
2023	71,075	2.78	25,567	8,309
2024	74,256	2.78	26,711	8,681
2025	77,437	2.78	27,855	9,053
2026	80,618	2.78	28,999	9,425
2027	83,799	2.78	30,144	9,797
2028	86,980	2.78	31,288	10,169
2029	90,161	2.78	32,432	10,540

Table 5.3 demonstrates growth in population, total water connections, and new connections for the Plum Creek water system. The calculations in the table assume that the population will continue to grow as it did in the years 2007-2008 with an average of **2.78** persons per household. Original population estimates were obtained from the City of Kyle "Building Activity Report 2008".

The increase in population for the years 2007-2008 is approximately **1,667** persons per year, future population is estimated by adding **1,667** each year. The total number of connections in the City of Kyle is calculated by dividing population estimates in column A. by **2.78**. Future connections for the Plum Creek water system are calculated by multiplying the total number of connections in column B, by **32.5 percent**.

Table 5.3 City of Kyle Growth Assuming Growth from the Years 2007-2008

City of Kyle Growth: Assuming Growth from the Years 2007-2008				
Year	**A** **Population of City** **2007-2008 Average = Additional 1,667 persons per year**	**B** **Persons Per Household**	**C** **Total Connections For City** $\frac{A}{B} = C$	**D** **Connections for Plum Creek Water System** $C * 32.5\% = D$
2008	23,360	2.78	8,403	2,731
2009	25,027	2.78	9,003	2,926
2010	26,694	2.78	9,602	3,121
2011	28,361	2.78	10,202	3,316
2012	30,028	2.78	10,801	3,510
2013	31,695	2.78	11,401	3,705
2014	33,362	2.78	12,001	3,900
2015	35,029	2.78	12,600	4,095
2016	36,696	2.78	13,200	4,290
2017	38,363	2.78	13,800	4,485
2018	40,030	2.78	14,399	4,680
2019	41,697	2.78	14,999	4,875
2020	43,364	2.78	15,599	5,070
2021	45,031	2.78	16,198	5,264
2022	46,698	2.78	16,798	5,459
2023	48,365	2.78	17,397	5,654
2024	50,032	2.78	17,997	5,849
2025	51,699	2.78	18,597	6,044
2026	53,366	2.78	19,196	6,239
2027	55,033	2.78	19,796	6,434
2028	56,700	2.78	20,396	6,629
2029	58,367	2.78	20,995	6,823

Table 5.4 demonstrates growth in population, total water connections, and new connections for the Plum Creek water system. The calculations in the table assume that the city will continue to grow as it did in the years 2005-2008 with a **2.78** person per household average. Original population estimates were obtained from the City of Kyle "Building Activity Report 2008". The increase in population for the years 2005-2008 is approximately **2,369** persons per year, future population is estimated by adding **2,369** each year.

The total number of connections in the City of Kyle is calculated by dividing population estimates in column A. by **2.78**. Future connections for the Plum Creek water system is calculated by multiplying total connections in column B. by **32.5** percent.

Table 5.4 City of Kyle Growth Assuming Growth from the Years 2005-2008

City of Kyle Growth: Assuming Growth from the Years 2005-2008				
Year	**A** **Population of City** **2005-2008 Average = Additional 2,369 persons per year**	**B** **Persons Per Household**	**C** **Total Connections For City** $\frac{A}{B} = C$	**D** **Connections for Plum Creek Water System** $C * 32.5\% = D$
2008	23,360	2.78	8,403	2,731
2009	25,729	2.78	9,255	3,008
2010	28,098	2.78	10,107	3,285
2011	30,467	2.78	10,959	3,562
2012	32,836	2.78	11,812	3,839
2013	35,205	2.78	12,664	4,116
2014	37,574	2.78	13,516	4,393
2015	39,943	2.78	14,368	4,670
2016	42,312	2.78	15,220	4,947
2017	44,681	2.78	16,072	5,223
2018	47,050	2.78	16,924	5,500
2019	49,419	2.78	17,777	5,777
2020	51,788	2.78	18,629	6,054
2021	54,157	2.78	19,481	6,331
2022	56,526	2.78	20,333	6,608
2023	58,895	2.78	21,185	6,885
2024	61,264	2.78	22,037	7,162
2025	63,633	2.78	22,890	7,439
2026	66,002	2.78	23,742	7,716
2027	68,371	2.78	24,594	7,993
2028	70,740	2.78	25,446	8,270
2029	73,109	2.78	26,298	8,547

Recurring Cost

Recurring cost identified in this analysis include: debt service, employee services, supplies and materials, facility operations, equipment operations, service fees and contracts, water supply and capital expenditure.

Debt Retirement

Debt retirement costs equal the principle and interest paid each year for the life of the bonds issued for purchase of the system. Four different debt service schedules were provided by the City of Kyle. The schedules provided were for the amounts of $10 million, $12.5 million, $27.5 million and $30 million for a period of twenty years. The $2.5 million difference between $10 million and $12.5 million estimates and $27.5 million and $30 million estimates have the same effect on payment amounts for all four of the provided schedules. For example the difference between the first payment of the $12.5 schedule and the $10 million schedule was $73,141, the difference between the first payment of the 30 million dollar schedule and the 27.5 million dollar schedule was $73,342. This relationship exists between all payments on the provided schedules. The original debt service estimates provide a starting point for calculating a range of debt service schedules from $5 million to $30 million in half million dollar increments.

Table 5.5 demonstrates debt service calculations between two of the estimates provided by the City of Kyle. Each half million dollar increment represents one fifth of the difference in payments between column F. and Column A. For example Column B. is calculated by adding on fifth of that difference to column A. Column C. is calculated by adding two fifths of that difference to column A. The complete debt service table is provided in Appendix A.

Table 5.5 Debt Service Schedule (First Southwest Company. 2009. The City of Kyle, Texas General Obligation Bonds Series 2009)

	A	**B**	**C**	**D**	**E**	**F**
Year	27.5M	**28M**	**28.5M**	**29M**	**29.5M**	30M
2009	$804,539.87	$819,168.06	$833,796.26	$848,424.45	$863,052.65	$877,680.84
2010	$2,173,010.50	$2,212,520.10	$2,252,029.70	$2,291,539.30	$2,331,048.90	$2,370,558.50
2011	$2,171,930.50	$2,210,784.10	$2,249,637.70	$2,288,491.30	$2,327,344.90	$2,366,198.50
2012	$2,168,775.00	$2,208,961.40	$2,249,147.80	$2,289,334.20	$2,329,520.60	$2,369,707.00
2013	$2,173,495.00	$2,212,918.20	$2,252,341.40	$2,291,764.60	$2,331,187.80	$2,370,611.00
2014	$2,170,710.00	$2,210,359.20	$2,250,008.40	$2,289,657.60	$2,329,306.80	$2,368,956.00
2015	$2,170,687.50	$2,210,510.20	$2,250,332.90	$2,290,155.60	$2,329,978.30	$2,369,801.00
2016	$2,173,275.50	$2,212,220.20	$2,251,164.90	$2,290,109.60	$2,329,054.30	$2,367,999.00
2017	$2,173,103.50	$2,212,160.20	$2,251,216.90	$2,290,273.60	$2,329,330.30	$2,368,387.00
2018	$2,169,885.50	$2,209,995.10	$2,250,104.70	$2,290,214.30	$2,330,323.90	$2,370,433.50
2019	$2,173,305.50	$2,212,357.10	$2,251,408.70	$2,290,460.30	$2,329,511.90	$2,368,563.50
2020	$2,168,449.50	$2,208,433.90	$2,248,418.30	$2,288,402.70	$2,328,387.10	$2,368,371.50
2021	$2,169,965.50	$2,209,769.90	$2,249,574.30	$2,289,378.70	$2,329,183.10	$2,368,987.50
2022	$2,172,426.50	$2,211,985.50	$2,251,544.50	$2,291,103.50	$2,330,662.50	$2,370,221.50
2023	$2,171,090.50	$2,210,348.10	$2,249,605.70	$2,288,863.30	$2,328,120.90	$2,367,378.50
2024	$2,171,225.50	$2,210,130.70	$2,249,035.90	$2,287,941.10	$2,326,846.30	$2,365,751.50
2025	$2,172,250.50	$2,211,746.30	$2,251,242.10	$2,290,737.90	$2,330,233.70	$2,369,729.50
2026	$2,173,364.50	$2,212,335.10	$2,251,305.70	$2,290,276.30	$2,329,246.90	$2,368,217.50
2027	$2,169,759.50	$2,209,146.10	$2,248,532.70	$2,287,919.30	$2,327,305.90	$2,366,692.50
2028	$2,171,759.50	$2,211,459.70	$2,251,159.90	$2,290,860.10	$2,330,560.30	$2,370,260.50
2029	$2,168,456.50	$2,208,360.30	$2,248,264.10	$2,288,167.90	$2,328,071.70	$2,367,975.50
Totals	**$44,231,466.37**	**$45,035,669.46**	**$45,839,872.56**	**$46,644,075.65**	**$47,448,278.75**	**$48,252,481.84**

Cost Per Connection

Employee services, supplies and materials, facility operations, equipment operations, service fees and contracts and water supply are calculated using cost per connection estimates. Cost per connection is calculated using the 2008-09 re-estimated cost from the City of Kyle "Water Operations Budget". This analysis assumes that the re-estimated cost provides the most current information on the cost of operating a water system in the City of Kyle.

Table 5.6 provides an example of how cost per connection is calculated using the cost of employee services for the City of Kyle Water System. The cost per connection is found by dividing the re-estimated cost by **6,850** the total number of connections the City of Kyle currently serves. The resulting cost per connection is then multiplied by the number of new system connections each year to find total employee services cost. The complete water operations budget is available in Appendix C.

Table 5.6 Employee Services Cost (City of Kyle Annual Budget 2009)

RESOURCE CATEGORY	2006-07	2007-08	2008-09		2009-10				% Diff.
	Actual	Actual	Adopted	Re-estimat	Baseline Proposed	% Diff.	Prog. Change	Total Proposed	
(1)Employee Services	266,325	224,319	241,753	261,612	254,884	-3%	42,889	297,773	14%

Employee Services

Employee Services cost is calculated using the most current cost estimates based on the 2008-09 re-estimated budgets for the City of Kyle water system. Total employee services cost is divided by **6,850**, the number of connections currently served by the City of Kyle to find the yearly cost per connection.

The cost per connection is then multiplied by the number of connections estimated for the Plum Creek water system using three different growth assumptions. Current estimated cost for the 2008-09 year is **$261,262**. The estimated cost per connection is **$38.19** per year. The number of connections is calculated using current housing unit estimates.

Table 5.7 demonstrates employee services cost assuming **2.78** persons per household and the population growth experienced during the years 2002-2006. Calculations were repeated to find the employee services cost for each growth assumption and persons per household estimate.

Table 5.7 Employee Services Cost

Employee Services Cost: Assuming growth from years 2002-2006 (3,181 additional persons per year)			
2.78 persons per household	**A * Connections to Plum Creek System**	**B Annual Cost Per Connection**	**C Total Employee Service Cost** $A * B = C$
2008	2,731	$38.19	$104,294.42
2009	3,103	$38.19	$118,496.50
2010	3,475	$38.19	$132,698.57
2011	3,847	$38.19	$146,900.65
2012	4,218	$38.19	$161,102.73
2013	4,590	$38.19	$175,304.81
2014	4,962	$38.19	$189,506.89
2015	5,334	$38.19	$203,708.96
2016	5,706	$38.19	$217,911.04
2017	6,078	$38.19	$232,113.12
2018	6,450	$38.19	$246,315.20
2019	6,822	$38.19	$260,517.27
2020	7,193	$38.19	$274,719.35
2021	7,565	$38.19	$288,921.43
2022	7,937	$38.19	$303,123.51
2023	8,309	$38.19	$317,325.59
2024	8,681	$38.19	$331,527.66
2025	9,053	$38.19	$345,729.74
2026	9,425	$38.19	$359,931.82
2027	9,797	$38.19	$374,133.90
2028	10,169	$38.19	$388,335.98
2029	10,540	$38.19	$402,538.05
Totals			**$5,470,862.77**

*See table 5.2 for calculations in column A

Supplies and Material

Supplies and Materials costs is calculated using the most current cost estimates based on the 2008-09 re-estimated budgets for the City of Kyle water system. Total Supplies and materials cost is divided by **6,850**, the number of connections currently served by the city to find the yearly cost per connection. The cost per connection is then multiplied by the number of connections for the Plum Creek water system using three different growth assumptions. Current estimated cost for the 2008-09 year is **$71,390**. The estimated cost per connection is **$10.42** per year. The number of connections is calculated using current housing unit estimates.

Table 5.8 demonstrates supplies and materials cost assuming **2.78** persons per household and the population growth experienced during the years 2002-2006. Calculations were repeated to find the supplies and materials cost for each growth assumption and person per household estimate.

Table 5.8 Supplies & Materials Cost

Supplies &Materials Cost: Assuming growth from years 2002-2006 (3,181 additional persons per year)			
2.78 persons per household	**A Connections to Plum Creek System**	**B Annual Cost Per Connection**	**C Total Supplies and Materials Cost** $A * B = C$
2008	2,731	$10.42	$28,456.35
2009	3,103	$10.42	$32,331.33
2010	3,475	$10.42	$36,206.31
2011	3,847	$10.42	$40,081.30
2012	4,218	$10.42	$43,956.28
2013	4,590	$10.42	$47,831.27
2014	4,962	$10.42	$51,706.25
2015	5,334	$10.42	$55,581.24
2016	5,706	$10.42	$59,456.22
2017	6,078	$10.42	$63,331.20
2018	6,450	$10.42	$67,206.19
2019	6,822	$10.42	$71,081.17
2020	7,193	$10.42	$74,956.16
2021	7,565	$10.42	$78,831.14
2022	7,937	$10.42	$82,706.13
2023	8,309	$10.42	$86,581.11
2024	8,681	$10.42	$90,456.09
2025	9,053	$10.42	$94,331.08
2026	9,425	$10.42	$98,206.06
2027	9,797	$10.42	$102,081.05
2028	10,169	$10.42	$105,956.03
2029	10,540	$10.42	$109,831.02
Totals			**$1,492,704.64**

*See table 5.2 for calculations in column A

Facility Operations

Facility Operations cost is calculated using the most current cost estimates based on the 2008-09 re-estimated budgets for the City of Kyle water system. Total facility operations cost is divided by **6,850**, the current number of connections currently served by the city to find the yearly cost per connection. The cost per connection is then multiplied by the number of connections for the Plum Creek water system using three different growth assumptions. Current estimated cost for the 2008-09 year is **$12,110**. The estimated cost per connection is **$1.76** per year. The number of connections is calculated using current housing unit estimates.

Table 5.9 demonstrates facility operations cost assuming **2.78** persons per household and the population growth experienced during the years 2002-06. Calculations were repeated to find the facility operations cost for each growth assumption and persons per household estimate.

