UNIVERSITY OF MINNESOTA
ST. ANTHONY FALLS LABORATORY
Engineering, Environmental and Geophysical Fluid Dynamics

PROJECT REPORT NO. 473

Sediment Production Model for the South Branch of the Buffalo River Watershed

By

Wes Lauer, Miguel Wong and Omid Mohseni

Prepared for
Houston Engineering, Inc.
and
Buffalo-Red River Watershed District

May 2006
Minneapolis, Minnesota

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age or veteran status.

Abstract

To predict the relative risk of soil erosion from various parts of the South Branch Buffalo River watershed, southwest of Moorhead, MN, the surficial geology of the area has been studied and a methodology has been developed. The methodology comprises the use of the sediment production component of the United States Department of Agriculture AnnAGNPS model to quantify surface erosion rates and sediment yields from the upland areas, and a sediment routing model to estimate the channel bank migration rates and the supply of sediment from stream bank sources. The AnnAGNPS model was calibrated using the suspended sediment load observations made at Sabin, Minnesota during 1978. The calibrated model predicts a sediment yield of 14,400 tons/yr at the watershed outlet (13.0 tons/km^2/yr) for the years 2002-2005. This amount is nine times larger than the channel bank erosion estimate of 1600 tons/yr (1.45 tons/km^2/year). Modifications to the AnnAGNPS program allow routing multiple grain sizes of sediment produced in the watershed, including aggregated pellets formed from silts and clays, and predicting the likely locations of sediment deposition in the river network.

Acknowledgments

The work reported herein was supported by Houston Engineering, Inc. and the Buffalo-Red River Watershed District through a Section 319 grant from the Minnesota Pollution Control Agency. Dr. Mark Deutschman from Houston Engineering, Inc. was the project officer. We would like to thank Professor Gary Parker at University of Illinois Urbana-Champaign for his contribution to the model development and his insights in carrying out this study.

Table of Contents

List of Figures

List of Tables

1. Introduction

The Red River of the North and its major tributaries flow through a very flat, wide valley that is exceptionally prone to flooding. On the Minnesota side of the valley, tributaries tend to head in relatively steep, glacially derived uplands and then flow across the very flat bed of Glacial Lake Agassiz before joining the Red River. The change in grade along the tributaries can potentially lead to problems associated with sedimentation in the channel bed and an associated loss of flood capacity.

The Buffalo-Red River Watershed District through Houston Engineering, Inc. asked St. Anthony Falls Laboratory to develop a methodology for predicting the relative risk of such sedimentation-related management problems on a typical tributary, the South Branch of the Buffalo River, a watershed of 1106 sq km located in the southwest of Moorhead, MN. The method developed in this study is intended to serve as a framework for application to a range of watersheds tributary to the Red River of the North.

The goals of this project are to identify the sources of sediment carried by the South Branch Buffalo River and to quantify the morphologic sensitivity of the system to changes in sediment supply. In relatively low gradient systems like the South Branch Buffalo River, sediment can come from either concentrated erosion along stream beds and banks or non-localized surface or sheet/rill erosion from the upland areas. In this study, bed and bank erosion were quantified in a general way from the geometry of a stream and the estimates of the maximum likely morphodynamic movement of stream channels in the system. To quantify surface erosion rates, a lumped-parameter, event-driven continuous sediment production model was developed for the South Branch Buffalo River. The model framework is distributed by the Agricultural Research Service of the United States Department of Agriculture, known as Agricultural Non-Point Source Sediment Production Model (AnnAGNPS) and runs on a daily time step. AnnAGNPS was chosen because it is capable of predicting both gross erosion rates and sediment yields from agricultural landscapes. It can also account for multiple grain sizes in the sediment produced from the watershed. Furthermore, it can route the sediment downstream through the river network.

The sediment on the bed of the low gradient portion of the Buffalo River is primarily composed of silts and clays which often take the form of aggregated pellets. AnnAGNPS is one of the few existing models with a sediment production component capable of predicting the supply rate of aggregated sediment in agricultural runoff. However, it is not capable of routing this sediment through the system in the aggregated form. Consequently, it was necessary to expand the routing capabilities of AnnAGNPS by developing a post-processor which could read the output from the AnnAGNPS program and then predict how this sediment would have been routed had the aggregates been allowed to persist in the stream system.

The sediment production modeling allows for an initial estimate of the relative importance of bed/bank erosion vs. surface erosion for the watershed. In addition, it shows the hot spots for both gross erosion and erosion of material that is likely to influence the capacity of downstream channels. Finally, it allows mapping the stream reaches that are most sensitive to upland erosion and to provide approximate estimates of the order of magnitude of the sedimentation problem within those reaches.

2. Background

The Red River of the North flows across the relatively flat bed of Glacial Lake Agassiz. The lake formed at the southern edge of the Laurentide Ice Sheet as the ice retreated northward toward Hudson Bay and the Arctic Ocean at the end of the last ice age. While the lake was in existence for approximately 4000 years, from approximately 11,500 to 7500 years before present (Teller and Clayton, 1983), its position and level changed as the ice uncovered and sometimes recovered new, lower outlets to the sea. The four major outlets included the Mississippi River through the Minnesota River valley, the Arctic Ocean through the Clearwater, Athabasca and MacKenzie Rivers in Canada, the Atlantic Ocean through the Great Lakes and St. Lawrence River, and Hudson Bay. Occupation of new outlets could occur catastrophically, resulting in decreases of at least 15-20 meters in lake level over a very short period. Within the study area, the lake level retreated below the level of the lake plain for the last time approximately 9500-10,000 years ago (Teller and Leverington, 2004).

Within the study site and over much of the old lake bed, the lake left behind a thick, flat layer of fine, clay-rich sediment (Fenton et al., 1983). When the water level in the lake was high, beach ridges rich in sand formed near the lake shore. Sand rich zones probably representative of these old shorelines are apparent on soil texture maps based on data available from the Natural Resources Conservation Service (NRCS) through its SSURGO (Soil Survey Geographic) database (Figure 1). They represent the sandiest soils within the study watershed. The soils within the old lake bed are the finest-grained within the study watershed.

During periods of low water in Glacial Lake Agassiz, rivers flowed across much of the existing lake bed forming an extensive delta in the area near Fargo and Moorhead (Fenton et al., 1983). These rivers as well as rivers that formed under the glacial ice margins left zones enriched in sand and gravel in the lake plain and near the lake margins, particularly in the area east of Moorhead (Harris et al., 1974; Fenton et al., 1983). While these channels were mostly buried by subsequent sedimentation, their topographic signature is still present within portions of the lake plain (Fenton et al., 1983). The sands and gravels within these deposits represent important aquifers for the region.

Topographic relief increases significantly outside the historic lake bed (Figure 2). The topography in this region is glacial in origin and represents a complicated assemblage of moraines and outwash deposits left by the glaciers as they advanced and retreated. The topography in this area is very hummocky with many enclosed basins with no direct hydrologic connection to the Red River Valley except in times of extremely high runoff. Glacial till deposits in these areas contain a full range of sediment grain sizes from clays to boulders. All of the steep slopes within the study site are in this type of topography.

North of the Buffalo River basin and the adjacent Wild Rice, Sandhill, and Clearwater Rivers, the topographic relief of the uplands decreases in a flat area known as the lake washed till plain (Stoner et al., 1993). This upland area was submerged by Lake Agassiz from time to time and probably has different soil properties than the unsubmerged uplands that are the subject of this study. Because of the lower topographic relief and different soil properties, any conclusions regarding erosion rates and sediment sources made in this study may not be applicable to basins whose streams originate in the lake washed till plain.

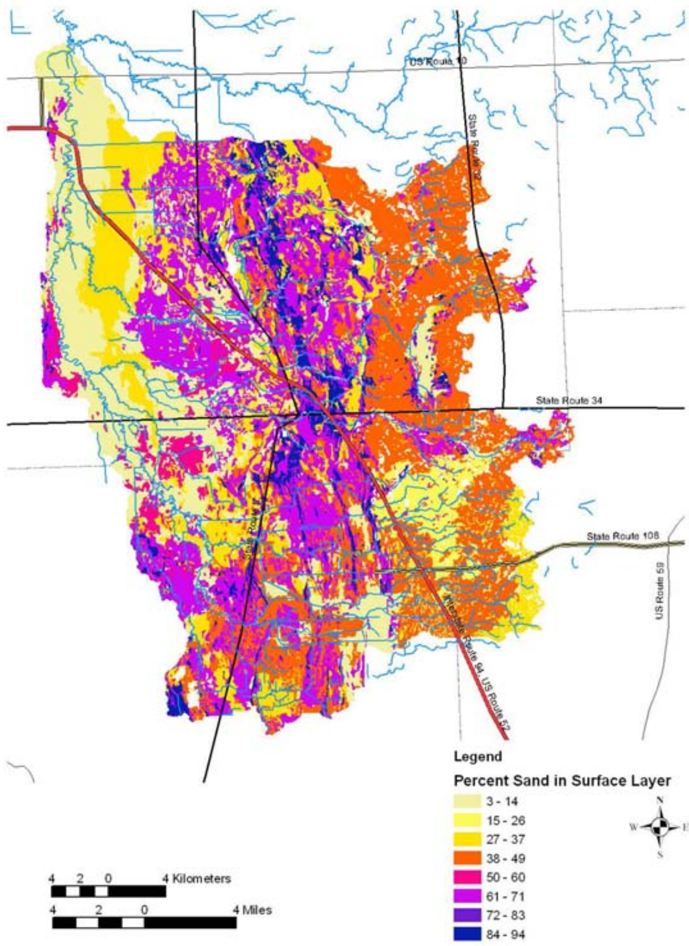


Figure 1. Fraction sand in surface soils described by USDA SSURGO dataset.

2.1. Study Watershed

The South Brach Buffalo River Watershed is located southwest of Moorhead, Minnesota, and contains both flat lake bed deposits and glacial moraine topography in approximately equal proportions. The glacial topography delineates the watershed somewhat ambiguous because of the presence of many closed lakes and wetland basins in the area. While these basins probably contribute groundwater to the South Branch Buffalo River, it is unlikely that they contribute significant quantities of sediment. Consequently, they have been removed from the basin for the purpose of this study, and only drainages with clear hydrologic connections have been included. A shaded relief topographic image of the watershed is shown in Figure 2. The hydrologically open portion of the watershed, i.e. with no landlocked basins, is approximately 1106 km^2 with minimum and maximum elevations of approximately 271 m and 454 m, respectively. The mean annual discharge of the South Branch Buffalo River at the Sabin Gauge (gauge location shown on Figure 2 below) is 1.87 m^3/s.

Prior to the agricultural development of the region, most of the lake plain was covered in prairie vegetation, while the uplands were vegetated with a mixture of forest and grassland (Maclay et al., 1972). Borderland vegetation east of the lake bed consisted of oak woodland, while further east and higher in the uplands, forests dominated by oak and pine were present. Much of the upland forest within the South Branch basin has been removed for agricultural purposes.

Based on a scientific report published around the turn of the 19th century (Griggs, 1906), the lower Buffalo River through the lake plain was turbid and sluggish at that time, while the upper main stem of the Buffalo River was “clear and swift”. The upper river migrated rapidly but the lower river was entrenched and stationary. However, both banks were reported as eroding (albeit very slowly) within the lower reach.

Land use within the South Branch Basin is currently primarily agricultural, with field and row crops predominating. For the Red River Basin as a whole, major crops include wheat, soybeans, corn, edible beans, sugar beats, and some barley (Stoner et al., 1993). While the uplands within the South Branch watershed do not contain large areas of forest or grazing land, this land use is common in the upland portion of some of the other tributaries to the Red River of the North.

