SUBSTITUTE COSTS: A METHOD FOR DETERMINING ECOLOGICAL SERVICE VALUES IN STORMWATER MANAGEMENT

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ABSTRACT

Many alternatives exist for estimating the value of the natural environment. These approaches have been developed over the past 40 to 50 years and began principally because of increasing awareness that economic development had an associated cost in environmental degradation. Environmental economics provides some of the tools necessary to aid in balancing economic growth with the environmental impacts created by this growth and to do so through evaluating policy. Using environmental economics as a mechanism for policy assessment allows the evaluation of potential gains from specific courses of economic growth and of the trade-offs in environmental services that may be necessary.

Melding economics, environmental science, engineering, and public policy, this research develops and demonstrates a methodology for the calculation of an Ecological Service Value (ESV) by using the substitute cost valuation method for a single ecosystem service: stormwater management. Geographic Information Systems (GIS) is used to provide the required input parameters for the WinSLAMM (Source Loading and Management Model for Windows) stormwater runoff model, which provides the input variables for the ESV calculation.

This research produces a methodology to aid in quantifying the environmental impact and cost associated with land disturbance or development. In addition, through determining of a common metric, this research aids in understanding relationships between economic development perspectives, stormwater pollution control engineering cost implications, and the value of natural stormwater services provided by the ecosystem. Lastly, this research contributes to the greater body of knowledge on the topics of stormwater runoff impacts, environmental economics, and geographic information sciences.

DEDICATION

To my father, my mother, and, above all, my loving wife - thank you for your patience, love, and support through all of the long days and nights.

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LIST OF ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
AOI	Area of Interest
CVM	Contingent Value Method
CWA	Clean Water Act
ESV	Ecological Service Values
GIS	Geographic Information System
IDW	Inverse Distance Weighted
LiDAR	Light Detection and Ranging
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
OECD	Organization for Economic Cooperation and Development
SCM	Substitute Cost Method
SCS TR55	Soil Conservation Service Technical Release 55
TCM	Travel Cost Method
TEV	Total Economic Value
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
WinSLAMM	Windows Source Loading and Management Model
WQS	Water Quality Standards

WTP	Willingness To Pay

1 INTRODUCTION

Assigning value to ecosystems has been expressed in various ways. Expression of value can be dependent on disciplines, cultural concepts, and philosophical views [1]. Although there are many factors that influence economic valuation, the purpose is to make comparable the disparate services provided by ecosystems and to do so by using a common metric. An example of the problem that municipal officials face consists of trying to compare development and the potential tax revenues it brings with the need for clean water and for managing quantity of runoff produced in converting undeveloped lands to developed lands. Without a common metric, this comparison is difficult and extremely variable.

Ecosystems can be said to have value because they provide services that satisfy human needs, both material and nonmaterial. These services take many forms and may be specific to a region or ecosystem. Examples of the services provided by a forest ecosystem range from the use of timber for building houses to the spiritual value that some cultures place on the forest. Examples of services provided by inland water ecosystems range from the fresh water required for all life to the aesthetic values that people ascribe to water amenities. The value assigned to an ecosystem or to parts of an ecosystem may be based on ecological processes, on the services that they provide, on socio-cultural impacts, or on the intrinsic value of the existence of the systems and the species that comprise it. Natural scientists have also assigned value on the basis of the causal relationships among parts of the system; an example would be the value of one species to the survival of another [2]. This study will discuss these concepts of ecosystem value and, more specifically, will examine the application of value to stormwater management services by focusing on a single method of valuation: the substitute cost method.

Many alternatives exist for estimating the value of the natural environment. These approaches have been developed over the past 40 to 50 years and began principally because of increasing awareness that continued economic development of nations had an associated cost in environmental degradation. This environmental degradation takes many forms, and the effects are clear in air and water. Understanding the motivations for and problems associated with the needs for instituting environmental controls and for preserving economic growth requires knowledge of some of the principles associated with the study of environmental economics. A brief history of the significant literature and of valuation methods is important in furthering an understanding of the application of the substitute cost method selected for this study for use in stormwater management.

Field [3] defines environmental economics as "the application of the principles of economics to the study of how environmental resources are managed." The major goal of the study of environmental economics is to aid humankind in balancing economic growth with the environmental impacts that this growth creates and to do so through evaluating policy. Using environmental economics as a method for policy assessment allows us to evaluate both the potential gains in specific courses of economic growth and the potentially necessary trade-offs in their environmental impacts [4]. Beckerman [5] stated in his 1972 report to the Organization for Economic Cooperation and Development (OECD) that not only could economic growth continue in the presence of environmental protection policies, but the same policies would give birth to new technologies that would themselves contribute to economic growth [6]. In fact, within stormwater management field, new technologies driven by policy and society's recognized need for better water quality have become a significant industry.

Stormwater management issues have been a topic of discussion since the earliest human settlements. Routing drainage and pooling water reserves were critical in domestication and settlement of early human civilizations. In the last century, issues associated with stormwater runoff and management have changed from simply routing and controlling and now include issues of quality.

Stormwater runoff is a natural phenomenon that is influenced by various mechanisms within an ecosystem. The physical features that influence stormwater runoff are varied and spatially dependent because each ecosystem has different characteristics such as climate, terrain, and indigenous flora. As urbanization occurs, the physical features of the ecosystem are changed. This change occurs largely through the increase of impervious surfaces but also through landscape and terrain change. These changes influence the recharge of groundwater and increase the speed at which runoff reaches streams or channels. The higher volume and velocity of water increases peak flows in the streams and channels, and the reduced groundwater recharge influence stream base flows. Over time, the change to a more volatile stream condition leads to changes in channel geomorphology and to an overall degradation of habitat for flora and fauna [7, 8].

The value placed on ecological services is a topic of frequent debate in academic and scientific communities, largely because of the disparity between traditional economic methods and traditional scientific methods. In traditional economics, many characteristics that are to be quantified are not physically tangible. In contrast, scientific methods focus on characteristics measurable through physical observation. Environmental economics and, in specific, the valuation of ecological services provide a common language and currency for the discussion.

1.1 Objectives

This research demonstrates the use of Geographic Information Systems (GIS) and stormwater runoff modeling with control costing approaches as a method for defining the necessary inputs for calculating the Ecological Services Value (ESV). The method is applied to three land use types in central Alabama. The ESV is a method of using a common metric to quantify the ecological services provided by an undisturbed site. The inputs defined for calculating the ESV in this research will focus on stormwater management services only and intended not to represent the total value of the ecosystem but to show the method and its application to a specific service.

1.2 Purpose of Study

The primary goal of this research is to develop a method that policy makers can use to evaluate development decisions about stormwater management and involves terms that are more common to them. Often site development decisions are made on the basis of consideration of engineering or scientific data. Although significant and valid for use in understanding the effects of transitioning an undeveloped site to a developed state, the units and presentation of these data may differ from those of other data used in the decision making process. Many times metrics like sales tax revenues, represented in the form of dollars or currency, are more readily available to policy makers. The consideration of currency without consideration of scientific data could lead to an unbalanced decision making process that does not consider the long-term implications on the environment or the consequences of the loss of stormwater management services provided by natural systems. This research presents a method for converting engineering and scientific data created in evaluating the stormwater management properties of a site in a predeveloped and developed state. This is performed by using current technologies such as geographic information systems (GIS) and the hydrologic modeling software WinSLAMM. This represents a new approach to the local or municipal development decision making process because the method combines of current engineering techniques with environmental economic principles. Therefore, this research is intended to provide a method of determining the value of the natural stormwater management services provided by an undeveloped site in the form of dollars to policy makers to allow evaluation of the impacts of development using a commonly available metric.

1.3 Background

This research is founded on a melding of economics, environmental science, engineering, and public policy. The principles summarized below provide background information about the problems, theories, and science on which this research is based.

1.3.1 Economic Principles

The complexity of the relationships in ecosystem valuation requires discussing several principles of economic theory. Although not exhaustive, the following subsections highlight several principles necessary for assessing and developing processes needed in calculating the ESV.

1.3.1.1 The Opportunity Cost Principle

Considering society's resources is important because resources are scarce. Scarcity can be defined as an insufficient supply of a resource. Insufficient supply means that the resources cannot meet all potential uses; as a result, society is required to make decisions that result in the trading off of one use of a resource in favor of another. Because trade-offs are necessary, the costs and benefits of alternative uses of a resource (i.e., the consequences of various actions) must be compared. Economics defines the cost of a resource as its opportunity costs. The opportunity cost of a resource includes both explicit and implicit costs, including the value of time. Field's [3] uses the example of production of cardboard boxes to explain opportunity cost. Some of the resources used to create the cardboard boxes include timber for paper pulp, water, machinery, fuel in the form electricity and gasoline, and the time and labor required for production. The opportunity cost of the cardboard boxes would be the maximum value of other outputs that could have been produced from the resources used to make the boxes. These outputs could have been many things like books, houses, or many other products [3]. The Opportunity Cost Principle states that, if a scarce resource is to be put to a specific use, then the opportunity costs must be considered; the benefits must be greater than the opportunity costs. Therefore, deciding based on the Opportunity Cost Principle ensures that resources are put to their highest valued use.

The example of the cardboard boxes can be used in further discussions of environmental economics. If resources are used for production of goods and if the environment is used as a receptacle for waste, the decision to be evaluated is whether the need for the cardboard boxes is great enough to induce acceptance of the resulting reduction in the resources utilized and of the deposit of waste in the environment. By this approach, we see that, instead being correlated to books or cars, the opportunity costs of the cardboard boxes can be correlated to environmental deterioration. Producing goods should not continue if the benefits are not greater than the opportunity costs. This example shows the Opportunity Cost Principle as a suitable guideline for framing environmental policy [9].

1.3.1.2 The Polluter Pays Principle

The Polluter Pays Principle states that the opportunity costs associated with environmental deterioration should be assigned to the units of society that cause them. The polluter pays principle is an institutional expression of the opportunity cost principle. Once the environmental pollution targets are set up, the Polluter Pays Principle can be applied. The principle provides an incentive for the individual polluters to reduce their pollution [3, 9]. This principle is applied in many policies and rules of the USEPA. An example would be the emissions allowed to be discharged by coal burning electricity generation companies. These companies are only allowed to discharge certain quantities of pollutants into the atmosphere. They must remove pollutants to the levels stated in their permits from the USEPA and must incorporate monitoring procedures to verify the discharge levels. The companies are responsible for the costs associated with pollutant removal and monitoring.

1.3.1.3 Valuation Methods

Determining the value of the ecosystem is not a new concept. In particular, over the last 30 to 40 years, many methods have been developed in the attempt to assign a value to the natural environment. In this section, these methods are divided and discussed in a hierarchy to help understand each method's strengths and weaknesses and the ways in which they are used in determining value of ecological systems. The concepts for defining value fall into two categories: nonutilitarian and utilitarian.

Nonutilitarian values are those noted by people for various ethical, cultural, religious, and philosophical reasons. Nonutilitarian values can be the most difficult and controversial to quantify because of their foundation in intangible or nonphysical elements such as human emotions. An example of nonutilitarian value applied to a location would be the value ascribed to the place at which a moral transformation occurred or to a place that is seen as embodying national ideals [2]. The city of Jerusalem in Israel has value ascribed to it by many religious groups, but attempts to quantify its value or justify the city's value to one group more than another would be controversial.

The utilitarian valuation concept is based on services or "utility" that people receive from the ecosystem. These services can be direct or indirect and can be current or future. There are two facets of utilitarian valuation that significantly influence determining value. The first facet is an individual's perspective. The value an individual gets from an ecosystem is based on that person's motives, needs, and preferences. To address this issue, the utilitarian approach assigns value on the basis of specific measures of "usefulness" that ecosystems provide. The second facet is that "utility" cannot be directly and simply measured. Because ecosystems provide a broad array of services, a method of directly measuring all use has not been determined. To provide a mechanism for the comparison of ecosystem services and other processes, the utilitarian approach assigns a monetary value to these services. Monetary value provides a common metric in units that are well recognized [2, 10, 11].

A framework commonly used in determining the utilitarian value of an ecosystem is Total Economic Value (TEV). Pearce and Warford (1993) are credited with developing this idea from their work in "World without end: Economics, environment, and sustainable development," as referenced by many authors [1, 2, 10, 12, 13]. This disaggregates TEV into two categories. The rest of this subsection describes these categories as use values and nonuse values [2, 12].

Use value refers to the value of ecosystem services that are used by people. These services are typically employed for consumption or production purposes and include tangible and intangible services of ecosystems. Also, use values refer to services that are currently being used directly or indirectly or that have a potential to provide future use. Use value is separated into three categories of value: direct use, indirect use, and option [2, 12].

Direct use values may be based on consumptive or nonconsumptive uses. Consumptive use is a use that reduces the overall supply of a resource, whereas nonconsumptive use causes no decrease in quantity or supply of that resource [1, 2, 12, 14-16]. An example of a consumptive use would be cutting down a tree and using the wood to build a house. An example of nonconsumptive use would be waterskiing on a lake. Figure 1-1 shows an organizational chart of these value categories.

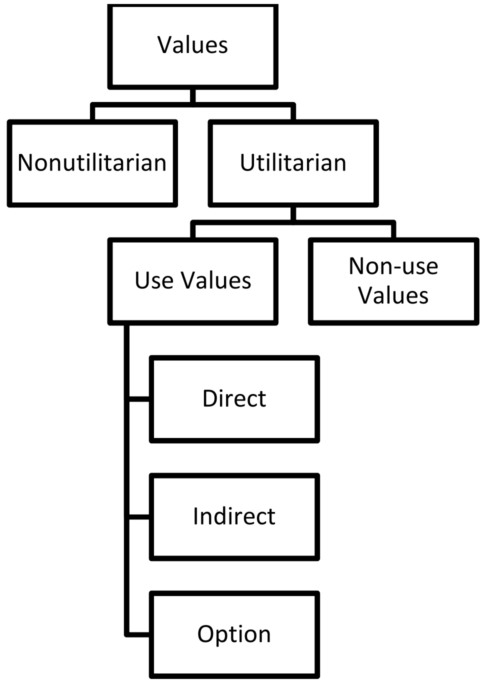

Figure 1-1 Values Hierarchy

According to Barbier (1994), indirect use values can be described as "support and protection provided to economic activity" [17]. Many ecosystem services are intermediate inputs for producing goods (e.g. insect pollination in food production). Other ecosystem services indirectly contribute to consumption of goods [1, 2, 12, 14, 15].

Fisher (2000) stated that option value is "a value of information about future returns net of environmental damages conditional on refraining … from making an investment that would entail uncertain future environmental damages" [18]. Within this context and within environmental literature, option value is often referred to as quasi-option value. In the simplest of terms, option value consists of the value of preserving the choice to use ecosystem services in the future by not taking actions on the environment that are irreversible [2, 12, 18, 19]. Examples of an option value include wildlife preserves or other long-term land conservation projects that allow some use of resources but do not permit actions that cannot be undone.

Nonuse values are often referred to as existence values, conservation values, or passive use values. These are values applied to a resource that, because a "loss" would be felt if the resource were to disappear, individuals do not intend to use. This could be stated as value ascribed to the knowledge of existence. Studies have linked these applied values to the knowledge of preserving a resource for one's descendents and to the knowledge of assured survival for a resource like habitats or species [2, 12]. Examples of nonuse values would be areas set aside for conservation, such as wildlife or forest preserves.

1.3.1.4 Substitute Cost Method

The Substitute Cost Method (SCM) is one of several cost-based approaches to valuation. These approaches are based on the principle that the value of the resource may be assigned on the basis of the cost of replacing or finding a substitute for the resource or on the basis of the cost of repairing damage caused by the use of the resource [20]. Substitution cost is a method that is selectively applicable in ecosystem valuation. The central premises of substitute cost determination are that a "substitute" can be found for the resource in question and that a cost can be determined for that substitute. Therefore, substitution is technologically limited within the context of ecosystem valuation. For the cost determination to be valid, the substitute must be equal to or greater than its predecessor. This must be determined through comparative analysis of the original and its substitute. In ecosystem valuation, this analysis can be performed through isolating specific processes preformed by the ecosystem.

1.3.2 Previous Studies

There is much discussion about the different valuation methods in environmental economic literature. Many authors have devised and applied varying techniques to quantify the value of ecological services. A few of the more common methods are contingent value, hedonic pricing, and travel cost. Others include the benefit-transfer method and replacement cost method. These techniques are often similar in approach but are referred to in various ways. For example, both benefit-transfer and replacement cost methods focus on a surrogate resource; however the benefit-transfer method typically has a different resource in its conclusion, and the replacement cost method has a restoration of the resource at its conclusion. Although this can cause confusion when a valuation method is being selected naming systems can be converged in to a broad classification of whether the measures of the method are based on observed or hypothetical behavior [2]. Brauer (2003) also states that this broad classification can be determined by whether the valuation depends on surrogate markets or on simulated markets [12]. Many studies have addressed parts of ecosystem valuation and range from evaluation of a single part or service to attempts at total system valuation. The rest of this subsection discusses the most commonly used methods in current literature.

1.3.2.1 Contingent Valuation Method

The most prominent and controversial method of ecosystem valuation is the contingent valuation method (CVM). The CVM is a method of determination of demand, usually by survey, by posing hypothetical scenarios that involve some valuation of alternatives [1, 21, 22]. In this review of the literature, studies applying the CVM to water related issues were all found to address water resource management or water quality. In water management, Gurluk (2006) used the CVM for valuation of the nonuse benefits (benefits not directly bought in the form of goods) of forest and river ecosystems for a specific rural development project area in Bursa, Turkey [23]. In another study, Birol, Karousakis, and Koundouri (2006) applied the CVM in an attempt to define the role of economic valuation techniques in the design of efficient, equitable, and sustainable policies for water resources management in the face of environmental problems such as pollution, intensive agricultural land use, and climate change. Birol and others presented a case study to estimate the nonuse values of the Cheimaditida wetland in Greece by using the CVM method. The nonuse values were combined with use values of the Cheimaditida wetland to obtain its TEV for use in a cost-benefit analysis of management strategies for this wetland [22]. Also in water management, Loomis, Smith, and Huszar (2005) used the CVM to estimate homeowners' willingness to pay for water leasing to maintain stable lake levels at an irrigation reservoir in a residential neighborhood [24]. Dutta and Tiwari (2005) provided a framework within which to assign value to economic and environmental externalities for the urban water supply while using the CVM to show willingness to pay for a water supply with better quality and reliability [25].

In water quality management, assessment of value can vary on the basis of the intended use of the water. Individuals surveyed for willingness to pay or for willingness to accept may have greatly varying responses if the ecosystem service of clean water is for drinking as opposed to being for other uses. Qiu, Prato, and Boehm (2006) who conducted a study to aid in water quality management, used the CVM to evaluate the residents' views of and willingness to pay for adopting riparian buffers and preserving farmland [26]. Cho and others (2005) used the CVM to find out how much consumers would be willing to pay to improve their drinking water quality in community water systems in southwestern Minnesota [27]. Bederli Tumay and Brouwer (2007) conducted a study using the CVM to assess public opinion, understanding, and valuation of improved wastewater treatment facilities in the Koycegiz-Dalyan watershed's largest two population centers, both of which faced water pollution problems because of lack of proper wastewater treatment [28].

1.3.2.2 Hedonic Pricing Method

The Hedonic Pricing Method (HPM), a method of determining the demand for services, is based on the prices people will pay for associated goods. The HPM is the method of choice for discovering real estate pricing but can be used in environmental economic analysis for willingness to pay and to accept assessments of land values. An example of HPM use is found in Qiu, Prato, and Boehm (2006), as discussed in the previous section. In their study, conducted to aid in water quality management, the authors used the CVM to evaluate the residents' views of and willingness to pay for adopting riparian buffers and preserving farmland. Although the CVM was the predominate study method, Qiu and others also used a hedonic pricing model. Actual sale prices of homes in the study area were used to estimate the market value of open space and of other environmental conditions such as flood zone and stream proximity. This information was then used to determine whether the residents' willingness to pay was consistent with the economic values of open space and proximity to streams embedded in existing home prices [26].