Table 5.9 Facility Operations Cost

Facility Operations Cost: Assuming growth from years 2002-2006 (3,181 additional persons per year)			
2.78 persons per household	**A Connections to Plum Creek System**	**B Annual Cost Per Connection**	**C Total Facility Operations Cost** $\boldsymbol{A * B = C}$
2008	2,731	$1.76	$4,806.45
2009	3,103	$1.76	$5,460.95
2010	3,475	$1.76	$6,115.46
2011	3,847	$1.76	$6,769.97
2012	4,218	$1.76	$7,424.48
2013	4,590	$1.76	$8,078.99
2014	4,962	$1.76	$8,733.49
2015	5,334	$1.76	$9,388.00
2016	5,706	$1.76	$10,042.51
2017	6,078	$1.76	$10,697.02
2018	6,450	$1.76	$11,351.53
2019	6,822	$1.76	$12,006.03
2020	7,193	$1.76	$12,660.54
2021	7,565	$1.76	$13,315.05
2022	7,937	$1.76	$13,969.56
2023	8,309	$1.76	$14,624.06
2024	8,681	$1.76	$15,278.57
2025	9,053	$1.76	$15,933.08
2026	9,425	$1.76	$16,587.59
2027	9,797	$1.76	$17,242.10
2028	10,169	$1.76	$17,896.60
2029	10,540	$1.76	$18,551.11
Totals			**$252,126.69**

*See table 5.2 for calculations in column A

Equipment Operations

Equipment Operations cost is calculated using the most current cost estimates based on the 2008-09 re-estimated budgets for the City of Kyle water system. Total equipment operations cost is divided by **6,850**, the current number of connections currently served by the City of Kyle to find the yearly cost per connection. The cost per connection is then multiplied by the number of connections for the Plum Creek water system using three different growth assumptions. Current estimated cost for the 2008-09 year is **$16,860**. The estimated cost per connection is **$2.46** per year. The number of connections is calculated using current housing unit estimates.

Table 5.10 demonstrates equipment operations cost assuming **2.78** persons per household and the population growth experienced during the years 2002-2006. Calculations were repeated to find the equipment operations cost for each growth assumption and person per household estimate.

Table 5.10 Equipment Operations Cost

Equipment Operations Cost: Assuming growth from years 2002-2006 (3,181 additional persons per year)			
2.78 persons per household	**A Connections to Plum Creek System**	**B Annual Cost Per Connection**	**C Total Equipment Operations Cost $A * B = C$**
2008	2,731	$2.46	$6,718.10
2009	3,103	$2.46	$7,632.92
2010	3,475	$2.46	$8,547.75
2011	3,847	$2.46	$9,462.57
2012	4,218	$2.46	$10,377.39
2013	4,590	$2.46	$11,292.22
2014	4,962	$2.46	$12,207.04
2015	5,334	$2.46	$13,121.87
2016	5,706	$2.46	$14,036.69
2017	6,078	$2.46	$14,951.51
2018	6,450	$2.46	$15,866.34
2019	6,822	$2.46	$16,781.16
2020	7,193	$2.46	$17,695.98
2021	7,565	$2.46	$18,610.81
2022	7,937	$2.46	$19,525.63
2023	8,309	$2.46	$20,440.45
2024	8,681	$2.46	$21,355.28
2025	9,053	$2.46	$22,270.10
2026	9,425	$2.46	$23,184.92
2027	9,797	$2.46	$24,099.75
2028	10,169	$2.46	$25,014.57
2029	10,540	$2.46	$25,929.40
Totals			**$352,404.36**

*See table 5.2 for calculations in column A

Service Fees and Contracts

Service Fees and Contract cost is calculated using the most current cost estimates based on the 2008-09 re-estimated budgets for the City of Kyle water system. Total service fees and contract cost is divided by **6,850**, the number of connections currently served by the city to find the yearly cost per connection. The cost per connection is then multiplied by the number of connections for the Plum Creek water system using three different growth assumptions. Current estimated cost for the 2008-09 year is **$47,181**. The estimated cost per connection is **$6.88** per year. The number of connections is calculated using current housing unit estimates.

Table 5.11 demonstrates service fees and contract cost assuming **2.78** persons per household and the population growth experienced during the years 2002-2006. Calculations were repeated to find the service fees and contract cost for each growth assumption and person per household estimate.

Table 5.11 Service Fees & Contract Cost

Service Fees & Contract Cost: Assuming growth from years 2002-2006 (3,181 additional persons per year)			
2.78 persons per household	**A Connections to Plum Creek System**	**B Annual Cost Per Connection**	**C Total Service Fees & Contracts Cost** $A * B = C$
2008	2,731	$6.88	$18,788.83
2009	3,103	$6.88	$21,347.37
2010	3,475	$6.88	$23,905.90
2011	3,847	$6.88	$26,464.43
2012	4,218	$6.88	$29,022.96
2013	4,590	$6.88	$31,581.49
2014	4,962	$6.88	$34,140.02
2015	5,334	$6.88	$36,698.55
2016	5,706	$6.88	$39,257.08
2017	6,078	$6.88	$41,815.61
2018	6,450	$6.88	$44,374.14
2019	6,822	$6.88	$46,932.67
2020	7,193	$6.88	$49,491.21
2021	7,565	$6.88	$52,049.74
2022	7,937	$6.88	$54,608.27
2023	8,309	$6.88	$57,166.80
2024	8,681	$6.88	$59,725.33
2025	9,053	$6.88	$62,283.86
2026	9,425	$6.88	$64,842.39
2027	9,797	$6.88	$67,400.92
2028	10,169	$6.88	$69,959.45
2029	10,540	$6.88	$72,517.98
Totals			**$985,586.17**

*See table 5.2 for calculations in column A

Water Supply

Water Supply cost is calculated using the most current cost estimates based on the 2008-09 re-estimated budgets for the City of Kyle water system. Total water supply cost is divided by **6,850**, the number of connections currently served by the city to find the yearly cost per connection. The cost per connection is then multiplied by the number of connections for the Plum Creek water system under three different growth assumptions. Current estimated cost for the 2008-09 year is **$1,437,353**. The estimated cost per connection is **$209.83** per year. The number of connections is calculated using current housing unit estimates.

Table 5.12 demonstrates water supply cost assuming **2.78** persons per household and the population growth experienced during the years 2002-2006. Calculations were repeated to find the water supply cost for each growth assumption and person per household estimate.

Table 5.12 Water Supply Cost

Water Supply Cost: Assuming growth from years 2002-2006 (3,181 additional persons per year)			
2.78 persons per household	**A Connections to Plum Creek System**	**B Annual Cost Per Connection**	**C Total Water Supply Cost $A * B = C$**
2008	2,731	$209.83	$573,032.14
2009	3,103	$209.83	$651,063.62
2010	3,475	$209.83	$729,095.09
2011	3,847	$209.83	$807,126.57
2012	4,218	$209.83	$885,158.04
2013	4,590	$209.83	$963,189.52
2014	4,962	$209.83	$1,041,220.99
2015	5,334	$209.83	$1,119,252.47
2016	5,706	$209.83	$1,197,283.94
2017	6,078	$209.83	$1,275,315.42
2018	6,450	$209.83	$1,353,346.89
2019	6,822	$209.83	$1,431,378.37
2020	7,193	$209.83	$1,509,409.84
2021	7,565	$209.83	$1,587,441.32
2022	7,937	$209.83	$1,665,472.79
2023	8,309	$209.83	$1,743,504.26
2024	8,681	$209.83	$1,821,535.74
2025	9,053	$209.83	$1,899,567.21
2026	9,425	$209.83	$1,977,598.69
2027	9,797	$209.83	$2,055,630.16
2028	10,169	$209.83	$2,133,661.64
2029	10,540	$209.83	$2,211,693.11
Totals			**$30,058,945.68**

*See table 5.2 for calculations in column A

Capital Expenditure

Capital Expenditure is calculated based on Estimates provided by the "E.P.A. Community Water System Survey 2000". Publicly owned systems with 501-3,300 connections average expense is $48,000 per year. Systems with 3,301-10,000 connections average expense was $199,000 per year and Systems with 10,001-100,000 connections average expense was $1,114,000 per year.

Capital expenditure for this analysis was calculated based on the number of connections for the Plum Creek water system, under three different growth assumptions. For example if the system is estimated to have **3,008** connections in a particular year **$48,000** is used as the capital expenditure cost for that year. Capital expenditure for this analysis was not estimated based on the City of Kyle water operations budget because projected and past capital expenditure was not consistent and total expenditure was far below the estimates provided by the Environmental Protection Agency.

Table 5.13 demonstrates capital expenditure cost assuming **2.78** persons per household and the population growth experienced during the years 2002-06. Calculations were repeated to find the capital expenditure cost for each growth assumption and person per household estimate.

Table 5.13 Capital Expenditure Cost

Capital Expenditure Cost: Assuming growth from years 2002-2006 (3,181 additional persons per year)		
2.78 persons per household	**Connections to Plum Creek System**	**Annual Capital Expenditure Cost**
2009	3,103	$48,000.00
2010	3,475	$199,000.00
2011	3,847	$199,000.00
2012	4,218	$199,000.00
2013	4,590	$199,000.00
2014	4,962	$199,000.00
2015	5,334	$199,000.00
2016	5,706	$199,000.00
2017	6,078	$199,000.00
2018	6,450	$199,000.00
2019	6,822	$199,000.00
2020	7,193	$199,000.00
2021	7,565	$199,000.00
2022	7,937	$199,000.00
2023	8,309	$199,000.00
2024	8,681	$199,000.00
2025	9,053	$199,000.00
2026	9,425	$199,000.00
2027	9,797	$199,000.00
2028	10,169	$199,000.00
2029	10,540	$199,000.00
Totals		**$4,028,000.00**

*See table 5.2 for calculations in column A

Benefits

Increased Revenue

The benefit of increased water revenues for the City of Kyle is calculated by multiplying the total number of connections for the Plum Creek water system by the average water bill inside the City of Kyle. The average water bill is based on the average household consumption of **325 gallons per day** (EPA 2000, 10). Monthly consumption is applied to the City of Kyle water rate scale. The estimated average water bill in the City of Kyle is **$45.83** per month or **$549.96** per year. Revenue estimates are calculated according to three different growth assumptions to determine future revenues.

Table 5.14 demonstrates water revenue assuming **2.78** persons per household and the population growth experienced during the years 2002-06. Calculations were repeated to find the water revenue for each growth assumption and person per household estimate.

Table 5.14 Water Revenue

Water Revenue: Assuming growth from years 2002-2006 (3,181 additional persons per year)			
2.78 persons per household	A Connections to Plum Creek System	B Annual Revenue Per Connection	C Total Water Revenue $A * B = C$
2008	2,731	$549.96	$1,501,905.15
2009	3,103	$549.96	$1,706,424.00
2010	3,475	$549.96	$1,910,942.85
2011	3,847	$549.96	$2,115,461.69
2012	4,218	$549.96	$2,319,980.54
2013	4,590	$549.96	$2,524,499.39
2014	4,962	$549.96	$2,729,018.24
2015	5,334	$549.96	$2,933,537.09
2016	5,706	$549.96	$3,138,055.93
2017	6,078	$549.96	$3,342,574.78
2018	6,450	$549.96	$3,547,093.63
2019	6,822	$549.96	$3,751,612.48
2020	7,193	$549.96	$3,956,131.33
2021	7,565	$549.96	$4,160,650.17
2022	7,937	$549.96	$4,365,169.02
2023	8,309	$549.96	$4,569,687.87
2024	8,681	$549.96	$4,774,206.72
2025	9,053	$549.96	$4,978,725.56
2026	9,425	$549.96	$5,183,244.41
2027	9,797	$549.96	$5,387,763.26
2028	10,169	$549.96	$5,592,282.11
2029	10,540	$549.96	$5,796,800.96
Totals			**$78,783,862.02**

*See table 5.2 for calculations in column A

Insurance Savings

The savings on homeowner insurance premiums is estimated based on the average savings for homeowners insurance with Property Protection Class rating change from nine to six with the addition of sufficient water flow for fire suppression. The savings that would result from this change on brick veneer house is **11.8** percent (TDI 2009, 4). The average homeowner insurance premium in Texas is **$1,280** dollars (TDI 2009). Based on the average homeowner premium in Texas an 11.8 percent decrease would result in **$151.04** savings per house per year. The **$151.04** savings is multiplied by the number of connections for the Plum Creek water system beginning with **871**, the number of homes that are currently in neighborhoods with insufficient flow for fire suppression.

Table 5.15 demonstrates insurance savings assuming **2.78** persons per household and the population growth experienced during the years 2002-2006. These calculations were repeated to find the insurance savings for each growth assumption and person per household estimate. This analysis assumes that all future connections to the new system would receive sufficient water flow to support fire suppression.

Table 5.15 Insurance Savings

Insurance Savings Benefit: Assuming growth from years 2002-2006 (3,181 additional persons per year)			
2.78 persons per household	**A Affected Homes**	**B Annual Savings Per Home**	**C Total Insurance Savings** $\boldsymbol{A * B = C}$
2009	871	$151.04	$131,555.84
2010	1243	$151.04	$187,712.51
2011	1615	$151.04	$243,869.18
2012	1986	$151.04	$300,025.86
2013	2358	$151.04	$356,182.53
2014	2730	$151.04	$412,339.20
2015	3102	$151.04	$468,495.87
2016	3474	$151.04	$524,652.54
2017	3845	$151.04	$580,809.22
2018	4217	$151.04	$636,965.89
2019	4589	$151.04	$693,122.56
2020	4961	$151.04	$749,279.23
2021	5333	$151.04	$805,435.90
2022	5704	$151.04	$861,592.58
2023	6076	$151.04	$917,749.25
2024	6448	$151.04	$973,905.92
2025	6820	$151.04	$1,030,062.59
2026	7192	$151.04	$1,086,219.26
2027	7563	$151.04	$1,142,375.94
2028	7935	$151.04	$1,198,532.61
2029	8307	$151.04	$1,254,689.28
Totals			**$14,555,573.76**

Discount Rate

With the exception of the rates supplied by the Office of Management and Budget, there is no set discount rate that is appropriate for all projects (Ascott 2006, 19). This project will be evaluated at three different discount rates to provide a comparison. The discount rates used will be 3, 4.8 and 7 percent. The 3 and 7 percent rates are the rates required by the Office of Management and Budget. The third rate of 4.8 percent represents the rate to be paid by the city on general obligation bonds in recent months as proposed by Galambos and Schreiber.

Time Horizon

Using the useful life of the utility as the time horizon would be difficult to calculate because the physical life of water supply assets varies considerably by the type of asset (Warford and Williams 1971, 298). Because the components system are perpetually maintained, replaced or repaired, it is difficult to assign a useful life to the system as a whole. The time horizon used for this analysis will represent the length of the bonds issued for the purchase price of the utility. The choice of time horizon plays an important role in the valuation of a project. If the time horizon is lengthened the benefit stream will be increased and can skew the decision criterion (Ascott 2006, 17). This analysis will calculate the value of the utility with a twenty year time horizon. Instead of useful project life, this time horizon reflects the opportunity cost of the resources used to purchase, operate and maintain a municipal water system.

Decision Criterion

The decision criterion for this analysis is Net present value. The formula for net present value is provided in Figure 5.1

Figure 5.1 Net Present Value Formula

$$NPV = PVB - PVC$$

Net present value is calculated by subtracting the present value of the benefits from the present value of the cost (Mikesell 1986, 206). If the net present value results are positive the project is socially profitable and considered an efficient use of resources. This analysis calculates the net present value of the net benefits generated each year from the water system. Net benefits are calculated by finding the difference between benefits and expenses for each year of operation. Net present value is the most appropriate decision criteria for cost-benefit analysis because it incorporates the time value of money (Ascott 2006, 22). This analysis only evaluates one project, when only one project is being considered the decision is to pursue or not to pursue (Fuguitt and Wilcox 1999, 39). If there are competing projects the results can be compared to other projects to determine which project is more socially profitable.