The predominant crops planted within the South Branch basin probably differ somewhat between the lake plain and the uplands. Little formal information is available on detailed cropping patterns within the watershed, but a simple review of agricultural census data for the year 2002 for each of the four counties included in the watershed reveals some interesting trends (data from http://www.nass.usda.gov/Data_and_Statistics/). Clay and Wilkin Counties are located primarily within the lake plain, while Becker and Otter Tail Counties are located primarily within the glacial uplands. Consequently, the crops grown in Clay and Wilkin Counties are probably most representative of the crops grown in the lake plain, while the crops grown in Becker and Otter Tail Counties are probably most representative of the crops grown in the uplands. The combined statistics for percent of total agricultural land in a given crop or land use for each set of counties is presented in Table 1. For Clay and Wilkin Counties, i.e. for the lake plain, soybeans and wheat are the dominant crops, with sugarbeats and corn a distant third and fourth. For Becker and Otter Tail Counties, i.e. for the uplands, the crop distribution is more uniform, with soybeans, corn, forage, and wheat (in that order) each representing significant acreage.

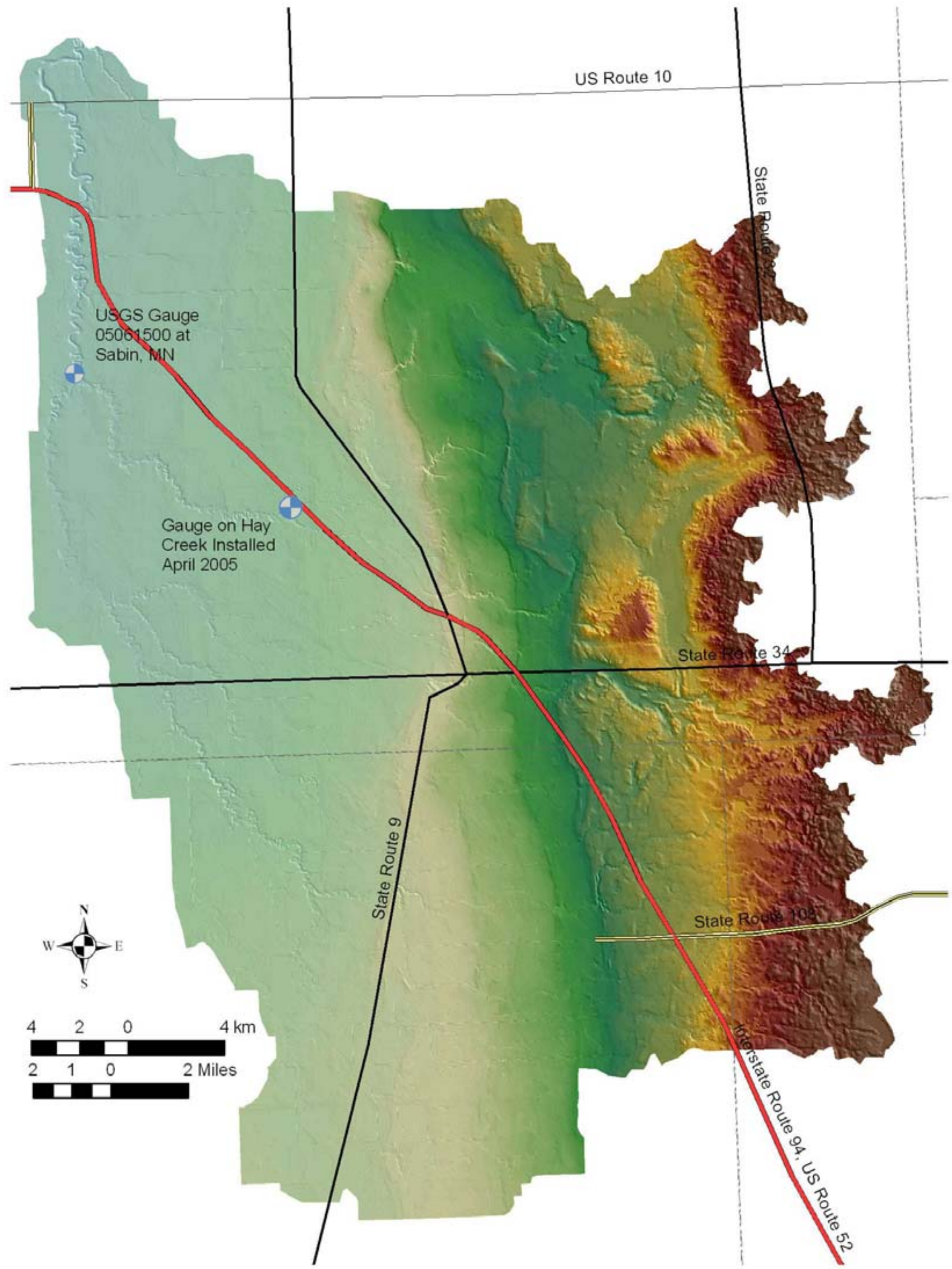


Figure 2. Shaded topographic map of the hydrologically connected portion of the South Branch Buffalo River watershed. Note the presence of beach terraces in the center of the image immediately east of State Route 9.

Table 1. Crop patterns in the four counties comprising portions of the South Branch Buffalo River watershed.

	Land (acres)						Percent of Total Cropland	
	Clay	**Wilkin**	**Otter Tail**	**Becker**	**Clay & Wilkin**	**Otter Tail & Becker**	**Clay & Wilkin**	**Otter Tail & Becker**
Land in farms (acres)	600,600	424,508	880,525	416,554	1,025,108	1,297,079	-	-
Total cropland (acres)	543,324	404,180	614,307	294,964	947,504	909,271	100.0	100.0
Soybeans	171,193	140,627	126,316	83,501	311,820	209,817	32.9	23.1
Wheat	173,168	138,356	60,375	61,321	311,524	121,696	32.9	13.4
Sugarbeets	58,135	44,875	1,925	7,600	103,010	9,525	10.9	1.0
Corn	37,722	40,649	138,386	22,532	78,371	160,918	8.3	17.7
Forage	27,000	7,673	108,925	49,669	34,673	158,594	3.7	17.4
Sunflower Seed	6,132	4,985	1,482	1,241	11,117	2,723	1.2	0.3
Barley	5,352	4,178	4,145	1,608	9,530	5,723	1.0	0.6
Dry Edible Beans	4,825	1,075	11,942	1,370	5,900	13,312	0.6	1.5
Oats	3,431	826	18,494	5,498	4,257	23,992	0.4	2.6
Potatoes	2,058	860	10,255	0	2,918	10,255	0.3	1.1
Vegetables	205	0	359	148	205	507	0.0	0.1
Sorghum	0	0	303	121	0	424	0.0	0.0
Orchards	0	0	50	24	0	74	0.0	0.0

According to the agricultural census data, for the four counties combined, the total acreage in crops increased from 1.69 million acres to 1.86 million acres from 1987 to 2002, an increase of approximately 10 percent, most of which occurred in Otter Tail and Becker Counties.

2.2. Climate

The Red River basin experiences extremely cold, relatively long winters and short, warm, humid, and sometimes windy summers. The mean annual precipitation at the National Weather Service station at Hawley, Minnesota (gauge station no. 3 in Figure 20), approximately 4 km north of the northern watershed boundary of the South Branch, over the period 1971 to 2000 was 54.8 cm (21.6 in). Most of the annual precipitation occurs between May and September. For the Red River basin as a whole, about 75% of the annual precipitation occurs between April and September, with 60% of this falling during the active growing season (Stoner et al., 1993).

2.3. Hydrology

The United States Geological Survey has maintained a stream gauge on the South Branch Buffalo River at Sabin since 1945, well within the lake plain in a low gradient portion of the channel. Few other gauge data are available within the South Branch watershed, although stream gauges are present on the main stem of the Buffalo River both upstream and downstream of the confluence with the South Branch. The long gauge record at Sabin is useful for characterizing the hydrology of the system. In general, the highest discharge of the year occurs in March or April (Table 2), as does most of the annual discharge (Table 3). However, summer storms during the months of July and August cause those months to see more discharge than does May. The highest flow on record at the gauge, 8500 cfs, occurred on July 2, 1975.

Table 2. Monthly distribution of highest water discharge at Sabin, MN.

Month	**Number of years with peak in month**	**Fraction of years with peak in month**
March	17	0.28
April	23	0.38
May	6	0.10
June	9	0.15
July	4	0.07
August	0	0.00
September	1	0.02

Table 3. Monthly distribution of volume runoff at Sabin, MN.

Month	Percent of annual discharge
January	1.0
February	1.3
March	14.9
April	24.9
May	10.2
June	13.4
July	17.3
August	6.0
September	4.8
October	2.7
November	2.2
December	1.2

2.4. Sediment

Most of the sediment conveyed across the lake plain by the Red River of the North and its tributaries is composed of fine silt and clay. There are few sources of material coarser than silt within the old lake bed. However, the uplands do have access to relatively coarse sands and gravels stored in the glacial till, glacial outwash deposits, and old river courses.

Brooks (2003, 2005) characterizes the sediment load of the Red River of the North at several locations in Canada near the United States border. At these locations, the suspended load of the Red River of the North is composed primarily of silt with some clay. Sediment collected from overbank deposits and from suspension indicates that much of the sediment moves in the form of aggregated pellets of fine sand size. These pellets are composed primarily of silt-sized sediment. However, the presence of silty disaggregated sediment layers between the pelleted layers indicates that the pellets may not be suspended evenly through the water column on the trailing end of flood hydrographs and that the system conveys significant volumes of sediment in disaggregated form.

Brooks (2003, 2005) also describe the planform movement of the Red River on the Canadian side of the border. Erosion and vertical accretion by overbank deposition occurs on both sides of the channel even within bends. Accreted sediment is recycled as overbank deposits slump back into the channel. This results in very slow net expansion of bends along the lower course of the Red River. Rates have been on the order of 4 cm/yr over the past 1000 years and perhaps somewhat higher over 6000 years ago. Long term bed incision rates at this location are on the order of 0.4 to 0.8 mm/yr. This characterization of the system presumably applies to the larger tributaries of the Red River of the North where they flow across the lake plain.

We observed silt/clay pellets similar to those described by Brooks on the beds of both the Red River of the North near Fargo, on the bed of both the main stem and South Branch Buffalo River, and on the bed of Stony and Hay creeks in bed material samples taken using a hand-held Ponar bed grab sampler on June 6, 2005 (Figure 3).

Figure 3. Pellets formed from fine silt and clay particles sampled from the bed of the South Branch Buffalo River.

The characteristics of the pellets probably influence the sediment transport through the system. The pellets observed by Brooks (2003) are primarily silt, with 0-25% fine sand and 10-20% clay. Similar pellets have been described by Maroulis and Nanson (1996) on the Copper Creek floodplain in south-central Australia and by Teisseyre (1989) in Poland. In the Australian case, the pellets have clay contents of >50% and the clay in the pellets has high shrink-swell potential. Maroulis and Nanson showed that the pellets could be created from disaggregated floodplain sediment by wetting and drying under a heat lamp in the laboratory. Three wetting and drying cycles were sufficient to regenerate the pellets. They use the term "self mulching soil" to describe the material, since it spontaneously develops a granular structure in the field without mechanical disturbance. The high shrink-swell properties of the schmectite clay forming their particles and an environment that leads to repeated wetting and drying are probably the most important factors for the development of the Australian pellets (Rust and Nanson, 1989). It is interesting to note that many of the lake bed deposits below about 5 feet of depth in the Red River Valley are composed of montmorillonite (schmectite) clays (Maclay et al., 1972). These clays are notorious for causing geotechnical problems because of their high shrink-swell potential (Schwert, 2003). However, it is curious that the pellets observed by Brooks are not composed primarily of this clay. In any case, the fact that the pellets are present all the way into Canada and have been observed by the authors in small tributaries within the South Branch Buffalo River watershed indicates that they can last a long time and/or that there are significant sources throughout the system.

3. Study Methods

This project was organized into an initial field reconnaissance, a sediment source budget that accounts for the major sediment supply areas within the watershed, and the development of a routing model that can predict where the sediment eroded from the landscape is likely to be deposited. The AnnAGNPS model chosen for sediment production modeling performs rudimentary routing only of disaggregated particles, even though the model is capable of predicting the erosion rate of aggregated soil particles. Consequently, since observations indicate that the aggregated particles move through the system, a more detailed routing procedure was developed to ensure that bed material on the low gradient streams could be represented in aggregated form.