1.3.2.3 Travel Cost Method

The Travel Cost Method (TCM) is used to estimate use values associated with recreational ecosystems or sites to which people travel for hunting, fishing, hiking, or watching wildlife. Example sites are forests, wetlands, parks, and beaches. The premise of the TCM is that the time and travel costs that people incur when visiting a site represent the perceived value of access to the site. More trips to the site represent a higher perceived value or willingness to pay. The TCM cannot capture the nonuse values of environmental resources [21, 22].

Scott, Bilyard, Link, and others (1998) used multiple valuation methods to estimate the value of economic resources in shrub-steppe dryland habitat being displaced by development. TCM was used in conjunction with other methods to determine a willingness to pay for game hunting on shrub-steppe sites. Data were provided by the US Department of Fish and Wildlife and consisted of information about the distance traveled by each permitted hunter. The cost of their travel was determined by using mileage cost estimates. These costs were then used to determine a willingness to pay that represents actual use data [29].

1.3.2.4 Replacement Cost Method

The Replacement Cost Method (RCM), which values the costs of replacing damaged environmental assets, assumes that these costs are estimates of the benefit flows from avertive behavior. The RCM assumes that the damage is measurable and that the value of the environmental asset is no greater than the replacement cost. The method also assumes that there are no secondary benefits to environmental protection that arise from the expenses. Birol and others stated, "This method is particularly applicable where there is a standard that must be met, such as a certain level of water quality" [12, 21, 22].

As previously discussed, Scott, Bilyard, Link, and others (1998) used multiple valuation methods to estimate the value of economic resources in shrub-steppe dryland habitat being displaced by development. RCM was used with several other methods to determine a willingness to pay for game hunting on shrub-steppe; the authors used data from the purchase of a ranch to be set aside as a hunting club. Because the data involved the purchase of property with and exact cost and dues to be paid by club members, a willingness to pay could be related to use of the resource [29].

1.3.3 Laws and Regulations Related to Stormwater Management

Urban, suburban, and developing rural communities are continually faced with economic development issues in the form of residential, commercial, or industrial development. Each of these brings both economic and environmental impacts. Environmental policies in the form or laws, ordinances, and regulations are developed to minimize environmental impacts and to protect environmental resources. Environmental policies may be seen to be in conflict with economic benefits. The purpose of environmental economics is to aid decision makers in developing and carrying out effective public policy that can be used to balance environmental and economic goals such as clean water and poverty reduction. The following discussion addresses stormwater management laws and regulations that govern the study areas included in this research. Of particular interest are those that require each development to consider and mitigate influences on land cover on water quantity and quality.

1.3.3.1 Water Quality Laws

The principal law governing pollution of the nation's surface waters is the Federal Water Pollution Control Act, or Clean Water Act (CWA). This act, originally passed in 1948, was substantially changed by amendments in 1972. These amendments gave the CWA its current form. The 1972 legislation defined ambitious programs for water quality improvements that have since been expanded and are still being carried out by industries and municipalities. The CWA consists of two major parts. The first deals with rules that sanction federal financial aid for municipal sewage treatment plant construction. The second part, which is the focus of this subsection, includes regulatory requirements that apply to industrial and municipal dischargers. Before 1987, CWA programs were mainly directed at point source pollution. Amendments in that year approved measures to address nonpoint source pollution. Under the amended version of the Act, the federal government required developing the Water Quality Standards (WQS) [30].

The US Environmental Protection Agency (USEPA) describes the WQS as defining “the goals for a waterbody by designating its uses, setting criteria to protect those uses, and establishing provisions to protect water quality from pollutants.” According to the USEPA, a water quality standard is composed of four parts: Designated Uses, Water Quality Criteria, Antidegradation Policy, and General Policy.

These four parts are the foundation of the water quality based control programs mandated by the CWA. Designated Uses are defined by categories of use of a waterbody, such as recreation or a drinking water supply. States, territories, and authorized tribes are responsible for submitting to the USEPA a listing of their waterbodies and of the correct use category for each [27]. The USEPA defines Water

Quality Criteria as "statements of the conditions presumed to support or protect the designated use or uses of a waterbody." Water Quality Criteria may be narrative or numeric and currently exist in four types including chemical specific, biological, nutrient, and sediment. The third part of the WQS is the Antidegradation Policy. This part requires the state, territory, or tribe to set up a three-tiered antidegradation program. The program varies by tier and allows water quality with "high quality" to be lowered but requires the preservation of the existing quality of waters that receive other ratings. The final part of the WQS is General Policy. These are policies that states, territories, or tribes may adopt on implementation of the WQS and may specifically address items such as mixing zones, variances, and low flows [27].

The states, territories, and tribes are required to notify the US Environmental Protection Agency every two years of the waterbodies that do not meet their Designated Use requirements. These waterbodies are then required to have Total Maximum Daily Loadings (TMDLs) developed for their pollutant of concern. TMDLs are intended to assess problems, define cause-and-effect relationships, and provide a method of quantifying the amount of pollution abatement necessary to achieve designated use conditions. This quantification would ideally provide the needed information for imposing stormwater controls to aid in achieving the defined numerical or narrative goals [8, 27, 31]. These regulations address both point and nonpoint sources of discharge and therefore have significant bearing on the stormwater controls for site design and on the determinations of land use within all jurisdictions.

1.3.3.2 State Regulations

For the State of Alabama, the Alabama Department of Environmental Management (ADEM) is charged with stormwater runoff regulation. The ADEM Administrative Code states that "Construction & Small Noncoal, Nonmetallic Mining & Dry Processing Sites, And Associated Areas" must apply for a permit. The Administrative Code also states, "Federal and state regulations regarding discharges of stormwater require operators/owners to apply for and obtain NPDES [National Pollutant Discharge Elimination System] permit coverage prior to conducting regulated construction disturbance and/or initial operation of small noncoal, nonmetallic mining sites, and associated land disturbance activities" [32]. Although permits are required, there are no numeric discharge limits on a statewide basis. The Code, section 335-6-12-.06 (4), continues to state, "The operator shall take all reasonable steps to prevent and/or minimize, to the maximum extent practicable, any discharge in violation of this Chapter or which has a reasonable likelihood of adversely affecting the quality of groundwater or surface water receiving the discharge(s)" [32]. These regulations are directed largely at quality of water, and there is no clear requirement or restriction on volume or velocity of stormwater to be discharged. Section 335-6-12-.33 (6) of the Code states, "Post-construction stormwater management is not required for projects that do not significantly alter runoff volumes or velocities from conditions existing prior to the NPDES construction activity. Said management, if required, shall be implemented to control the discharge of pollutants associated with significant hydrologic modifications to the site resulting from construction activities. Post-construction stormwater management is not required by the provisions of this Chapter to address stormwater quality from operation of the completed facility provided construction activity is complete, reclamation or effective stormwater quality remediation of the construction disturbance has been achieved." [32]. Although not specifically referencing velocities, ADEM does recommend reference to the Alabama Soil and Water Conservation Committee's "2003 Alabama Handbook for Erosion Control, Sediment Control, and Stormwater Management on Construction Sites and Urban Areas." This manual states, "The peak release rate of stormwater runoff from the design storm should not exceed the predevelopment runoff rate for the drainage area or the rate allowed by local ordinances, whichever is less" [33].

1.3.3.3 Local Regulations

The local authority for the research sites included in this study is the City of Trussville, Alabama. The City manages water quantity and quality based stormwater regulations through its zoning ordinance. The zoning ordinance states that post-development volumes of water cannot exceed predevelopment volumes. As well as volumes, runoff velocities must be shown to be nonerosive [34].

1.4 Approach Summary

Collectively, this research presents a method composed of three major parts: the geoprocessing of inputs, modeling, and ESV calculation. Geoprocessing is the use of GIS to manipulate data. The inputs needed are terrain data, hydrologic data, and soils data. The terrain data are used to create a mean aspect surface model and a mean slope model. This is used to ascertain inclination direction and severity on each site. Aerial photography and site observations are used to create the hydrologic data describing the size of the sites and to divide the sites into source areas on the basis of the surface characteristics and on the basis of the land cover types. The soils data are used for assessing the site's ability to allow infiltration of stormwater. The data are then combined by using a GIS overlay analysis to develop the required inputs for the WinSLAMM model.

The second part of the method is modeling. The model selected for use in this research was WinSLAMM. The initial model run represents the predevelopment state. WinSLAMM requires the entry of both the Natural Resource Conservation Service (NRCS) soils hydrologic group and the area of each group for a model site. The following model runs comprise the developed condition. The base developed condition run represents a fully developed site without any stormwater controls. The controlled developed condition run represents a fully developed site with stormwater controls sized and designed to carry out selected decreases in stormwater runoff volume and particulate solids. WinSLAMM does allow for modeling several pollutants, but this research only addresses particulate solids and runoff volume.

The last part of the method is the ESV calculation. Results from the model are used to identify the predevelopment, base, and controlled condition volume and particulate solids. Furthermore, the capital, operations, and maintenance costs for the controlled condition are identified. These variables are used in the ESV equations to calculate the "Year One ESV", which represents the total costs for the construction and first year of operation for a site designed in controlled condition to meet the predevelopment condition. The "Year One ESV" is then used to amortize the costs for 20 years at 6% interest to calculate the "Total ESV." Section 2 describe in detail all of the items discussed in this summary of the method.

2 METHODS

This study explains the methods necessary for calculating the ESV for three common development types. The sites represent commercial, high-density residential and low-density residential land use developments showing stormwater controls to address water quantity and quality. The study location was selected for its rapid growth over the past two decades, the state of data availability, and the application of local, state, and federal requirements.

2.1 Ecological Services Value (ESV)

By using the substitute cost method of valuation, we can determine the Ecological Services Value (ESV). This value can be isolated to a specific service or function provided by the ecosystem or can be a combination of services. For the purposes of this study, the ESV will be restricted to a single service provided by the ecosystem: stormwater management. The foundation of this premise is shown in Equation 2-1.

Equation 2-1 Ecological Services Value (ESV)

$$V_{ES} = \sum_{i=1}^{n} \left(C_{C_i} + C_{O_i} \right)$$

Where:

V_{ES} = Ecological Services Value

C_C = Capital costs of the construction of the stormwater controls

C_O = Operations and maintenance costs of the stormwater controls

Land cost is not factored into determining the ESV because of the attempt to isolate the value of the services only. This is important for many reasons, one of which is the extreme variability in land costs that depends on many factors not associated with ecological systems services.

2.2 Cost Determination Methods

There has been a vast amount of research and publication on the topics of cost determination for stormwater management controls. Cost determination is critical in use of the Substitute Cost Method (SCM). Narayanan and Pitt (2006) reviewed and summarized the prevalent methods for cost determination in their work, "Costs of Urban Stormwater Control Practices" [35]. Other recent works of significance include Sample and others (2001, 2003) and Thurston (2006) [7, 36, 37].

Other cost determination references are discussed throughout this document; however, Narayanan and Pitt (2006) were selected as the primary reference on cost determination approaches for this research, with some expansion on the mathematical processes provided by Sample and others (2001, 2003). This selection was made because of the overall inclusiveness of the publications review and because of the detailed discussion of the most prominent methods of cost determination. In addition, the collectively discussed methods have been integrated into WinSLAMM as of version 9.2. Narayanan and Pitt (2006) evaluated five cost estimation methodologies: the Bottom-Up Method, Top-Down Method, Analogy Method, Expert Judgment Method, and Algorithmic or Parametric Method. The Bottom-Up method involves identifying and estimating the costs of individual parts of a project and then combining these costs to estimate the cost of the entire project. The Top-Down Method estimates the costs of the entire project by partitioning the project into lower-level parts and life cycle phases beginning at the highest level. The Analogy Method uses cost data available from a previously completed project and estimates the cost of a proposed project. The Expert Judgment Method uses consulting experts in the field to estimate the cost of a proposed project by using their experience and their understanding of the proposed project. Last is the Algorithmic or Parametric Method [35]. In regard to the Algorithmic or Parametric Method, Sample and others (2001, 2003) cite the "power function" method that is a single explanatory variable equation. In addition, Sample and others expanded the discussion with a variation of the equation in a multiple explanatory variable form [36, 38]. Each of these equations is grouped by Narayanan and Pitt (2006) to form an "algorithmic or parametric" method and is shown in Equation 2-2 and Equation 2-3 [35].

Equation 2-2 Algorithmic or Parametric Single Explanatory Variable Method

$$C = ax^b$$

Where:

C = Cost
x = Independent variable such as measure of component size
a,b = Constants, depends on overall physical characteristics of component

Equation 2-3 Algorithmic or Parametric Multiple Explanatory Variable Method

$$C = f(x_1, x_2, \ldots x_i, \ldots x_n)$$

Where:

C = Cost
x_i = Independent variable such as component size

In this study, these five cost estimation methodologies are collectively applied in WinSLAMM in calculating costs of the selected stormwater controls used in analysis and provide the foundation of cost determination for stormwater conveyance system controls. WinSLAMM's cost calculations are predominately based on the following four data sources [39].

1. *Costs of Urban Nonpoint Source Water Pollution Control Measures,* prepared by Southeastern Wisconsin Regional Planning Commission, 1991.
2. *Costs of Urban Stormwater Control,* by Heaney, Sample, and Wright for the US EPA, 2002.
3. *BMP Retrofit Pilot Program,* prepared by CALTRANS, 2001.
4. *Engineering News Record (ENR) Cost Indices.*

2.3 Study Site Analysis

The study was conducted on areas within the Upper Cahaba Watershed in Trussville, Alabama, USA. Trussville is an NPDES Phase I Municipal permittee and therefore is subject to the federal requirements named in the Clean Water Act. Figure 2-1 and Figure 2-2 locate the research sites.

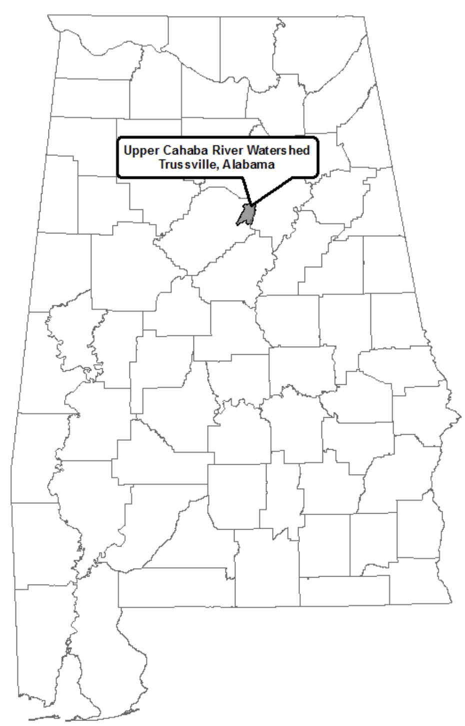

Figure 2-1 Location within Alabama

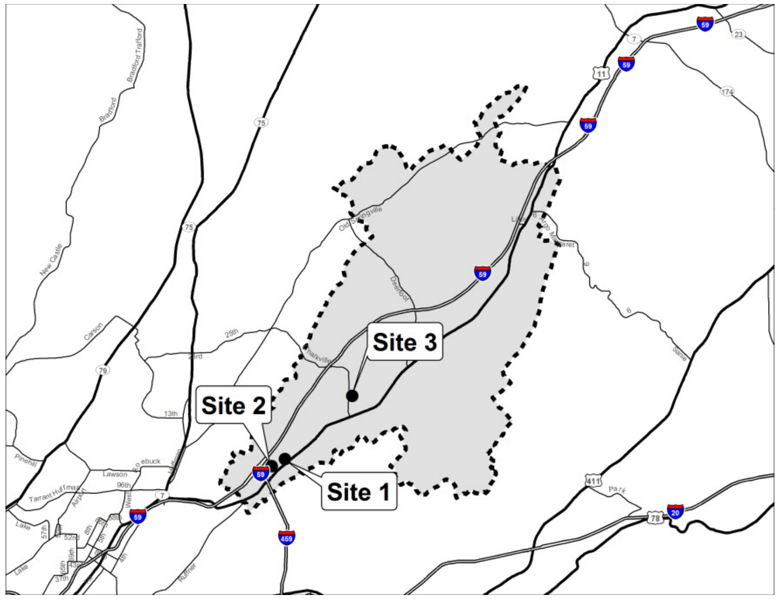

Figure 2-2 Water Quality and Quantity Study Sites

2.3.1 Stormwater Modeling

Stormwater modeling, the simulation of stormwater runoff processes, is most often carried out by using sophisticated computer models. These computer models allow simulation of actual rainfall events for experimentation purposes. Through comparison of measurements of runoff processes in natural events with those of model results, the user can calibrate, validate, and verify the models. This allows scientists and engineers to apply different combinations of variables in the models and then to evaluate the impacts of the variables on results. The primary focus of stormwater modeling is to predict the quantity and quality of runoff leaving the area of interest. Quantity is measured in volume of runoff, whereas quality may be measured in various ways and may be composed of many constituents. The model used for characterization of runoff in this research was WinSLAMM.

2.3.2 WinSLAMM

There are several academically and professionally recognized models for simulating and predicting the processes that occur within ecosystems. These models are typically specific to a targeted process or environmental condition. An example of such a model is WinSLAMM (Source Loading and Management Model). WinSLAMM, a long-term continuous simulation model based on small storm event hydrology, uses source areas, or categories of land use, with stormwater controls to simulate the constituents of discharge from an area of interest. This model was developed to evaluate nonpoint source pollutant loadings in urban areas by using small storm hydrology. The model determines the runoff quantity from a series of normal rainfall events and calculates the pollutant loading created by these rainfall events. The user is also able to apply a series of control devices such as infiltration/biofiltration, street sweeping, wet detention ponds, grass swales, porous pavement, or catch basins to discover how effectively these devices remove pollutants [40]. WinSLAMM is a powerful stormwater runoff model but is recommended for areas not exceeding 10 square miles. There are several parameters the user must provide to carry out the model simulation. These parameters can be accurately extracted by using GIS.

2.3.3 Geoprocessing

Geoprocessing is the use of GIS to process, manipulate, or produce data, often through the use of multiple datasets and various GIS analysis techniques. The inputs required by WinSLAMM were produced by using multiple spatial datasets in a GIS. The following subsections describe the processes used to extract this information for the study example sites.

2.3.3.1 Terrain Preparation

One foot dispersion LIDAR (Light Detection and Ranging) data were used as the source of terrain information for the area of interest. The boundaries of each of the research sites were used to extract the areas of interest (AOIs) LIDAR. An Inverse Distance Weighted (IDW) interpolation was used to create the surface model, which was used to create slope and aspect models. Zonal statistics were used to calculate the mean slope and aspect. Figure 2-3 shows this workflow.

2.3.3.2 Hydrologic Data Preparation

To model a site for predevelopment and developed states, WinSLAMM requires several variables that describe the surface conditions and stormwater controls. The variables can be grouped into three major components: land cover, soils, and stormwater controls. This model performs best in site specific simulations. For this research, three sites were selected. Site 1 represents a commercial land use, Site 2 represents a high-density residential land use, and Site 3 represents a low-density residential land use. Together, these three sites represent the general developed land cover characteristics of the selected watershed.

For delineation of the land cover, referred to as source areas in the model, six inch resolution digital aerial photography was found for each of the sites. The aerial photographs had been orthorectified and were therefore acceptable for accurate determination of geometric objects and measurements. Figure 2-4, Figure 2-5, and Figure 2-6 show the bounding areas of each site over the aerial photographs.