Table 5.16 demonstrates the net benefit calculations for the Plum Creek water system for the population growth experienced in the years 2002-2006 assuming **2.78** persons per household. Debt service estimates for this example assume a **$12.5** million purchase price.

Table 5.16 Example of Net Benefit Calculations Assuming Growth for the years 2002-2006 with 2.78 Persons per household

Year	Revenue	Insurance Savings	Employee Services	Supplies and Material	Equipment Operations	Service Fees and Contracts	Water Supply	Facility Operations	Capital Expenditure	Debt Service	Net Benefits
2009	$1,706,424	$131,555	$118,496	$32,331	$7,632.92	$21,347	$651,063	$5,460	$48,000	$365,708	**$587,938**
2010	$1,910,942	$187,712	$132,698	$36,206	$8,547.75	$23,905	$729,095	$6,115	$199,000	$987,746	**-$24,660**
2011	$2,115,461	$243,869	$146,900.	$40,081	$9,462.57	$26,464	$807,126	$6,769	$199,000	$986,346	**$137,178**
2012	$2,319,980	$300,025	$161,102	$43,956	$10,377.39	$29,022	$885,158	$7,424	$199,000	$989,041	**$294,923**
2013	$2,524,499	$356,182	$175,304	$47,831	$11,292.22	$31,581	$963,189	$8,078	$199,000	$985,597	**$458,806**
2014	$2,729,018	$412,339	$189,506	$51,706	$12,207.04	$34,140	$1,041,220	$8,733	$199,000	$986,247	**$618,595**
2015	$2,933,537	$468,495	$203,708	$55,581	$13,121.87	$36,698	$1,119,252	$9,388	$199,000	$985,802	**$779,479**
2016	$3,138,055	$524,652	$217,911	$59,456	$14,036.69	$39,257	$1,197,283	$10,042	$199,000	$989,291	**$936,429**
2017	$3,342,574	$580,809	$232,113	$63,331	$14,951.51	$41,815	$1,275,315	$10,697	$199,000	$986,425	**$1,099,735**
2018	$3,547,093	$636,965	$246,315	$67,206	$15,866.34	$44,374	$1,353,346	$11,351	$199,000	$987,296	**$1,259,302**
2019	$3,751,612	$693,122	$260,517	$71,081	$16,781.16	$46,932	$1,431,378	$12,006	$199,000	$986,536	**$1,420,501**
2020	$3,956,131	$749,279	$274,719	$74,956	$17,695.98	$49,491	$1,509,409	$12,660	$199,000	$984,392	**$1,583,084**
2021	$4,160,650	$805,435	$288,9213	$78,831	$18,610.81	$52,049	$1,587,441	$13,315	$199,000	$985,600	**$1,742,316**
2022	$4,365,169	$861,592	$303,123	$82,706	$19,525.63	$54,608	$1,665,472	$13,969	$199,000	$984,944	**$1,903,411**
2023	$4,569,687	$917,749	$317,325	$86,581	$20,440.45	$57,166	$1,743,504	$14,624	$199,000	$987,650	**$2,061,144**
2024	$4,774,206	$973,905	$331,527	$90,456	$21,355.28	$59,725	$1,821,535	$15,278	$199,000	$988,599	**$2,220,634**
2025	$4,978,725	$1,030,062	$345,729	$94,331	$22,270.10	$62,283	$1,899,567	$15,933	$199,000	$987,635	**$2,382,038**
2026	$5,183,244	$1,086,219	$359,931	$98,206	$23,184.92	$64,842	$1,977,598	$16,587	$199,000	$989,505	**$2,540,607**
2027	$5,387,763	$1,142,375	$374,133	$102,081	$24,099.75	$67,400	$2,055,630	$17,242	$199,000	$989,162	**$2,701,388**
2028	$5,592,282	$1,198,532	$388,335	$105,956	$25,014.57	$69,959	$2,133,661	$17,896	$199,000	$986,754	**$2,864,235**
2029	$5,796,800	$1,254,689	$402,538	$109,831	$25,929.40	$72,517	$2,211,693	$18,551	$199,000	$987,094	**3,024,335**
Totals	**$78,783,862**	**$14,555,573**	**$5,470,862**	**$1,492,704**	**$352,404**	**$985,586**	**$30,058,945**	**$252,126**	**$4,028,000**	**$20,107,375**	**$30,591,429**

Initial Purchase Price

The initial purchase price of the Plum Creek water system is not available for use in this analysis. Without the initial purchase price it is difficult to determine the net present value of this project. Instead of finding the net present value with a particular purchase price, the results of this analysis provide a range of purchase prices using different growth assumptions and discount rates where the net present value equals zero. The purchase price under the given growth assumption represents the highest price that can be paid for the water system and remain economically efficient. A range of purchase prices and their debt service cost are used to calculate net benefits throughout the life of the project. The resulting net benefit calculations are used to determine four different net present values for each discount rate, growth assumption and person per household count.

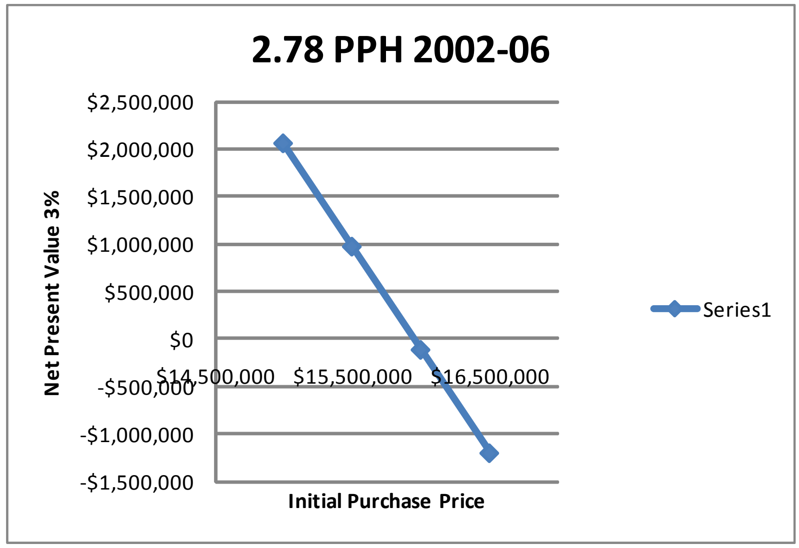
Table 5.16 demonstrated the net benefits of the water system using the debt service estimates for a **$12.5** million purchase price. The net present value is then calculated using **$12.5** million as the initial purchase price. For each growth assumption and discount rate scenario, debt service estimates for four different purchase prices are substituted to find net benefits and calculate net present value. Image 5.1 demonstrates the net present values for four different purchase prices assuming the population growth for the years 2002-2006 with **2.78** persons per household.

Image 5.1 Net Present Value Graph

Purchase Price	Net Present Value
$15,000,000	$2,052,989
$15,500,000	$968,446
$16,000,000	-$116,097
$16,500,000	-$1,200,640

Net Present Value = 0

$15,946,476.54



The net present value for each purchase price is plotted to a graph that represents the net present value at a given purchase price. The two point equation of a line is then used to find the point where the net present value (y) is equal to zero. A net present value graph for each growth scenario is provided in Appendix B. The two point equation of a line is provided below in figure 5.2.

Figure 5.2

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

In this analysis, x represents the initial purchase price, and y represents the net present value. The values of (x_1, y_1) and (x_2, y_2) are known. For example, for the population growth during 2002-2006 with 2.78 residents per household and a discount rate of 3%, x_1 = $15,000,000, y_1 = $2,052,989, x_2 = $16,500,000 and y_2 = -$1,200,640. The above equation is solve for x when $y = 0$ (net present value is zero).

Strengths and Weakness

Cost-benefit analysis strengthens the decision making process because it presents all of the relevant consequences of a project. The results provide information on the economic efficiency of the projects measurable costs and benefits allowing decision makers to rank projects based on their social benefits. Beyond economic efficiency cost-benefit analysis provides a discussion of the costs and benefits that are important to the decision but do not lend themselves to measurement. One limitation of cost-benefit analysis is the reliance on estimation; this applies to both the costs and benefits that do not have market equivalents and the estimation of values in the future.

Although the calculations in this analysis are based on the most current information on operating a water system inside the City of Kyle, the results of this analysis rely on estimations of future costs and revenues based on population growth over the next twenty years. This analysis assumes that the identified costs will remain stable, but clean water is a scarce resource and with the rate of expansion along the interstate 35 corridor water supply cost is likely to increase in the years to come. Providers will likely have to seek other sources of water that will require transportation or the construction of storage facilities that will increase supply cost. This analysis assumes that connections to the new system over time will continue to represent 32.5 percent of the total connections in the City of Kyle.

Although there are some methods for calculating inflation, this analysis does not include adjustments for inflation. This analysis assumes that if prices in general increase the values of benefits should not change at different rates than cost. The relationship between cost and benefits would remain the same (Galambos and Schreiber 1978, 73).

Chapter Six: Results

Introduction

The purpose of this research is to evaluate the purchase of Monarch Water Utility by the City of Kyle. This research evaluates the purchase based on three different growth trends that have recently occurred in the City of Kyle at different discount rates. This chapter presents the results of the analysis.

The initial purchase price for the water system was not available for use in this study. The missing purchase price prohibits the use of cost-benefit analysis to calculate a single net present value that would determine whether this project is an efficient use of resources. Instead the results provide a range of purchase prices where the net present value equals zero. The results represent the highest efficient purchase price for each growth assumption. The results are presented in the tables below.

Table 6.1 Potential Purchase Prices Assuming 2.78 Persons Per Household

2.78 Persons Per Household	**2002-06 Growth Assumption (3,181 persons per year)**	**2007-08 Growth Assumption (1,667 persons per year)**	**2005-08 Growth Assumption (2,369 persons per year)**
3%	$15,946,476	$10,817,396	$13,225,910
4.8%	$14,126,631	$9,694,703	$11,781,706
7%	$12,187,440	$8,487,912	$10,236,994

Table 6.2 Potential Purchase Prices Assuming 3.25 Persons Per Household

3.25 Persons Per Household	**2002-06 Growth Assumption (3,181 persons per year)**	**2007-08 Growth Assumption (1,667 persons per year)**	**2005-08 Growth Assumption (2,369 persons per year)**
3%	$14,367,802	$10,053,994	$12,050,890
4.8%	$12,758,704	$9,044,168	$10,763,545
7%	$11,041,013	$7,955,408	$9,383,698

Table 6.3 Potential Purchase Prices Assuming 3.57 Persons Per Household

3.57 Persons Per Household	2002-06 Growth Assumption (3,181 persons per year)	2007-08 Growth Assumption (1,667 persons per year)	2005-08 Growth Assumption (2,369 persons per year)
3%	$13,526,128	$9,615,978	$11,427,426
4.8%	$12,034,579	$8,664,632	$10,223,320
7%	$10,434,144	$7,637,335	$8,930,959

Table 5.1 provides purchase price results for the water system at three different discount rates assuming **2.78** persons per household for the population growth that occurred in the City of Kyle between the years of 2002-06, 2007-08 and 2005-08. Table 5.2 provides purchase price results for the water system at three different discount rates assuming **3.25** persons per household for the population growth that occurred in the City of Kyle between the years of 2002-06, 2007-08 and 2005-08. Table 5.3 provides purchase price results for the water system at three different discount rates assuming **3.57** persons per household for the population growth that occurred in the City of Kyle between the years of 2002-06, 2007-08 and 2005-08.

The least conservative estimate results in a purchase price of **$15,946,476**, the highest potential purchase price. This price occurs at the growth assumption for the years 2002-06, with **2.78** persons per household discounted at **3%**. The most conservative estimate, therefore the lowest potential purchase price is **$7,637,335**. This price occurs at the growth assumption for the years 2007-08 with **3.57** persons per household discounted at **7%**.

If bonds are approved for the purchase of the water system it is likely that they would be paid back by accessing a surcharge on water connections. The surcharge could be calculated by dividing the estimated number of connections each year by the debt service expense for that year. If the least conservative estimate is used and the system is purchased for **$15,946,476** it would result in an average surcharge of **$5.37** a month per connection for the life of the bond. If the most conservative estimate is used and the system is purchased for **$7,637,335** the average surcharge would be **$3.65** per month for the life of the bond.

Chapter Seven: Conclusions

The purpose of this research is to evaluate the purchase of the Plum Creek water system by the City of Kyle using different growth assumptions. This research evaluates one solution to problems caused by private water delivery in the northern portion of Kyle, Texas. Residents who are served by Monarch Water Utilities currently pay higher rates than residents who are served by the City of Kyle water system and water flow provided by Monarch is not sufficient to support fire suppression. In 2007 Monarch Utilities applied to the Texas Commission on Environmental Quality for a 42 percent rate increase. The City of Kyle provided residents with legal representation to protest the proposed rate increase. The protest was settled through mediation. Monarch Utilities and the City of Kyle agreed to a 28 percent rate increase and Monarch Utilities agreed not to file for additional rate increase before January 2011. One proposed solution to provide fair rates and fire protection for the affected residents is for the City of Kyle to purchase the Plum Creek Water System.

Summary

Chapter 2 provides a review of the literature on the history of water distribution in the United States, the characteristics of the industry and the differences public and private water distribution. This review provides information on the potential cost and benefits involved in a switch from private to public provision of water.

Chapter three follows with a discussion on cost-benefit analysis, the role of cost- benefit analysis in the decision making process and the steps involved in an analysis.

Chapter four presents the setting for the research by describing the City of Kyle, the Plum Creek water system and the problems experienced customers of Monarch Utilities. This chapter concludes by using the steps of cost-benefit analysis to construct a conceptual framework that identifies the costs and benefits of the purchase of the Plum Creek water system by the City of Kyle. The identified costs are debt service, employee services, supplies and materials, facility operations, equipment operations, service fees and contracts, water supply and capital expenditure. The benefits that were identified and used in the analysis are increased revenue from added water connections for the city and savings on homeowner insurance due to increased fire protection. Non measurable benefits included local input and accountability for citizens over future water rates and infrastructure decisions, greater control over natural resources by the city and increased influence of city over future development.

Chapter five explains the methodology used in this research. This chapter includes explanations of growth trends that were used in the project, a discussion on the discount rates used in the analysis and an explanation of how each cost and benefit is measured. Chapter six follows with the results of the analysis.

Conclusions

Because the purchase price was not available to use in this analysis for the calculation of the net present value, the results of this analysis provide a range of purchase prices under different growth assumptions and discount rates where the net present value equals zero. If the actual purchase price for the system is less than the price under a particular growth assumption, the purchase is economically feasible. Like the results of cost-benefit analysis, the results of this analysis provide just one aspect of the decisions involved with the purchase of the water system.

The purchase price for growth that occurred during the years 2007-2008 assuming 3.57 persons per household and a 7 percent discount rate provides the most conservative estimate for the value of the Plum Creek water system. Given its location along the Interstate 35 corridor between Austin and San Antonio the City of Kyle is likely to grow faster that it did during those years. The purchase price estimates for growth that occurred during the years 2005-2008 assuming 3.25 persons per household present a more likely scenario. The purchase prices for this growth scenario range from $9 million to $12 million. For a city the size and population of Kyle that is just beginning to develop, purchasing the Plum Creek water system seems to be a reasonable use of resources.

Monarch Utilities agreed not to file for additional rate increases before 2011. Given their responsibility to shareholders, Monarch Utilities will apply for future rate increases. The residents served by Monarch Utilities are likely to continue applying political pressure until they receive fire protection and reasonable water rates. This problem will continue to grow as the population of Kyle grows.