3.1. Field Reconnaissance

The field reconnaissance was based on several windshield tours of the watershed performed on October 25, 2004 and April 8, 2005 and by a fly-over tour performed on October 25, 2004. The survey indicated that while both eroding streambanks and surface erosion sources of sediment could potentially be present in the system, eroding streambanks were relatively rare in the uplands. Where they were present, the banks were often stabilized by vegetation, implying relatively slow mass-wasting rates. Furthermore, the actively eroding banks all tended to be along a line roughly parallel with State Highway 9 representing one of the old shorelines of Lake Agassiz. The gullies wherein the eroding banks were found are clearly visible on Figure 2. Where banks were actively eroding, there tended to be an inner bank being rebuilt not much lower than the elevation of the eroding bank. Surface erosion as well as some gully erosion was apparent on the windshield tour.

Sediment samples were taken from the bed at locations shown on Figure 4. Grain size distributions at different sites are shown in Figure 5. Of the sites without much sand on the bed, aggregated pellets were observed at sites A, B, D, E, F, and G but were not sampled at C, I, J, K, or N. Pellets were observed mixed with sand at sites L and M. (Pellets from site D are shown in Figure 3). The pellets were taken back to the lab for grain size analysis (the pellets had disintegrated by the time grain size analysis was performed, but the loss of the pelleted structure should not have influenced the results). The source of the pellets is not known, but their presence on the bed mixed with sand grains at sites L and M implies that there is a source in the uplands.

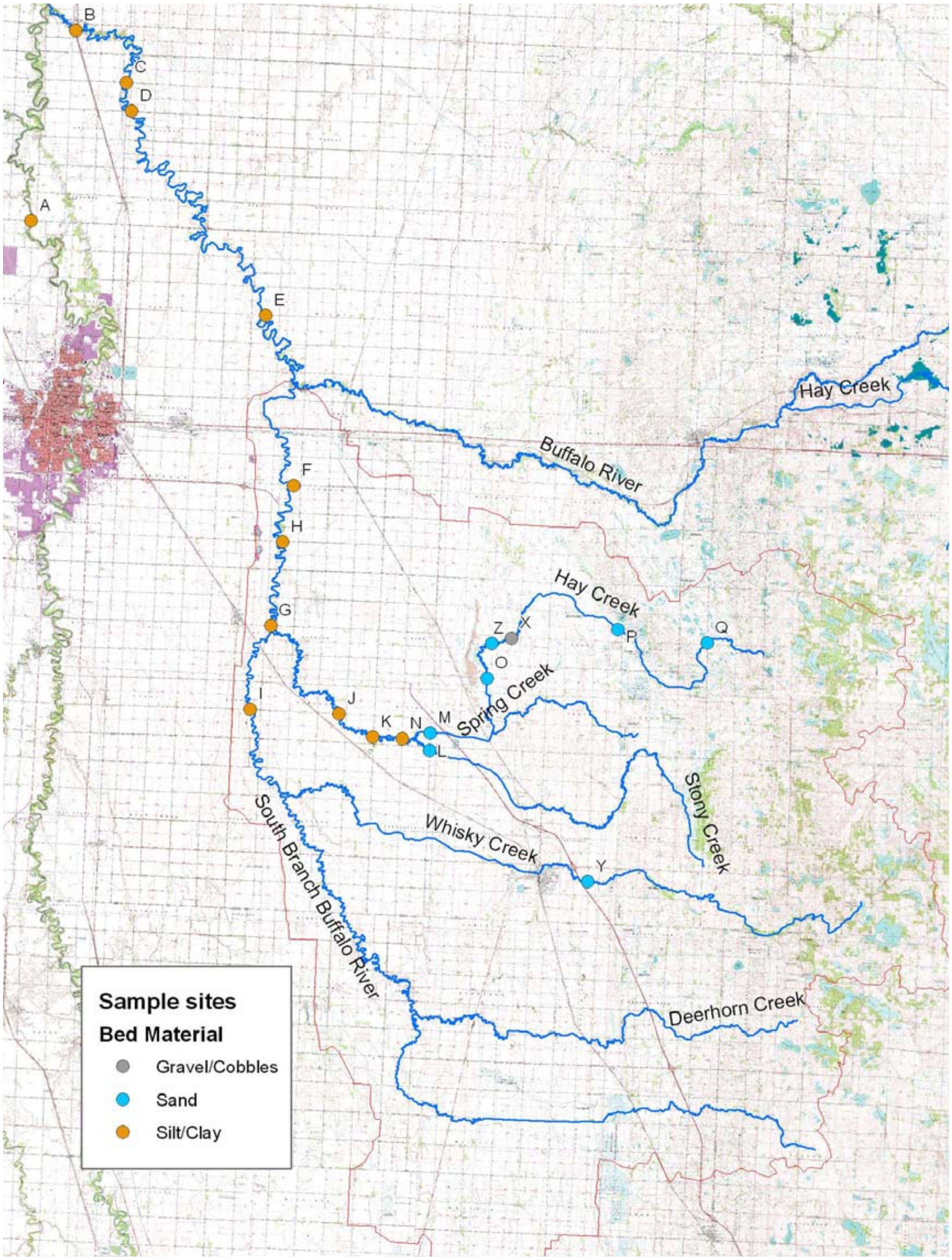


Figure 4. Bed material sampling sites.

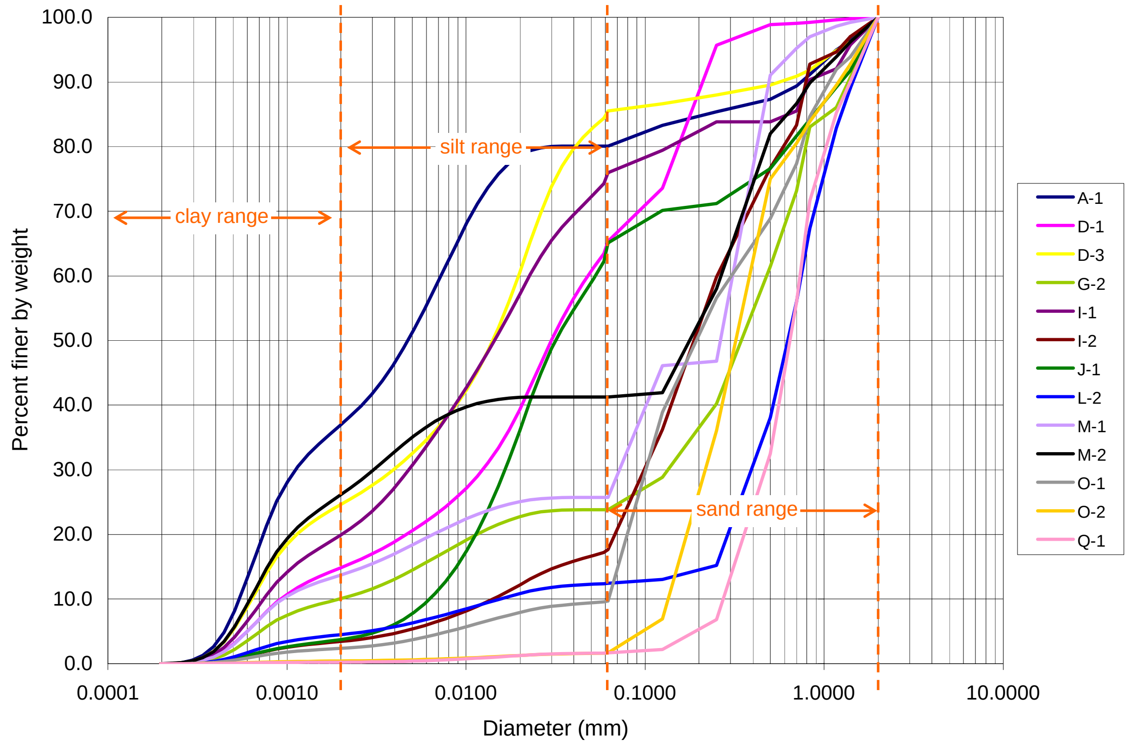


Figure 5. Grain size distributions for bed sediment samples.

In general, since we did not observe any sand downstream of the small tributaries, it appears that any sand produced in the uplands does not travel far out onto the lake plain. This implies that any sand brought into the stream network from the uplands stays in the stream network, leading to bed aggradation.

3.2. Sediment Budget

One of the primary management issues along the tributaries of the Red River of the North is determining where the sediment potentially causing turbidity and sedimentation problems originates. The sediment could conceivably come either from eroding stream banks, gullies, or from surface erosion of agricultural fields. A study of the Wild Rice River (Brigham et al., 2001) attempted to identify the source of the sediment moving through that system using radioisotope tracers. The study concluded that 65 to 80 percent of the suspended sediment load was due to surface erosion, with the rest due either to bank erosion or the erosion of long buried sediment in deep rills and gullies.

The sediment budget presented here is used to determine the limits of the potential rates of erosion from bank and surface erosion sources for the South Branch Buffalo River.

3.3. Bank Erosion Analysis

Most single-thread rivers are formed by banks that erode regularly. Actively eroding banks have been observed along the main stem of the Buffalo River since at least 1906 (Griggs, 1906). Most eroding streambanks do not contribute sediment to the river channel in the net, because the channel usually rebuilds a new bank on the opposite side of the channel from the eroding bank. The new bank is usually built to approximately the elevation of the older eroding bank, leaving little net sediment to be moved downstream, and if any sediment is produced, it could be lost further downstream to overbank sedimentation that can occur during flooding.

Consequently, even if the channel banks along the South Branch Buffalo River were eroding actively, they may not be significant sources of sediment. Nevertheless, it is possible that some of the bed material we observed in the field could be associated with bank erosion, so it is worthwhile attempting to estimate the rate at which the channels in the South Branch Buffalo River system migrate.

Channel migration rates can be measured in various ways. Common methods include repeat surveys of river cross sections, installation of permanent pins in the banks that begin to protrude into the channel as banks retreat, and by comparing aerial photographs taken at different dates. Lawler (1993) provides a good review of the existing methods, and Hughes et al. (2006) provide a useful description of the problems associated with performing aerial photograph analysis.

The aerial photographs were used for this study because there were not any accurate historical cross sections of the stream channel. The oldest set of aerial photographs available for the channel corresponds to a flight in 1939. Those aerial photos were scanned and then georeferenced to a USGS orthophoto quadrangle developed in 1991 using second order polynomial transformations in the ArcMAP 9.1 GIS software.

For each set of photographs, the banks on the South Branch Buffalo River from the confluence of the South Branch and Stony Creek downstream to the confluence with the main stem of the Buffalo River were digitized. The analysis could not be extended to upstream of Stony Creek because the resolution of the photographs was not high enough to identify the streambanks farther upstream. A centerline from each set of bank lines was interpolated, and then the lateral displacement between the two centerlines at evenly spaced points was measured (Figure 6).

The average migration rate for all points determined by this method was 5.9 m in 52 years, for a rate of about 11 cm/yr, which is significantly higher than the rate given by Brooks (2005) of 4 cm/yr for the Red River in Manitoba. However, since this number is still quite low with respect to the resolution of the images and is close to the error one would expect between photographs, most of this apparent migration is probably due simply to photograph misalignment.