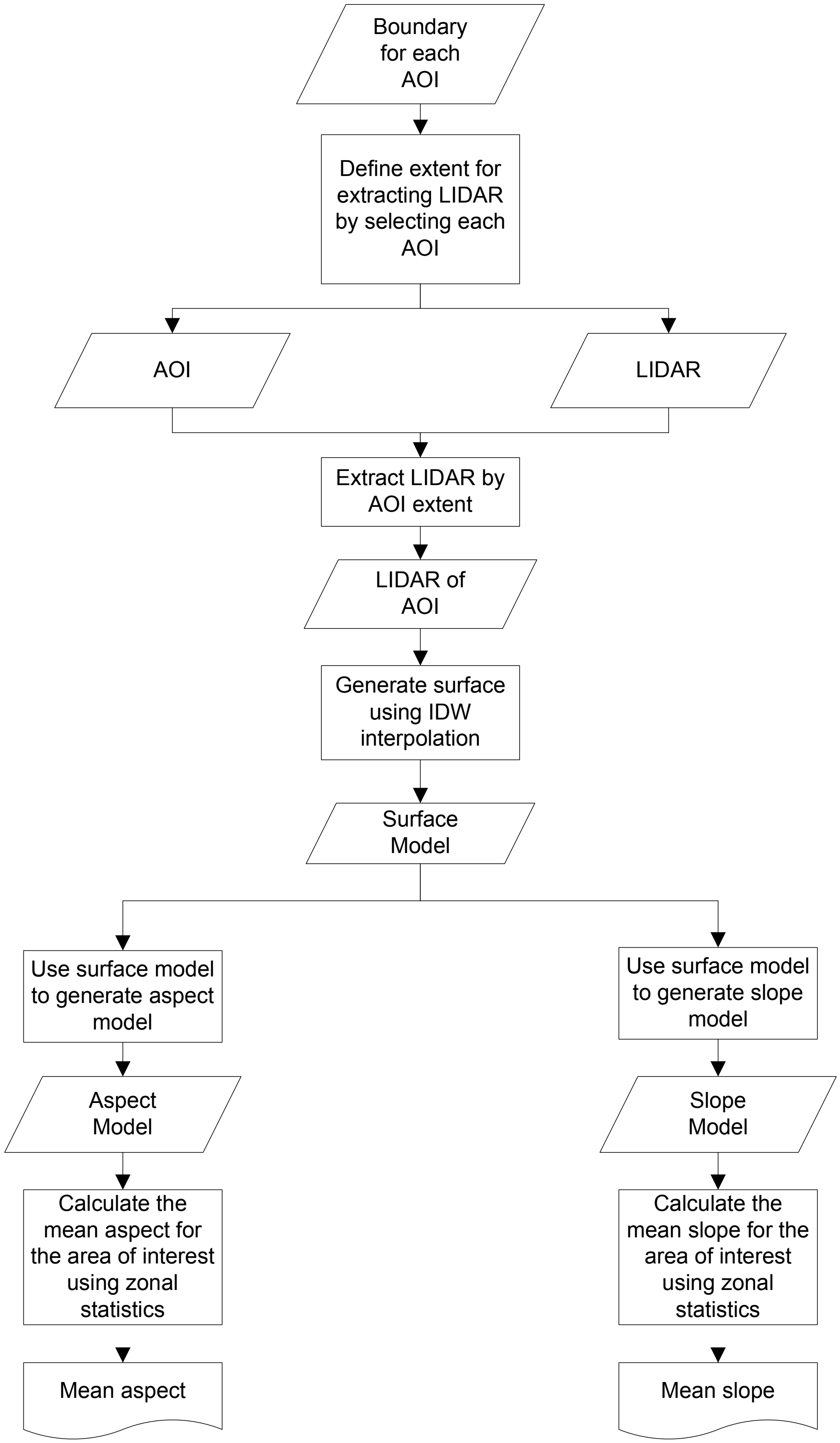

Figure 2-3 Terrain Geoprocessing

Figure 2-4 Site 1: Commercial Development with Aerial Photograph

Figure 2-5 Site 2: High Density Residential Development with Aerial Photograph

Figure 2-6 Site 3: Low Density Residential Development with Aerial Photograph

Each image was loaded into ESRI's ArcView 9.1, and each of the source areas was "heads-up" digitized. WinSLAMM allows for multiple source areas to be entered by land use type. The source area categories are dictated by selecting a land use. Several steps were needed to calculate the acreage of each source area: first was visual by determining and grouping of all applicable source area types on each site, second was creating a spatial dataset for each of the source area types by site, third was digitizing each source area by type by site, and last was combining all source area types by site into a single spatial dataset. The resulting datasets are represented in Figure 2-7, Figure 2-8, and Figure 2-9. Confirmation of the source area determination was corroborated through field observations. Field observation worksheets are shown in Appendix A, with site photographs shown in Appendix B.

Figure 2-7 Site 1: Commercial Development with Delineated Source Areas

Figure 2-8 Site 2: High Density Residential Development with Delineated Source Areas

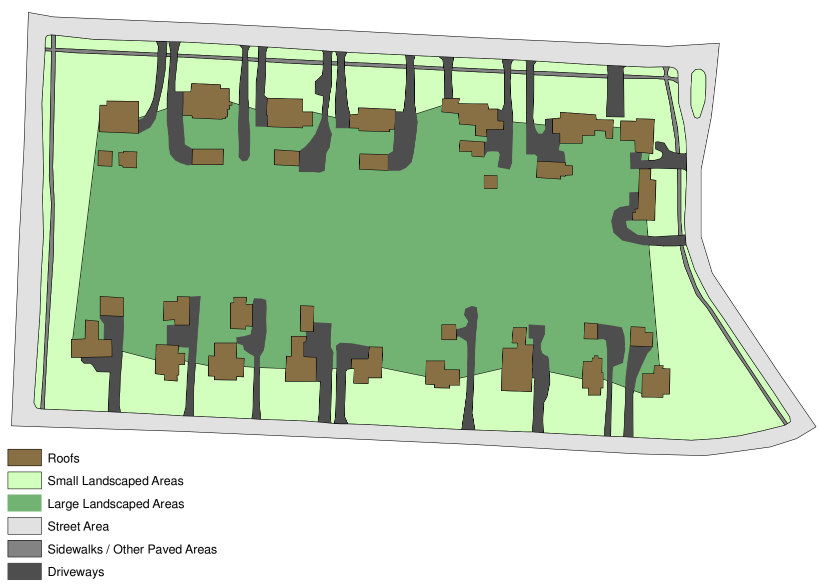

Figure 2-9 Site 3: Low Density Residential Development with Delineated Source Areas

After the source areas were determined, each polygon was assigned the proper attribution to represent its source area, and the area was calculated. The area was initially calculated in square feet and then converted to acres to adapt to the input format required by WinSLAMM. Figure 2-10 shows this process. Table 2-1 lists the source areas and their area by site.

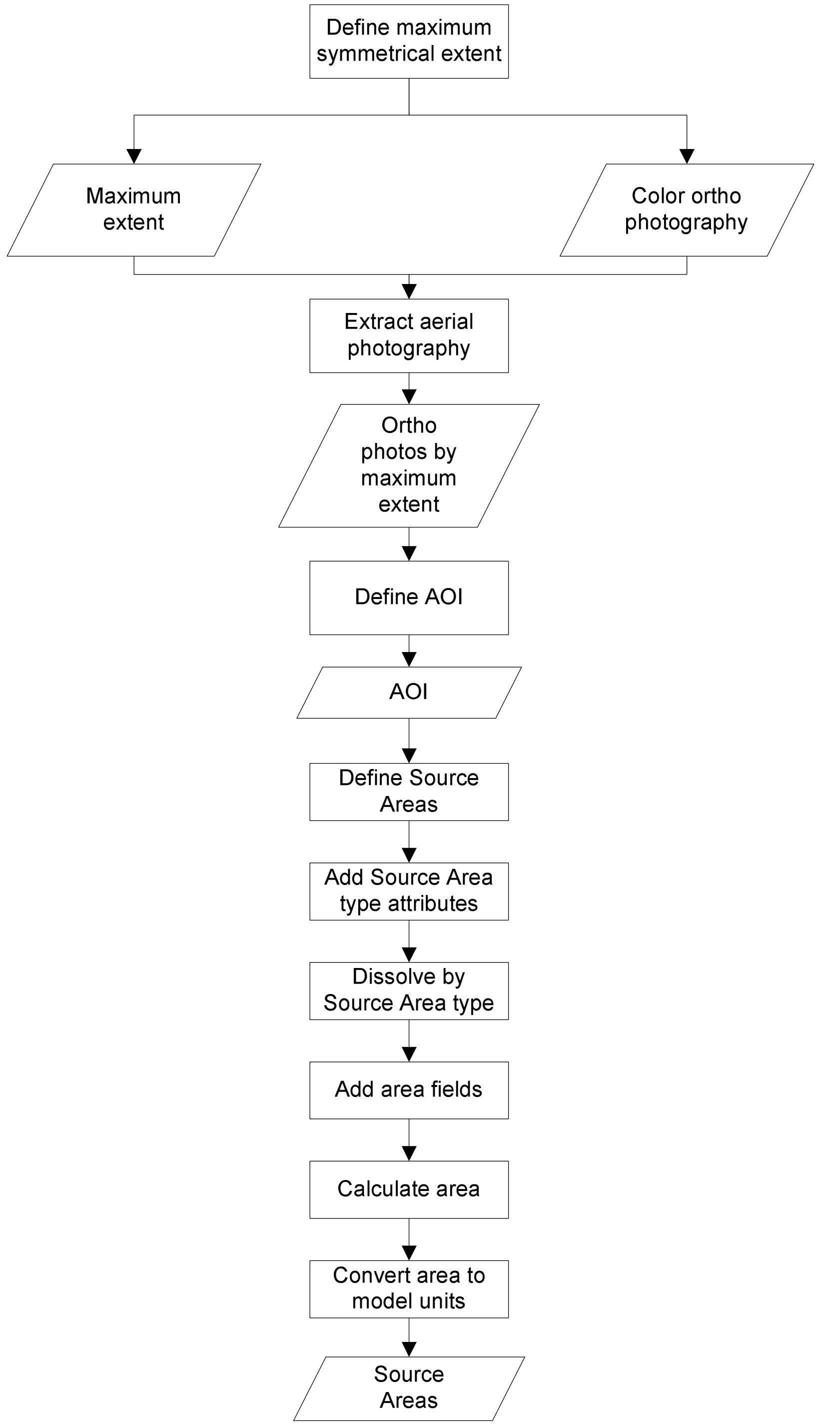

Figure 2-10 Hydrologic Data Geoprocessing

Table 2-1 Source Areas

	Acres		
	Site 1	**Site 2**	**Site 3**
Roofs	13.070	4.959	1.099
Paved Parking	22.057	0.000	0.000
Small Landscaped Areas	16.597	12.204	3.921
Large Landscaped Areas	0.000	0.000	5.407
Street Area	13.608	7.258	1.975
Sidewalks / Other Paved Areas	0.000	0.564	0.203
Driveways	0.000	0.000	1.261
Total Site Area (ac)	**65.330**	**24.990**	**13.860**

WinSLAMM is a spatially independent model and therefore does not consider some variables that are location dependent on a site, such as topography. Instead, the model requires calculating the source area and dividing that source area by type and characteristics of infiltration and runoff influencing features. Figure 2-11 shows the preparation process of the soils datasets.

The soil characteristics needed by WinSLAMM is the ability of the soil to allow infiltration (i.e. the degree to which the soil repeals water and encourages stormwater runoff. These characteristics are termed the soil's runoff potential. The runoff potential has been identified and grouped, along with an extensive array of other descriptive characteristics, by the United States Department Agriculture (USDA) Natural Resources Conservation Service (NRCS) in the Soil Survey Geographic (SSURGO) dataset. Figure 2-12, Figure 2-13, and Figure 2-14 show the soil distribution for each of the research sites.

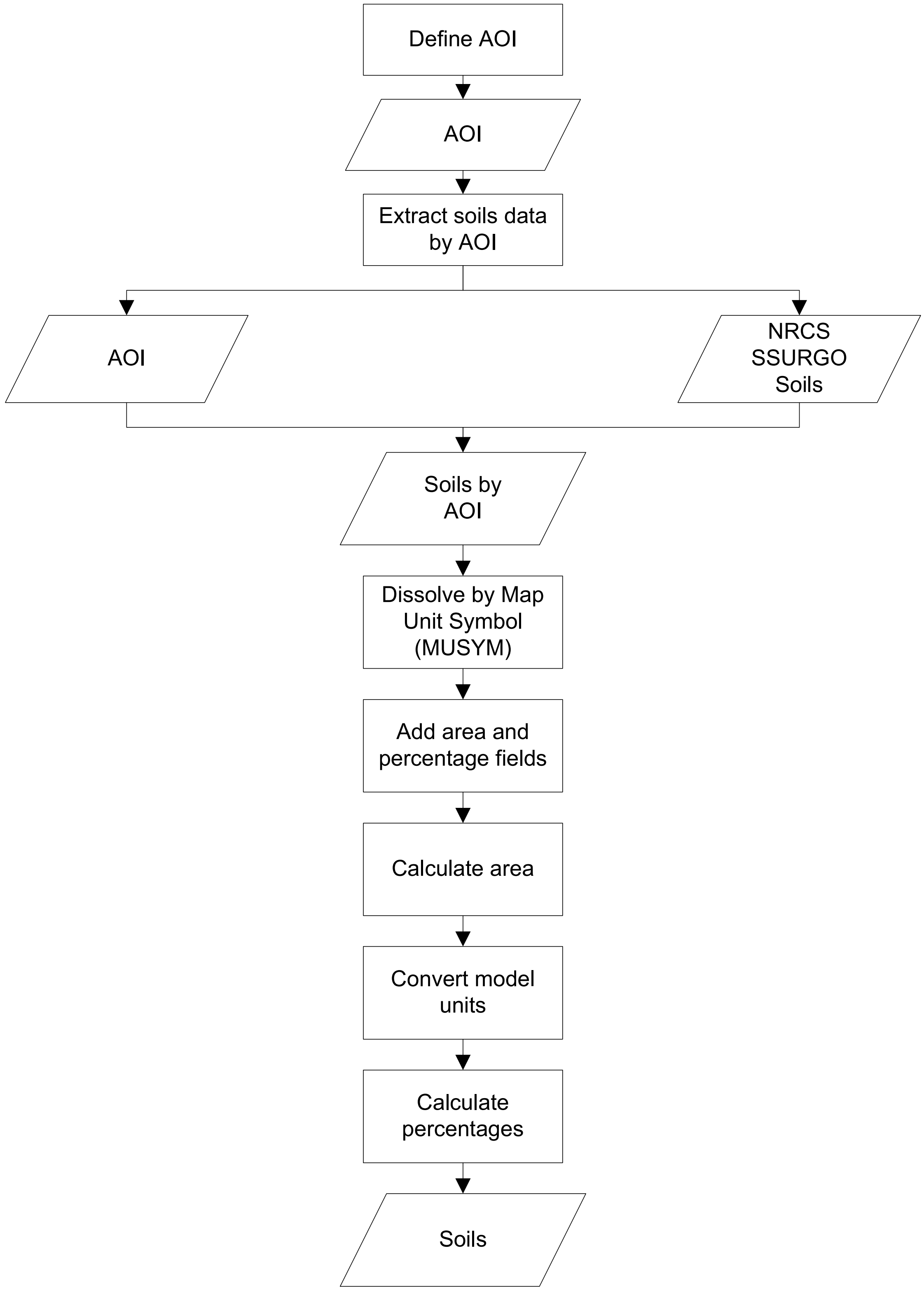

Figure 2-11 Soils Geoprocessing

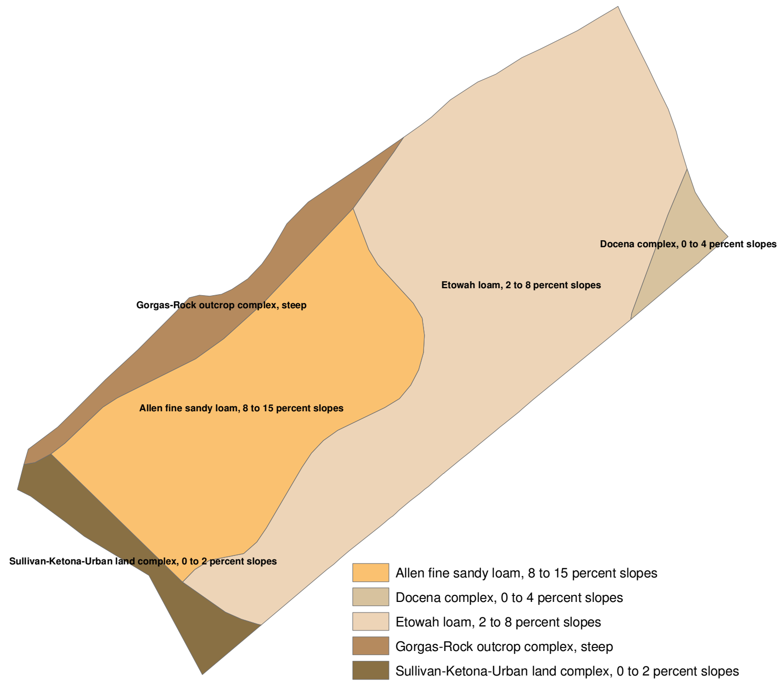

Figure 2-12 Site 1: Soils Distribution

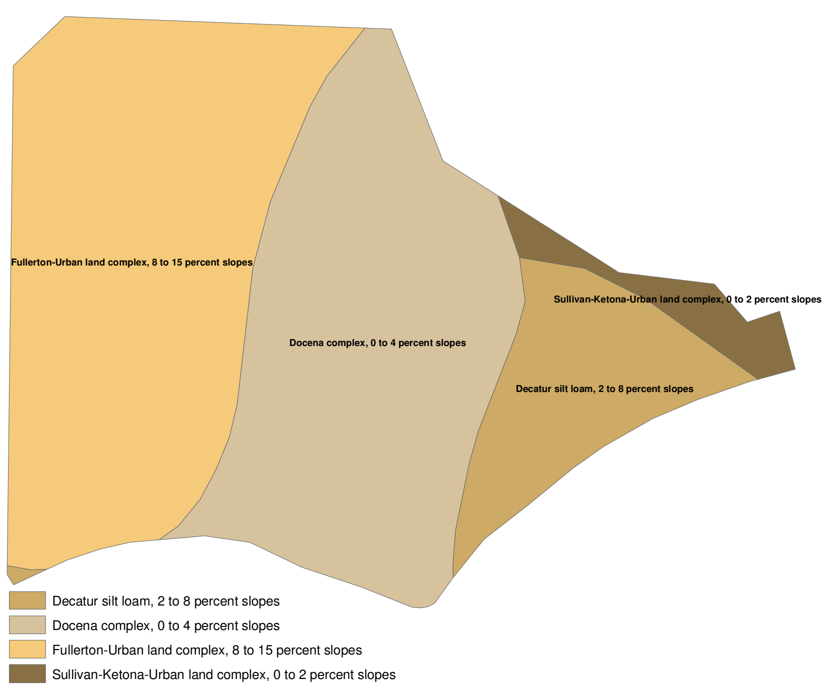

Figure 2-13 Site 2: Soils Distribution

Figure 2-14 Site 3: Soils Distribution

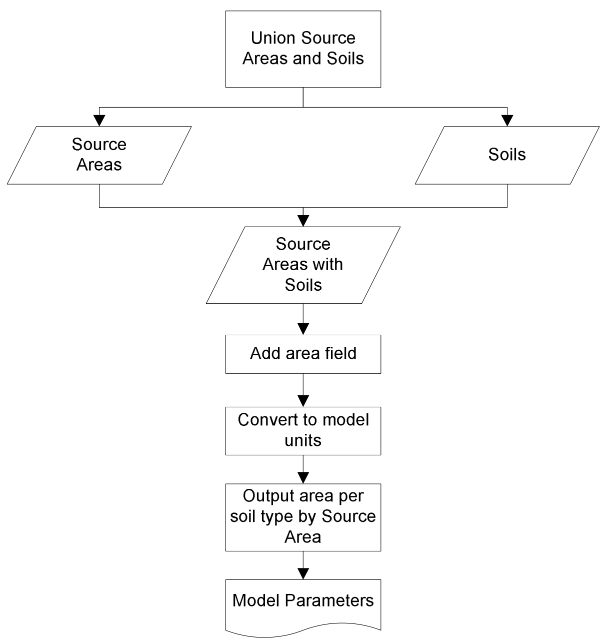

Figure 2-15 Model Parameters Geoprocessing

Sites 1 and 3 have homogeneous soils, whereas Site 2 is more heterogeneous. Each source area is input into WinSLAMM in acres as its default unit for area. If the source area is composed of multiple soil types (i.e., heterogeneous), the source area input must be set apart as individual source areas because of the distinctive runoff potential characteristics. The source area inputs were separated to reflect soil type by using overlay analysis in ArcView v9.1. Figure 2-15 illustrates this process.