If the actual purchase price is reasonably close to results in this analysis it would be beneficial for the City of Kyle to purchase the water system now so that it can gain influence on the development of the city and provide residents with equitable rates and fire protection.

Recommendations for Future Analysis

The City of Kyle was provided the actual purchase price of the Plum Creek water system by Monarch Utilities, it is not clear whether or not they plan to evaluate this purchase. The problems discussed in this research indicate that the purchase of the Plum Creek water system merits an evaluation of the costs, and benefits by the City of Kyle.

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Appendix A

Debt Service Schedule

Year	5M	5.5M	6M	6.5M	7M	7.5M	8M
2009	$146,280.41	$160,908.98	$175,537.55	$190,166.11	$204,794.68	$219,423.25	$234,051.82
2010	$395,093.50	$434,603.70	$474,113.90	$513,624.10	$553,134.30	$592,644.50	$632,154.70
2011	$388,533.50	$428,387.70	$468,241.90	$508,096.10	$547,950.30	$587,804.50	$627,658.70
2012	$386,861.50	$427,006.80	$467,152.10	$507,297.40	$547,442.70	$587,588.00	$627,733.30
2013	$394,865.50	$434,247.60	$473,629.70	$513,011.80	$552,393.90	$591,776.00	$631,158.10
2014	$392,125.50	$431,733.60	$471,341.70	$510,949.80	$550,557.90	$590,166.00	$629,774.10
2015	$404,078.00	$442,859.60	$481,641.20	$520,422.80	$559,204.40	$597,986.00	$636,767.60
2016	$390,078.50	$430,026.00	$469,973.50	$509,921.00	$549,868.50	$589,816.00	$629,763.50
2017	$401,198.50	$440,213.60	$479,228.70	$518,243.80	$557,258.90	$596,274.00	$635,289.10
2018	$401,276.50	$440,344.50	$479,412.50	$518,480.50	$557,548.50	$596,616.50	$635,684.50
2019	$401,506.50	$440,508.50	$479,510.50	$518,512.50	$557,514.50	$596,516.50	$635,518.50
2020	$399,560.50	$438,549.30	$477,538.10	$516,526.90	$555,515.70	$594,504.50	$633,493.30
2021	$402,760.50	$441,616.50	$480,472.50	$519,328.50	$558,184.50	$597,040.50	$635,896.50
2022	$405,067.00	$443,725.50	$482,384.00	$521,042.50	$559,701.00	$598,359.50	$637,018.00
2023	$396,571.00	$435,976.30	$475,381.60	$514,786.90	$554,192.20	$593,597.50	$633,002.80
2024	$387,805.50	$427,858.40	$467,911.30	$507,964.20	$548,017.10	$588,070.00	$628,122.90
2025	$393,711.50	$433,306.40	$472,901.30	$512,496.20	$552,091.10	$591,686.00	$631,280.90
2026	$388,459.50	$428,529.20	$468,598.90	$508,668.60	$548,738.30	$588,808.00	$628,877.70
2027	$382,619.50	$423,055.70	$463,491.90	$503,928.10	$544,364.30	$584,800.50	$625,236.70
2028	$391,251.50	$430,951.70	$470,651.90	$510,352.10	$550,052.30	$589,752.50	$629,452.70
2029	$388,537.00	$428,440.80	$468,344.60	$508,248.40	$548,152.20	$588,056.00	$627,959.80
Totals	**$8,038,241.41**	**$8,842,850.38**	**$9,647,459.35**	**$10,452,068.31**	**$11,256,677.28**	**$12,061,286.25**	**$12,865,895.22**

Year	8.5M	9M	9.5M	10M	10.5M	11M	11.5M
2009	$248,680.39	$263,308.95	$277,937.52	$292,566.09	$307,194.66	$321,823.23	$336,451.79
2010	$671,664.90	$711,175.10	$750,685.30	$790,195.50	$829,705.70	$869,215.90	$908,726.10
2011	$667,512.90	$707,367.10	$747,221.30	$787,075.50	$826,929.70	$866,783.90	$906,638.10
2012	$667,878.60	$708,023.90	$748,169.20	$788,314.50	$828,459.80	$868,605.10	$908,750.40
2013	$670,540.20	$709,922.30	$749,304.40	$788,686.50	$828,068.60	$867,450.70	$906,832.80
2014	$669,382.20	$708,990.30	$748,598.40	$788,206.50	$827,814.60	$867,422.70	$907,030.80
2015	$675,549.20	$714,330.80	$753,112.40	$791,894.00	$830,675.60	$869,457.20	$908,238.80
2016	$669,711.00	$709,658.50	$749,606.00	$789,553.50	$829,501.00	$869,448.50	$909,396.00
2017	$674,304.20	$713,319.30	$752,334.40	$791,349.50	$830,364.60	$869,379.70	$908,394.80
2018	$674,752.50	$713,820.50	$752,888.50	$791,956.50	$831,024.50	$870,092.50	$909,160.50
2019	$674,520.50	$713,522.50	$752,524.50	$791,526.50	$830,528.50	$869,530.50	$908,532.50
2020	$672,482.10	$711,470.90	$750,459.70	$789,448.50	$828,437.30	$867,426.10	$906,414.90
2021	$674,752.50	$713,608.50	$752,464.50	$791,320.50	$830,176.50	$869,032.50	$907,888.50
2022	$675,676.50	$714,335.00	$752,993.50	$791,652.00	$830,310.50	$868,969.00	$907,627.50
2023	$672,408.10	$711,813.40	$751,218.70	$790,624.00	$830,029.30	$869,434.60	$908,839.90
2024	$668,175.80	$708,228.70	$748,281.60	$788,334.50	$828,387.40	$868,440.30	$908,493.20
2025	$670,875.80	$710,470.70	$750,065.60	$789,660.50	$829,255.40	$868,850.30	$908,445.20
2026	$668,947.40	$709,017.10	$749,086.80	$789,156.50	$829,226.20	$869,295.90	$909,365.60
2027	$665,672.90	$706,109.10	$746,545.30	$786,981.50	$827,417.70	$867,853.90	$908,290.10
2028	$669,152.90	$708,853.10	$748,553.30	$788,253.50	$827,953.70	$867,653.90	$907,354.10
2029	$667,863.60	$707,767.40	$747,671.20	$787,575.00	$827,478.80	$867,382.60	$907,286.40
Totals	**$13,670,504.19**	**$14,475,113.15**	**$15,279,722.12**	**$16,084,331.09**	**$16,888,940.06**	**$17,693,549.03**	**$18,498,157.99**

Year	12M	12.5M	13M	13.5M	14M	14.5M	15M
2009	$351,080.36	$365,708.93	$380,337.50	$394,966.07	$409,594.63	$424,223.20	$438,851.77
2010	$948,236.30	$987,746.50	$1,027,256.70	$1,066,766.90	$1,106,277.10	$1,145,787.30	$1,185,297.50
2011	$946,492.30	$986,346.50	$1,026,200.70	$1,066,054.90	$1,105,909.10	$1,145,763.30	$1,185,617.50
2012	$948,895.70	$989,041.00	$1,029,186.30	$1,069,331.60	$1,109,476.90	$1,149,622.20	$1,189,767.50
2013	$946,214.90	$985,597.00	$1,024,979.10	$1,064,361.20	$1,103,743.30	$1,143,125.40	$1,182,507.50
2014	$946,638.90	$986,247.00	$1,025,855.10	$1,065,463.20	$1,105,071.30	$1,144,679.40	$1,184,287.50
2015	$947,020.40	$985,802.00	$1,024,583.60	$1,063,365.20	$1,102,146.80	$1,140,928.40	$1,179,710.00
2016	$949,343.50	$989,291.00	$1,029,238.50	$1,069,186.00	$1,109,133.50	$1,149,081.00	$1,189,028.50
2017	$947,409.90	$986,425.00	$1,025,440.10	$1,064,455.20	$1,103,470.30	$1,142,485.40	$1,181,500.50
2018	$948,228.50	$987,296.50	$1,026,364.50	$1,065,432.50	$1,104,500.50	$1,143,568.50	$1,182,636.50
2019	$947,534.50	$986,536.50	$1,025,538.50	$1,064,540.50	$1,103,542.50	$1,142,544.50	$1,181,546.50
2020	$945,403.70	$984,392.50	$1,023,381.30	$1,062,370.10	$1,101,358.90	$1,140,347.70	$1,179,336.50
2021	$946,744.50	$985,600.50	$1,024,456.50	$1,063,312.50	$1,102,168.50	$1,141,024.50	$1,179,880.50
2022	$946,286.00	$984,944.50	$1,023,603.00	$1,062,261.50	$1,100,920.00	$1,139,578.50	$1,178,237.00
2023	$948,245.20	$987,650.50	$1,027,055.80	$1,066,461.10	$1,105,866.40	$1,145,271.70	$1,184,677.00
2024	$948,546.10	$988,599.00	$1,028,651.90	$1,068,704.80	$1,108,757.70	$1,148,810.60	$1,188,863.50
2025	$948,040.10	$987,635.00	$1,027,229.90	$1,066,824.80	$1,106,419.70	$1,146,014.60	$1,185,609.50
2026	$949,435.30	$989,505.00	$1,029,574.70	$1,069,644.40	$1,109,714.10	$1,149,783.80	$1,189,853.50
2027	$948,726.30	$989,162.50	$1,029,598.70	$1,070,034.90	$1,110,471.10	$1,150,907.30	$1,191,343.50
2028	$947,054.30	$986,754.50	$1,026,454.70	$1,066,154.90	$1,105,855.10	$1,145,555.30	$1,185,255.50
2029	$947,190.20	$987,094.00	$1,026,997.80	$1,066,901.60	$1,106,805.40	$1,146,709.20	$1,186,613.00
Totals	**$19,302,766.96**	**$20,107,375.93**	**$20,911,984.90**	**$21,716,593.87**	**$22,521,202.83**	**$23,325,811.80**	**$24,130,420.77**

Year	15.5M	16M	16.5M	17M	17.5M	18M	18.5M
2009	$453,480.34	$468,108.91	$482,737.47	$497,366.04	$511,994.61	$526,623.18	$541,251.75
2010	$1,224,807.70	$1,264,317.90	$1,303,828.10	$1,343,338.30	$1,382,848.50	$1,422,358.70	$1,461,868.90
2011	$1,225,471.70	$1,265,325.90	$1,305,180.10	$1,345,034.30	$1,384,888.50	$1,424,742.70	$1,464,596.90
2012	$1,229,912.80	$1,270,058.10	$1,310,203.40	$1,350,348.70	$1,390,494.00	$1,430,639.30	$1,470,784.60
2013	$1,221,889.60	$1,261,271.70	$1,300,653.80	$1,340,035.90	$1,379,418.00	$1,418,800.10	$1,458,182.20
2014	$1,223,895.60	$1,263,503.70	$1,303,111.80	$1,342,719.90	$1,382,328.00	$1,421,936.10	$1,461,544.20
2015	$1,218,491.60	$1,257,273.20	$1,296,054.80	$1,334,836.40	$1,373,618.00	$1,412,399.60	$1,451,181.20
2016	$1,228,976.00	$1,268,923.50	$1,308,871.00	$1,348,818.50	$1,388,766.00	$1,428,713.50	$1,468,661.00
2017	$1,220,515.60	$1,259,530.70	$1,298,545.80	$1,337,560.90	$1,376,576.00	$1,415,591.10	$1,454,606.20
2018	$1,221,704.50	$1,260,772.50	$1,299,840.50	$1,338,908.50	$1,377,976.50	$1,417,044.50	$1,456,112.50
2019	$1,220,548.50	$1,259,550.50	$1,298,552.50	$1,337,554.50	$1,376,556.50	$1,415,558.50	$1,454,560.50
2020	$1,218,325.30	$1,257,314.10	$1,296,302.90	$1,335,291.70	$1,374,280.50	$1,413,269.30	$1,452,258.10
2021	$1,218,736.50	$1,257,592.50	$1,296,448.50	$1,335,304.50	$1,374,160.50	$1,413,016.50	$1,451,872.50
2022	$1,216,895.50	$1,255,554.00	$1,294,212.50	$1,332,871.00	$1,371,529.50	$1,410,188.00	$1,448,846.50
2023	$1,224,082.30	$1,263,487.60	$1,302,892.90	$1,342,298.20	$1,381,703.50	$1,421,108.80	$1,460,514.10
2024	$1,228,916.40	$1,268,969.30	$1,309,022.20	$1,349,075.10	$1,389,128.00	$1,429,180.90	$1,469,233.80
2025	$1,225,204.40	$1,264,799.30	$1,304,394.20	$1,343,989.10	$1,383,584.00	$1,423,178.90	$1,462,773.80
2026	$1,229,923.20	$1,269,992.90	$1,310,062.60	$1,350,132.30	$1,390,202.00	$1,430,271.70	$1,470,341.40
2027	$1,231,779.70	$1,272,215.90	$1,312,652.10	$1,353,088.30	$1,393,524.50	$1,433,960.70	$1,474,396.90
2028	$1,224,955.70	$1,264,655.90	$1,304,356.10	$1,344,056.30	$1,383,756.50	$1,423,456.70	$1,463,156.90
2029	$1,226,516.80	$1,266,420.60	$1,306,324.40	$1,346,228.20	$1,386,132.00	$1,426,035.80	$1,465,939.60
Totals	**$24,935,029.74**	**$25,739,638.71**	**$26,544,247.67**	**$27,348,856.64**	**$28,153,465.61**	**$28,958,074.58**	**$29,762,683.55**

Year	19M	19.5M	20M	20.5M	21M	21.5M	22M
2009	$555,880.31	$570,508.88	$585,137.45	$599,745.15	$614,373.35	$629,001.54	$643,629.74
2010	$1,501,379.10	$1,540,889.30	$1,580,399.50	$1,619,876.10	$1,659,385.70	$1,698,895.30	$1,738,404.90
2011	$1,504,451.10	$1,544,305.30	$1,584,159.50	$1,627,980.10	$1,666,833.70	$1,705,687.30	$1,744,540.90
2012	$1,510,929.90	$1,551,075.20	$1,591,220.50	$1,606,165.40	$1,646,351.80	$1,686,538.20	$1,726,724.60
2013	$1,497,564.30	$1,536,946.40	$1,576,328.50	$1,621,570.20	$1,660,993.40	$1,700,416.60	$1,739,839.80
2014	$1,501,152.30	$1,540,760.40	$1,580,368.50	$1,615,621.20	$1,655,270.40	$1,694,919.60	$1,734,568.80
2015	$1,489,962.80	$1,528,744.40	$1,567,526.00	$1,613,169.70	$1,652,992.40	$1,692,815.10	$1,732,637.80
2016	$1,508,608.50	$1,548,556.00	$1,588,503.50	$1,628,049.70	$1,666,994.40	$1,705,939.10	$1,744,883.80
2017	$1,493,621.30	$1,532,636.40	$1,571,651.50	$1,626,309.70	$1,665,366.40	$1,704,423.10	$1,743,479.80
2018	$1,495,180.50	$1,534,248.50	$1,573,316.50	$1,608,351.10	$1,648,460.70	$1,688,570.30	$1,728,679.90
2019	$1,493,562.50	$1,532,564.50	$1,571,566.50	$1,626,583.10	$1,665,634.70	$1,704,686.30	$1,743,737.90
2020	$1,491,246.90	$1,530,235.70	$1,569,224.50	$1,608,667.90	$1,648,652.30	$1,688,636.70	$1,728,621.10
2021	$1,490,728.50	$1,529,584.50	$1,568,440.50	$1,612,703.90	$1,652,508.30	$1,692,312.70	$1,732,117.10
2022	$1,487,505.00	$1,526,163.50	$1,564,822.00	$1,618,600.50	$1,658,159.50	$1,697,718.50	$1,737,277.50
2023	$1,499,919.40	$1,539,324.70	$1,578,730.00	$1,621,484.10	$1,660,741.70	$1,699,999.30	$1,739,256.90
2024	$1,509,286.70	$1,549,339.60	$1,589,392.50	$1,626,552.70	$1,665,457.90	$1,704,363.10	$1,743,268.30
2025	$1,502,368.70	$1,541,963.60	$1,581,558.50	$1,619,309.30	$1,658,805.10	$1,698,300.90	$1,737,796.70
2026	$1,510,411.10	$1,550,480.80	$1,590,550.50	$1,627,776.10	$1,666,746.70	$1,705,717.30	$1,744,687.90
2027	$1,514,833.10	$1,555,269.30	$1,595,705.50	$1,618,347.10	$1,657,733.70	$1,697,120.30	$1,736,506.90
2028	$1,502,857.10	$1,542,557.30	$1,582,257.50	$1,615,956.70	$1,655,656.90	$1,695,357.10	$1,735,057.30
2029	$1,505,843.40	$1,545,747.20	$1,585,651.00	$1,609,803.30	$1,649,707.10	$1,689,610.90	$1,729,514.70
Totals	**$30,567,292.51**	**$31,371,901.48**	**$32,176,510.45**	**$32,972,623.05**	**$33,776,826.15**	**$34,581,029.24**	**$35,385,232.34**