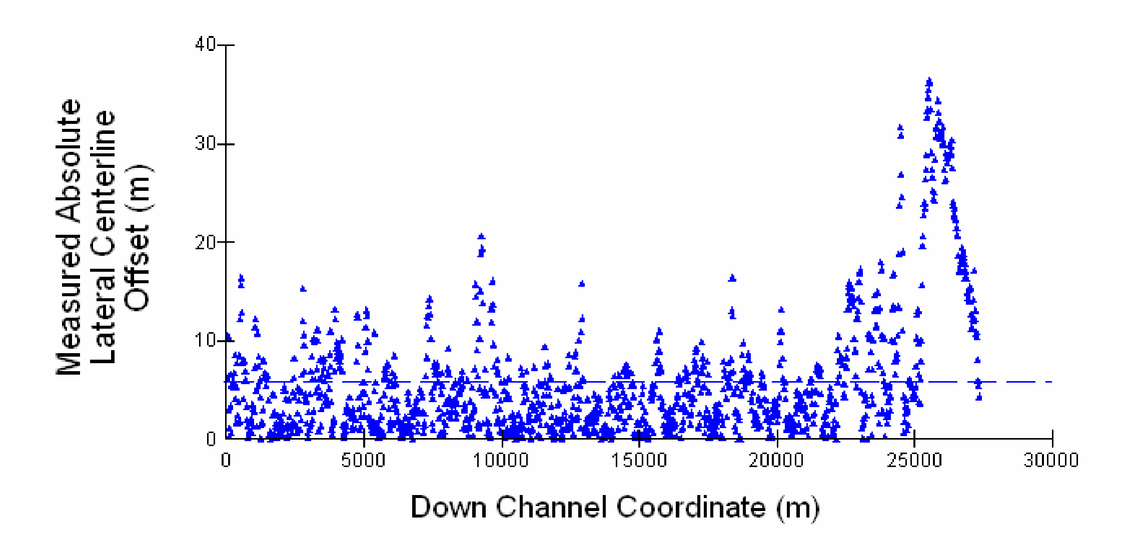


Figure 6. Absolute channel centerline offset between 1939 and 1991 at approximately half-channel width intervals along the South Branch Buffalo River. Much of the observed shift, particularly near the downstream end of the system, is likely due to photograph misalignment.

It is possible to make a better estimate for channel migration rates that is less sensitive to potential errors in photograph rectification. As rivers migrate laterally, their centerlines tend to get longer since erosion tends to occur on the concave side of river bends, enlarging the bends at a rate proportional to the average erosion rate (Lauer and Parker, 2005). Even when migration at individual points is below the resolution of a photograph, it is still possible to determine whether a stream is migrating by looking at whether the centerline length along the stream changed between the two images.

Lauer and Parker (2005) showed that the rate of extension is correlated with the average lateral erosion rate, with the volume of sediment exported from the system due to channel extension accounting for approximately 10% of total cut-bank erosion. Ignoring the possibility that the outer bank is somewhat higher than the inner bank, and assuming the 10% relation holds for the South Branch Buffalo River, it is possible to show that

$$\bar{c} = 9.5 \frac{\Delta L B_{bf}}{L} \tag{1}$$

where $\bar{c}$ is the mean migration rate for the reach, ΔL is the change in channel length over a given time period for a given reach, L is the total length of that reach (averaged for the period) and B_{bf} is the bankfull channel width for the reach.

Figure 7 shows a plot of the increase in channel length ΔL, measured from the upstream end of the analyzed reach to a given location along the channel, between the two images. The change in position was measured by finding the channel coordinate on the newer photograph that was closest (along a Bezier Curve arc) to a given coordinate on the older channel. There is a clear dependence on the change in channel length with down channel position in Figure 7, implying that channel length increased at many locations on the channel between 1939 and 1991, i.e. implying that many bends were migrating, though perhaps very slowly. The decrease in channel coordinate position for the first 5000 m of the channel may imply that the channel was eroding into point bars for this reach. In any case, the overall trend for the study reach was for the channel to increase in length at a ΔL/L rate of about 0.0065 m per m of length.

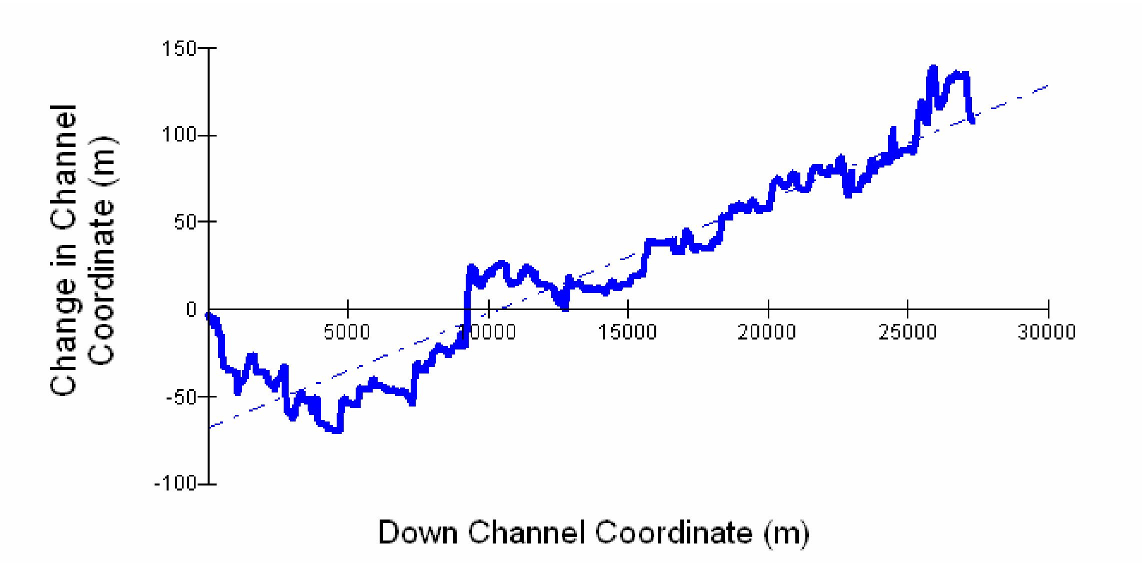


Figure 7. Change in down channel position for evenly spaced points along the channel between aerial photographs taken in 1939 and 1991. The slope of the best fit line is approximately 0.0065 m/m.

Using equation 1, the best fit slope of 0.0065, and an average channel width of 23.5 m, the migration rate for the South Branch Buffalo would become approximately 2.8 cm/yr, much closer to the value of 4 cm/yr estimated by Brooks (2005) for the Red River. Therefore, it was concluded that most of the movement seen in the centerlines between the 1939 and 1991 images was due to error in the alignment of the images, but that a small portion of the movement, roughly 25 percent, was due to real channel shifting processes.

3.4. Bank Migration Rates in Tributaries

Some of the larger tributaries of the South Branch Buffalo River flow for a significant distance through the lake plain. The soils and channel slopes for these tributaries within the lake plain are similar to those along the South Branch. Consequently, within the lake plain, these tributaries probably do not migrate faster than the South Branch Buffalo since they are generally significantly shallower and the erosive hydraulic shear forces increase with channel depth while bank stability decreases with channel depth. Both trends would tend to slow migration in shallower streams, everything else being equal, so the rate of

2.8 cm/yr estimated for the South Branch Buffalo River likely represents an upper estimate of migration rates in smaller streams in the lake plain.

Estimating bank migration rates outside of the lake plain is inherently uncertain because the streams within this area are not easily visible on the relatively low resolution historic aerial photographs. However, our site reconnaissance did not identify many actively eroding banks within this region. The only places where eroding streambanks were obvious were in straightened channels above the lake plain (Figure 8), in short gullies where the streams cut through ridges of glacial till (Figure 9), and a few other isolated places where vegetation on the banks had apparently been removed by grazing (Figure 10 and 11) None of these banks are likely to be significant net sources of sediment for the South Branch because they are relatively isolated, their banks are often composed of a mixture of sand and mud (the sand portion does not make it to the South Branch), and/or because the inner banks are built to an elevation not much lower than the eroding banks. In most places, bends were well vegetated on both the inner and outer banks, implying both that the bends were somewhat resistant to erosion due to the strengthening effect of the vegetation and that they had not moved for some time, since the vegetation was well established on the point bar bank (Figure 12).

Figure 8. Bank erosion on straightened portion of Hay Creek. Photo taken upstream from point M in Figure 4.

Figure 9. Bank erosion within deep, narrow section of Hay Creek where channel cuts through glacial till. Note large cobbles on banks and stabilizing bed. The incised stream reach is approximately 1 km long. Photo taken at approximately point X in Figure 4.

Figure 10. Potentially eroding banks on Whisky creek. Note that inner point bar is built to nearly same elevation as eroding bank.

Figure 11. Cut bank on Stony Creek. Note trees on both inside and outside banks. Photo taken at approximately point L in Figure 4.

Figure 12. Typical forested reach of Hay Creek through uplands. Note approximately constant elevation and well-established vegetation on both banks.

To estimate the total net supply of sediment from eroding streambanks, it is necessary to both approximate an average lateral migration rate and an average net difference in elevation between the eroding and accreting banks. For natural channels within the lake plain, we did not observe any systematic elevation difference from one channel bank to the other. However, on other more active river systems, Lauer and Parker (2005) have observed a typical difference of about 7% of bankfull depth between the inner and outer bank. Counting the South Branch Buffalo and the un-straightened portions Stony, Whiskey, and Deerhorn Creeks, there are approximately 117 km of natural channel on the lake plain. Assuming that these all migrate at 2.8 cm/year, the bankfull depth is approximately 2 m, approximately 7% of bankfull depth is not replaced on accreting point bars, and using a bulk density of 1.6 tons/m^3, this would result in a supply of 733 tons/yr. The 733 tons/yr should be considered an upper bound to the possible net supply from banks in the lake plain, since no net bank elevation difference was actually observed here and it does not account for potential re-deposition of eroded material on the upper banks away from the adjacent point bar.

For straightened channels within the lake plain (delineated approximately by Highway 9, as shown in Figure 2), however, it is possible that bank erosion is contributing sediment to the stream network. We assume that for the straightened reaches of the channel within the lake plain, the banks have moved laterally an average of 0.5 m since the channels were constructed approximately 40 years ago, and that the newly deposited bank is approximately 0.5 m below the eroding bank. . For an estimated total length of straightened channel of 18.3 km (6.7 km on Hay Creek, 4.0 km on Stony Creek and 7.6 km on Whisky Creek), and assuming a bulk density of the eroded sediment of 1.6 tons/m^3, this results in a net annual supply of approximately 180 tons/yr. This should be interpreted as an upper limit on the amount of erosion possible from this source (not all of the straightened channels were visited to confirm the lateral shifting estimates).

For channels passing through the old lake shorelines and the uplands, there is no firm estimate for either migration rates or bank heights. However, one can make some approximations to give a rough estimate of bank sediment supply from these tributaries. All first order streams in this region were not included because many of them appear to have been confined to artificial ditches for agricultural reasons (Figure 13 and 14). While these ditches may be sources of sediment, bed erosion and channel widening is more likely than bank erosion to supply sediment to the downstream network. The magnitude of erosion cannot be directly estimated from this source because there is no long-term information on the evolution of these streams. However, if they are maintained within buffer strips and not cultivated, and if they maintain their cross-sectional geometry without incising, i.e. if maintenance activities do not involve physically adding material to the ditches to replace material lost to erosion, then the net supply from these ditches should be either zero or negative. Therefore, these streams were not included in the sediment production analysis. If significant gullying within these first-order streams and ditches is observed by others, this assumption should be revisited.

Figure 13. First order streams flowing through recently harvested and cultivated agricultural fields. Image taken on October 25, 2004. The channels have been modified by agricultural activities.

Figure 14. Channelized flow through an agricultural field tributary to Davenport Creek.

Using the stream network delineated by the AnnAGNPS program (described later), the total length of second order and higher stream channel outside the lake plain is approximately 78 km. For these streams, little is known regarding long-term erosion rates or bank geometry. For the present purposes, it was assumed that a maximum value of lateral migration for an active bend could be 10 cm/yr, that perhaps 10% of banks are along active bends, and that the difference in height between the eroding bank and the depositional bank is 0.5 m or less. For the 78 km of such stream in the watershed, and assuming a bulk density of 1.6 tons/m^3, this produces a net erosion rate of about 620 tons/yr, again representing an upper limit on the likely production of sediment from this source.