The calculation of the ESV requires evaluation of the predevelopment condition. WinSLAMM had predevelopment condition analysis incorporated into version 9.2, but the analysis only evaluates water quantity and is predicated on the Soil Conservation Service Technical Release 55 (SCS TR55) curve number method, which is not recommended for rain events less than 0.5 inches and therefore should be evaluated cautiously [40]. For this research, each site was analyzed by using the predevelopment functionality within WinSLAMM. The predevelopment land cover was assumed to be forested because this land cover was the predominate type for this region. The soils dataset previously described was used to determine the hydrologic soil groups. All predevelopment characteristics entered into the model complied with TR55 forested land cover and with the correct distribution of hydrologic soil group [41].

The recommended method for model use involves developing a "base conditions" scenario that is then compared with various "control condition" scenarios. The base condition represents a fully developed site without any stormwater controls, and the control condition represents various implementations of stormwater controls on the site.

Site specific modeling can become complex and therefore allows for planners and designers to evaluate various combinations of controls before selecting the combination that best meets planning, water quality, and water quantity needs. For this analysis, common controls were used to explain the method and aid in calculation of the ESV. The controls selected were biofiltration with land use routing and wet detention.

The first control type selected was biofiltration. It is used in many pollution control techniques but here refers to a stormwater control using materials that capture pollutants and allow the pollutants to degrade or have characteristics that encourage the pollutants to degrade. This technique, coupled with land use routing, which is the process of routing stormwater through specified areas or other controls, can increase efficiencies. An example of biofiltration would be a rain garden in which the soils have been excavated and replaced with layers of various materials; such a garden may also have selected species of plants to aid in degradation, filtration, or uptake of pollutants. The second control type selected was wet detention, which is a ponding stormwater control structure used to provide retention of runoff volume and treat contaminated stormwater through settling.

A significant strength of WinSLAMM lies in its ability to calculate runoff volume, pollutant concentration, and pollutant loading. This ability separates it from many stormwater runoff models. Through use of the "Batch Editor," WinSLAMM also calculates the pound and cubic foot removal costs and performs a comparative analysis of the scenarios. These results were used in the ESV calculations.

2.4 ESV Analysis

Model results were compiled to isolate needed variables. The required variables for calculation of the ESV are shown in Table 2-2.

Table 2-2 Calculation Variables

Predevelopment
Predevelopment condition volume (cu ft)
Base Condition
Base condition volume (cu ft)
Base condition particulate solids (lb)
Control Condition
Control condition volume (cu ft)
Control condition particulate solids (lb)
Control capital costs
Annual control operations and maintenance costs
Unit Costs
Capital cost per cubic foot of runoff
Capital cost per pound particulate solids
Control cost to reach predevelopment runoff
Control cost to reach predevelopment or better solids
Finance Costs
Interest of a 20 year amortization at 6%
Capital cost plus 20 years of operations and maintenance

As well as the stated variables, several assumptions are made when the ESV was calculated. These address parts of the environment and limits of the model. The following list states these important assumptions.

1. Predevelopment is the optimal condition.
2. Predevelopment conditions with respect to runoff quantity and quality can be achieved through technology.
3. Land cost is not factored.
4. If predevelopment data is not available for particulate solids, then 0 is assumed.

Several considerations led to these assumptions. For example, land costs were not factored into the analysis because the research involved isolating the value of the ecosystem services and excluding the influence of market costs of land that are geographically dependent. Also, predevelopment data from runoff and water quality monitoring on or around the site are often not available. If observations indicate the probability of high particulate solids discharge under predevelopment conditions, then special attention should be paid to this assumption.

Equation 2-4 shows the calculation method for control costs to reach predevelopment runoff. This represents the capital costs of implementation of controls needed to improve stormwater runoff management to its predevelopment condition. Equation 2-5 depicts the calculation method for control costs to reach no discharge of particulate solids. No data was found to show the optimal condition for particulate solids discharge, therefore for this analysis no particulate discharge was assumed for the predevelopment condition. Equation 2-6 shows the method used to calculate overall capital costs through the summation of all projected capital costs. At this point in the analysis, the remaining needed variable is the control operations and maintenance costs. WinSLAMM was used for calculation of these costs and the results represented as an annual cost. The cost calculations were based on the previously mentioned study by Narayanan and Pitt (2006), and corrected for the region of the United States using cost indices as multipliers [35, 40, 42]. The operations and maintenance costs were multiplied by 20-years and the capital costs were added. This figure was amortized at 6% interest for 20-years to yield the final ESV.

Equation 2-4 Capital Cost of Control to Reach Predevelopment Runoff

$$C_{PR} = (V_{BC} - V_{CC}) \times C_{RR}$$

Where:

C_{PR} = Control Costs to Reach Predevelopment Runoff
V_{BC} = Base Condition Volume (cu ft)
V_{CC} = Control Condition Volume (cu ft)
C_{RR} = Capital Cost Per Cubic Foot of Runoff

Equation 2-5 Capital Cost of Control to Reach No Particulate Solids

$$C_{PS} = V_{BC} \times C_{RPS}$$

Where:

C_{PS} = Control Costs to Reach No Particulate Solids
V_{BC} = Base Condition Volume (cu ft)
C_{RPS} = Capital Cost Per Pound Particulate Solids

Equation 2-6 All Capital Costs

$$C_C = C_{PR} + C_{PS}$$

Where:

C_C = Capital Costs
C_{PR} = Capital Costs to Reach Predevelopment Runoff
C_{PS} = Capital Costs to Reach No Particulate Solids

3 RESULTS

Table 3-1 presents the model results for the "base condition" of each site, and the control simulation results can be found in Table 3-2. The stormwater runoff model was used to conduct an analysis on the stormwater services provided by the ecosystems of the research area. The ecosystem services were quantified in measurements of water quantity and quality. Model results for each site in each control scenario can be found in Appendix C. ESV calculations were then applied to express the model results into a single common metric: dollars. The results are expressed in the form of year one ESV and total ESV. Year one ESV refers to the capital costs plus operations and maintenance costs for all site stormwater controls for the first year of development. Total ESV refers to the capital costs plus 20 years of projected operations and maintenance costs amortized for a 20-year period at 6% interest. Table 3-3 expresses the ESV results, and the amortization calculations can be found in Appendix D.

Table 3-1 WinSLAMM Base Condition Analysis

	Site 1	Site 2	Site 3
Runoff Volume (cf)	8,708,669.000	1,676,428.000	931,220.800
Particulate Solids Yield (lb)	30,161.940	18,579.000	19,530.640
Particulate Solids Concentration (mg/L)	55.523	177.664	336.222

Table 3-2 WinSLAMM Control Condition Analysis

	Site 1	Site 2	Site 3
Runoff Volume (cf)	2,335,415.000	1,263,731.000	243,570.300
Particulate Solids Yield (lb)	1,290.994	573.931	21.321
Particulate Solids Concentration (mg/L)	8.862	7.281	1.403
Cost per Cubic Foot Runoff Volume Reduced ($/cf)	$0.58	$2.15	$0.63
Cost per Pound Particulate Solids Reduced ($/lb)	$127.72	$49.18	$22.09

Table 3-3 ESV Results

	Site 1	Site 2	Site 3
Year One ESV	$10,725,269.98	$4,202,669.42	$4,975,937.98
Total ESV	$ 51,046,758.29	$ 15,063,483.57	$ 5,933,349.03

4 CONCLUSION/DISCUSSION

This research successfully demonstrates the use of the Ecological Services Value (ESV) method for converting scientific and engineering stormwater management data into a more common metric expressed in the form of dollars or currency. The method is composed of three major parts represented as geoprocessing, modeling, and ESV calculation. Geographic Information Systems (GIS) were used for the geoprocessing of spatial datasets, and WinSLAMM was selected as the hydrologic model for the research. The ESV method uses GIS with spatial datasets for formulation of the inputs for the WinSLAMM model. One foot dispersion LiDAR was used for terrain modeling. Six inch resolution aerial photography was used to create hydrologic data in the form of source areas comprised of surface characteristics and land cover types. Soils data from the NRCS was used to ascertain soil types, infiltration characteristics, and distribution.

The ESV method will aid policy makers in decisions on developments, on the potential economic impacts of those developments, and on the foundation for fiscal plans if developments continue. Decisions on developments are often conducted at local levels of government and policy councils. The use of this research would best be placed in these settings because of the localized focus. For instance, in deciding whether to allow the conversion of a large undeveloped area into a shopping plaza in a suburban region, the policy makers often need the ability to understand the long-term implications of the development on the local municipality. These implications are often presented to the policy makers in terms of engineering data by showing increases in runoff or other environmental impacts. If the policy makers are not educated in the meaning of these data, their decisions may not be founded on sufficient understanding. Other times, data presented as the foundation of the development decision making process comes in the form of dollars or currency, such as sales tax revenues. Because this research provides a way to translate the engineering or scientific data into the common metric of dollars, it can used to provide policy makers the ability to compare the economic gains of new development with the costs of replacing the services carried out by the natural systems; to evaluate whether the benefits justify the costs; and then to accept the development proposal or to reject it, or to try to find compromises through alternative development or site designs.

It is important to note that the ESV is intended not to be an exact quantification of value but to be a as reasonable estimate that is based on firm science and engineering on established methods and models. Most assessments in environmental economics (e.g., contingent valuation assessments) attempt to demonstrate the willingness to pay or accept of the recipient of services. Although useful, this can present issues because of the inherent links to an individual's values and to the potential for bias in the choice of values presented. As an alternative to these types of assessments, a market based value such as the ESV can provide useful information for planning and development efforts.

The individual processes used in this research to devise the overall method of determination of the ESV are readily available and well established. Although the software utilized in this research is commercial, many alternatives exist with the same functionality. The models used in this research are also available through their developers, but other models with similar functionality exist as alternatives. Data used in this research were provided through agreements with local municipalities or through other public sources. Therefore, the method can be duplicated with a reasonable amount of effort.

Although research and literature review have not found the use of this method anywhere to date, the potential exists to provide significant aid to policy makers facing difficult decisions about the development of their regions. The most significant impediment to integrating this method into policy makers' processes involves accepting environmental economics and the valuation of natural systems as a more holistic approach to understanding the impacts of development. Field defined environmental economics as "the application of the principles of economics to the study of how environmental resources are managed"; the ESV provides a mechanism through which policy makers, who may have little understanding of science and engineering, can build a platform for formulating policy on the basis of easy-to-understand information and therefore can more effectively manage environmental resources.

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APPENDIX A

SITE 3: FIELD OBSERVATION WORKSHEETS

Site Survey for Site Development Conditions

Location: Site number: 1
Date: 11/7 Time: 8:10
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious
Roof types: flat composition shingle wood shingle other: metal shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
100 Lake St

Site Survey for Site Development Conditions

Location: Site number: 2
Date: 11/7 Time: 8:15
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious – No Gutters
Roof types: flat composition shingle wood shingle other: metal shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
Lake St

Site Survey for Site Development Conditions

Location: Site number: 3
Date: 11/7 Time: 8:15
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious
Roof types: flat composition shingle wood shingle other: - Metal Shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
108 Lake St

Site Survey for Site Development Conditions

Location: Site number: 4
Date: 11/7 Time: 8:20
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious - No gutters
Roof types: flat composition shingle wood shingle other: metal Shingles
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:

Site Survey for Site Development Conditions

Location: Site number: 5
Date: 11/7 Time: 8:25
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious
Roof types: flat composition shingle wood shingle other: metal shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
112 Lake St

Site Survey for Site Development Conditions

Location: Site number: 6
Date: 11/7 Time: 8:25
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious
Roof types: flat composition shingle wood shingle other: metal shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
114 Lake St

Site Survey for Site Development Conditions

Location: Site number: 7
Date: 11/7 Time: 8:27
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious
Roof types: flat composition shingle wood shingle other: metal shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:

116 Lake St

Site Survey for Site Development Conditions

Location: Site number: 8
Date: 11/7 Time: 8:30
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious
Roof types: flat composition shingle wood shingle other: metal shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:

118 Lake S

Site Survey for Site Development Conditions

Location:
Site number: 9
Date: 11/7 Time: 8:30
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious
Roof types: flat composition shingle wood shingle other: Metal Shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:

120 Lake St

Site Survey for Site Development Conditions

Location:
Site number: 10
Date: 11/7 Time: 8:40
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious - No gutters
Roof types: flat composition shingle wood shingle other: MS
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 1
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:

125 South Hall + 123

Site Survey for Site Development Conditions

Location: Site number: 11
Date: 11/7 Time: 8:40
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious – No Gutters
Roof types: flat composition shingle wood shingle other: MS
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 1
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:

South Mall

Site Survey for Site Development Conditions

Location: Site number: 12
Date: 11/7 Time: 8:45
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious – No Gutter
Roof types: flat composition shingle wood shingle other: MS
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 1
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:

115 South Mall

Site Survey for Site Development Conditions

Location: Site number: 13
Date: 11/7 Time: 8:47
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious — No gutters
Roof types: flat composition shingle wood shingle other: MS
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 1
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
111 South Mall

Site Survey for Site Development Conditions

Location: Site number: 14
Date: 11/7 Time: 8:50
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious — NG
Roof types: flat composition shingle wood shingle other: — MS
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 1
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
109 South Mall

Site Survey for Site Development Conditions

Location: Site number: 15
Date: 11/7 Time: 8:55
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious – NG
Roof types: flat composition shingle wood shingle other: – MS
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 1
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
105 South Mall
Large parking area in back (paved)

Site Survey for Site Development Conditions

Location: Site number: 16
Date: 11/7 Time: 9:00
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious / No gutters
Roof types: flat composition shingle wood shingle other: metal shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 2
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
101 South Mall

Site Survey for Site Development Conditions

Location: Site number: 17
Date: 11/7 Time: 8:05
Photo numbers:
Land-use and industrial activity:
Residential: low medium high density single family
multiple family
trailer parks
high rise apartments
Income level: low medium high
Age of development: <1960 1960-1980 >1980
Institutional: school hospital other (type):
Commercial: strip shopping center downtown hotel offices
Industrial: light medium heavy (manufacturing) describe:
Open space: undeveloped park golf cemetery
Other: freeway utility ROW railroad ROW other:
Maintenance of building: excellent moderate poor
Heights of buildings: 1 2 3 4+ stories
Roof drains: % underground % gutter % impervious % pervious – No gutters
Roof types: flat composition shingle wood shingle other: – Metal shingle
Sediment source nearby? No Yes (describe):
Treated wood near street? No telephone poles fence other:
Landscaping near road:
Quantity: none some much
Type: deciduous evergreen lawn
Maintenance: excessive adequate poor
Leafs on street: none some much
Topography:
Street slope: flat (<2%) medium (2-5%) steep (>5%)
Land slope: flat (<2%) medium (2-5%) steep (>5%)
Traffic speed: <25mph 25-40mph >40mph
Traffic density: light moderate heavy
Parking density: none light moderate heavy
Width of street: number of parking lanes: 0
number of driving lanes: 2
Condition of street: good fair poor
Texture of street: smooth intermediate rough
Pavement material: asphalt concrete unpaved
Driveways: paved unpaved
Condition: good fair poor
Texture: smooth intermediate rough
Gutter material: grass swale lined ditch concrete asphalt
Condition: good fair poor
Street/gutter interface: smooth fair uneven
Litter loadings near street: clean fair dirty
Parking/storage areas (describe):
Condition of pavement: good fair poor
Texture of pavement: smooth intermediate rough unpaved
Other paved areas (such as alleys and playgrounds), describe:
Condition: good fair poor
Texture: smooth intermediate rough
Notes:
308 Parkway

APPENDIX B

SITE PHOTOS

B.1 Site 1: Commercial Site Observations

Photograph 1

Photograph 2

Photograph 3

Photograph 4

Photograph 5

Photograph 6

Photograph 7

Photograph 8

Photograph 9

Photograph 10

Photograph 11

Photograph 12

Photograph 13

Photograph 14

B.2 Site 2: High Density Residential Site Observations

Photograph 15

Photograph 16

Photograph 17

Photograph 18

Photograph 19

Photograph 20

B.3 Site 3: Low Density Residential Site Observations

Photograph 21

Photograph 22

Photograph 23

Photograph 24

Photograph 25

Photograph 26

Photograph 27

Photograph 28

Photograph 29

Photograph 30

Photograph 31

Photograph 32

Photograph 33

Photograph 34

Photograph 35

Photograph 36

Photograph 37

Photograph 38

Photograph 39

Photograph 40

Photograph 41

Photograph 42

Photograph 43

Photograph 44

Photograph 45

Photograph 46

Photograph 47

Photograph 48

Photograph 49

Photograph 50

Photograph 51

Photograph 52

Photograph 53

Photograph 54

APPENDIX C

MODEL OUTPUT

Table C-1 Site 1: WinSLAMM Model Results - Batch Processor

File Number	File Name	Catchment Area (ac)	Number of Years in Model Run	Runoff Volume (cf)	Rv	Biological Condition	Runoff Volume Percent Reduction	Particulate Solids Yield (lbs)	Particulate Solids Yield Percent Reduction	Particulate Solids Concentration (mg/L)	Sub Basin Capital Cost	Sub Basin Land Cost	Sub Basin Maintenance Cost	Sub Basin Total Annualized Cost	Sub Basin Total Present Value Cost	Cost per cubic foot Runoff Volume Reduced ($/cf)	Cost per pound Particulate Solids Reduced ($/lb)
1	BaseConditions	65.33	0.993	8708669	0.665	Poor	N/A	30161.94	N/A	55.52264	0	0	0	0	0	N/A	N/A
2	Bio-LanduseRouting	65.33	0.993	2370620	0.181	Poor	72.78	8538.262	71.69	57.73913	33062570	0	1051224	3704250	46163140	0.58	170.17
3	Biofilter-WetDet	65.33	0.993	8496106	0.649	Poor	2.44	4420.227	85.35	8.340406	33130180	0	1053492	3711943	46259020	17.35	143.24
4	BiofilterLanduseRouting-WetDet	65.33	0.993	2335415	0.178	Poor	73.18	1290.994	95.72	8.861816	33130180	0	1053492	3711943	46259020	0.58	127.72