Year	22.5M	23M	23.5M	24M	24.5M	25M	25.5M
2009	$658,257.93	$672,886.12	$687,514.32	$702,142.51	$716,770.71	$731,398.90	$746,027.09
2010	$1,777,914.50	$1,817,424.10	$1,856,933.70	$1,896,443.30	$1,935,952.90	$1,975,462.50	$2,014,972.10
2011	$1,783,394.50	$1,822,248.10	$1,861,101.70	$1,899,955.30	$1,938,808.90	$1,977,662.50	$2,016,516.10
2012	$1,766,911.00	$1,807,097.40	$1,847,283.80	$1,887,470.20	$1,927,656.60	$1,967,843.00	$2,008,029.40
2013	$1,779,263.00	$1,818,686.20	$1,858,109.40	$1,897,532.60	$1,936,955.80	$1,976,379.00	$2,015,802.20
2014	$1,774,218.00	$1,813,867.20	$1,853,516.40	$1,893,165.60	$1,932,814.80	$1,972,464.00	$2,012,113.20
2015	$1,772,460.50	$1,812,283.20	$1,852,105.90	$1,891,928.60	$1,931,751.30	$1,971,574.00	$2,011,396.70
2016	$1,783,828.50	$1,822,773.20	$1,861,717.90	$1,900,662.60	$1,939,607.30	$1,978,552.00	$2,017,496.70
2017	$1,782,536.50	$1,821,593.20	$1,860,649.90	$1,899,706.60	$1,938,763.30	$1,977,820.00	$2,016,876.70
2018	$1,768,789.50	$1,808,899.10	$1,849,008.70	$1,889,118.30	$1,929,227.90	$1,969,337.50	$2,009,447.10
2019	$1,782,789.50	$1,821,841.10	$1,860,892.70	$1,899,944.30	$1,938,995.90	$1,978,047.50	$2,017,099.10
2020	$1,768,605.50	$1,808,589.90	$1,848,574.30	$1,888,558.70	$1,928,543.10	$1,968,527.50	$2,008,511.90
2021	$1,771,921.50	$1,811,725.90	$1,851,530.30	$1,891,334.70	$1,931,139.10	$1,970,943.50	$2,010,747.90
2022	$1,776,836.50	$1,816,395.50	$1,855,954.50	$1,895,513.50	$1,935,072.50	$1,974,631.50	$2,014,190.50
2023	$1,778,514.50	$1,817,772.10	$1,857,029.70	$1,896,287.30	$1,935,544.90	$1,974,802.50	$2,014,060.10
2024	$1,782,173.50	$1,821,078.70	$1,859,983.90	$1,898,889.10	$1,937,794.30	$1,976,699.50	$2,015,604.70
2025	$1,777,292.50	$1,816,788.30	$1,856,284.10	$1,895,779.90	$1,935,275.70	$1,974,771.50	$2,014,267.30
2026	$1,783,658.50	$1,822,629.10	$1,861,599.70	$1,900,570.30	$1,939,540.90	$1,978,511.50	$2,017,482.10
2027	$1,775,893.50	$1,815,280.10	$1,854,666.70	$1,894,053.30	$1,933,439.90	$1,972,826.50	$2,012,213.10
2028	$1,774,757.50	$1,814,457.70	$1,854,157.90	$1,893,858.10	$1,933,558.30	$1,973,258.50	$2,012,958.70
2029	$1,769,418.50	$1,809,322.30	$1,849,226.10	$1,889,129.90	$1,929,033.70	$1,968,937.50	$2,008,841.30
Totals	**$36,189,435.43**	**$36,993,638.52**	**$37,797,841.62**	**$38,602,044.71**	**$39,406,247.81**	**$40,210,450.90**	**$41,014,653.99**

Year	26M	26.5M	27M	27.5M	28M	28.5M
2009	$760,655.29	$775,283.48	$789,911.68	$804,539.87	$819,168.06	$833,796.26
2010	$2,054,481.70	$2,093,991.30	$2,133,500.90	$2,173,010.50	$2,212,520.10	$2,252,029.70
2011	$2,055,369.70	$2,094,223.30	$2,133,076.90	$2,171,930.50	$2,210,784.10	$2,249,637.70
2012	$2,048,215.80	$2,088,402.20	$2,128,588.60	$2,168,775.00	$2,208,961.40	$2,249,147.80
2013	$2,055,225.40	$2,094,648.60	$2,134,071.80	$2,173,495.00	$2,212,918.20	$2,252,341.40
2014	$2,051,762.40	$2,091,411.60	$2,131,060.80	$2,170,710.00	$2,210,359.20	$2,250,008.40
2015	$2,051,219.40	$2,091,042.10	$2,130,864.80	$2,170,687.50	$2,210,510.20	$2,250,332.90
2016	$2,056,441.40	$2,095,386.10	$2,134,330.80	$2,173,275.50	$2,212,220.20	$2,251,164.90
2017	$2,055,933.40	$2,094,990.10	$2,134,046.80	$2,173,103.50	$2,212,160.20	$2,251,216.90
2018	$2,049,556.70	$2,089,666.30	$2,129,775.90	$2,169,885.50	$2,209,995.10	$2,250,104.70
2019	$2,056,150.70	$2,095,202.30	$2,134,253.90	$2,173,305.50	$2,212,357.10	$2,251,408.70
2020	$2,048,496.30	$2,088,480.70	$2,128,465.10	$2,168,449.50	$2,208,433.90	$2,248,418.30
2021	$2,050,552.30	$2,090,356.70	$2,130,161.10	$2,169,965.50	$2,209,769.90	$2,249,574.30
2022	$2,053,749.50	$2,093,308.50	$2,132,867.50	$2,172,426.50	$2,211,985.50	$2,251,544.50
2023	$2,053,317.70	$2,092,575.30	$2,131,832.90	$2,171,090.50	$2,210,348.10	$2,249,605.70
2024	$2,054,509.90	$2,093,415.10	$2,132,320.30	$2,171,225.50	$2,210,130.70	$2,249,035.90
2025	$2,053,763.10	$2,093,258.90	$2,132,754.70	$2,172,250.50	$2,211,746.30	$2,251,242.10
2026	$2,056,452.70	$2,095,423.30	$2,134,393.90	$2,173,364.50	$2,212,335.10	$2,251,305.70
2027	$2,051,599.70	$2,090,986.30	$2,130,372.90	$2,169,759.50	$2,209,146.10	$2,248,532.70
2028	$2,052,658.90	$2,092,359.10	$2,132,059.30	$2,171,759.50	$2,211,459.70	$2,251,159.90
2029	$2,048,745.10	$2,088,648.90	$2,128,552.70	$2,168,456.50	$2,208,360.30	$2,248,264.10
Totals	**$41,818,857.09**	**$42,623,060.18**	**$43,427,263.28**	**$44,231,466.37**	**$45,035,669.46**	**$45,839,872.56**

Year	29M	29.5M	30M
2009	$848,424.45	$863,052.65	$877,680.84
2010	$2,291,539.30	$2,331,048.90	$2,370,558.50
2011	$2,288,491.30	$2,327,344.90	$2,366,198.50
2012	$2,289,334.20	$2,329,520.60	$2,369,707.00
2013	$2,291,764.60	$2,331,187.80	$2,370,611.00
2014	$2,289,657.60	$2,329,306.80	$2,368,956.00
2015	$2,290,155.60	$2,329,978.30	$2,369,801.00
2016	$2,290,109.60	$2,329,054.30	$2,367,999.00
2017	$2,290,273.60	$2,329,330.30	$2,368,387.00
2018	$2,290,214.30	$2,330,323.90	$2,370,433.50
2019	$2,290,460.30	$2,329,511.90	$2,368,563.50
2020	$2,288,402.70	$2,328,387.10	$2,368,371.50
2021	$2,289,378.70	$2,329,183.10	$2,368,987.50
2022	$2,291,103.50	$2,330,662.50	$2,370,221.50
2023	$2,288,863.30	$2,328,120.90	$2,367,378.50
2024	$2,287,941.10	$2,326,846.30	$2,365,751.50
2025	$2,290,737.90	$2,330,233.70	$2,369,729.50
2026	$2,290,276.30	$2,329,246.90	$2,368,217.50
2027	$2,287,919.30	$2,327,305.90	$2,366,692.50
2028	$2,290,860.10	$2,330,560.30	$2,370,260.50
2029	$2,288,167.90	$2,328,071.70	$2,367,975.50
Totals	**$46,644,075.65**	**$47,448,278.75**	**$48,252,481.84**

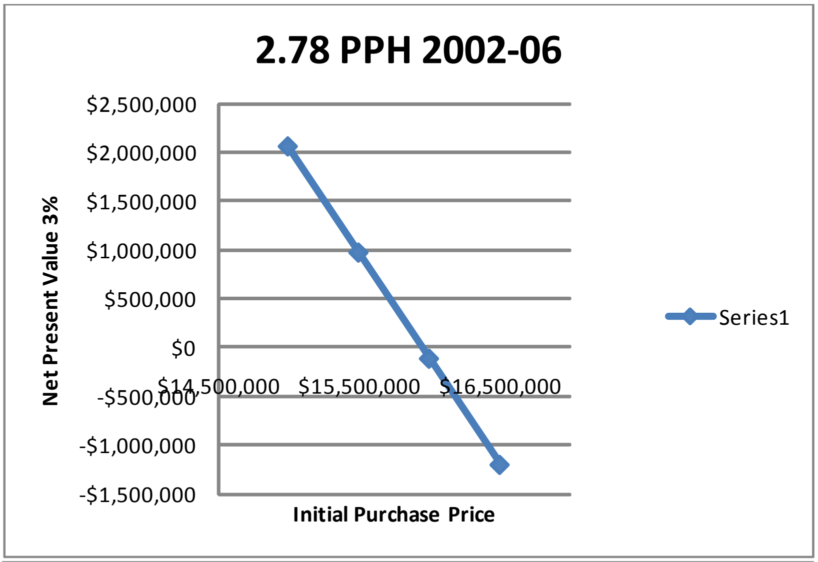
Appendix B

Net Present Value Graphs

P Price	NPV
$15,000,000	$2,052,989
$15,500,000	$968,446
$16,000,000	-$116,097
$16,500,000	-$1,200,640

Net Present Value = 0

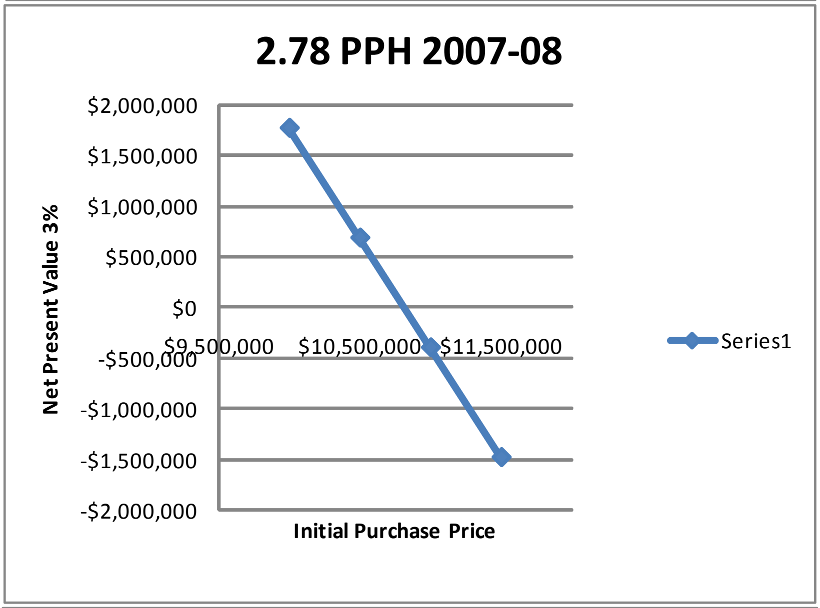
$15,946,476.54



P Price	NPV
$10,000,000	$1,773,002
$10,500,000	$688,459
$11,000,000	-$396,083
$11,500,000	-$1,480,626

Net Present Value = 0

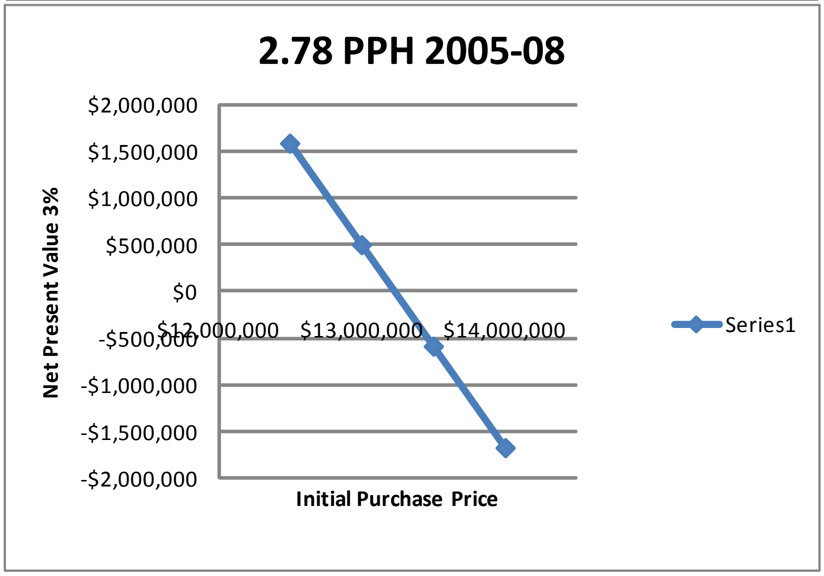
$10,817,396.13



P Price	NPV
$12,500,000	$1,574,563
$13,000,000	$490,020
$13,500,000	-$594,523
$14,000,000	-$1,679,066