A final potential source of bank and bed sediment are the gullies that are present where the major tributaries cross one of the steepest lake shorelines, i.e. point X in Figure 4 (photograph shown in Figure 9), at about elevation 305 m (1000 ft). Four such gullies are clearly visible in the north-central part of the watershed as shown in Figure 2. Large gravel, cobbles, and boulders are present on the beds of these gullies, providing an armor layer that resists erosion. Because of this armor, the gullies are probably not incising at a perceptible rate and thus probably do not represent significant sources of sediment to the downstream network. However, eroding stream banks within the gullies were observed during the site visit. Assuming that the net difference in inner and outer banks are on average 1.0 m in these gullies (conservative, see Figure 9), the total length of eroding bank is approximately 100 m in each of the four gullies, and the lateral erosion rate is 10 cm/yr, and using a bulk density of 1.6 tons/m^3, this results in a net supply of 64 tons/yr.

3.5. Surface Erosion Analysis

Field observations made on October 25, 2004 and April 8, 2005 indicate that a significant amount of sediment can be mobilized directly from agricultural fields. While some of the accumulated sediment could originally have been eroded from the fields by wind, its presence in the lowest portion of drainage ditches implies that a significant amount can also be transported by water. During the April 8 field reconnaissance, we documented several locations where sediment had partially filled the receiving drainage ditch downstream of fields cultivated during the fall of 2004. The only sources for the sediment were the fields themselves. Figure 15, 16 and 17 illustrate some of the more dramatic instances of such sediment deposition. In the case of Figure 15, wind is probably not the primary source of the sediment since the deposit has the classic fan-like shape of fluvially deposited material.

It is not clear whether the event(s) that caused the movement of sediment illustrated in the above figures were due primarily to rainfall or snowmelt. The spring period prior to the April 8 reconnaissance was essentially dry (no rainfall recorded at the NDAWN Sabin site after the mean daily temperature exceeded 0°C), so the sediment likely did not move due to rainfall that occurred after the spring thaw. The winter of 2005 was slightly above normal for total precipitation, but slightly below normal for snowfall according to the National Weather Service records for Fargo, North Dakota, so there was some snow present that during the melting season could have supplied water to move the observed sediment. However, 2.61 inches of rainfall on October 29-30, at the Sabin NDAWN rain gauge, immediately before the winter freeze and after many of the fields in the area had been harvested and cultivated (see Figure 13; taken immediately before this event on October 25, 2004) is probably more likely responsible for the sediment movement.

Figure 15. Deposition in ditch from agricultural runoff.

Figure 16. Depositional region within an agricultural field.

Figure 17. Deposition of sediment in roadside ditch.

In any case, it is clear that surface erosion within the watershed must be accounted for in any sediment budget. Because the sediment shown in Figure 15, 16 and 17 was clearly transported to the drainage ditch network by overland flow, and because sediment transport capacity presumably increases as soon as runoff is concentrated in a ditch, it is quite likely that the deposition shown in those figures represents only a fraction of the total material entrained from the upstream fields. Some almost certainly entered the channel network and was therefore transported downstream.

4. Sediment Production Model

The United States Department of Agriculture event based Agricultural Non-Point Source Polution Model (AnnAGNPS) was selected for modeling the supply of sediment to the stream network due to surface erosion. The model is based on the Revised Universal Soil Loss Equation (RUSLE, Renard, et al., 1997), which has been used for many years to predict erosion rates from agricultural landscapes. AnnAGNPS extends RUSLE in several ways, perhaps most importantly by converting gross erosion rates to sediment yield at the outlet of individual Subbasins. It allows for predictions of erosion and sediment yield on a daily basis, which is useful for calibration purposes. In addition, it accounts for erosion, yield and movement of soil aggregates each composed of many finer silt and clay-sized particles. This relatively unique capability is one of the primary reasons we selected AnnAGNPS for the sediment production modeling.

AnnAGNPS is a lumped parameter model that uses representative values of input parameters averaged across individual Subbasins to drive sediment erosion and yield. Subbasins are connected to a stream network through which the model routes the supplied sediment. Each reach of the stream network is characterized by a set of parameters that are assumed constant across the reach.

4.1. Input Parameters

The model requires a large set of input data (Appendix A of this report describes the steps to prepare an AnnAGNPS watershed model). The important categories of parameters are driven primarily by the need to characterize those required by RUSLE. RUSLE predicts erosion rates based on equation 2

$$E = R.K.LS.C.P \tag{2}$$

where E is the erosion rate from an agricultural field in tons per acre per year, R is a rainfall/runoff erosivity factor, K is a soil erodibility factor, LS is the length slope factor for a basin computed from basin geometry, C is a crop factor that varies with land use and crop type, and P is a management factor that varies with conservation practices implemented in the watershed.

AnnAGNPS uses the Natural Resources Conservation Service (NRCS, formerly Soil Conservation Service) Technical Report 55 (TR55) rainfall-runoff model in its conversion of the erosion rate predicted from RUSLE to the sediment yield actually given by AnnAGNPS at a given basin outlet. TR55 requires several additional input parameters, most of which are related either to basin geometry or soil and land use properties.

A brief summary of the important parameters required by AnnAGNPS, as well as our assumptions regarding these parameters in the South Branch Buffalo River, are provided below. For a more detailed summary of the importance of these parameters, the reader is referred to the AnnAGNPS technical documentation (Bigner et al. 2003).

4.1.1. Geometric Parameters

Several GIS interfaces have been developed that will delineate the Subbasins and reach network required to run AnnAGNPS from a Digital Elevation Model (DEM). An interface developed for ArcView 3.1 (available at http://www.ars.usda.gov/Research/) was used for this purpose along with a 30 m DEM for the watershed. Prior to running the interface, the elevation of every cell on the DEM that intersected a USGS blue-line stream was arbitrarily reduced by 1 meter to ensure that the stream network delineated by the interface corresponded with reality. The resulting stream network is shown in Figure 18, and the basin network is shown in Figure 19. The GIS interface computes the

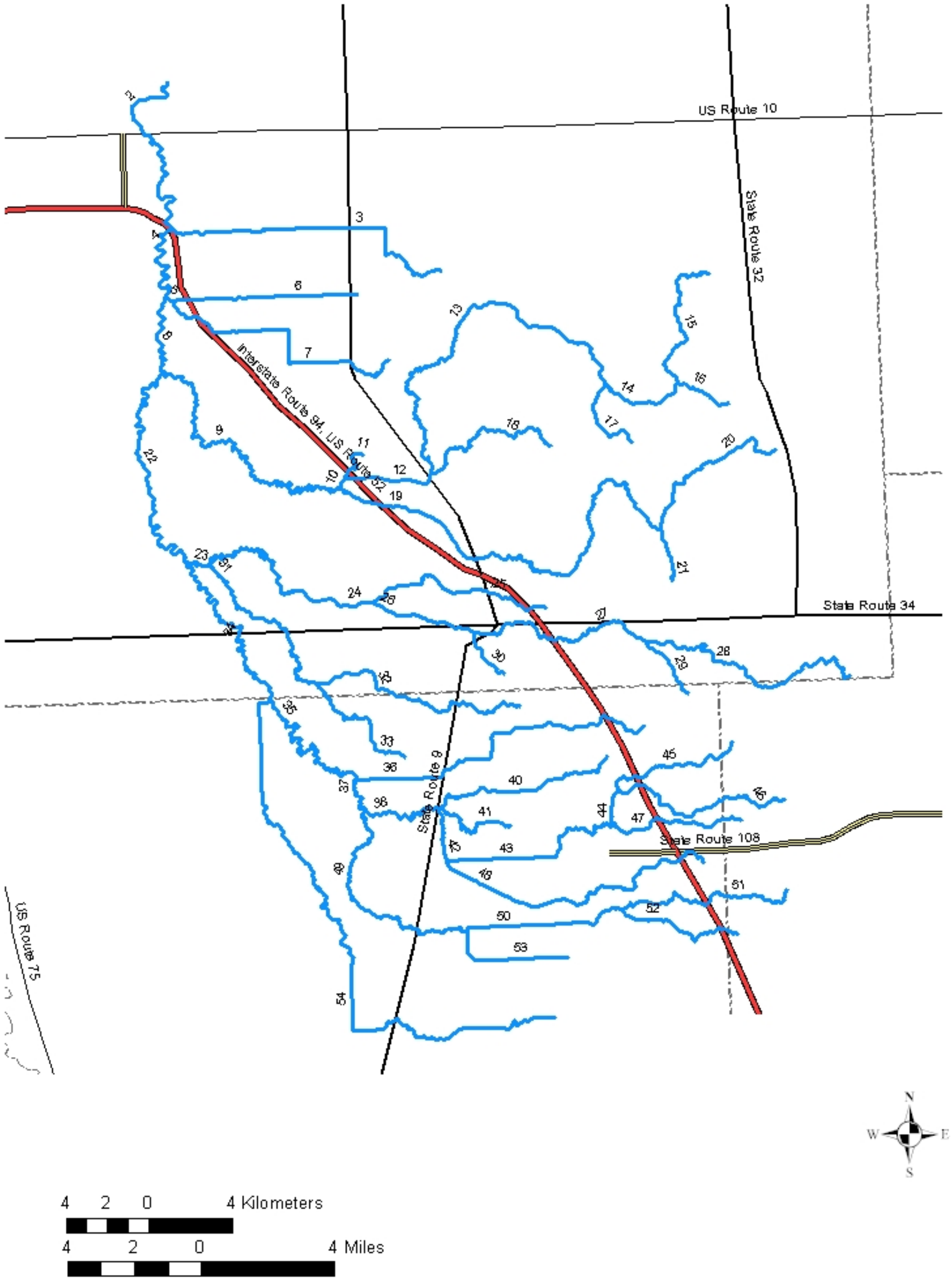


Figure 18. Stream network used by AnnAGNPS.

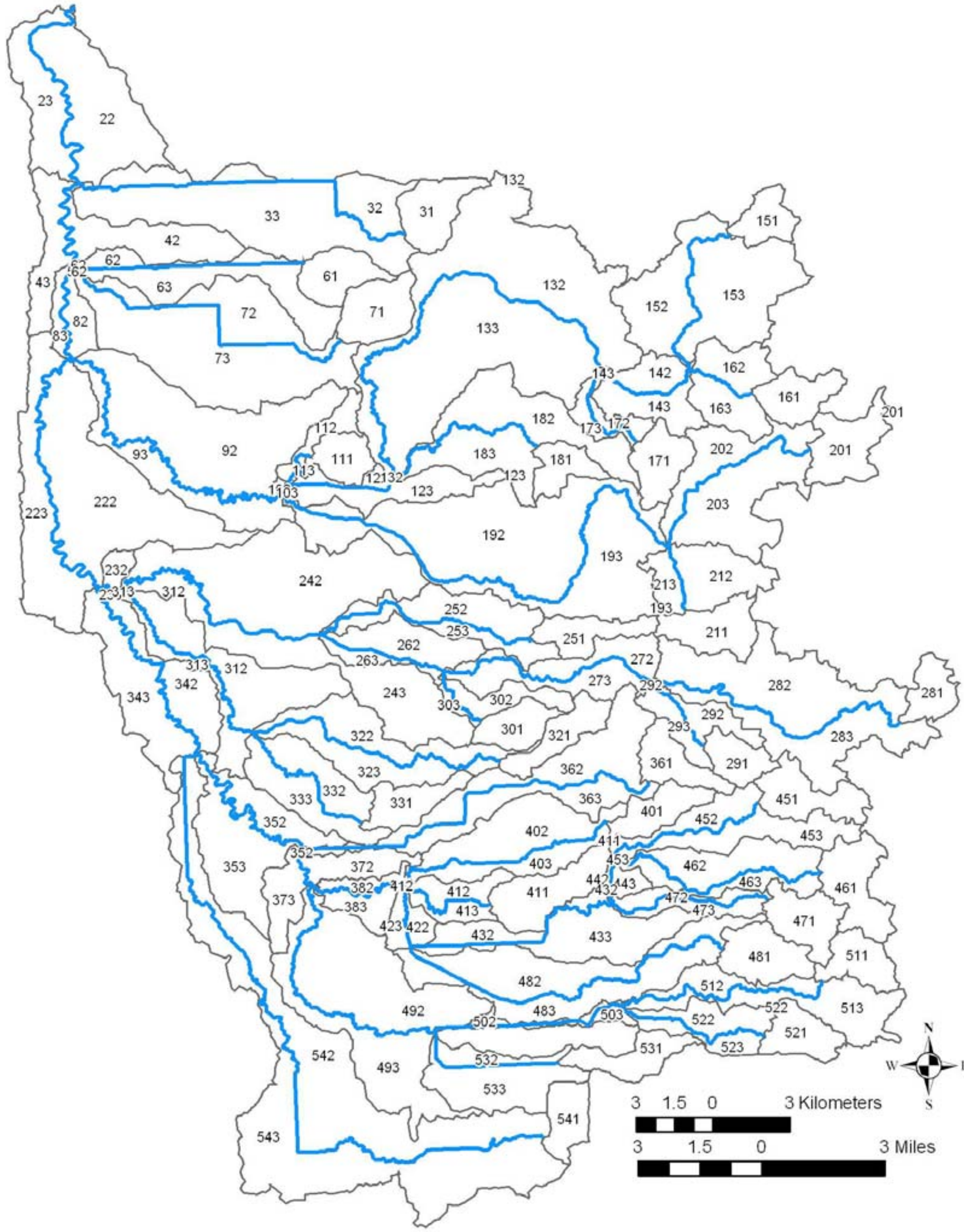


Figure 19. Basin delineation used by AnnAGNPS.