Table C-2 Site 2: WinSLAMM Model Results - Batch Processor

File Number	File Name	Catchment Area (ac)	Number of Years in Model Run	Runoff Volume (cf)	Rv	Biological Condition	Runoff Volume Percent Reduction	Particulate Solids Yield (lbs)	Particulate Solids Yield Percent Reduction	Particulate Solids Concentration (mg/L)	Sub Basin Capital Cost	Sub Basin Land Cost	Sub Basin Maintenance Cost	Sub Basin Total Annualized Cost	Sub Basin Total Present Value Cost	Cost per cubic foot Runoff Volume Reduced ($/cf)	Cost per pound Particulate Solids Reduced ($/lb)
1	BaseConditions	24.99	0.993	1676428	0.335	Poor	N/A	18579	N/A	177.6642	0	0	0	0	0	N/A	N/A
2	Biofilter-LanduseRouting	24.99	0.993	1291683	0.258	Poor	22.95	5537.941	70.19	68.73138	7916439	0	251703	886938	11053210	2.29	67.56
3	WetDetention	24.99	0.993	1646772	0.329	Poor	1.77	2438.877	86.87	23.74209	36707	0	1522	4468	55677	0.15	0.27
4	Biofilter-LURt-WetDet	24.99	0.993	1263731	0.252	Poor	24.62	573.9311	96.91	7.280612	7953146	0	253225	891406	11108890	2.15	49.18

Table C-3 Site 3: WinSLAMM Model Results - Batch Processor

File Number	File Name	Catchment Area (ac)	Number of Years in Model Run	Runoff Volume (cf)	Rv	Biological Condition	Runoff Volume Percent Reduction	Particulate Solids Yield (lbs)	Particulate Solids Yield Percent Reduction	Particulate Solids Concentration (mg/L)	Sub Basin Capital Cost	Sub Basin Land Cost	Sub Basin Maintenance Cost	Sub Basin Total Annualized Cost	Sub Basin Total Present Value Cost	Cost per cubic foot Runoff Volume Reduced ($/cf)	Cost per pound Particulate Solids Reduced ($/lb)
1	BaseConditions	13.86	0.993	931220.8	0.335	Poor	N/A	19530.64	N/A	336.2223	0	0	0	0	0	N/A	N/A
2	Biofilter-LanduseRouting	13.86	0.993	293810.1	0.106	Good	68.45	2481.241	87.3	135.3832	3831404	0	121819	429261	5349542	0.67	25.01
3	WetDetention	13.86	0.993	857453.6	0.309	Poor	7.92	757.6564	96.12	14.16525	37714	0	1546	4572	56979	0.06	0.24
4	Biofilter-LanduseRouting-WetDet	13.86	0.993	243570.3	0.088	Good	73.84	21.32102	99.89	1.403286	3869118	0	123365	433833	5406520	0.63	22.09

APPENDIX D

COST AMORTIZATIONS

Table D-1 Site 1: Cost Amortization

	Loan Amount (pv)	$29,688,108				
	Interest Rate (rate)	**0.50%**				
	Total # of Periods (Nper)	**240**				
	Payment per Period	$212,694.83				
	Total Interest Paid	**$ 21,358,650.32**				
Period	**Payment Amount**	**Interest**	**Cumulative Interest**	**Principal**	**Principal Paid**	**Balance**
						$ 29,688,107.98
1	212,694.83	148,440.54	148,440.54	64,254.29	64,254.29	29,623,853.69
2	212,694.83	148,119.27	296,559.81	64,575.56	128,829.84	29,559,278.13
3	212,694.83	147,796.39	444,356.20	64,898.44	193,728.28	29,494,379.70
4	212,694.83	147,471.90	591,828.10	65,222.93	258,951.21	29,429,156.77
5	212,694.83	147,145.78	738,973.88	65,549.04	324,500.25	29,363,607.73
6	212,694.83	146,818.04	885,791.92	65,876.79	390,377.04	29,297,730.94
7	212,694.83	146,488.65	1,032,280.57	66,206.17	456,583.21	29,231,524.77
8	212,694.83	146,157.62	1,178,438.20	66,537.20	523,120.41	29,164,987.57
9	212,694.83	145,824.94	1,324,263.14	66,869.89	589,990.30	29,098,117.68
10	212,694.83	145,490.59	1,469,753.72	67,204.24	657,194.54	29,030,913.44
11	212,694.83	145,154.57	1,614,908.29	67,540.26	724,734.80	28,963,373.18
12	212,694.83	144,816.87	1,759,725.16	67,877.96	792,612.76	28,895,495.22
13	212,694.83	144,477.48	1,904,202.63	68,217.35	860,830.11	28,827,277.87
14	212,694.83	144,136.39	2,048,339.02	68,558.44	929,388.54	28,758,719.43
15	212,694.83	143,793.60	2,192,132.62	68,901.23	998,289.77	28,689,818.20
16	212,694.83	143,449.09	2,335,581.71	69,245.74	1,067,535.51	28,620,572.47
17	212,694.83	143,102.86	2,478,684.57	69,591.96	1,137,127.47	28,550,980.50
18	212,694.83	142,754.90	2,621,439.48	69,939.92	1,207,067.40	28,481,040.58
19	212,694.83	142,405.20	2,763,844.68	70,289.62	1,277,357.02	28,410,750.96
20	212,694.83	142,053.75	2,905,898.43	70,641.07	1,347,998.09	28,340,109.89
21	212,694.83	141,700.55	3,047,598.98	70,994.28	1,418,992.37	28,269,115.61
22	212,694.83	141,345.58	3,188,944.56	71,349.25	1,490,341.62	28,197,766.36
23	212,694.83	140,988.83	3,329,933.39	71,705.99	1,562,047.61	28,126,060.37
24	212,694.83	140,630.30	3,470,563.70	72,064.52	1,634,112.13	28,053,995.84
25	212,694.83	140,269.98	3,610,833.67	72,424.85	1,706,536.98	27,981,571.00
26	212,694.83	139,907.85	3,750,741.53	72,786.97	1,779,323.95	27,908,784.02
27	212,694.83	139,543.92	3,890,285.45	73,150.91	1,852,474.86	27,835,633.12
28	212,694.83	139,178.17	4,029,463.62	73,516.66	1,925,991.52	27,762,116.46
29	212,694.83	138,810.58	4,168,274.20	73,884.24	1,999,875.76	27,688,232.21
30	212,694.83	138,441.16	4,306,715.36	74,253.67	2,074,129.43	27,613,978.55
31	212,694.83	138,069.89	4,444,785.25	74,624.93	2,148,754.36	27,539,353.62
32	212,694.83	137,696.77	4,582,482.02	74,998.06	2,223,752.42	27,464,355.56
33	212,694.83	137,321.78	4,719,803.80	75,373.05	2,299,125.47	27,388,982.51
34	212,694.83	136,944.91	4,856,748.71	75,749.91	2,374,875.38	27,313,232.59
35	212,694.83	136,566.16	4,993,314.87	76,128.66	2,451,004.05	27,237,103.93
36	212,694.83	136,185.52	5,129,500.39	76,509.31	2,527,513.35	27,160,594.63
37	212,694.83	135,802.97	5,265,303.37	76,891.85	2,604,405.20	27,083,702.77
38	212,694.83	135,418.51	5,400,721.88	77,276.31	2,681,681.52	27,006,426.46
39	212,694.83	135,032.13	5,535,754.01	77,662.69	2,759,344.21	26,928,763.77
40	212,694.83	134,643.82	5,670,397.83	78,051.01	2,837,395.22	26,850,712.76
41	212,694.83	134,253.56	5,804,651.39	78,441.26	2,915,836.48	26,772,271.50
42	212,694.83	133,861.36	5,938,512.75	78,833.47	2,994,669.95	26,693,438.03
43	212,694.83	133,467.19	6,071,979.94	79,227.64	3,073,897.59	26,614,210.39
44	212,694.83	133,071.05	6,205,050.99	79,623.77	3,153,521.36	26,534,586.62
45	212,694.83	132,672.93	6,337,723.93	80,021.89	3,233,543.25	26,454,564.72
46	212,694.83	132,272.82	6,469,996.75	80,422.00	3,313,965.26	26,374,142.72
47	212,694.83	131,870.71	6,601,867.46	80,824.11	3,394,789.37	26,293,318.61

48	212,694.83	131,466.59	6,733,334.06	81,228.23	3,476,017.60	26,212,090.38
49	212,694.83	131,060.45	6,864,394.51	81,634.37	3,557,651.98	26,130,456.00
50	212,694.83	130,652.28	6,995,046.79	82,042.55	3,639,694.52	26,048,413.45
51	212,694.83	130,242.07	7,125,288.86	82,452.76	3,722,147.28	25,965,960.70
52	212,694.83	129,829.80	7,255,118.66	82,865.02	3,805,012.30	25,883,095.67
53	212,694.83	129,415.48	7,384,534.14	83,279.35	3,888,291.65	25,799,816.33
54	212,694.83	128,999.08	7,513,533.22	83,695.74	3,971,987.40	25,716,120.58
55	212,694.83	128,580.60	7,642,113.82	84,114.22	4,056,101.62	25,632,006.36
56	212,694.83	128,160.03	7,770,273.85	84,534.79	4,140,636.41	25,547,471.56
57	212,694.83	127,737.36	7,898,011.21	84,957.47	4,225,593.88	25,462,514.09
58	212,694.83	127,312.57	8,025,323.78	85,382.26	4,310,976.14	25,377,131.84
59	212,694.83	126,885.66	8,152,209.44	85,809.17	4,396,785.31	25,291,322.67
60	212,694.83	126,456.61	8,278,666.06	86,238.21	4,483,023.52	25,205,084.46
61	212,694.83	126,025.42	8,404,691.48	86,669.40	4,569,692.92	25,118,415.05
62	212,694.83	125,592.08	8,530,283.55	87,102.75	4,656,795.67	25,031,312.30
63	212,694.83	125,156.56	8,655,440.11	87,538.26	4,744,333.94	24,943,774.04
64	212,694.83	124,718.87	8,780,158.98	87,975.96	4,832,309.89	24,855,798.08
65	212,694.83	124,278.99	8,904,437.97	88,415.84	4,920,725.73	24,767,382.25
66	212,694.83	123,836.91	9,028,274.89	88,857.91	5,009,583.64	24,678,524.33
67	212,694.83	123,392.62	9,151,667.51	89,302.20	5,098,885.85	24,589,222.13
68	212,694.83	122,946.11	9,274,613.62	89,748.72	5,188,634.56	24,499,473.41
69	212,694.83	122,497.37	9,397,110.99	90,197.46	5,278,832.02	24,409,275.95
70	212,694.83	122,046.38	9,519,157.37	90,648.45	5,369,480.47	24,318,627.51
71	212,694.83	121,593.14	9,640,750.50	91,101.69	5,460,582.16	24,227,525.82
72	212,694.83	121,137.63	9,761,888.13	91,557.20	5,552,139.36	24,135,968.62
73	212,694.83	120,679.84	9,882,567.97	92,014.98	5,644,154.34	24,043,953.64
74	212,694.83	120,219.77	10,002,787.74	92,475.06	5,736,629.40	23,951,478.58
75	212,694.83	119,757.39	10,122,545.14	92,937.43	5,829,566.83	23,858,541.15
76	212,694.83	119,292.71	10,241,837.84	93,402.12	5,922,968.95	23,765,139.03
77	212,694.83	118,825.70	10,360,663.54	93,869.13	6,016,838.08	23,671,269.89
78	212,694.83	118,356.35	10,479,019.89	94,338.48	6,111,176.56	23,576,931.42
79	212,694.83	117,884.66	10,596,904.54	94,810.17	6,205,986.73	23,482,121.25
80	212,694.83	117,410.61	10,714,315.15	95,284.22	6,301,270.95	23,386,837.03
81	212,694.83	116,934.19	10,831,249.33	95,760.64	6,397,031.59	23,291,076.39
82	212,694.83	116,455.38	10,947,704.72	96,239.44	6,493,271.03	23,194,836.94
83	212,694.83	115,974.18	11,063,678.90	96,720.64	6,589,991.67	23,098,116.30
84	212,694.83	115,490.58	11,179,169.48	97,204.24	6,687,195.92	23,000,912.06
85	212,694.83	115,004.56	11,294,174.04	97,690.27	6,784,886.19	22,903,221.79
86	212,694.83	114,516.11	11,408,690.15	98,178.72	6,883,064.90	22,805,043.07
87	212,694.83	114,025.22	11,522,715.37	98,669.61	6,981,734.51	22,706,373.46
88	212,694.83	113,531.87	11,636,247.23	99,162.96	7,080,897.47	22,607,210.50
89	212,694.83	113,036.05	11,749,283.29	99,658.77	7,180,556.25	22,507,551.73
90	212,694.83	112,537.76	11,861,821.05	100,157.07	7,280,713.31	22,407,394.66
91	212,694.83	112,036.97	11,973,858.02	100,657.85	7,381,371.17	22,306,736.81
92	212,694.83	111,533.68	12,085,391.70	101,161.14	7,482,532.31	22,205,575.67
93	212,694.83	111,027.88	12,196,419.58	101,666.95	7,584,199.26	22,103,908.72
94	212,694.83	110,519.54	12,306,939.13	102,175.28	7,686,374.54	22,001,733.44
95	212,694.83	110,008.67	12,416,947.79	102,686.16	7,789,060.70	21,899,047.28
96	212,694.83	109,495.24	12,526,443.03	103,199.59	7,892,260.29	21,795,847.69
97	212,694.83	108,979.24	12,635,422.27	103,715.59	7,995,975.88	21,692,132.10
98	212,694.83	108,460.66	12,743,882.93	104,234.17	8,100,210.04	21,587,897.94
99	212,694.83	107,939.49	12,851,822.42	104,755.34	8,204,965.38	21,483,142.60
100	212,694.83	107,415.71	12,959,238.13	105,279.11	8,310,244.49	21,377,863.49
101	212,694.83	106,889.32	13,066,127.45	105,805.51	8,416,050.00	21,272,057.98
102	212,694.83	106,360.29	13,172,487.74	106,334.54	8,522,384.54	21,165,723.44
103	212,694.83	105,828.62	13,278,316.36	106,866.21	8,629,250.75	21,058,857.23
104	212,694.83	105,294.29	13,383,610.64	107,400.54	8,736,651.29	20,951,456.69
105	212,694.83	104,757.28	13,488,367.92	107,937.54	8,844,588.83	20,843,519.15

106	212,694.83	104,217.60	13,592,585.52	108,477.23	8,953,066.06	20,735,041.92
107	212,694.83	103,675.21	13,696,260.73	109,019.62	9,062,085.68	20,626,022.30
108	212,694.83	103,130.11	13,799,390.84	109,564.71	9,171,650.39	20,516,457.59
109	212,694.83	102,582.29	13,901,973.13	110,112.54	9,281,762.93	20,406,345.05
110	212,694.83	102,031.73	14,004,004.85	110,663.10	9,392,426.03	20,295,681.95
111	212,694.83	101,478.41	14,105,483.26	111,216.42	9,503,642.45	20,184,465.53
112	212,694.83	100,922.33	14,206,405.59	111,772.50	9,615,414.94	20,072,693.03
113	212,694.83	100,363.47	14,306,769.06	112,331.36	9,727,746.31	19,960,361.67
114	212,694.83	99,801.81	14,406,570.87	112,893.02	9,840,639.32	19,847,468.65
115	212,694.83	99,237.34	14,505,808.21	113,457.48	9,954,096.81	19,734,011.17
116	212,694.83	98,670.06	14,604,478.26	114,024.77	10,068,121.58	19,619,986.40
117	212,694.83	98,099.93	14,702,578.20	114,594.89	10,182,716.47	19,505,391.51
118	212,694.83	97,526.96	14,800,105.15	115,167.87	10,297,884.34	19,390,223.64
119	212,694.83	96,951.12	14,897,056.27	115,743.71	10,413,628.05	19,274,479.93
120	212,694.83	96,372.40	14,993,428.67	116,322.43	10,529,950.47	19,158,157.50
121	212,694.83	95,790.79	15,089,219.46	116,904.04	10,646,854.51	19,041,253.46
122	212,694.83	95,206.27	15,184,425.73	117,488.56	10,764,343.07	18,923,764.90
123	212,694.83	94,618.82	15,279,044.55	118,076.00	10,882,419.07	18,805,688.90
124	212,694.83	94,028.44	15,373,073.00	118,666.38	11,001,085.46	18,687,022.52
125	212,694.83	93,435.11	15,466,508.11	119,259.71	11,120,345.17	18,567,762.81
126	212,694.83	92,838.81	15,559,346.92	119,856.01	11,240,201.18	18,447,906.80
127	212,694.83	92,239.53	15,651,586.46	120,455.29	11,360,656.47	18,327,451.50
128	212,694.83	91,637.26	15,743,223.71	121,057.57	11,481,714.04	18,206,393.93
129	212,694.83	91,031.97	15,834,255.68	121,662.86	11,603,376.90	18,084,731.08
130	212,694.83	90,423.66	15,924,679.34	122,271.17	11,725,648.07	17,962,459.91
131	212,694.83	89,812.30	16,014,491.64	122,882.53	11,848,530.60	17,839,577.38
132	212,694.83	89,197.89	16,103,689.53	123,496.94	11,972,027.54	17,716,080.44
133	212,694.83	88,580.40	16,192,269.93	124,114.42	12,096,141.96	17,591,966.02
134	212,694.83	87,959.83	16,280,229.76	124,735.00	12,220,876.96	17,467,231.02
135	212,694.83	87,336.16	16,367,565.91	125,358.67	12,346,235.63	17,341,872.35
136	212,694.83	86,709.36	16,454,275.27	125,985.46	12,472,221.09	17,215,886.89
137	212,694.83	86,079.43	16,540,354.71	126,615.39	12,598,836.48	17,089,271.49
138	212,694.83	85,446.36	16,625,801.07	127,248.47	12,726,084.95	16,962,023.03
139	212,694.83	84,810.12	16,710,611.18	127,884.71	12,853,969.66	16,834,138.31
140	212,694.83	84,170.69	16,794,781.87	128,524.13	12,982,493.80	16,705,614.18
141	212,694.83	83,528.07	16,878,309.94	129,166.76	13,111,660.55	16,576,447.42
142	212,694.83	82,882.24	16,961,192.18	129,812.59	13,241,473.14	16,446,634.83
143	212,694.83	82,233.17	17,043,425.36	130,461.65	13,371,934.79	16,316,173.18
144	212,694.83	81,580.87	17,125,006.22	131,113.96	13,503,048.75	16,185,059.22
145	212,694.83	80,925.30	17,205,931.52	131,769.53	13,634,818.28	16,053,289.69
146	212,694.83	80,266.45	17,286,197.97	132,428.38	13,767,246.66	15,920,861.31
147	212,694.83	79,604.31	17,365,802.27	133,090.52	13,900,337.18	15,787,770.80
148	212,694.83	78,938.85	17,444,741.13	133,755.97	14,034,093.15	15,654,014.82
149	212,694.83	78,270.07	17,523,011.20	134,424.75	14,168,517.91	15,519,590.07
150	212,694.83	77,597.95	17,600,609.15	135,096.88	14,303,614.78	15,384,493.19
151	212,694.83	76,922.47	17,677,531.62	135,772.36	14,439,387.14	15,248,720.83
152	212,694.83	76,243.60	17,753,775.22	136,451.22	14,575,838.36	15,112,269.61
153	212,694.83	75,561.35	17,829,336.57	137,133.48	14,712,971.84	14,975,136.13
154	212,694.83	74,875.68	17,904,212.25	137,819.15	14,850,790.99	14,837,316.99
155	212,694.83	74,186.58	17,978,398.83	138,508.24	14,989,299.23	14,698,808.75
156	212,694.83	73,494.04	18,051,892.88	139,200.78	15,128,500.01	14,559,607.97
157	212,694.83	72,798.04	18,124,690.92	139,896.79	15,268,396.80	14,419,711.18
158	212,694.83	72,098.56	18,196,789.47	140,596.27	15,408,993.07	14,279,114.91
159	212,694.83	71,395.57	18,268,185.05	141,299.25	15,550,292.32	14,137,815.66
160	212,694.83	70,689.08	18,338,874.13	142,005.75	15,692,298.07	13,995,809.91
161	212,694.83	69,979.05	18,408,853.18	142,715.78	15,835,013.84	13,853,094.13
162	212,694.83	69,265.47	18,478,118.65	143,429.36	15,978,443.20	13,709,664.78
163	212,694.83	68,548.32	18,546,666.97	144,146.50	16,122,589.70	13,565,518.27