Net Present Value = 0

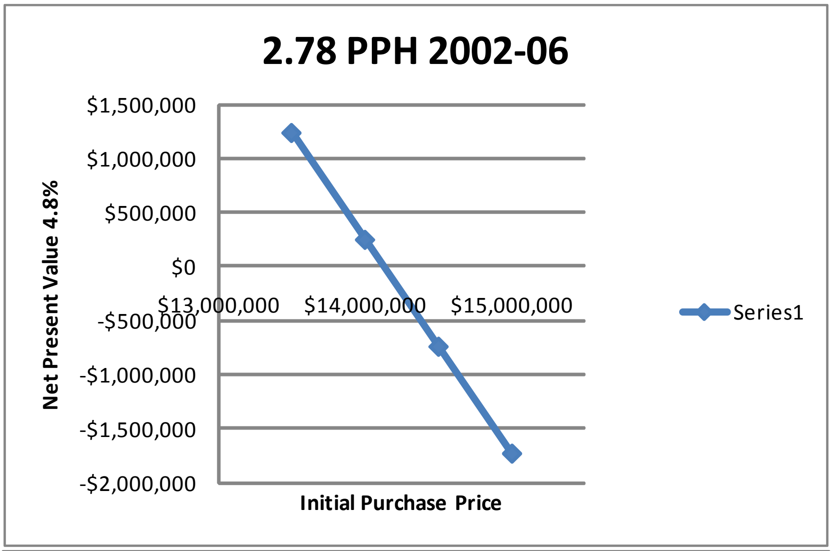
$13,225,910.84



P Price	NPV
$13,500,000	$1,242,636
$14,000,000	$251,116
$14,500,000	-$740,405
$15,000,000	-$1,731,926

Net Present Value = 0

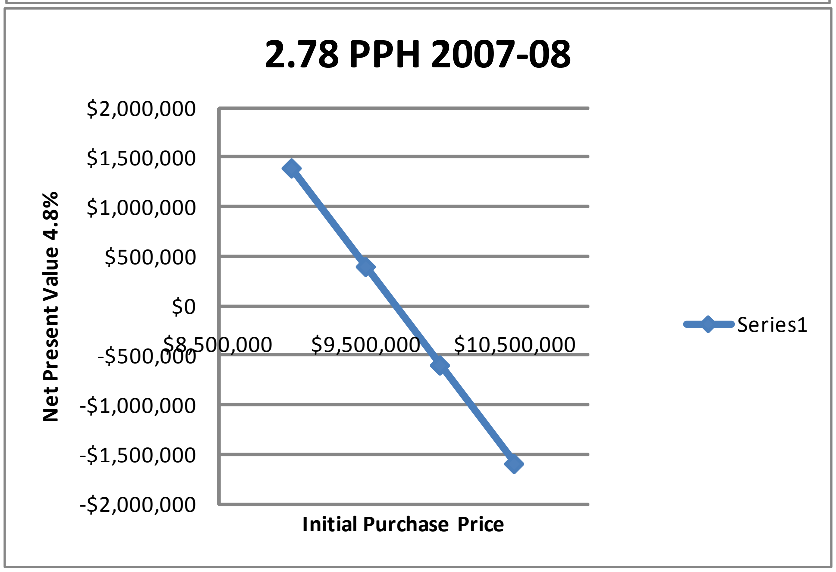
$14,126,631.51



P Price	NPV
$9,000,000	$1,377,626
$9,500,000	$386,105
$10,000,000	-$605,415
$10,500,000	-$1,596,936

Net Present Value = 0

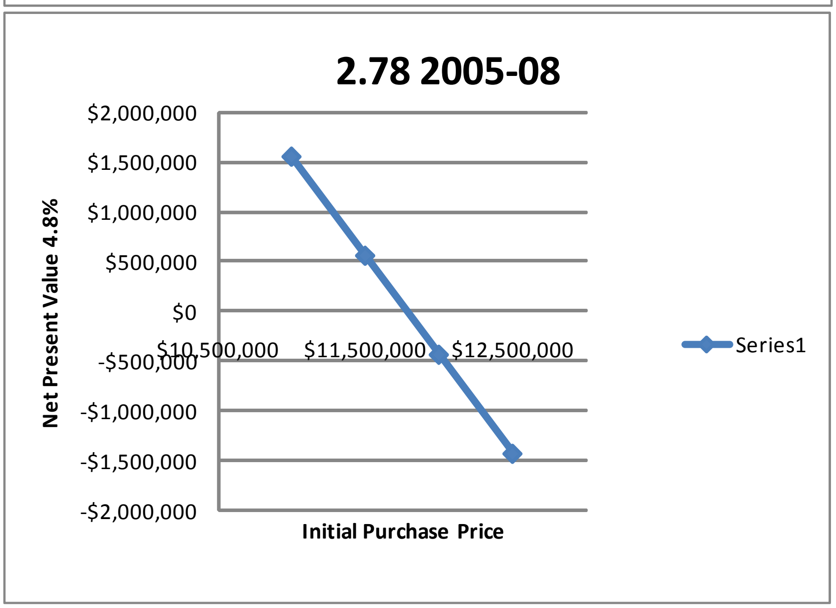
$9,694,703.57



P Price	NPV
$11,000,000	$1,550,155
$11,500,000	$558,634
$12,000,000	-$432,886
$12,500,000	-$1,424,407

Net Present Value = 0

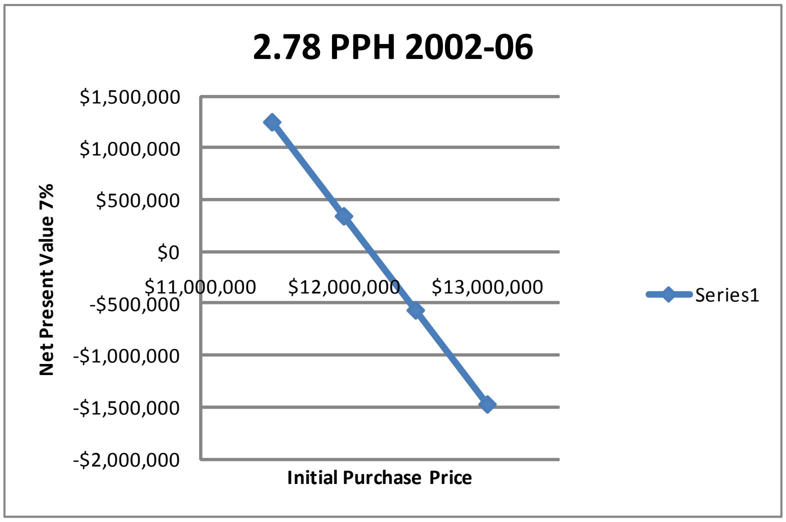
$11,781,706.02



P Price	NPV
$11,500,000	$1,243,675
$12,000,000	$339,105
$12,500,000	-$565,464
$13,000,000	-$1,470,034

Net Present Value = 0

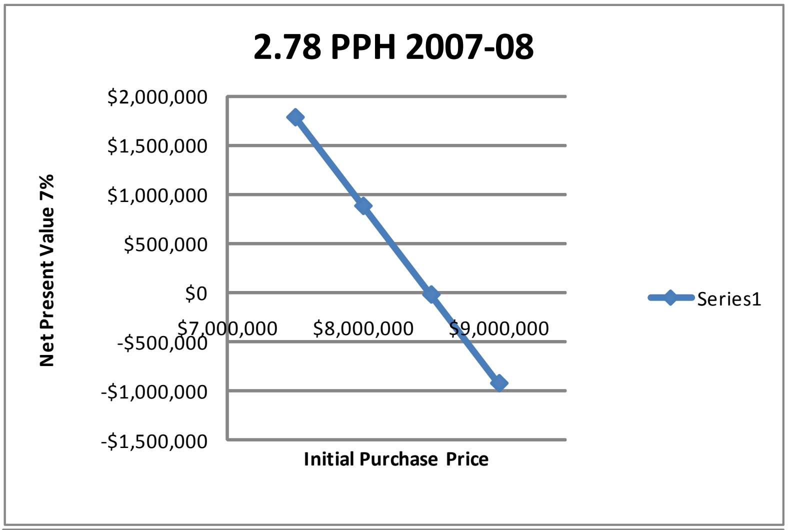
$12,187,440.05



P Price	NPV
$7,500,000	$1,787,271
$8,000,000	$882,701
$8,500,000	-$21,868
$9,000,000	-$926,438

Net Present Value = 0

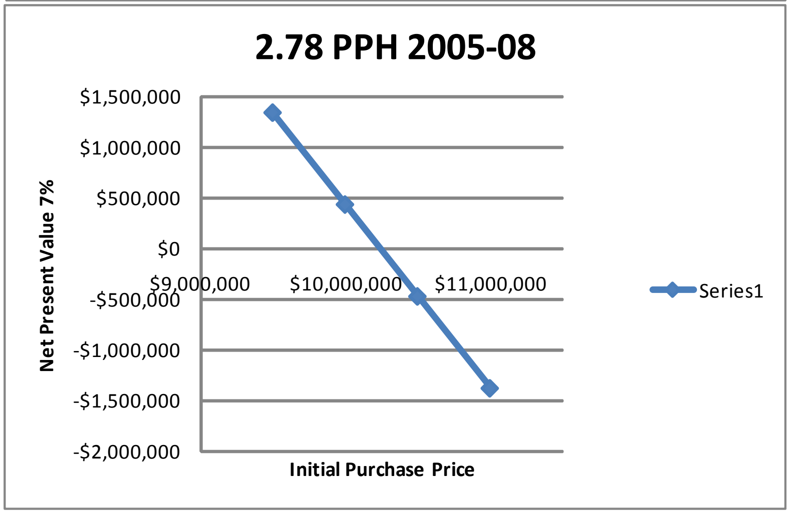
$8,487,912.43



P Price	NPV
$9,500,000	$1,333,326
$10,000,000	$428,757
$10,500,000	-$475,813
$11,000,000	-$1,380,382

Net Present Value = 0

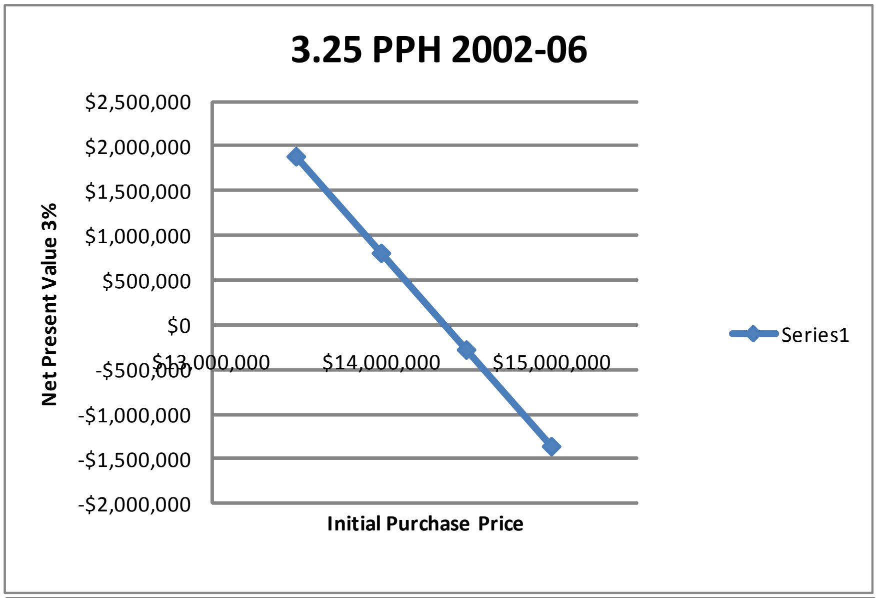
$10,236,994.93



P Price	NPV
$13,500,000	$1,882,339
$14,000,000	$797,796
$14,500,000	-$286,747
$15,000,000	-$1,371,290

Net Present Value = 0

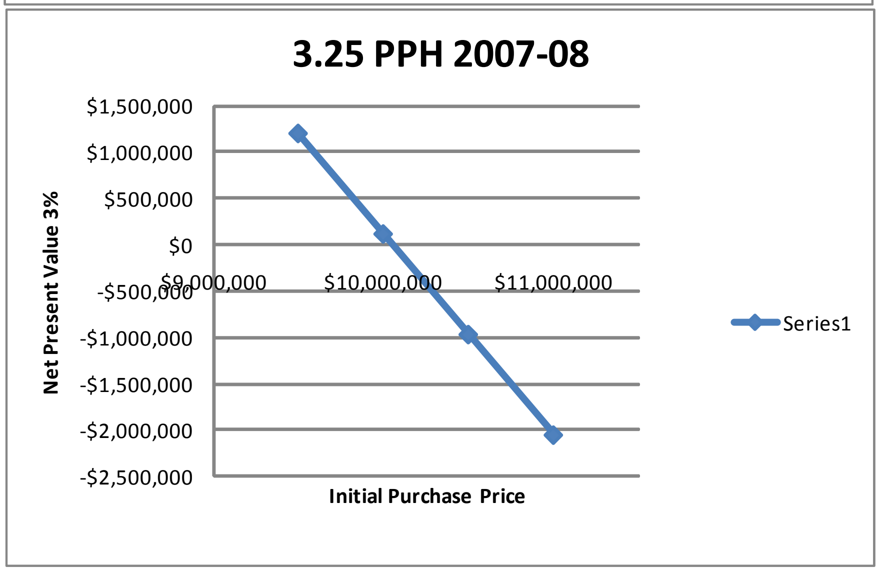
$14,367,802.90



P Price	NPV
$9,500,000	$1,201,662
$10,000,000	$117,119
$10,500,000	-$967,423
$11,000,000	-$2,051,966

Net Present Value = 0

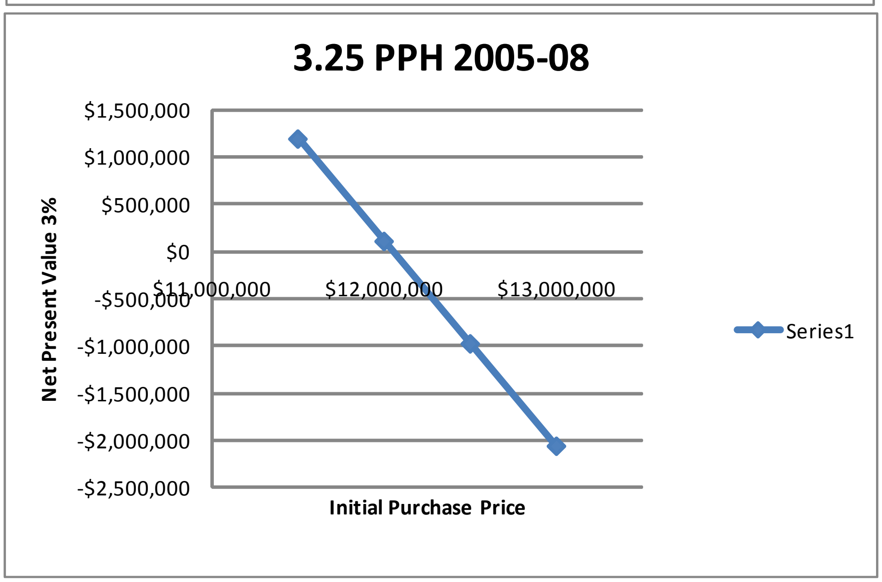
$10,053,994.85



P Price	NPV
$11,500,000	$1,194,928
$12,000,000	$110,385
$12,500,000	-$974,158
$13,000,000	-$2,058,701