RUSLE LS factor as well as basin area, average slope, runoff pathway length, and reach length and slope directly from the DEM.

The cross-sectional geometry of several of the larger, low-gradient stream reaches within the system was measured in the field on September 26, 2005. The field data were used to develop a hydraulic geometry relationship for streams within the lake plain as described in Appendix C of this report.

4.1.2. Climate

AnnAGNPS requires daily values of precipitation, maximum and minimum temperature, average dewpoint, fraction cloud cover, and average wind speed. While the model can be run using a weather generator appropriate for a particular climate region, historic data were necessary for model calibration and validation over the periods from 1976 to1978 and 2002 to 2005. Precipitation data were obtained from weather stations in or near the watershed that were active during the respective time period being modeled (Table 4). The gauge location and the Subbasins in the AnnAGNPS model attributed to each are shown in Figure 20 and 21.

Table 4. Precipitation gauges.

Code on 2002-2005 map	Code on 1976-1978 map	Agency	Agency ID / Code	Location
1	-	SWCD	-	10 mi SW of Barnesville, T135N R47W S1
2	-	NWS	212156	Dilworth
3	3	NWS	213588	Hawley
4	-	NWS	215586	Moorhead
5	5	NWS	216405	Pelican Rapids
6	6	NWS	217149	Rothsay
7	-	NDAWN	-	Sabin
8	-	SWCD	-	6 mi NE of Barnesville, T137N R45W S2
-	4	NWS	322859	Fargo

For gauges that were only partially active during the respective time period, precipitation from one of the nearest gauges was used where data were missing. This is particularly important for the North Dakota Agricultural Weather Network (NDAWN) gauge at Sabin, which does not record November-March precipitation. Wintertime precipitation at this gauge is taken from National Weather Service (NWS) gauge at Moorhead, MN.

Temperature, dew point, wind speed, and cloud cover data were taken from a single gauge for each time period—the Fargo National Weather Service (NWS) gauge for the 1976-1978 period, and the Sabin, Minnesota NDAWN gauge for the 2002-2005 period.

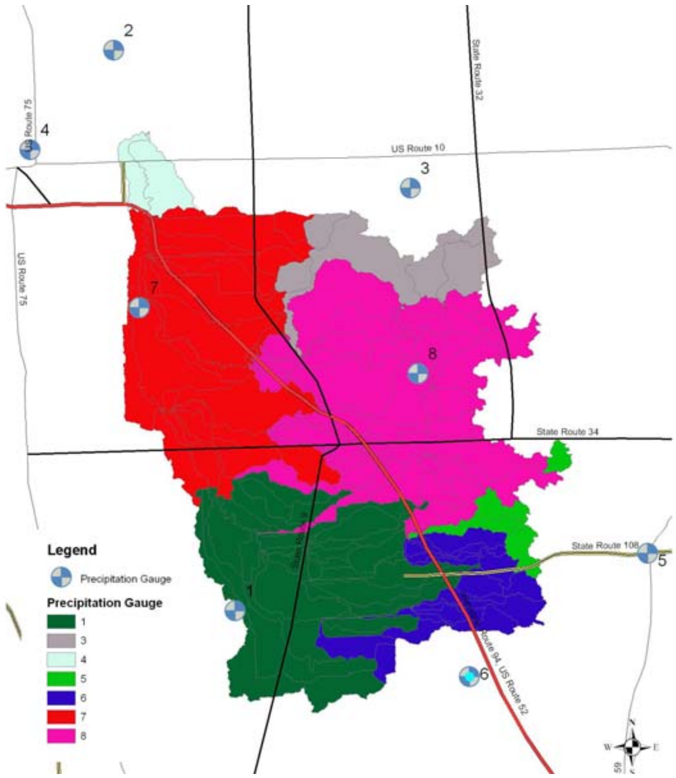


Figure 20. Precipitation gauges attributed to each basin for the 2002-2005 period.

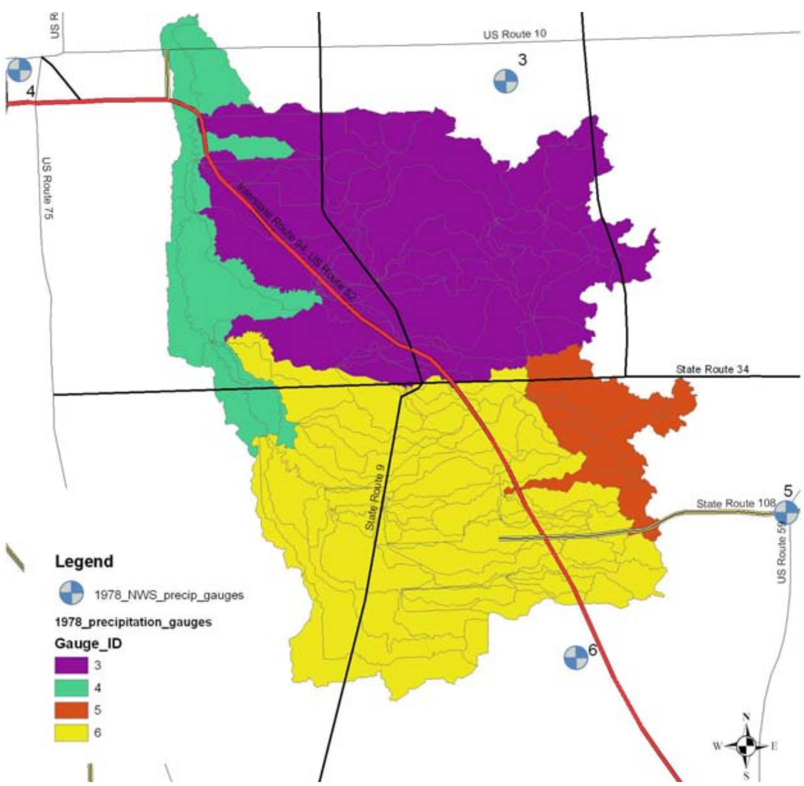


Figure 21. Precipitation gauges attributed to each basin for the 1976-1978 period.

For the 2002-2005 period, cloud cover data were not directly available at any gauge. Solar radiation data from the NDAWN Sabin site were available, and were sufficient for approximating cloud cover (Heerman et al., 1985).

4.1.3. Soils

AGNPS requires a description of soil texture, depth and runoff properties within each Subbasin. The USDA SSURGO dataset contains all the information required by AnnAGNPS. However, the SSURGO soils dataset presents this information at a finer resolution than the AnnAGNPS basin structure as delineated by the GIS pre-processor. Consequently, it was necessary to aggregate the SSURGO dataset by selecting the soil type with the largest single area within each Subbasin. The results of the aggregation process can be illustrated through the differences in the fraction sand in the surface soil for the entire SSURGO dataset (Figure 1) and the aggregated dataset used as input to AnnAGNPS (Figure 22). Both datasets show the sandiest soils near the middle of the watershed, presumably near the historic beach lines of Lake Agassiz.

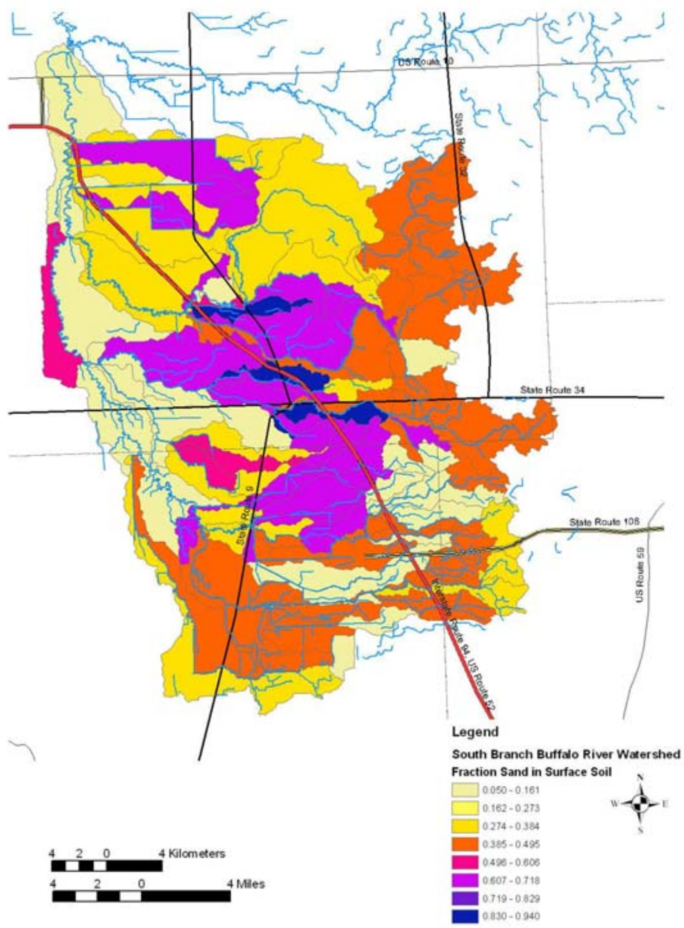


Figure 22. Fraction sand in surface soils of aggregated AnnAGNPS input dataset.

4.1.4. Land Use

Land use plays an important role both in the soil erosion rates and in the hydrologic response to rainfall events. However, in AnnAGNPS land use characteristics of each basin are lumped, i.e. a single agricultural crop type could be used in each Subbasin of the South Branch Buffalo River watershed. As shown in Table 1, the single most representative crop type for all basins is soybean. Consequently, it was assumed all basins were planted entirely in soybeans, even though soybeans probably represent only approximately a third of the cropland in the basin. For each crop type, AnnAGNPS requires a management plan that includes dates of cultivation, planting, and harvest and a description of the types and magnitudes of cultivation activities. Planting and harvest dates were taken from (USDA, 1997). The management assumptions for the crops used in the model are given in Table 5.

Several sensitivity tests were tried in which wheat, the second most important crop for Clay and Wilkin counties, or corn, the second most important crop for Becker and Otter Tail Counties, were assumed planted across the entire watershed rather than soybeans, and in which planting and harvesting dates and cultivation practices were adjusted as necessary.