164	212,694.83	67,827.59	18,614,494.56	144,867.23	16,267,456.94	13,420,651.04
165	212,694.83	67,103.26	18,681,597.82	145,591.57	16,413,048.51	13,275,059.47
166	212,694.83	66,375.30	18,747,973.12	146,319.53	16,559,368.04	13,128,739.94
167	212,694.83	65,643.70	18,813,616.81	147,051.13	16,706,419.16	12,981,688.81
168	212,694.83	64,908.44	18,878,525.26	147,786.38	16,854,205.55	12,833,902.43
169	212,694.83	64,169.51	18,942,694.77	148,525.31	17,002,730.86	12,685,377.12
170	212,694.83	63,426.89	19,006,121.66	149,267.94	17,151,998.80	12,536,109.18
171	212,694.83	62,680.55	19,068,802.20	150,014.28	17,302,013.08	12,386,094.90
172	212,694.83	61,930.47	19,130,732.68	150,764.35	17,452,777.43	12,235,330.54
173	212,694.83	61,176.65	19,191,909.33	151,518.17	17,604,295.61	12,083,812.37
174	212,694.83	60,419.06	19,252,328.39	152,275.76	17,756,571.37	11,931,536.61
175	212,694.83	59,657.68	19,311,986.07	153,037.14	17,909,608.51	11,778,499.46
176	212,694.83	58,892.50	19,370,878.57	153,802.33	18,063,410.84	11,624,697.13
177	212,694.83	58,123.49	19,429,002.06	154,571.34	18,217,982.18	11,470,125.79
178	212,694.83	57,350.63	19,486,352.69	155,344.20	18,373,326.38	11,314,781.60
179	212,694.83	56,573.91	19,542,926.59	156,120.92	18,529,447.30	11,158,660.68
180	212,694.83	55,793.30	19,598,719.90	156,901.52	18,686,348.82	11,001,759.16
181	212,694.83	55,008.80	19,653,728.69	157,686.03	18,844,034.85	10,844,073.12
182	212,694.83	54,220.37	19,707,949.06	158,474.46	19,002,509.31	10,685,598.66
183	212,694.83	53,427.99	19,761,377.05	159,266.83	19,161,776.15	10,526,331.83
184	212,694.83	52,631.66	19,814,008.71	160,063.17	19,321,839.31	10,366,268.66
185	212,694.83	51,831.34	19,865,840.06	160,863.48	19,482,702.80	10,205,405.18
186	212,694.83	51,027.03	19,916,867.08	161,667.80	19,644,370.60	10,043,737.38
187	212,694.83	50,218.69	19,967,085.77	162,476.14	19,806,846.74	9,881,261.24
188	212,694.83	49,406.31	20,016,492.07	163,288.52	19,970,135.26	9,717,972.72
189	212,694.83	48,589.86	20,065,081.94	164,104.96	20,134,240.22	9,553,867.76
190	212,694.83	47,769.34	20,112,851.28	164,925.49	20,299,165.71	9,388,942.27
191	212,694.83	46,944.71	20,159,795.99	165,750.11	20,464,915.82	9,223,192.16
192	212,694.83	46,115.96	20,205,911.95	166,578.87	20,631,494.69	9,056,613.29
193	212,694.83	45,283.07	20,251,195.02	167,411.76	20,798,906.45	8,889,201.53
194	212,694.83	44,446.01	20,295,641.02	168,248.82	20,967,155.26	8,720,952.71
195	212,694.83	43,604.76	20,339,245.79	169,090.06	21,136,245.33	8,551,862.65
196	212,694.83	42,759.31	20,382,005.10	169,935.51	21,306,180.84	8,381,927.14
197	212,694.83	41,909.64	20,423,914.74	170,785.19	21,476,966.03	8,211,141.95
198	212,694.83	41,055.71	20,464,970.45	171,639.12	21,648,605.15	8,039,502.83
199	212,694.83	40,197.51	20,505,167.96	172,497.31	21,821,102.46	7,867,005.52
200	212,694.83	39,335.03	20,544,502.99	173,359.80	21,994,462.26	7,693,645.72
201	212,694.83	38,468.23	20,582,971.22	174,226.60	22,168,688.85	7,519,419.12
202	212,694.83	37,597.10	20,620,568.31	175,097.73	22,343,786.59	7,344,321.39
203	212,694.83	36,721.61	20,657,289.92	175,973.22	22,519,759.80	7,168,348.17
204	212,694.83	35,841.74	20,693,131.66	176,853.09	22,696,612.89	6,991,495.09
205	212,694.83	34,957.48	20,728,089.13	177,737.35	22,874,350.24	6,813,757.74
206	212,694.83	34,068.79	20,762,157.92	178,626.04	23,052,976.28	6,635,131.70
207	212,694.83	33,175.66	20,795,333.58	179,519.17	23,232,495.45	6,455,612.53
208	212,694.83	32,278.06	20,827,611.64	180,416.76	23,412,912.21	6,275,195.77
209	212,694.83	31,375.98	20,858,987.62	181,318.85	23,594,231.06	6,093,876.92
210	212,694.83	30,469.38	20,889,457.01	182,225.44	23,776,456.50	5,911,651.48
211	212,694.83	29,558.26	20,919,015.26	183,136.57	23,959,593.07	5,728,514.91
212	212,694.83	28,642.57	20,947,657.84	184,052.25	24,143,645.32	5,544,462.66
213	212,694.83	27,722.31	20,975,380.15	184,972.51	24,328,617.83	5,359,490.14
214	212,694.83	26,797.45	21,002,177.60	185,897.38	24,514,515.21	5,173,592.77
215	212,694.83	25,867.96	21,028,045.57	186,826.86	24,701,342.07	4,986,765.91
216	212,694.83	24,933.83	21,052,979.40	187,761.00	24,889,103.07	4,799,004.91
217	212,694.83	23,995.02	21,076,974.42	188,699.80	25,077,802.87	4,610,305.11
218	212,694.83	23,051.53	21,100,025.95	189,643.30	25,267,446.17	4,420,661.81
219	212,694.83	22,103.31	21,122,129.26	190,591.52	25,458,037.69	4,230,070.29
220	212,694.83	21,150.35	21,143,279.61	191,544.47	25,649,582.16	4,038,525.82
221	212,694.83	20,192.63	21,163,472.24	192,502.20	25,842,084.36	3,846,023.62

222	212,694.83	19,230.12	21,182,702.35	193,464.71	26,035,549.07	3,652,558.91
223	212,694.83	18,262.79	21,200,965.15	194,432.03	26,229,981.10	3,458,126.88
224	212,694.83	17,290.63	21,218,255.78	195,404.19	26,425,385.29	3,262,722.69
225	212,694.83	16,313.61	21,234,569.40	196,381.21	26,621,766.50	3,066,341.47
226	212,694.83	15,331.71	21,249,901.10	197,363.12	26,819,129.62	2,868,978.36
227	212,694.83	14,344.89	21,264,246.00	198,349.93	27,017,479.56	2,670,628.42
228	212,694.83	13,353.14	21,277,599.14	199,341.68	27,216,821.24	2,471,286.74
229	212,694.83	12,356.43	21,289,955.57	200,338.39	27,417,159.63	2,270,948.34
230	212,694.83	11,354.74	21,301,310.31	201,340.08	27,618,499.72	2,069,608.26
231	212,694.83	10,348.04	21,311,658.35	202,346.78	27,820,846.50	1,867,261.47
232	212,694.83	9,336.31	21,320,994.66	203,358.52	28,024,205.02	1,663,902.96
233	212,694.83	8,319.51	21,329,314.18	204,375.31	28,228,580.33	1,459,527.64
234	212,694.83	7,297.64	21,336,611.82	205,397.19	28,433,977.52	1,254,130.46
235	212,694.83	6,270.65	21,342,882.47	206,424.17	28,640,401.69	1,047,706.28
236	212,694.83	5,238.53	21,348,121.00	207,456.29	28,847,857.99	840,249.99
237	212,694.83	4,201.25	21,352,322.25	208,493.58	29,056,351.57	631,756.41
238	212,694.83	3,158.78	21,355,481.03	209,536.04	29,265,887.61	422,220.37
239	212,694.83	2,111.10	21,357,592.13	210,583.72	29,476,471.33	211,636.64
240	212,694.83	1,058.18	21,358,650.32	211,636.64	29,688,107.98	0.00

Table D-2 Site 2: Cost Amortization

	Loan Amount (pv)	$8,760,719				
	Interest Rate (rate)	**0.50%**				
	Total # of Periods (Nper)	**240**				
	Payment per Period	$62,764.51				
	Total Interest Paid	**$ 6,302,764.15**				
Period	**Payment Amount**	**Interest**	**Cumulative Interest**	**Principal**	**Principal Paid**	**Balance**
						$ 8,760,719.42
1	62,764.51	43,803.60	43,803.60	18,960.92	18,960.92	8,741,758.50
2	62,764.51	43,708.79	87,512.39	19,055.72	38,016.64	8,722,702.78
3	62,764.51	43,613.51	131,125.90	19,151.00	57,167.64	8,703,551.78
4	62,764.51	43,517.76	174,643.66	19,246.76	76,414.40	8,684,305.02
5	62,764.51	43,421.53	218,065.19	19,342.99	95,757.39	8,664,962.03
6	62,764.51	43,324.81	261,390.00	19,439.70	115,197.09	8,645,522.33
7	62,764.51	43,227.61	304,617.61	19,536.90	134,733.99	8,625,985.43
8	62,764.51	43,129.93	347,747.54	19,634.59	154,368.58	8,606,350.84
9	62,764.51	43,031.75	390,779.29	19,732.76	174,101.34	8,586,618.08
10	62,764.51	42,933.09	433,712.38	19,831.42	193,932.77	8,566,786.65
11	62,764.51	42,833.93	476,546.31	19,930.58	213,863.35	8,546,856.07
12	62,764.51	42,734.28	519,280.59	20,030.23	233,893.58	8,526,825.84
13	62,764.51	42,634.13	561,914.72	20,130.39	254,023.97	8,506,695.45
14	62,764.51	42,533.48	604,448.20	20,231.04	274,255.01	8,486,464.41
15	62,764.51	42,432.32	646,880.52	20,332.19	294,587.20	8,466,132.22
16	62,764.51	42,330.66	689,211.18	20,433.85	315,021.05	8,445,698.37
17	62,764.51	42,228.49	731,439.68	20,536.02	335,557.08	8,425,162.34
18	62,764.51	42,125.81	773,565.49	20,638.70	356,195.78	8,404,523.64
19	62,764.51	42,022.62	815,588.11	20,741.90	376,937.68	8,383,781.74
20	62,764.51	41,918.91	857,507.01	20,845.61	397,783.28	8,362,936.14
21	62,764.51	41,814.68	899,321.70	20,949.83	418,733.12	8,341,986.30
22	62,764.51	41,709.93	941,031.63	21,054.58	439,787.70	8,320,931.72
23	62,764.51	41,604.66	982,636.29	21,159.86	460,947.56	8,299,771.86
24	62,764.51	41,498.86	1,024,135.14	21,265.66	482,213.21	8,278,506.21
25	62,764.51	41,392.53	1,065,527.68	21,371.98	503,585.20	8,257,134.22
26	62,764.51	41,285.67	1,106,813.35	21,478.84	525,064.04	8,235,655.38
27	62,764.51	41,178.28	1,147,991.62	21,586.24	546,650.28	8,214,069.14
28	62,764.51	41,070.35	1,189,061.97	21,694.17	568,344.45	8,192,374.97
29	62,764.51	40,961.87	1,230,023.84	21,802.64	590,147.09	8,170,572.33
30	62,764.51	40,852.86	1,270,876.71	21,911.65	612,058.74	8,148,660.68
31	62,764.51	40,743.30	1,311,620.01	22,021.21	634,079.95	8,126,639.47
32	62,764.51	40,633.20	1,352,253.21	22,131.32	656,211.27	8,104,508.15
33	62,764.51	40,522.54	1,392,775.75	22,241.97	678,453.24	8,082,266.18
34	62,764.51	40,411.33	1,433,187.08	22,353.18	700,806.43	8,059,912.99
35	62,764.51	40,299.56	1,473,486.64	22,464.95	723,271.38	8,037,448.04
36	62,764.51	40,187.24	1,513,673.88	22,577.27	745,848.65	8,014,870.77
37	62,764.51	40,074.35	1,553,748.24	22,690.16	768,538.81	7,992,180.61
38	62,764.51	39,960.90	1,593,709.14	22,803.61	791,342.42	7,969,377.00
39	62,764.51	39,846.88	1,633,556.03	22,917.63	814,260.05	7,946,459.37
40	62,764.51	39,732.30	1,673,288.32	23,032.22	837,292.27	7,923,427.15
41	62,764.51	39,617.14	1,712,905.46	23,147.38	860,439.65	7,900,279.77
42	62,764.51	39,501.40	1,752,406.86	23,263.12	883,702.77	7,877,016.65
43	62,764.51	39,385.08	1,791,791.94	23,379.43	907,082.20	7,853,637.22
44	62,764.51	39,268.19	1,831,060.13	23,496.33	930,578.53	7,830,140.89
45	62,764.51	39,150.70	1,870,210.83	23,613.81	954,192.34	7,806,527.08
46	62,764.51	39,032.64	1,909,243.47	23,731.88	977,924.22	7,782,795.20
47	62,764.51	38,913.98	1,948,157.44	23,850.54	1,001,774.76	7,758,944.66

48	62,764.51	38,794.72	1,986,952.17	23,969.79	1,025,744.55	7,734,974.87
49	62,764.51	38,674.87	2,025,627.04	24,089.64	1,049,834.19	7,710,885.23
50	62,764.51	38,554.43	2,064,181.47	24,210.09	1,074,044.28	7,686,675.14
51	62,764.51	38,433.38	2,102,614.84	24,331.14	1,098,375.42	7,662,344.00
52	62,764.51	38,311.72	2,140,926.56	24,452.79	1,122,828.21	7,637,891.21
53	62,764.51	38,189.46	2,179,116.02	24,575.06	1,147,403.27	7,613,316.15
54	62,764.51	38,066.58	2,217,182.60	24,697.93	1,172,101.20	7,588,618.22
55	62,764.51	37,943.09	2,255,125.69	24,821.42	1,196,922.63	7,563,796.79
56	62,764.51	37,818.98	2,292,944.67	24,945.53	1,221,868.16	7,538,851.26
57	62,764.51	37,694.26	2,330,638.93	25,070.26	1,246,938.42	7,513,781.00
58	62,764.51	37,568.91	2,368,207.83	25,195.61	1,272,134.03	7,488,585.39
59	62,764.51	37,442.93	2,405,650.76	25,321.59	1,297,455.62	7,463,263.80
60	62,764.51	37,316.32	2,442,967.08	25,448.20	1,322,903.81	7,437,815.61
61	62,764.51	37,189.08	2,480,156.16	25,575.44	1,348,479.25	7,412,240.17
62	62,764.51	37,061.20	2,517,217.36	25,703.31	1,374,182.56	7,386,536.86
63	62,764.51	36,932.68	2,554,150.04	25,831.83	1,400,014.39	7,360,705.03
64	62,764.51	36,803.53	2,590,953.57	25,960.99	1,425,975.38	7,334,744.04
65	62,764.51	36,673.72	2,627,627.29	26,090.79	1,452,066.18	7,308,653.24
66	62,764.51	36,543.27	2,664,170.56	26,221.25	1,478,287.43	7,282,431.99
67	62,764.51	36,412.16	2,700,582.72	26,352.35	1,504,639.78	7,256,079.64
68	62,764.51	36,280.40	2,736,863.11	26,484.12	1,531,123.90	7,229,595.52
69	62,764.51	36,147.98	2,773,011.09	26,616.54	1,557,740.43	7,202,978.99
70	62,764.51	36,014.89	2,809,025.99	26,749.62	1,584,490.05	7,176,229.37
71	62,764.51	35,881.15	2,844,907.13	26,883.37	1,611,373.42	7,149,346.00
72	62,764.51	35,746.73	2,880,653.86	27,017.78	1,638,391.21	7,122,328.21
73	62,764.51	35,611.64	2,916,265.50	27,152.87	1,665,544.08	7,095,175.34
74	62,764.51	35,475.88	2,951,741.38	27,288.64	1,692,832.72	7,067,886.70
75	62,764.51	35,339.43	2,987,080.81	27,425.08	1,720,257.80	7,040,461.62
76	62,764.51	35,202.31	3,022,283.12	27,562.21	1,747,820.01	7,012,899.41
77	62,764.51	35,064.50	3,057,347.62	27,700.02	1,775,520.03	6,985,199.39
78	62,764.51	34,926.00	3,092,273.62	27,838.52	1,803,358.54	6,957,360.88
79	62,764.51	34,786.80	3,127,060.42	27,977.71	1,831,336.25	6,929,383.17
80	62,764.51	34,646.92	3,161,707.34	28,117.60	1,859,453.85	6,901,265.57
81	62,764.51	34,506.33	3,196,213.66	28,258.19	1,887,712.04	6,873,007.38
82	62,764.51	34,365.04	3,230,578.70	28,399.48	1,916,111.52	6,844,607.90
83	62,764.51	34,223.04	3,264,801.74	28,541.48	1,944,652.99	6,816,066.43
84	62,764.51	34,080.33	3,298,882.07	28,684.18	1,973,337.18	6,787,382.24
85	62,764.51	33,936.91	3,332,818.98	28,827.60	2,002,164.78	6,758,554.64
86	62,764.51	33,792.77	3,366,611.76	28,971.74	2,031,136.52	6,729,582.90
87	62,764.51	33,647.91	3,400,259.67	29,116.60	2,060,253.12	6,700,466.30
88	62,764.51	33,502.33	3,433,762.00	29,262.18	2,089,515.31	6,671,204.11
89	62,764.51	33,356.02	3,467,118.02	29,408.49	2,118,923.80	6,641,795.62
90	62,764.51	33,208.98	3,500,327.00	29,555.54	2,148,479.34	6,612,240.08
91	62,764.51	33,061.20	3,533,388.20	29,703.31	2,178,182.65	6,582,536.77
92	62,764.51	32,912.68	3,566,300.89	29,851.83	2,208,034.48	6,552,684.94
93	62,764.51	32,763.42	3,599,064.31	30,001.09	2,238,035.57	6,522,683.85
94	62,764.51	32,613.42	3,631,677.73	30,151.10	2,268,186.67	6,492,532.75
95	62,764.51	32,462.66	3,664,140.39	30,301.85	2,298,488.52	6,462,230.90
96	62,764.51	32,311.15	3,696,451.55	30,453.36	2,328,941.88	6,431,777.54
97	62,764.51	32,158.89	3,728,610.44	30,605.63	2,359,547.51	6,401,171.91
98	62,764.51	32,005.86	3,760,616.30	30,758.66	2,390,306.16	6,370,413.26
99	62,764.51	31,852.07	3,792,468.36	30,912.45	2,421,218.61	6,339,500.81
100	62,764.51	31,697.50	3,824,165.87	31,067.01	2,452,285.62	6,308,433.80
101	62,764.51	31,542.17	3,855,708.04	31,222.35	2,483,507.97	6,277,211.45
102	62,764.51	31,386.06	3,887,094.09	31,378.46	2,514,886.42	6,245,833.00
103	62,764.51	31,229.16	3,918,323.26	31,535.35	2,546,421.77	6,214,297.65
104	62,764.51	31,071.49	3,949,394.75	31,693.03	2,578,114.80	6,182,604.62
105	62,764.51	30,913.02	3,980,307.77	31,851.49	2,609,966.29	6,150,753.13