Net Present Value = 0

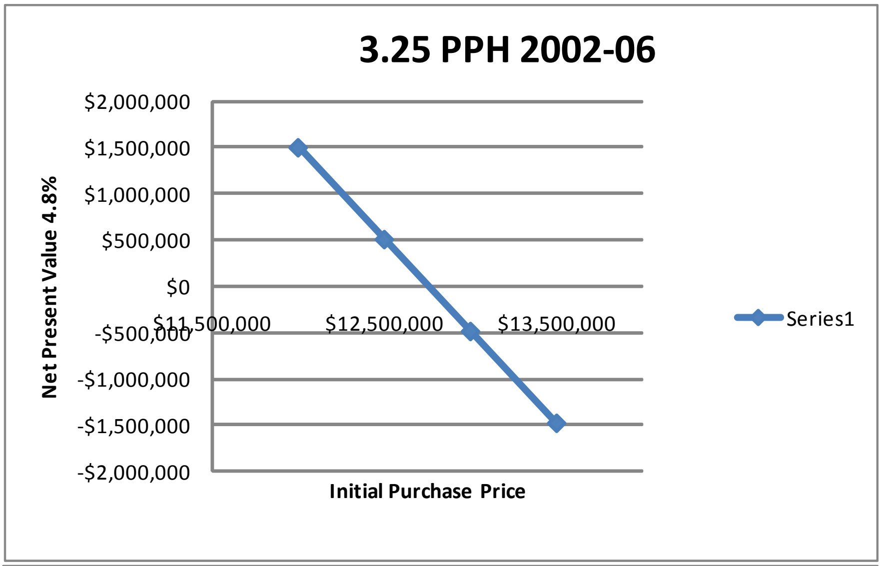
$12,050,890.17



P Price	NPV
$12,000,000	$1,504,543
$12,500,000	$513,022
$13,000,000	-$478,499
$13,500,000	-$1,470,020

Net Present Value = 0

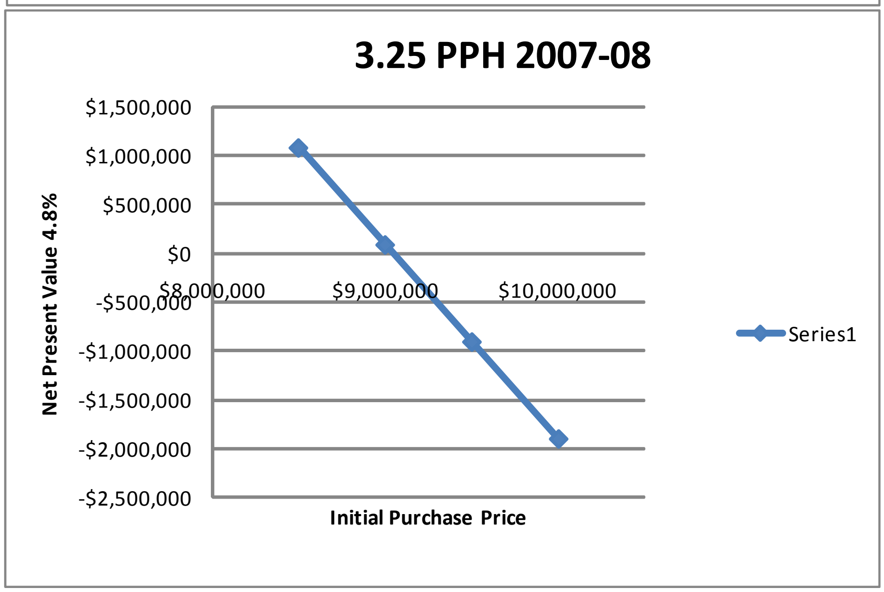
$12,758,704.57



P Price	NPV
$8,500,000	$1,079,109
$9,000,000	$87,588
$9,500,000	-$903,932
$10,000,000	-$1,895,453

Net Present Value = 0

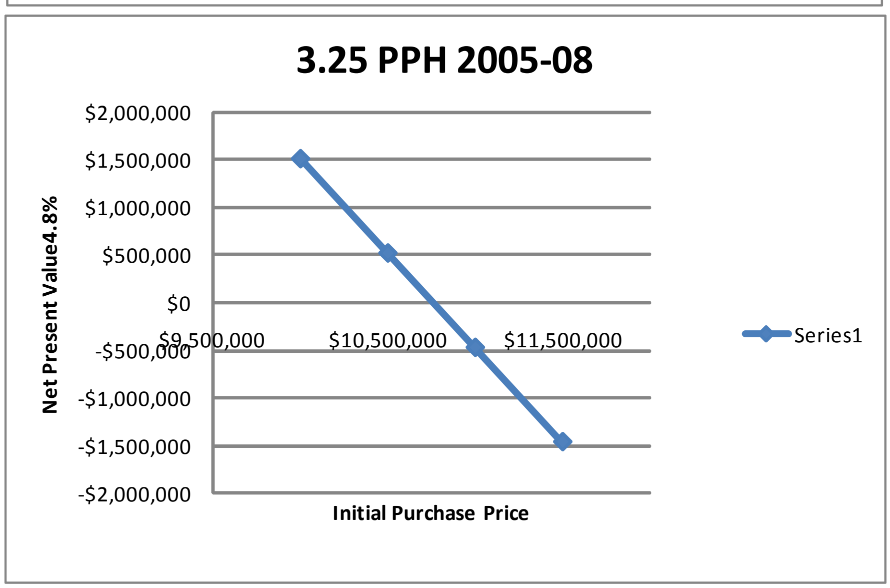
$9,044,168.71



P Price	NPV
$10,000,000	$1,514,142
$10,500,000	$522,621
$11,000,000	-$468,900
$11,500,000	-$1,460,420

Net Present Value = 0

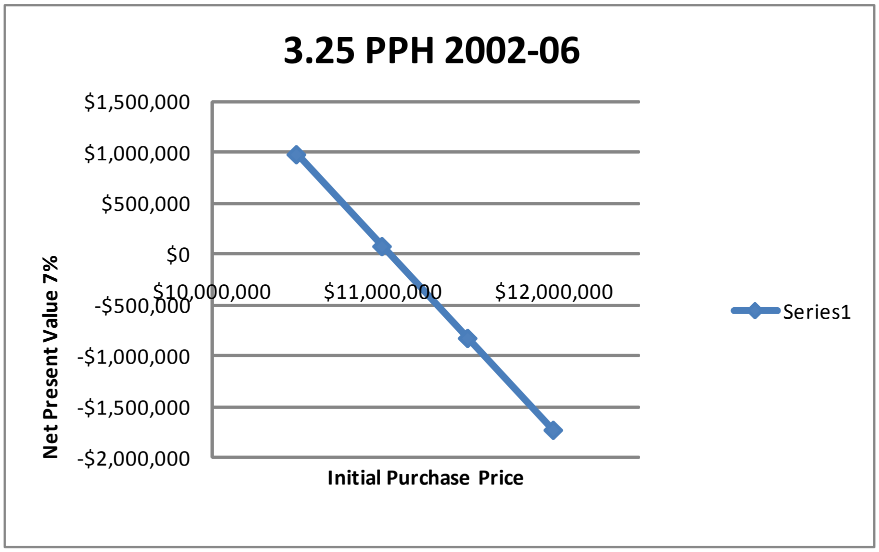
$10,763,545.20



P Price	NPV
$10,500,000	$978,770
$11,000,000	$74,200
$11,500,000	-$830,370
$12,000,000	-$1,734,939

Net Present Value = 0

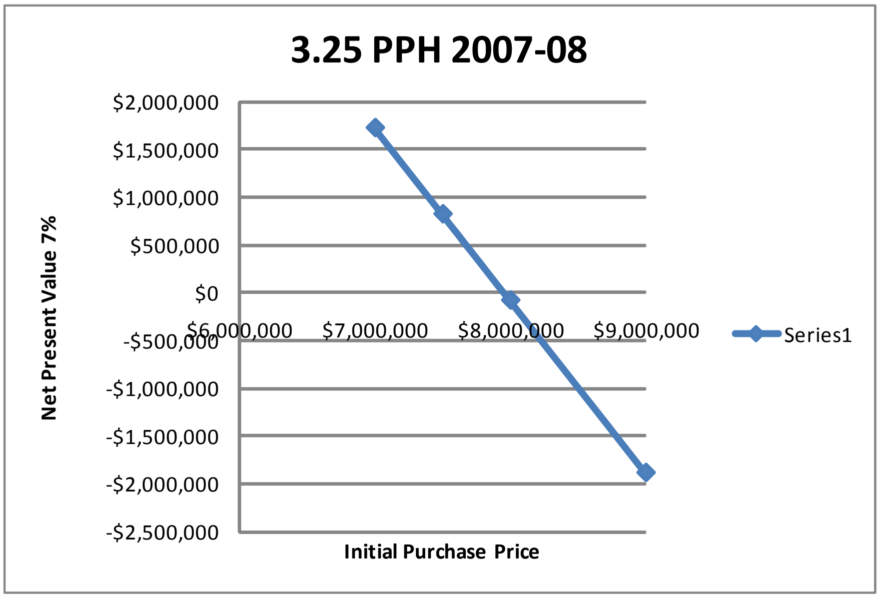
$11,041,013.97



P Price	NPV
$7,000,000	$1,728,466
$7,500,000	$823,897
$8,000,000	-$80,673
$9,000,000	-$1,889,812

Net Present Value = 0

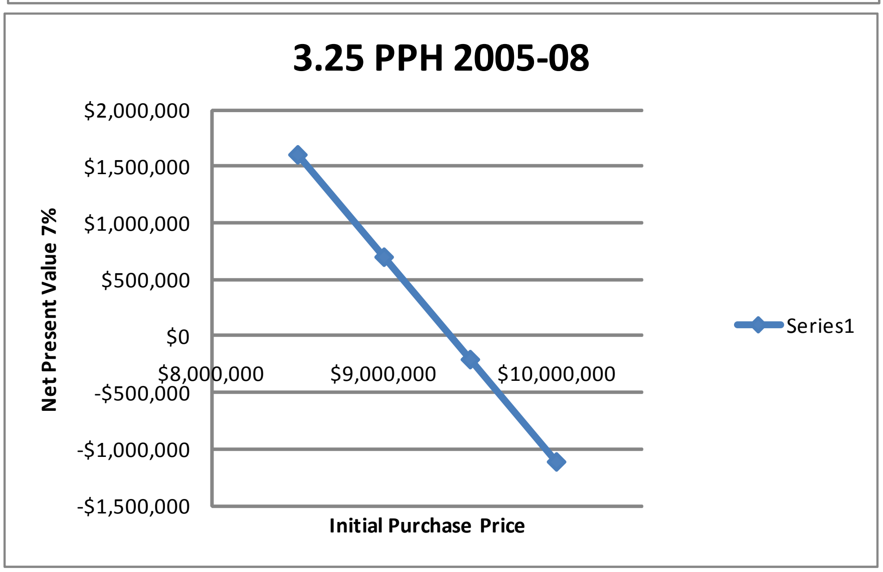
$7,955,408.13



P Price	NPV
$8,500,000	$1,598,733
$9,000,000	$694,164
$9,500,000	-$210,406
$10,000,000	-$1,114,975

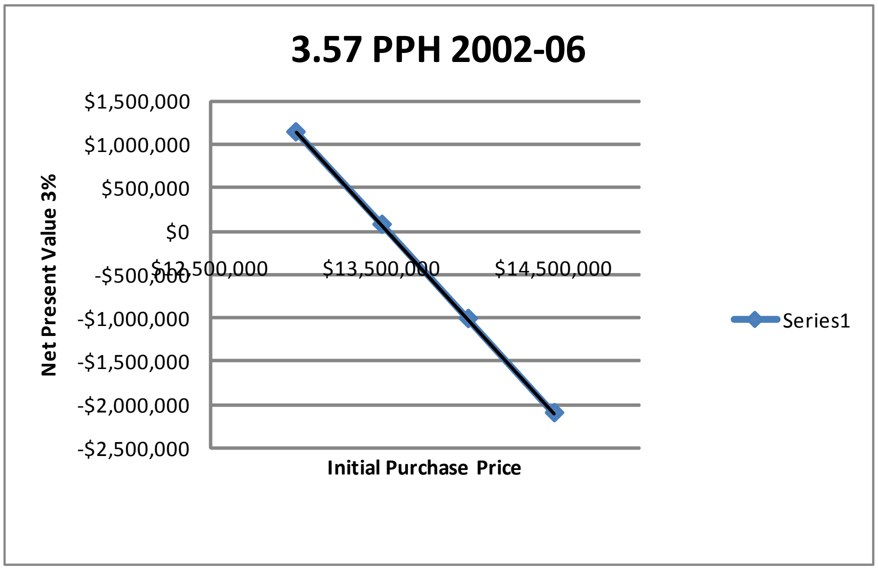
Net Present Value = 0

$9,383,698.37



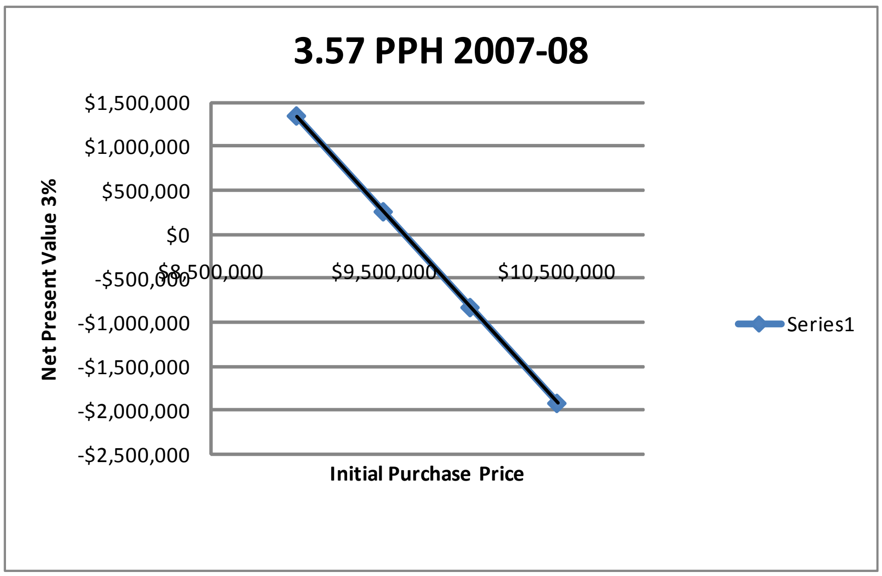
P Price	NPV
$13,000,000	$1,134,203
$13,500,000	$69,661
$14,000,000	-$1,014,882
$14,500,000	-$2,099,425