The results of the sensitivity analysis (Table 11) show that the assumption of crop type can significantly influence the amount of erosion from the system. However, since the two major crops, soybeans and wheat, both result in similar erosion rates, and since the crop that most influences erosion (corn) is probably relatively uncommon in the watershed with respect to wheat or soybeans, it was not justifiable to develop a complicated crop rotation scheme within the AnnAGNPS model.

It was assumed that soil conservation practices such as contour plowing or conservation tillage were not in use within the watershed.

4.1.5. Other parameters

AnnAGNPS allows reservoirs to be placed along the stream network. Four significant flood retention reservoirs are present in the watershed, two on Hay Creek (Bjornson North and Bjornson South), one on Spring Creek (Henry Detention) and one on Stony Creek (Barnesville Detention). Since the Bjornson North and Bjornson South basins occur within the same reach of Hay creek, and since only one reservoir is allowed by AnnAGNPS for each reach, only three reservoirs were placed in the AGNPS model. The input parameters for the reservoirs describe their storage and outflow characteristics and were developed from stage-storage-discharge curves provided by Houston Engineering, Inc. However, numerical problems on the Henry reservoir required a slight modification to the rating curve given by Houston Engineering, Inc.

Table 5. Crop management scenarios.

Crop	Date	Operation	Curve Number
Soybeans			
	10/21/0001	Moldboard plow	Bare Soil
	5/20/0002	disc harrow	Bare Soil
	5/26/0002	Plant	Straight row (SR) good
	10/20/0002	Harvest	Crop residue cover (CR) good
Wheat			
	10/21/0001	Moldboard plow	Bare Soil
	5/1/0002	disc harrow	Bare Soil
	5/10/0002	Plant	Straight row (SR) good
	10/20/0002	Harvest	Crop residue cover (CR) good
Corn			
	10/21/0001	Moldboard plow	Bare Soil
	5/20/0002	disc harrow	Bare Soil
	5/21/0002	Plant	Straight row (SR) good
	10/20/0002	Harvest	Crop residue cover (CR) good
Soybeans in Conservation Tillage			
	10/21/0001	Chisel plow	Crop residue cover (CR) good
	5/20/0002	disc harrow	Bare Soil
	5/26/0002	Plant	Straight row (SR) good
	10/20/0002	Harvest	Crop residue cover (CR) good
Corn in Conservation Tillage			
	10/21/0001	Chisel plow	Crop residue cover (CR) good
	5/20/0002	disc harrow	Bare Soil
	5/21/0002	Plant	Straight row (SR) good
	10/20/0002	Harvest	Crop residue cover (CR) good

4.2. Post-Processing of AnnAGNPS output

As indicated above, one of the primary reasons to select AnnAGNPS for the sediment production modeling was its capability to account for erosion, yield and movement of soil aggregates. This capability is particularly important in the study watershed, where aggregated pellets formed from clay and silt particles were observed in bed material samples (Figure 3).

AnnAGNPS computes soil erosion and yield rates from each subbasin for five different fractions: clay, silt, sand, small aggregates and large aggregates. The output file from AnnAGNPS, however, includes yield rates for clay, silt and sand only. It computes these by partitioning the small aggregates into clay and silt, and the large aggregates into clay, silt and sand. Such partitioning depends on the characteristics of the soil type in a given subbasin. The disaggregated quantities are then added to the original yield estimates of clay, silt and sand. Consequently, the estimates of sediment delivered from the subbasins and its routing through the stream network do not explicitly account for small and large aggregates. This would not be a critical issue if both the small and large aggregates were expected to be transported as suspended sediment and their effects on the river morphodynamics (bed aggradation or degradation) were considered negligible. Our field reconnaissance indicates that at least in the case of the large aggregates, the latter consideration may not necessarily be appropriate. Were settling velocity expressed in terms of a deposition ratio mass rate, its value for large aggregates would be about half that for sand.

We developed a programming code in MS Visual Basic for Applications (VBA) to post-process the output information of AnnAGNPS. This was done a) to obtain yield estimates from each subbasin for the five sediment fractions referred to above (i.e., including small and large aggregates), and b) to compute the order of magnitude of the average aggradational rates at each reach of the stream network. The post-processing uses the same sediment yield and sediment routing equations that AnnAGNPS does; the difference is in muting the disaggregation of the pellets. More specifically: (i) it performs the conversion of gross erosion rates to sediment yields at the outlet of individual subbasins by using a sediment delivery ratio computed from the Hydro-geomorphic Universal Soil Loss Equation (HUSLE, Theurer and Clarke, 1991); (ii) it obtains the grain size distribution of the sediment yield by implementing an iterative calculation based on the concept of mass fall velocity, which uses information on grain size and density for each of the five sediment fractions; and (iii) it conducts the sediment routing through the stream network on a grain size basis by comparing the actual and transport capacity rates, the latter computed from a relation based on a nonlinear transport relation.

The description of the post-processing steps is given in Appendix B of this report. While the VBA post-processing code was written to accept data from output files generated by any AnnAGNPS model, the code has not been tested for basin configurations that differ from the South Branch Buffalo River model.

5. Model Calibration and Validation

Model calibration is the process of adjusting some of the more uncertain input parameters until the model predictions can be shown to fall within the range of observations made in the system. Observations of sediment discharge on the South Branch Buffalo River are quite limited. The United States Geological Survey performed daily suspended sediment sampling at the Sabin stream gauge during the 1976-1978 water years. Because these data were measured somewhat downstream of some of the channels that needed to be modeled, additional discharge and suspended sediment concentration data were collected between May and July, 2005, on Hay Creek just upstream of the confluence with Spring Creek (point M in Figure 4; Figure 8 is photo looking upstream). A continuously recording pressure transducer was installed on April 8, 2005 at the same location so that an essentially continuous record of water level and thus discharge could be computed.

The goal of the 2005 gauging study was to develop a summer-long estimate of total suspended sediment load at this location. Unfortunately, a malfunction in the pressure transducer prevented collecting of a continuous record of discharge during the most intense rainfall events of 2005 and therefore prevented developing of the summer-long total suspended sediment discharge estimate. However, 11 discharge measurements and depth integrated suspended sediment samples taken during some of the higher flow events were sufficient to develop a rudimentary stage-discharge curve and a separate suspended sediment rating curve for the site. These are shown in Appendix D.

Discharge data for the 1977-1978 period at the USGS Sabin discharge gauge as well as rainfall and maximum and minimum temperature at Fargo are shown in Figure 23. Unfortunately, the 1977 data were not adequate for calibration because no significant runoff events occurred that year. The only significant discharge event for the entire period occurred in early April of 1978 and was almost entirely due to snowmelt.

Table 6 shows the predicted and observed sediment load at the Sabin Gauge for the 1978 snowmelt-driven runoff event of March 20-April 20, 1978, for the entire March-September period, and for the portion of the March-September period occurring after snowmelt essentially ended April 20. The total suspended sediment discharge of for the uncalibrated model is much larger than observed.

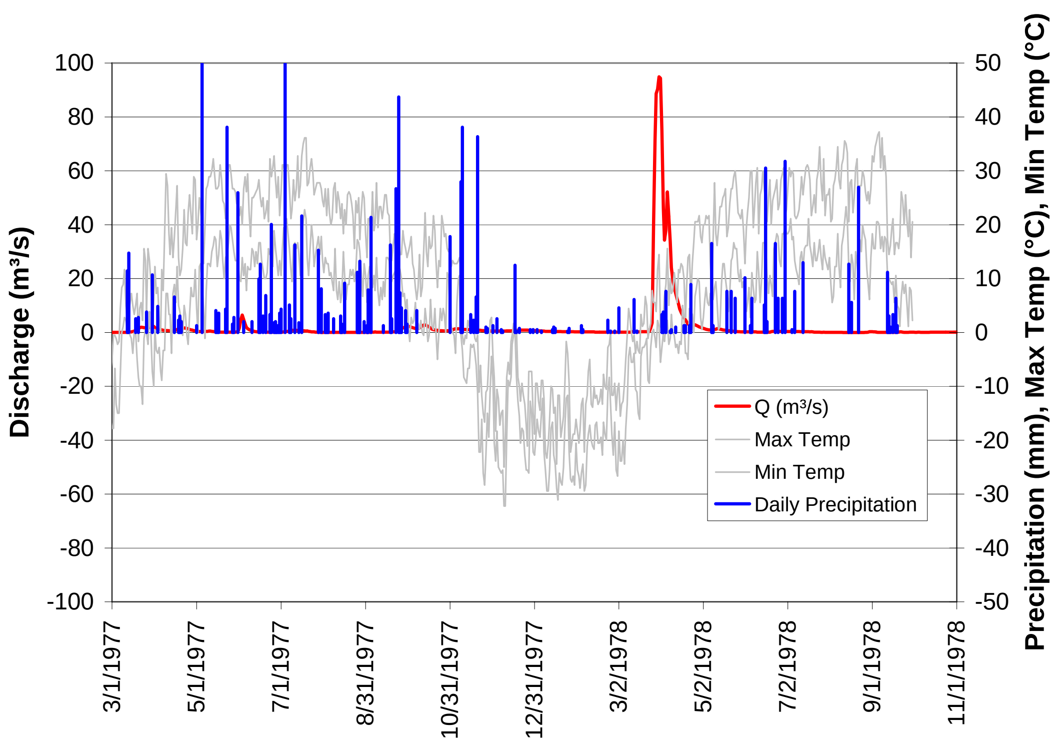


Figure 23. USGS discharge measurements at Sabin gauge and weather data from NWS Fargo gauge for 1978 calibration period.

Table 6. Uncalibrated results at Sabin gauge.

Event Dates	Water Discharge ($m^3 \times 10^6$)			Sediment Discharge (tons)		
	Predicted	Observed	Pred/Obs	Predicted	Observed	Pred/Obs
March - October 1978	143.8	87.8	1.6	67,100	5,300	12.7
3/20/1978 - 4/20/1978	85.8	81.5	1.1	35,700	4,800	7.4
4/21/1978 - 9/30/1978	58.0	6.1	9.6	31,700	400	79.3

The model was calibrated by reducing all runoff curve numbers by 5 percent, assuming that runoff events less than 0.5 mm at the watershed outlet did not produce any sediment, adding a deeper soil layer to the soils in the model to account for some additional soil moisture storage capacity (needed for model stability during snowmelt events), increasing the roughness coefficient for sheet flow by a factor of two and the coefficient for shallow concentrated flow by a factor of four (these increase the time of concentration for a basin and therefore reduce sediment delivery ratio), and by reducing the RUSLE slope-length factor by a factor of four for each basin. The results are shown in Table 7.

Table 7. Calibrated results at Sabin gauge.

Event Dates	Water Discharge ($m^3 \times 10^6$)			Sediment Discharge (tons)		
	Predicted	Observed	Pred/Obs	Predicted	Observed	Pred/Obs
March - October 1978	112.0	87.8	1.3	9,200	5,300	1.7
3/20/1978 - 4/20/1978	74.5	81.5	0.9	6,500	4,800	1.4
4/21/1978 - 9/30/1978	37.6	6.1	6.2	2,700	400	6.8

The calibrated model was applied to the period in 2005 during which the measurements of discharge and suspended sediment concentration on Hay Creek were available. The AnnAGNPS model predicts runoff at this site for only two days during June 7 and 8, 2005. Predictions for this event and the corresponding measured values are shown in Table 8.

Table 8. 2002-2005 validation, Sabin and Hay Creek gauges.