106	62,764.51	30,753.77	4,011,061.53	32,010.75	2,641,977.04	6,118,742.38
107	62,764.51	30,593.71	4,041,655.25	32,170.80	2,674,147.84	6,086,571.58
108	62,764.51	30,432.86	4,072,088.10	32,331.66	2,706,479.50	6,054,239.92
109	62,764.51	30,271.20	4,102,359.30	32,493.32	2,738,972.82	6,021,746.60
110	62,764.51	30,108.73	4,132,468.04	32,655.78	2,771,628.60	5,989,090.82
111	62,764.51	29,945.45	4,162,413.49	32,819.06	2,804,447.66	5,956,271.76
112	62,764.51	29,781.36	4,192,194.85	32,983.16	2,837,430.82	5,923,288.60
113	62,764.51	29,616.44	4,221,811.29	33,148.07	2,870,578.89	5,890,140.53
114	62,764.51	29,450.70	4,251,262.00	33,313.81	2,903,892.70	5,856,826.72
115	62,764.51	29,284.13	4,280,546.13	33,480.38	2,937,373.08	5,823,346.34
116	62,764.51	29,116.73	4,309,662.86	33,647.78	2,971,020.86	5,789,698.56
117	62,764.51	28,948.49	4,338,611.35	33,816.02	3,004,836.89	5,755,882.53
118	62,764.51	28,779.41	4,367,390.77	33,985.10	3,038,821.99	5,721,897.43
119	62,764.51	28,609.49	4,396,000.25	34,155.03	3,072,977.02	5,687,742.40
120	62,764.51	28,438.71	4,424,438.97	34,325.80	3,107,302.82	5,653,416.60
121	62,764.51	28,267.08	4,452,706.05	34,497.43	3,141,800.25	5,618,919.17
122	62,764.51	28,094.60	4,480,800.64	34,669.92	3,176,470.17	5,584,249.25
123	62,764.51	27,921.25	4,508,721.89	34,843.27	3,211,313.44	5,549,405.98
124	62,764.51	27,747.03	4,536,468.92	35,017.48	3,246,330.92	5,514,388.50
125	62,764.51	27,571.94	4,564,040.86	35,192.57	3,281,523.50	5,479,195.92
126	62,764.51	27,395.98	4,591,436.84	35,368.54	3,316,892.03	5,443,827.39
127	62,764.51	27,219.14	4,618,655.98	35,545.38	3,352,437.41	5,408,282.01
128	62,764.51	27,041.41	4,645,697.39	35,723.10	3,388,160.51	5,372,558.91
129	62,764.51	26,862.79	4,672,560.18	35,901.72	3,424,062.23	5,336,657.19
130	62,764.51	26,683.29	4,699,243.47	36,081.23	3,460,143.46	5,300,575.96
131	62,764.51	26,502.88	4,725,746.35	36,261.64	3,496,405.10	5,264,314.32
132	62,764.51	26,321.57	4,752,067.92	36,442.94	3,532,848.04	5,227,871.38
133	62,764.51	26,139.36	4,778,207.28	36,625.16	3,569,473.20	5,191,246.22
134	62,764.51	25,956.23	4,804,163.51	36,808.28	3,606,281.48	5,154,437.94
135	62,764.51	25,772.19	4,829,935.70	36,992.33	3,643,273.81	5,117,445.61
136	62,764.51	25,587.23	4,855,522.93	37,177.29	3,680,451.10	5,080,268.32
137	62,764.51	25,401.34	4,880,924.27	37,363.17	3,717,814.27	5,042,905.15
138	62,764.51	25,214.53	4,906,138.79	37,549.99	3,755,364.26	5,005,355.16
139	62,764.51	25,026.78	4,931,165.57	37,737.74	3,793,102.00	4,967,617.42
140	62,764.51	24,838.09	4,956,003.66	37,926.43	3,831,028.42	4,929,691.00
141	62,764.51	24,648.45	4,980,652.11	38,116.06	3,869,144.48	4,891,574.94
142	62,764.51	24,457.87	5,005,109.99	38,306.64	3,907,451.12	4,853,268.30
143	62,764.51	24,266.34	5,029,376.33	38,498.17	3,945,949.30	4,814,770.12
144	62,764.51	24,073.85	5,053,450.18	38,690.66	3,984,639.96	4,776,079.46
145	62,764.51	23,880.40	5,077,330.58	38,884.12	4,023,524.08	4,737,195.34
146	62,764.51	23,685.98	5,101,016.55	39,078.54	4,062,602.62	4,698,116.80
147	62,764.51	23,490.58	5,124,507.14	39,273.93	4,101,876.55	4,658,842.87
148	62,764.51	23,294.21	5,147,801.35	39,470.30	4,141,346.85	4,619,372.57
149	62,764.51	23,096.86	5,170,898.21	39,667.65	4,181,014.50	4,579,704.92
150	62,764.51	22,898.52	5,193,796.74	39,865.99	4,220,880.49	4,539,838.93
151	62,764.51	22,699.19	5,216,495.93	40,065.32	4,260,945.81	4,499,773.61
152	62,764.51	22,498.87	5,238,994.80	40,265.65	4,301,211.46	4,459,507.96
153	62,764.51	22,297.54	5,261,292.34	40,466.98	4,341,678.43	4,419,040.99
154	62,764.51	22,095.20	5,283,387.55	40,669.31	4,382,347.74	4,378,371.68
155	62,764.51	21,891.86	5,305,279.40	40,872.66	4,423,220.40	4,337,499.02
156	62,764.51	21,687.50	5,326,966.90	41,077.02	4,464,297.42	4,296,422.00
157	62,764.51	21,482.11	5,348,449.01	41,282.40	4,505,579.82	4,255,139.60
158	62,764.51	21,275.70	5,369,724.71	41,488.82	4,547,068.64	4,213,650.78
159	62,764.51	21,068.25	5,390,792.96	41,696.26	4,588,764.90	4,171,954.52
160	62,764.51	20,859.77	5,411,652.73	41,904.74	4,630,669.65	4,130,049.77
161	62,764.51	20,650.25	5,432,302.98	42,114.27	4,672,783.91	4,087,935.51
162	62,764.51	20,439.68	5,452,742.66	42,324.84	4,715,108.75	4,045,610.67
163	62,764.51	20,228.05	5,472,970.71	42,536.46	4,757,645.21	4,003,074.21

164	62,764.51	20,015.37	5,492,986.09	42,749.14	4,800,394.35	3,960,325.07
165	62,764.51	19,801.63	5,512,787.71	42,962.89	4,843,357.24	3,917,362.18
166	62,764.51	19,586.81	5,532,374.52	43,177.70	4,886,534.95	3,874,184.47
167	62,764.51	19,370.92	5,551,745.44	43,393.59	4,929,928.54	3,830,790.88
168	62,764.51	19,153.95	5,570,899.40	43,610.56	4,973,539.10	3,787,180.32
169	62,764.51	18,935.90	5,589,835.30	43,828.61	5,017,367.71	3,743,351.71
170	62,764.51	18,716.76	5,608,552.06	44,047.76	5,061,415.47	3,699,303.95
171	62,764.51	18,496.52	5,627,048.58	44,268.00	5,105,683.47	3,655,035.95
172	62,764.51	18,275.18	5,645,323.76	44,489.34	5,150,172.80	3,610,546.62
173	62,764.51	18,052.73	5,663,376.49	44,711.78	5,194,884.58	3,565,834.84
174	62,764.51	17,829.17	5,681,205.66	44,935.34	5,239,819.92	3,520,899.50
175	62,764.51	17,604.50	5,698,810.16	45,160.02	5,284,979.94	3,475,739.48
176	62,764.51	17,378.70	5,716,188.86	45,385.82	5,330,365.76	3,430,353.66
177	62,764.51	17,151.77	5,733,340.63	45,612.75	5,375,978.50	3,384,740.92
178	62,764.51	16,923.70	5,750,264.33	45,840.81	5,421,819.31	3,338,900.11
179	62,764.51	16,694.50	5,766,958.83	46,070.01	5,467,889.33	3,292,830.09
180	62,764.51	16,464.15	5,783,422.98	46,300.36	5,514,189.69	3,246,529.73
181	62,764.51	16,232.65	5,799,655.63	46,531.87	5,560,721.56	3,199,997.86
182	62,764.51	15,999.99	5,815,655.62	46,764.53	5,607,486.08	3,153,233.34
183	62,764.51	15,766.17	5,831,421.79	46,998.35	5,654,484.43	3,106,234.99
184	62,764.51	15,531.17	5,846,952.96	47,233.34	5,701,717.77	3,059,001.65
185	62,764.51	15,295.01	5,862,247.97	47,469.51	5,749,187.28	3,011,532.14
186	62,764.51	15,057.66	5,877,305.63	47,706.85	5,796,894.13	2,963,825.29
187	62,764.51	14,819.13	5,892,124.76	47,945.39	5,844,839.52	2,915,879.90
188	62,764.51	14,579.40	5,906,704.16	48,185.12	5,893,024.64	2,867,694.78
189	62,764.51	14,338.47	5,921,042.63	48,426.04	5,941,450.68	2,819,268.74
190	62,764.51	14,096.34	5,935,138.98	48,668.17	5,990,118.85	2,770,600.57
191	62,764.51	13,853.00	5,948,991.98	48,911.51	6,039,030.36	2,721,689.06
192	62,764.51	13,608.45	5,962,600.42	49,156.07	6,088,186.43	2,672,532.99
193	62,764.51	13,362.66	5,975,963.09	49,401.85	6,137,588.28	2,623,131.14
194	62,764.51	13,115.66	5,989,078.74	49,648.86	6,187,237.14	2,573,482.28
195	62,764.51	12,867.41	6,001,946.16	49,897.10	6,237,134.24	2,523,585.18
196	62,764.51	12,617.93	6,014,564.08	50,146.59	6,287,280.83	2,473,438.59
197	62,764.51	12,367.19	6,026,931.27	50,397.32	6,337,678.15	2,423,041.27
198	62,764.51	12,115.21	6,039,046.48	50,649.31	6,388,327.46	2,372,391.96
199	62,764.51	11,861.96	6,050,908.44	50,902.56	6,439,230.02	2,321,489.40
200	62,764.51	11,607.45	6,062,515.89	51,157.07	6,490,387.09	2,270,332.33
201	62,764.51	11,351.66	6,073,867.55	51,412.85	6,541,799.94	2,218,919.48
202	62,764.51	11,094.60	6,084,962.15	51,669.92	6,593,469.86	2,167,249.56
203	62,764.51	10,836.25	6,095,798.39	51,928.27	6,645,398.12	2,115,321.30
204	62,764.51	10,576.61	6,106,375.00	52,187.91	6,697,586.03	2,063,133.39
205	62,764.51	10,315.67	6,116,690.67	52,448.85	6,750,034.88	2,010,684.54
206	62,764.51	10,053.42	6,126,744.09	52,711.09	6,802,745.97	1,957,973.45
207	62,764.51	9,789.87	6,136,533.96	52,974.65	6,855,720.62	1,904,998.80
208	62,764.51	9,524.99	6,146,058.95	53,239.52	6,908,960.14	1,851,759.28
209	62,764.51	9,258.80	6,155,317.75	53,505.72	6,962,465.86	1,798,253.56
210	62,764.51	8,991.27	6,164,309.02	53,773.25	7,016,239.11	1,744,480.31
211	62,764.51	8,722.40	6,173,031.42	54,042.11	7,070,281.22	1,690,438.20
212	62,764.51	8,452.19	6,181,483.61	54,312.32	7,124,593.54	1,636,125.88
213	62,764.51	8,180.63	6,189,664.24	54,583.89	7,179,177.43	1,581,541.99
214	62,764.51	7,907.71	6,197,571.95	54,856.80	7,234,034.23	1,526,685.19
215	62,764.51	7,633.43	6,205,205.37	55,131.09	7,289,165.32	1,471,554.10
216	62,764.51	7,357.77	6,212,563.14	55,406.74	7,344,572.07	1,416,147.35
217	62,764.51	7,080.74	6,219,643.88	55,683.78	7,400,255.85	1,360,463.57
218	62,764.51	6,802.32	6,226,446.20	55,962.20	7,456,218.04	1,304,501.38
219	62,764.51	6,522.51	6,232,968.71	56,242.01	7,512,460.05	1,248,259.37
220	62,764.51	6,241.30	6,239,210.00	56,523.22	7,568,983.27	1,191,736.15
221	62,764.51	5,958.68	6,245,168.68	56,805.83	7,625,789.10	1,134,930.32

222	62,764.51	5,674.65	6,250,843.34	57,089.86	7,682,878.97	1,077,840.45
223	62,764.51	5,389.20	6,256,232.54	57,375.31	7,740,254.28	1,020,465.14
224	62,764.51	5,102.33	6,261,334.86	57,662.19	7,797,916.47	962,802.95
225	62,764.51	4,814.01	6,266,148.88	57,950.50	7,855,866.97	904,852.45
226	62,764.51	4,524.26	6,270,673.14	58,240.25	7,914,107.22	846,612.20
227	62,764.51	4,233.06	6,274,906.20	58,531.45	7,972,638.67	788,080.75
228	62,764.51	3,940.40	6,278,846.61	58,824.11	8,031,462.79	729,256.63
229	62,764.51	3,646.28	6,282,492.89	59,118.23	8,090,581.02	670,138.40
230	62,764.51	3,350.69	6,285,843.58	59,413.82	8,149,994.84	610,724.58
231	62,764.51	3,053.62	6,288,897.20	59,710.89	8,209,705.73	551,013.69
232	62,764.51	2,755.07	6,291,652.27	60,009.45	8,269,715.18	491,004.24
233	62,764.51	2,455.02	6,294,107.29	60,309.49	8,330,024.67	430,694.75
234	62,764.51	2,153.47	6,296,260.77	60,611.04	8,390,635.71	370,083.71
235	62,764.51	1,850.42	6,298,111.19	60,914.10	8,451,549.81	309,169.61
236	62,764.51	1,545.85	6,299,657.03	61,218.67	8,512,768.48	247,950.94
237	62,764.51	1,239.75	6,300,896.79	61,524.76	8,574,293.24	186,426.18
238	62,764.51	932.13	6,301,828.92	61,832.38	8,636,125.62	124,593.80
239	62,764.51	622.97	6,302,451.89	62,141.55	8,698,267.17	62,452.25
240	62,764.51	312.26	6,302,764.15	62,452.25	8,760,719.42	0.00

Table D-3 Site 3: Cost Amortization

	Loan Amount (pv)	$3,450,756				
	Interest Rate (rate)	**0.50%**				
	Total # of Periods (Nper)	**240**				
	Payment per Period	$24,722.29				
	Total Interest Paid	**$ 2,482,593.04**				
Period	**Payment Amount**	**Interest**	**Cumulative Interest**	**Principal**	**Principal Paid**	**Balance**
						$ 3,450,755.98
1	24,722.29	17,253.78	17,253.78	7,468.51	7,468.51	3,443,287.47
2	24,722.29	17,216.44	34,470.22	7,505.85	14,974.36	3,435,781.62
3	24,722.29	17,178.91	51,649.13	7,543.38	22,517.74	3,428,238.24
4	24,722.29	17,141.19	68,790.32	7,581.10	30,098.83	3,420,657.15
5	24,722.29	17,103.29	85,893.60	7,619.00	37,717.84	3,413,038.15
6	24,722.29	17,065.19	102,958.79	7,657.10	45,374.93	3,405,381.05
7	24,722.29	17,026.91	119,985.70	7,695.38	53,070.31	3,397,685.67
8	24,722.29	16,988.43	136,974.13	7,733.86	60,804.17	3,389,951.81
9	24,722.29	16,949.76	153,923.89	7,772.53	68,576.70	3,382,179.28
10	24,722.29	16,910.90	170,834.78	7,811.39	76,388.09	3,374,367.89
11	24,722.29	16,871.84	187,706.62	7,850.45	84,238.54	3,366,517.44
12	24,722.29	16,832.59	204,539.21	7,889.70	92,128.24	3,358,627.74
13	24,722.29	16,793.14	221,332.35	7,929.15	100,057.39	3,350,698.59
14	24,722.29	16,753.49	238,085.84	7,968.79	108,026.19	3,342,729.80
15	24,722.29	16,713.65	254,799.49	8,008.64	116,034.82	3,334,721.16
16	24,722.29	16,673.61	271,473.10	8,048.68	124,083.51	3,326,672.48
17	24,722.29	16,633.36	288,106.46	8,088.93	132,172.43	3,318,583.55
18	24,722.29	16,592.92	304,699.38	8,129.37	140,301.80	3,310,454.18
19	24,722.29	16,552.27	321,251.65	8,170.02	148,471.82	3,302,284.16
20	24,722.29	16,511.42	337,763.07	8,210.87	156,682.69	3,294,073.30
21	24,722.29	16,470.37	354,233.43	8,251.92	164,934.61	3,285,821.38
22	24,722.29	16,429.11	370,662.54	8,293.18	173,227.79	3,277,528.19
23	24,722.29	16,387.64	387,050.18	8,334.65	181,562.43	3,269,193.55
24	24,722.29	16,345.97	403,396.15	8,376.32	189,938.75	3,260,817.23
25	24,722.29	16,304.09	419,700.24	8,418.20	198,356.95	3,252,399.03
26	24,722.29	16,262.00	435,962.23	8,460.29	206,817.25	3,243,938.73
27	24,722.29	16,219.69	452,181.92	8,502.59	215,319.84	3,235,436.14
28	24,722.29	16,177.18	468,359.10	8,545.11	223,864.95	3,226,891.03
29	24,722.29	16,134.46	484,493.56	8,587.83	232,452.78	3,218,303.20
30	24,722.29	16,091.52	500,585.08	8,630.77	241,083.55	3,209,672.43
31	24,722.29	16,048.36	516,633.44	8,673.93	249,757.48	3,200,998.50
32	24,722.29	16,004.99	532,638.43	8,717.30	258,474.77	3,192,281.21
33	24,722.29	15,961.41	548,599.84	8,760.88	267,235.65	3,183,520.33
34	24,722.29	15,917.60	564,517.44	8,804.69	276,040.34	3,174,715.64
35	24,722.29	15,873.58	580,391.02	8,848.71	284,889.05	3,165,866.93
36	24,722.29	15,829.33	596,220.35	8,892.95	293,782.00	3,156,973.98
37	24,722.29	15,784.87	612,005.22	8,937.42	302,719.42	3,148,036.56
38	24,722.29	15,740.18	627,745.40	8,982.10	311,701.53	3,139,054.46
39	24,722.29	15,695.27	643,440.68	9,027.02	320,728.54	3,130,027.44
40	24,722.29	15,650.14	659,090.81	9,072.15	329,800.69	3,120,955.29
41	24,722.29	15,604.78	674,695.59	9,117.51	338,918.20	3,111,837.78
42	24,722.29	15,559.19	690,254.78	9,163.10	348,081.30	3,102,674.68
43	24,722.29	15,513.37	705,768.15	9,208.91	357,290.21	3,093,465.77
44	24,722.29	15,467.33	721,235.48	9,254.96	366,545.17	3,084,210.81
45	24,722.29	15,421.05	736,656.53	9,301.23	375,846.41	3,074,909.57
46	24,722.29	15,374.55	752,031.08	9,347.74	385,194.15	3,065,561.83
47	24,722.29	15,327.81	767,358.89	9,394.48	394,588.63	3,056,167.36