Net Present Value = 0
$13,526,128.79



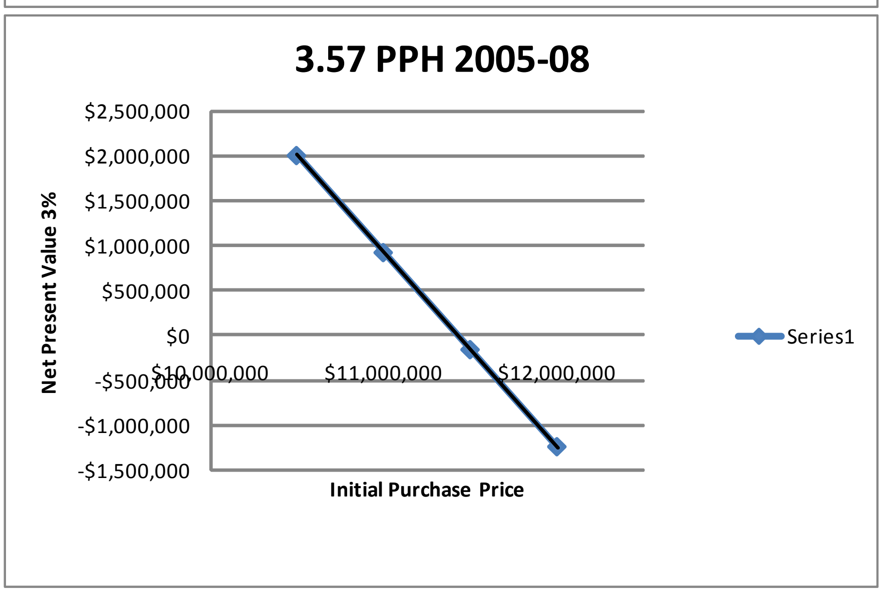
P Price	NPV
$9,000,000	$1,336,110
$9,500,000	$251,567
$10,000,000	-$832,976
$10,500,000	-$1,917,519

Net Present Value = 0
$9,615,978.28



P Price	NPV
$10,500,000	$2,011,668
$11,000,000	$927,125
$11,500,000	-$157,417
$12,000,000	-$1,241,960

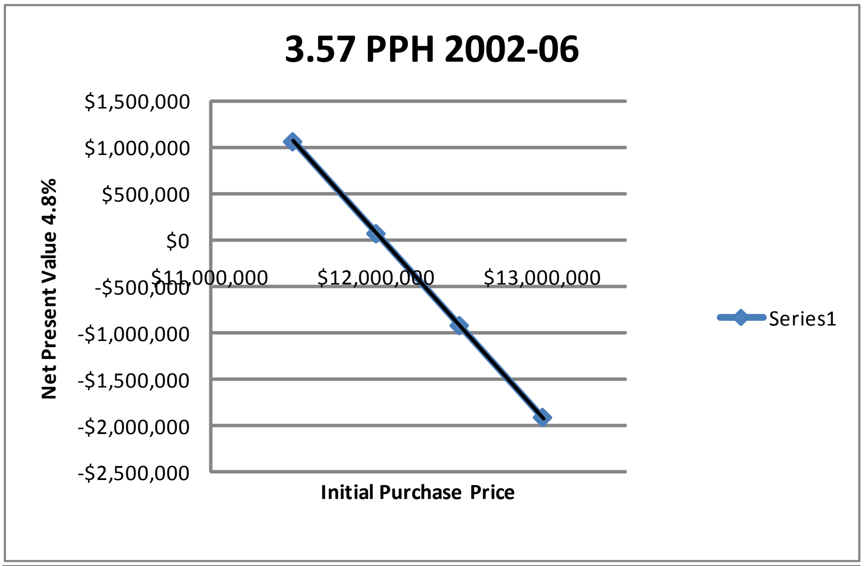
Net Present Value = 0
$11,427,426.83



P Price	NPV
$11,500,000	$1,060,094
$12,000,000	$68,573
$12,500,000	-$922,948
$13,000,000	-$1,914,469

Net Present Value = 0

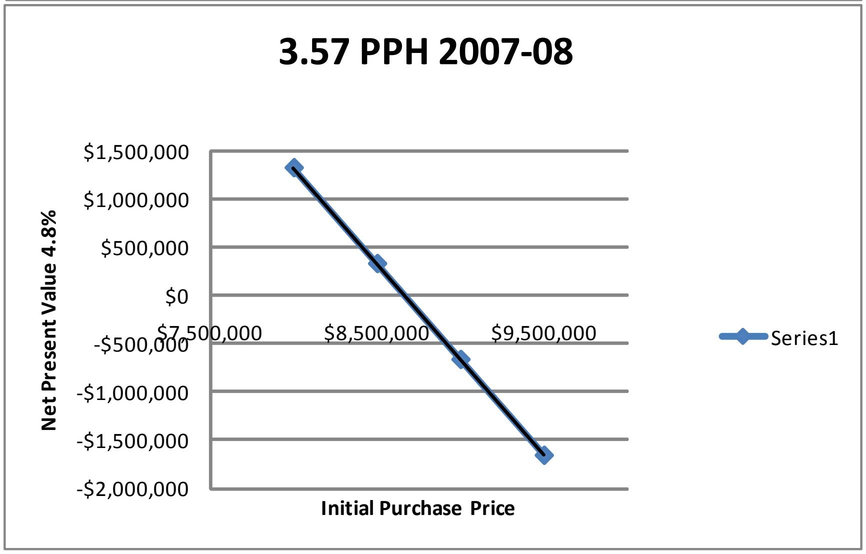
$12,034,579.62



P Price	NPV
$8,000,000	$1,317,994
$8,500,000	$326,473
$9,000,000	-$665,048
$9,500,000	-$1,656,568

Net Present Value = 0

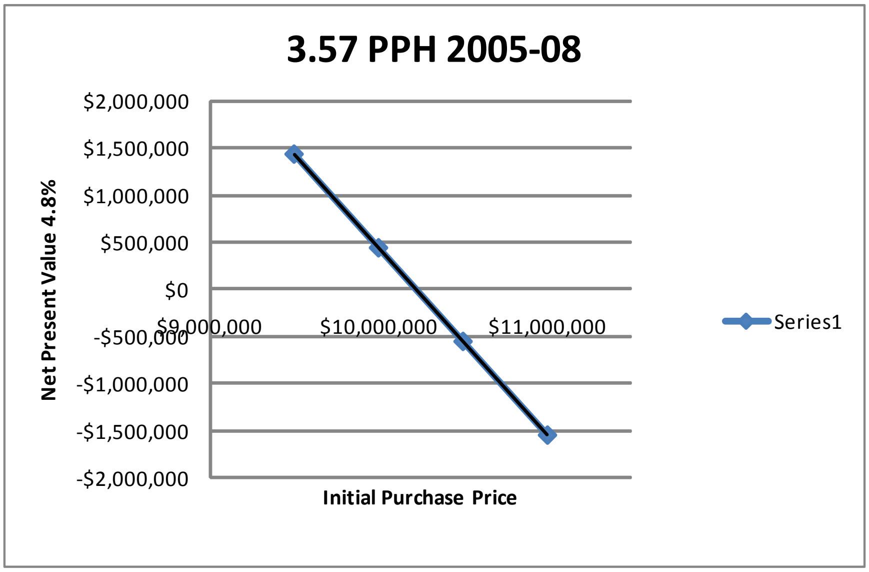
$8,664,632.47



P Price	NPV
$9,500,000	$1,434,375
$10,000,000	$442,854
$10,500,000	-$548,666
$11,000,000	-$1,540,187

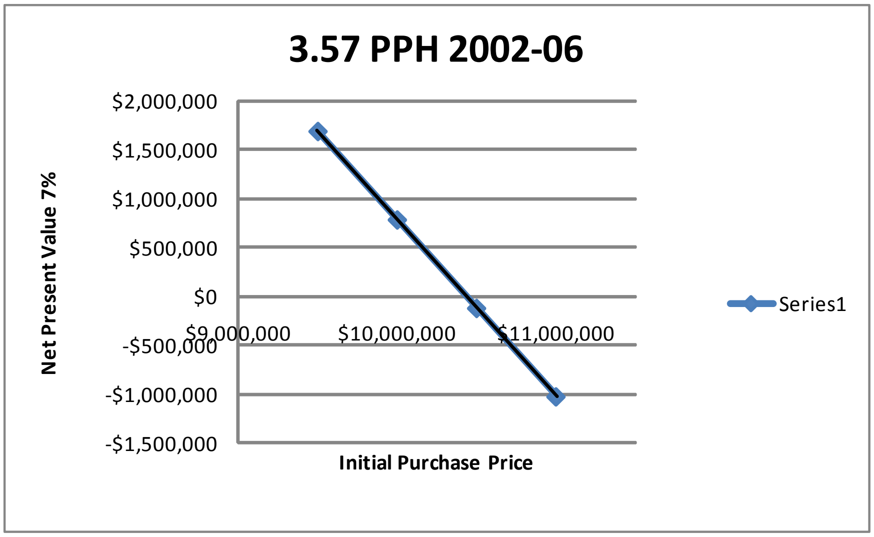
Net Present Value = 0

$10,223,320.83



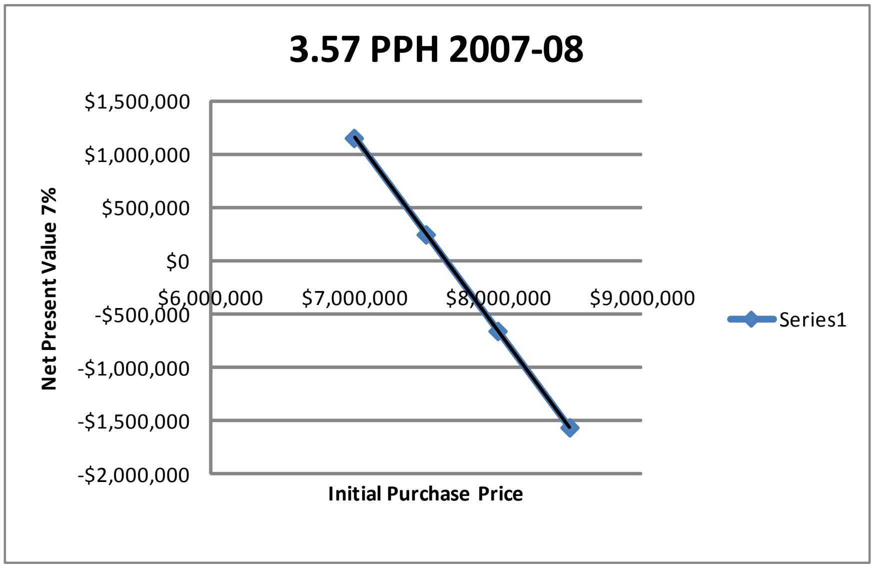
P Price	NPV
$9,500,000	$1,689,997
$10,000,000	$785,428
$10,500,000	-$119,142
$11,000,000	-$1,023,711

Net Present Value = 0
$10,434,144.62



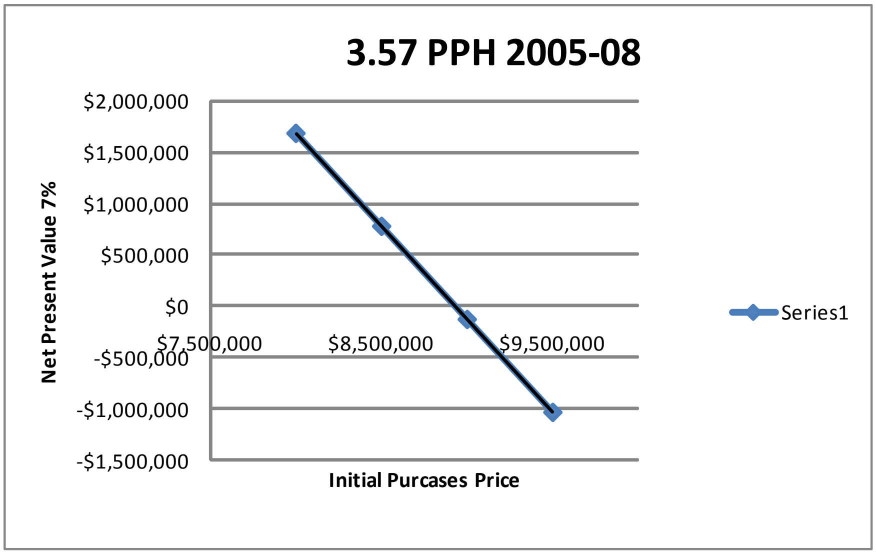
P Price	NPV
$7,000,000	$1,153,029
$7,500,000	$248,460
$8,000,000	-$656,110
$8,500,000	-$1,560,679

Net Present Value = 0
$7,637,335.87



P Price	NPV
$8,000,000	$1,684,236
$8,500,000	$779,666
$9,000,000	-$124,904
$9,500,000	-$1,029,473

Net Present Value = 0
$8,930,959.70



Appendix C

City of Kyle 2009-10 Proposed Budgets

Appropriations by Major Category of Expenditure
Water System Operations

RESOURCE CATEGORY	2006-07	2007-08	2008-09		2009-10				% Diff.
	Actual	Actual	Adopted	Re-estimat	Baseline Proposed	% Diff.	Prog. Change	Total Proposed	
(1)Employee Services	266,325	224,319	241,753	261,612	254,884	-3%	42,889	297,773	14%
(2)Supplies & Materials	220,422	97,530	76,000	71,390	81,550	14%	-	81,550	14%
(3)Facility Operations	167,928	130,077	138,112	12,110	38,067	214%	-	38,067	214%
(4)Equipment Operations	19,588	30,767	11,938	16,860	53,480	217%	-	53,480	217%
(5)Service Fees/ Contracts	244,245	98,985	52,500	47,181	58,154	23%	-	58,154	23%
(6)Capital Outlay	28,000	19,327	130,000	130,000	15,000	-88%	35,000	50,000	-62%
(7)Transfers Out	339,301	700,501	1,073,306	1,408,306	1,433,553	2%	144,823	1,578,376	12%
Total	1,285,809	1,301,506	1,723,608	1,947,460	1,934,688	-1%	222,712	2,157,400	11%

Water Supply

RESOURCE CATEGORY	2006-07	2007-08	2008-09		2009-10				% Diff.
	Actual	Actual	Adopted	Re-estimate	Baseline Proposed	% Diff.	Prog. Change	Total Proposed	
(3)Facility Operations	-	-	-	2,915	-	-100%	-	-	-100%
(5)Service Fees/ Contracts	1,279,958	781,567	1,154,106	1,434,439	1,517,340	6%	-	1,517,340	6%
(6)Capital Outlay	-	340,019	-	-	-	0%	-	-	0%
(7)Transfers Out	178,843	61,160	67,276	-	-	0%	-	-	0%
Total	1,458,801	1,182,746	1,221,382	1,437,353	1,517,340	6%	-	1,517,340	6%

Appendix D

City of Kyle Texas Water Rate Table

Water/Sewer/Trash Collection Rates as of October 1, 2009

WATER Monthly Minimums by meter size

Meter	5/8"3/4"	1"	1 1/2"	2"	3"	4"	6"	8"
Inside City	$ 17.75	$ 26.62	$ 44.36	$ 88.73	$ 141.96	$ 283.92	$ 443.63	$ 887.25
Outside City	$ 21.29	$ 31.94	$ 53.24	$ 106.47	$ 170.35	$ 340.70	$ 532.35	$ 1,064.70

Volume Rate per 1,000 gallons monthly use for Single Family Residential customers only

Tiers	0 to 4,000gal.	4,001 to 8,000 gal	8,001 to 12,000 gal.	12,001 to 16,000 gal.	16,001 to 20,000 gal.	20,001 to 30,000 gal.	30,001 to 50,000 gal.	> 50,001 gal
Inside City	$ 2.08	$ 2.60	$ 3.12	$ 3.64	$ 4.16	$ 4.68	$ 5.20	$ 6.24
Outside City	$2.50	$ 3.12	$ 3.74	$ 4.37	$ 4.99	$ 5.62	$ 6.24	$ 7.49