48	24,722.29	15,280.84	782,639.73	9,441.45	404,030.08	3,046,725.91
49	24,722.29	15,233.63	797,873.36	9,488.66	413,518.73	3,037,237.25
50	24,722.29	15,186.19	813,059.54	9,536.10	423,054.84	3,027,701.15
51	24,722.29	15,138.51	828,198.05	9,583.78	432,638.62	3,018,117.36
52	24,722.29	15,090.59	843,288.64	9,631.70	442,270.32	3,008,485.66
53	24,722.29	15,042.43	858,331.07	9,679.86	451,950.18	2,998,805.80
54	24,722.29	14,994.03	873,325.09	9,728.26	461,678.44	2,989,077.55
55	24,722.29	14,945.39	888,270.48	9,776.90	471,455.34	2,979,300.65
56	24,722.29	14,896.50	903,166.99	9,825.78	481,281.12	2,969,474.86
57	24,722.29	14,847.37	918,014.36	9,874.91	491,156.03	2,959,599.95
58	24,722.29	14,798.00	932,812.36	9,924.29	501,080.32	2,949,675.66
59	24,722.29	14,748.38	947,560.74	9,973.91	511,054.23	2,939,701.75
60	24,722.29	14,698.51	962,259.25	10,023.78	521,078.01	2,929,677.97
61	24,722.29	14,648.39	976,907.64	10,073.90	531,151.91	2,919,604.07
62	24,722.29	14,598.02	991,505.66	10,124.27	541,276.17	2,909,479.81
63	24,722.29	14,547.40	1,006,053.06	10,174.89	551,451.06	2,899,304.92
64	24,722.29	14,496.52	1,020,549.58	10,225.76	561,676.83	2,889,079.16
65	24,722.29	14,445.40	1,034,994.98	10,276.89	571,953.72	2,878,802.26
66	24,722.29	14,394.01	1,049,388.99	10,328.28	582,281.99	2,868,473.99
67	24,722.29	14,342.37	1,063,731.36	10,379.92	592,661.91	2,858,094.07
68	24,722.29	14,290.47	1,078,021.83	10,431.82	603,093.73	2,847,662.25
69	24,722.29	14,238.31	1,092,260.14	10,483.98	613,577.71	2,837,178.28
70	24,722.29	14,185.89	1,106,446.03	10,536.40	624,114.10	2,826,641.88
71	24,722.29	14,133.21	1,120,579.24	10,589.08	634,703.18	2,816,052.80
72	24,722.29	14,080.26	1,134,659.50	10,642.02	645,345.20	2,805,410.78
73	24,722.29	14,027.05	1,148,686.56	10,695.23	656,040.44	2,794,715.54
74	24,722.29	13,973.58	1,162,660.14	10,748.71	666,789.15	2,783,966.83
75	24,722.29	13,919.83	1,176,579.97	10,802.45	677,591.60	2,773,164.38
76	24,722.29	13,865.82	1,190,445.79	10,856.47	688,448.07	2,762,307.92
77	24,722.29	13,811.54	1,204,257.33	10,910.75	699,358.81	2,751,397.17
78	24,722.29	13,756.99	1,218,014.32	10,965.30	710,324.12	2,740,431.87
79	24,722.29	13,702.16	1,231,716.48	11,020.13	721,344.24	2,729,411.74
80	24,722.29	13,647.06	1,245,363.53	11,075.23	732,419.47	2,718,336.51
81	24,722.29	13,591.68	1,258,955.22	11,130.61	743,550.08	2,707,205.90
82	24,722.29	13,536.03	1,272,491.25	11,186.26	754,736.34	2,696,019.64
83	24,722.29	13,480.10	1,285,971.35	11,242.19	765,978.53	2,684,777.46
84	24,722.29	13,423.89	1,299,395.23	11,298.40	777,276.93	2,673,479.06
85	24,722.29	13,367.40	1,312,762.63	11,354.89	788,631.82	2,662,124.16
86	24,722.29	13,310.62	1,326,073.25	11,411.67	800,043.49	2,650,712.50
87	24,722.29	13,253.56	1,339,326.81	11,468.73	811,512.21	2,639,243.77
88	24,722.29	13,196.22	1,352,523.03	11,526.07	823,038.28	2,627,717.70
89	24,722.29	13,138.59	1,365,661.62	11,583.70	834,621.98	2,616,134.00
90	24,722.29	13,080.67	1,378,742.29	11,641.62	846,263.60	2,604,492.39
91	24,722.29	13,022.46	1,391,764.75	11,699.83	857,963.42	2,592,792.56
92	24,722.29	12,963.96	1,404,728.71	11,758.32	869,721.75	2,581,034.24
93	24,722.29	12,905.17	1,417,633.88	11,817.12	881,538.86	2,569,217.12
94	24,722.29	12,846.09	1,430,479.97	11,876.20	893,415.07	2,557,340.92
95	24,722.29	12,786.70	1,443,266.67	11,935.58	905,350.65	2,545,405.33
96	24,722.29	12,727.03	1,455,993.70	11,995.26	917,345.91	2,533,410.07
97	24,722.29	12,667.05	1,468,660.75	12,055.24	929,401.15	2,521,354.84
98	24,722.29	12,606.77	1,481,267.53	12,115.51	941,516.66	2,509,239.32
99	24,722.29	12,546.20	1,493,813.72	12,176.09	953,692.75	2,497,063.23
100	24,722.29	12,485.32	1,506,299.04	12,236.97	965,929.72	2,484,826.26
101	24,722.29	12,424.13	1,518,723.17	12,298.16	978,227.88	2,472,528.10
102	24,722.29	12,362.64	1,531,085.81	12,359.65	990,587.53	2,460,168.46
103	24,722.29	12,300.84	1,543,386.65	12,421.45	1,003,008.97	2,447,747.01
104	24,722.29	12,238.74	1,555,625.39	12,483.55	1,015,492.52	2,435,263.46
105	24,722.29	12,176.32	1,567,801.70	12,545.97	1,028,038.49	2,422,717.49

106	24,722.29	12,113.59	1,579,915.29	12,608.70	1,040,647.19	2,410,108.79
107	24,722.29	12,050.54	1,591,965.84	12,671.74	1,053,318.94	2,397,437.04
108	24,722.29	11,987.19	1,603,953.02	12,735.10	1,066,054.04	2,384,701.94
109	24,722.29	11,923.51	1,615,876.53	12,798.78	1,078,852.82	2,371,903.16
110	24,722.29	11,859.52	1,627,736.05	12,862.77	1,091,715.59	2,359,040.39
111	24,722.29	11,795.20	1,639,531.25	12,927.09	1,104,642.68	2,346,113.31
112	24,722.29	11,730.57	1,651,261.82	12,991.72	1,117,634.40	2,333,121.59
113	24,722.29	11,665.61	1,662,927.42	13,056.68	1,130,691.08	2,320,064.91
114	24,722.29	11,600.32	1,674,527.75	13,121.96	1,143,813.04	2,306,942.94
115	24,722.29	11,534.71	1,686,062.46	13,187.57	1,157,000.61	2,293,755.37
116	24,722.29	11,468.78	1,697,531.24	13,253.51	1,170,254.12	2,280,501.86
117	24,722.29	11,402.51	1,708,933.75	13,319.78	1,183,573.90	2,267,182.08
118	24,722.29	11,335.91	1,720,269.66	13,386.38	1,196,960.28	2,253,795.70
119	24,722.29	11,268.98	1,731,538.64	13,453.31	1,210,413.59	2,240,342.39
120	24,722.29	11,201.71	1,742,740.35	13,520.58	1,223,934.16	2,226,821.82
121	24,722.29	11,134.11	1,753,874.46	13,588.18	1,237,522.34	2,213,233.64
122	24,722.29	11,066.17	1,764,940.63	13,656.12	1,251,178.46	2,199,577.52
123	24,722.29	10,997.89	1,775,938.51	13,724.40	1,264,902.86	2,185,853.12
124	24,722.29	10,929.27	1,786,867.78	13,793.02	1,278,695.88	2,172,060.10
125	24,722.29	10,860.30	1,797,728.08	13,861.99	1,292,557.87	2,158,198.11
126	24,722.29	10,790.99	1,808,519.07	13,931.30	1,306,489.17	2,144,266.81
127	24,722.29	10,721.33	1,819,240.41	14,000.95	1,320,490.12	2,130,265.86
128	24,722.29	10,651.33	1,829,891.73	14,070.96	1,334,561.08	2,116,194.90
129	24,722.29	10,580.97	1,840,472.71	14,141.31	1,348,702.39	2,102,053.59
130	24,722.29	10,510.27	1,850,982.98	14,212.02	1,362,914.41	2,087,841.57
131	24,722.29	10,439.21	1,861,422.18	14,283.08	1,377,197.49	2,073,558.49
132	24,722.29	10,367.79	1,871,789.98	14,354.50	1,391,551.99	2,059,204.00
133	24,722.29	10,296.02	1,882,086.00	14,426.27	1,405,978.25	2,044,777.73
134	24,722.29	10,223.89	1,892,309.89	14,498.40	1,420,476.65	2,030,279.33
135	24,722.29	10,151.40	1,902,461.28	14,570.89	1,435,047.54	2,015,708.44
136	24,722.29	10,078.54	1,912,539.82	14,643.75	1,449,691.29	2,001,064.69
137	24,722.29	10,005.32	1,922,545.15	14,716.96	1,464,408.25	1,986,347.73
138	24,722.29	9,931.74	1,932,476.89	14,790.55	1,479,198.80	1,971,557.18
139	24,722.29	9,857.79	1,942,334.67	14,864.50	1,494,063.30	1,956,692.68
140	24,722.29	9,783.46	1,952,118.14	14,938.82	1,509,002.13	1,941,753.85
141	24,722.29	9,708.77	1,961,826.91	15,013.52	1,524,015.65	1,926,740.33
142	24,722.29	9,633.70	1,971,460.61	15,088.59	1,539,104.23	1,911,651.75
143	24,722.29	9,558.26	1,981,018.87	15,164.03	1,554,268.26	1,896,487.72
144	24,722.29	9,482.44	1,990,501.30	15,239.85	1,569,508.11	1,881,247.87
145	24,722.29	9,406.24	1,999,907.54	15,316.05	1,584,824.16	1,865,931.82
146	24,722.29	9,329.66	2,009,237.20	15,392.63	1,600,216.79	1,850,539.19
147	24,722.29	9,252.70	2,018,489.90	15,469.59	1,615,686.38	1,835,069.60
148	24,722.29	9,175.35	2,027,665.25	15,546.94	1,631,233.32	1,819,522.66
149	24,722.29	9,097.61	2,036,762.86	15,624.67	1,646,857.99	1,803,897.99
150	24,722.29	9,019.49	2,045,782.35	15,702.80	1,662,560.79	1,788,195.19
151	24,722.29	8,940.98	2,054,723.33	15,781.31	1,678,342.10	1,772,413.88
152	24,722.29	8,862.07	2,063,585.40	15,860.22	1,694,202.32	1,756,553.66
153	24,722.29	8,782.77	2,072,368.16	15,939.52	1,710,141.84	1,740,614.14
154	24,722.29	8,703.07	2,081,071.23	16,019.22	1,726,161.06	1,724,594.93
155	24,722.29	8,622.97	2,089,694.21	16,099.31	1,742,260.37	1,708,495.61
156	24,722.29	8,542.48	2,098,236.69	16,179.81	1,758,440.18	1,692,315.80
157	24,722.29	8,461.58	2,106,698.27	16,260.71	1,774,700.89	1,676,055.09
158	24,722.29	8,380.28	2,115,078.54	16,342.01	1,791,042.90	1,659,713.08
159	24,722.29	8,298.57	2,123,377.11	16,423.72	1,807,466.62	1,643,289.36
160	24,722.29	8,216.45	2,131,593.55	16,505.84	1,823,972.46	1,626,783.52
161	24,722.29	8,133.92	2,139,727.47	16,588.37	1,840,560.83	1,610,195.15
162	24,722.29	8,050.98	2,147,778.45	16,671.31	1,857,232.14	1,593,523.84
163	24,722.29	7,967.62	2,155,746.07	16,754.67	1,873,986.81	1,576,769.17

164	24,722.29	7,883.85	2,163,629.91	16,838.44	1,890,825.25	1,559,930.73
165	24,722.29	7,799.65	2,171,429.57	16,922.63	1,907,747.89	1,543,008.09
166	24,722.29	7,715.04	2,179,144.61	17,007.25	1,924,755.14	1,526,000.85
167	24,722.29	7,630.00	2,186,774.61	17,092.28	1,941,847.42	1,508,908.56
168	24,722.29	7,544.54	2,194,319.15	17,177.74	1,959,025.16	1,491,730.82
169	24,722.29	7,458.65	2,201,777.81	17,263.63	1,976,288.80	1,474,467.18
170	24,722.29	7,372.34	2,209,150.14	17,349.95	1,993,638.75	1,457,117.23
171	24,722.29	7,285.59	2,216,435.73	17,436.70	2,011,075.45	1,439,680.53
172	24,722.29	7,198.40	2,223,634.13	17,523.88	2,028,599.34	1,422,156.65
173	24,722.29	7,110.78	2,230,744.92	17,611.50	2,046,210.84	1,404,545.14
174	24,722.29	7,022.73	2,237,767.64	17,699.56	2,063,910.40	1,386,845.58
175	24,722.29	6,934.23	2,244,701.87	17,788.06	2,081,698.46	1,369,057.52
176	24,722.29	6,845.29	2,251,547.16	17,877.00	2,099,575.46	1,351,180.52
177	24,722.29	6,755.90	2,258,303.06	17,966.39	2,117,541.85	1,333,214.13
178	24,722.29	6,666.07	2,264,969.13	18,056.22	2,135,598.06	1,315,157.92
179	24,722.29	6,575.79	2,271,544.92	18,146.50	2,153,744.56	1,297,011.42
180	24,722.29	6,485.06	2,278,029.98	18,237.23	2,171,981.79	1,278,774.19
181	24,722.29	6,393.87	2,284,423.85	18,328.42	2,190,310.21	1,260,445.77
182	24,722.29	6,302.23	2,290,726.08	18,420.06	2,208,730.27	1,242,025.71
183	24,722.29	6,210.13	2,296,936.20	18,512.16	2,227,242.43	1,223,513.55
184	24,722.29	6,117.57	2,303,053.77	18,604.72	2,245,847.15	1,204,908.84
185	24,722.29	6,024.54	2,309,078.32	18,697.74	2,264,544.89	1,186,211.09
186	24,722.29	5,931.06	2,315,009.37	18,791.23	2,283,336.12	1,167,419.86
187	24,722.29	5,837.10	2,320,846.47	18,885.19	2,302,221.31	1,148,534.67
188	24,722.29	5,742.67	2,326,589.15	18,979.61	2,321,200.92	1,129,555.06
189	24,722.29	5,647.78	2,332,236.92	19,074.51	2,340,275.44	1,110,480.54
190	24,722.29	5,552.40	2,337,789.32	19,169.88	2,359,445.32	1,091,310.66
191	24,722.29	5,456.55	2,343,245.88	19,265.73	2,378,711.06	1,072,044.93
192	24,722.29	5,360.22	2,348,606.10	19,362.06	2,398,073.12	1,052,682.86
193	24,722.29	5,263.41	2,353,869.52	19,458.87	2,417,531.99	1,033,223.99
194	24,722.29	5,166.12	2,359,035.64	19,556.17	2,437,088.16	1,013,667.82
195	24,722.29	5,068.34	2,364,103.97	19,653.95	2,456,742.11	994,013.87
196	24,722.29	4,970.07	2,369,074.04	19,752.22	2,476,494.33	974,261.65
197	24,722.29	4,871.31	2,373,945.35	19,850.98	2,496,345.31	954,410.68
198	24,722.29	4,772.05	2,378,717.41	19,950.23	2,516,295.54	934,460.44
199	24,722.29	4,672.30	2,383,389.71	20,049.99	2,536,345.53	914,410.46
200	24,722.29	4,572.05	2,387,961.76	20,150.24	2,556,495.76	894,260.22
201	24,722.29	4,471.30	2,392,433.06	20,250.99	2,576,746.75	874,009.23
202	24,722.29	4,370.05	2,396,803.11	20,352.24	2,597,098.99	853,656.99
203	24,722.29	4,268.28	2,401,071.39	20,454.00	2,617,552.99	833,202.99
204	24,722.29	4,166.01	2,405,237.41	20,556.27	2,638,109.26	812,646.72
205	24,722.29	4,063.23	2,409,300.64	20,659.05	2,658,768.32	791,987.66
206	24,722.29	3,959.94	2,413,260.58	20,762.35	2,679,530.67	771,225.31
207	24,722.29	3,856.13	2,417,116.71	20,866.16	2,700,396.83	750,359.15
208	24,722.29	3,751.80	2,420,868.50	20,970.49	2,721,367.32	729,388.66
209	24,722.29	3,646.94	2,424,515.44	21,075.34	2,742,442.66	708,313.32
210	24,722.29	3,541.57	2,428,057.01	21,180.72	2,763,623.39	687,132.60
211	24,722.29	3,435.66	2,431,492.67	21,286.62	2,784,910.01	665,845.97
212	24,722.29	3,329.23	2,434,821.90	21,393.06	2,806,303.07	644,452.91
213	24,722.29	3,222.26	2,438,044.17	21,500.02	2,827,803.09	622,952.89
214	24,722.29	3,114.76	2,441,158.93	21,607.52	2,849,410.61	601,345.37
215	24,722.29	3,006.73	2,444,165.66	21,715.56	2,871,126.18	579,629.81
216	24,722.29	2,898.15	2,447,063.81	21,824.14	2,892,950.31	557,805.67
217	24,722.29	2,789.03	2,449,852.84	21,933.26	2,914,883.57	535,872.41
218	24,722.29	2,679.36	2,452,532.20	22,042.93	2,936,926.50	513,829.48
219	24,722.29	2,569.15	2,455,101.35	22,153.14	2,959,079.64	491,676.34
220	24,722.29	2,458.38	2,457,559.73	22,263.91	2,981,343.54	469,412.44
221	24,722.29	2,347.06	2,459,906.79	22,375.23	3,003,718.77	447,037.21

222	24,722.29	2,235.19	2,462,141.98	22,487.10	3,026,205.87	424,550.11
223	24,722.29	2,122.75	2,464,264.73	22,599.54	3,048,805.41	401,950.57
224	24,722.29	2,009.75	2,466,274.48	22,712.53	3,071,517.94	379,238.04
225	24,722.29	1,896.19	2,468,170.67	22,826.10	3,094,344.04	356,411.94
226	24,722.29	1,782.06	2,469,952.73	22,940.23	3,117,284.27	333,471.71
227	24,722.29	1,667.36	2,471,620.09	23,054.93	3,140,339.20	310,416.78
228	24,722.29	1,552.08	2,473,172.17	23,170.20	3,163,509.40	287,246.58
229	24,722.29	1,436.23	2,474,608.41	23,286.05	3,186,795.46	263,960.53
230	24,722.29	1,319.80	2,475,928.21	23,402.48	3,210,197.94	240,558.04
231	24,722.29	1,202.79	2,477,131.00	23,519.50	3,233,717.44	217,038.54
232	24,722.29	1,085.19	2,478,216.19	23,637.09	3,257,354.53	193,401.45
233	24,722.29	967.01	2,479,183.20	23,755.28	3,281,109.81	169,646.17
234	24,722.29	848.23	2,480,031.43	23,874.06	3,304,983.87	145,772.11
235	24,722.29	728.86	2,480,760.29	23,993.43	3,328,977.30	121,778.68
236	24,722.29	608.89	2,481,369.18	24,113.39	3,353,090.69	97,665.29
237	24,722.29	488.33	2,481,857.51	24,233.96	3,377,324.65	73,431.33
238	24,722.29	367.16	2,482,224.67	24,355.13	3,401,679.78	49,076.20
239	24,722.29	245.38	2,482,470.05	24,476.91	3,426,156.69	24,599.29
240	24,722.29	123.00	2,482,593.04	24,599.29	3,450,755.98	0.00