Event Location and Dates	Water Discharge ($m^3 \times 10^6$)			Sediment Discharge (tons)		
	Predicted	Observed	Pred/Obs	Predicted	Observed	Pred/Obs
Sabin 1/1/2002 - 10/30/2005	470.0	328.0	1.4	53,000	n/a	n/a
Hay Creek 8/28/2005 - 10/30/2005	8.5	3.5	2.4	278	n/a	n/a
Hay Creek 6/7/2005 - 6/8/2005	1.1	0.5	2.3	57	68.7	0.8

The calibrated model predicts a total annual sediment yield at the downstream end of the model of 14,400 tons/yr or 13.0 tons/km²/yr when averaged across the 1106 km² basin. A USGS report authored by Sether et al. (2004) describes an analysis of suspended sediment load measurements on the Red River both upstream and downstream of the confluence with the Buffalo for the 1997-1999 period. The data are sufficient to compute by difference the approximate contribution from the entire Buffalo River. The expected supply and yield per unit area are shown in Table 9. The AnnAGNPS predictions are somewhat lower in terms of yield per unit area than the Sether et al. (2004) prediction for the Buffalo River as a whole, but are still well within the confidence limits. Table 9 is consistent with the observation that the main stem Buffalo watershed is significantly steeper and thus likely more erodible than the South Branch Buffalo watershed.

Table 9. Annual sediment yield for the entire Buffalo River watershed (Sether et. al 2004) in comparison with AnnAGNPS predictions.

Watershed	Yield (tons)	Yield/unit area (tons/km²)
Entire Buffalo River		
Upper 90% limit	277,000	93.8
Expected	144,000	48.8
Lower 90% limit	9,000	3.0
South Branch		
AnnAGNPS	14,400	13.0

6. Results

The AnnAGNPS model results for the 2002-2005 period for both gross erosion rates (Figure 24) and sediment yield (Figure 25) vary dramatically across the watershed. The steepest basins in the uplands contribute by far the most sediment to the stream system. This implies that any management practices intended to reduce sediment yield should be focused on the steepest part of the watershed, i.e. the northeastern part of the basin.

The results in Table 10 provide additional information on the grain size distribution of the sediment delivered from the subbasins to the stream network of the South Branch Buffalo River. It is of interest to note that for the period 2002-2005, the post-processing with the VBA code resulted in 13.7% of the total yield to the channel system corresponding to sand and large aggregates.

Table 10. Grain size distribution of sediment yield for South Branch Buffalo River, 2002-2005 model period.

Sediment fraction	Percent of total sediment yield	
	AnnAGNPS	VBA code
Clay	41.9	31.2
Silt	48.9	21.5
Sand	9.2	1.2
Small Aggregates	0.0	33.6
Large Aggregates	0.0	12.5

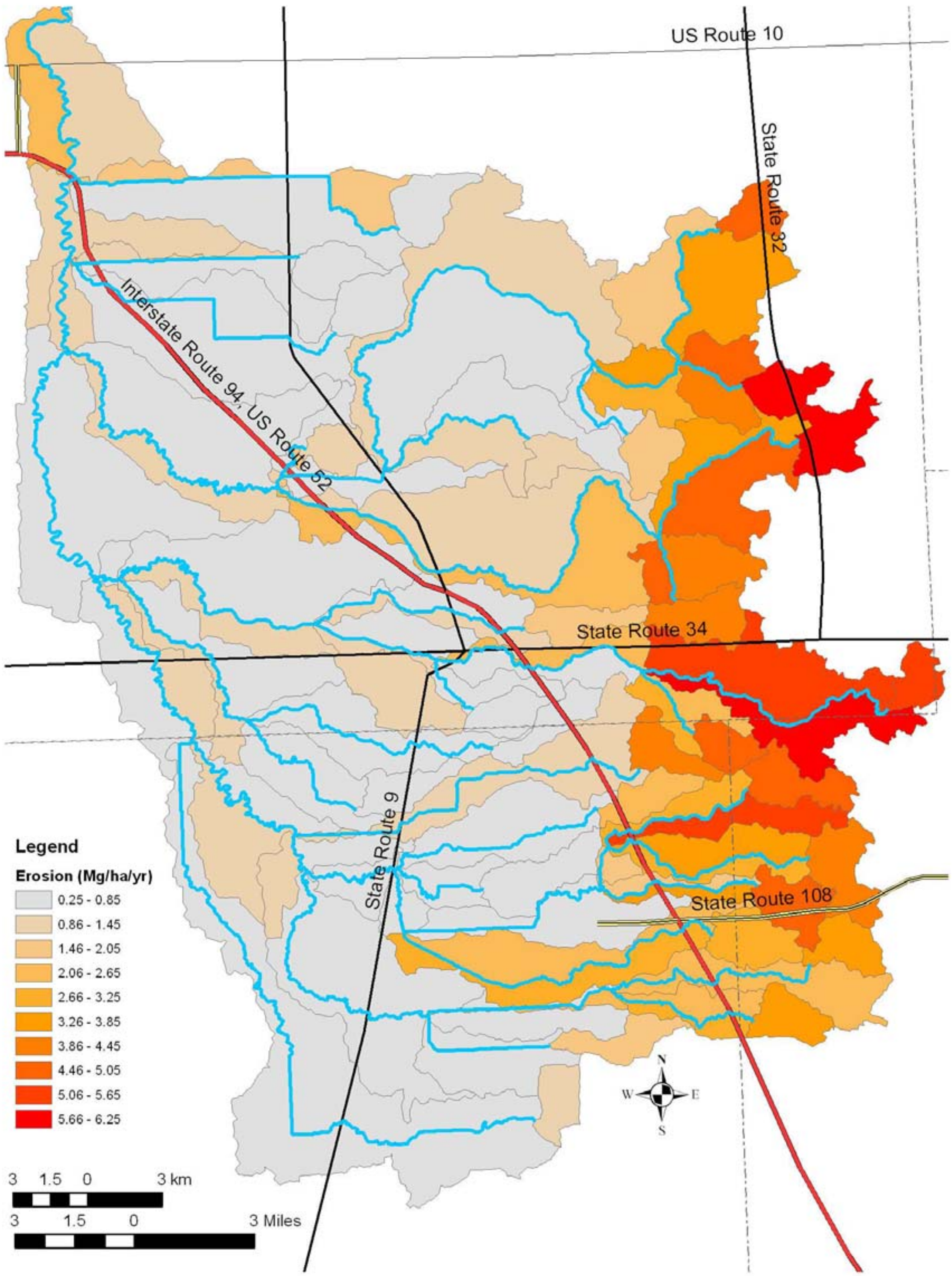


Figure 24. Gross annual erosion rates in metric tons (megagrams) per hectare per year, Mg/ha/yr (all grain sizes).

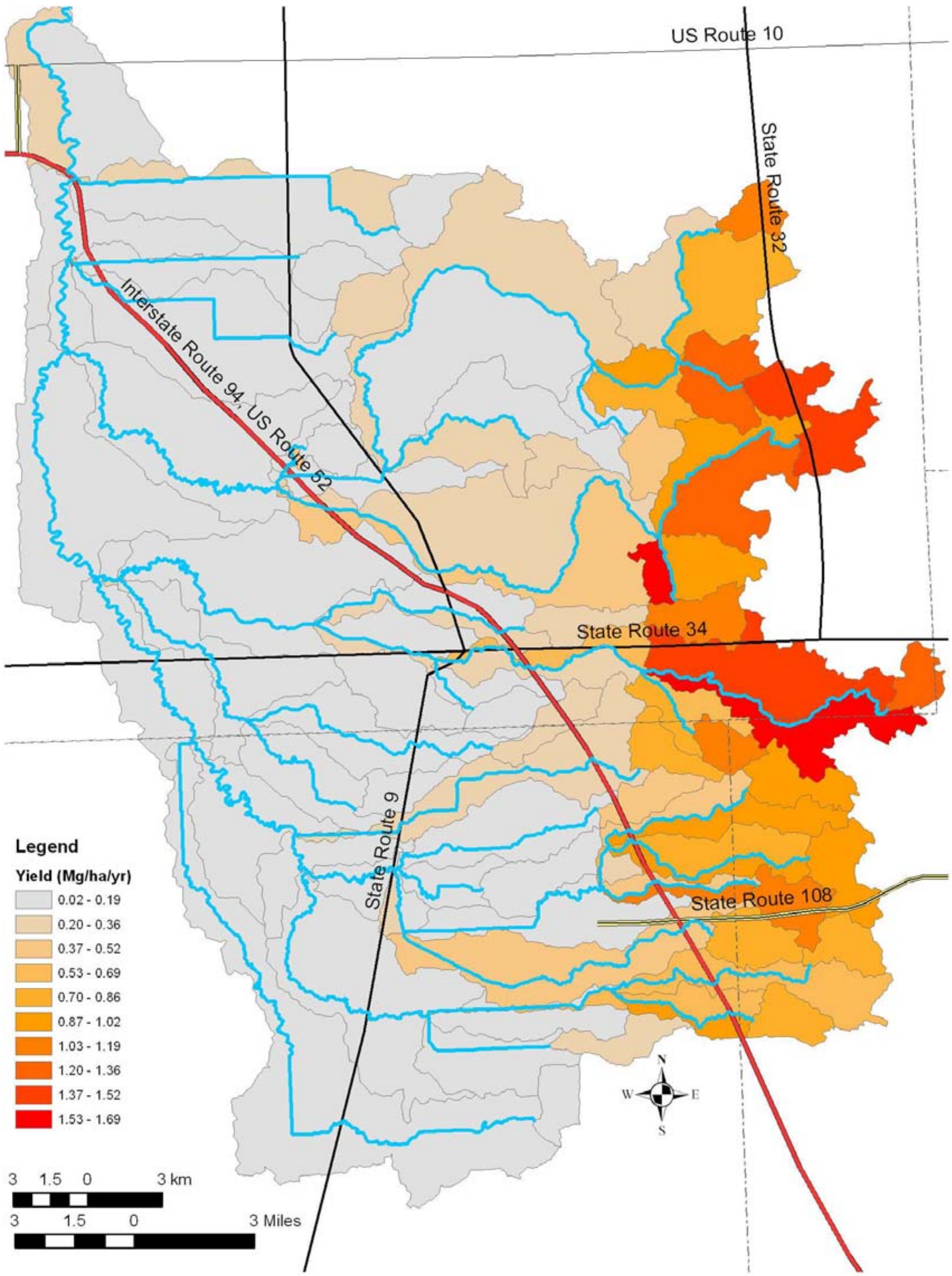


Figure 25. Gross annual sediment yield in metric tons (megagrams) per hectare per year, Mg/ha/yr (all grain sizes) at subbasin outlet per unit area.

The total bank erosion rates were estimated using the assumptions listed previously (which should be considered to represent an upper limit to the net bank erosion sources in the watershed rather than precise estimates of these rates) are shown in Table 11 along with the average annual 2002-2005 sediment yield computed by AnnAGNPS for surface erosion. The AnnAGNPS estimate is much larger than the estimate for net bank erosion, implying that most of the sediment moving through the system originates from surface erosion.

Table 11. Bank erosion and surface sediment yield estimates.

Source	**Supply (tons/yr)**
Banks of natural channels in lake bed	733
Banks of straightened channels, main tributaries	180
Banks of natural channels in uplands	620
Banks of gullies where tributaries cross old lake shore	64
Banks of first order tributaries[1]	0
Total Bank Erosion	1,597 ≈ 1,600
2002-2005 Annual AnnAGNPS sediment yield	14,400
Bank Erosion / AnnAGNPS yield	11%

[1] Not accounted for due to lack of data.

One of the primary goals of this analysis is to determine the sensitivity of the watershed to changes in land use. This was accounted for in a simple way by comparing the calibrated model results (which represent the watershed as being planted entirely in soybeans) with cases where the watershed is planted instead in a) soybeans with conservation tillage, b) wheat without conservation tillage, c) corn without conservation tillage, and d) corn with conservation tillage. For the purposes of this analysis, conservation tillage means the replacement of fall moldboard plowing, which completely turns over the soil column, with fall chisel plowing, which retains some of the crop residue near the soil surface. The curve number is somewhat lower during the winter under fall chisel plowing rather than fall moldboard plowing as well. The predicted annual average sediment discharge at the watershed outlet for the 2002-2005 model period are shown in Table 12.

There is a large range of sediment yield in Table 12, with the highest yield resulting from conventional soybean cultivation. The lowest yield, at 62% that of the conventional soybean yield, is due to corn in conservation tillage. Conventional tillage corn also results in somewhat lower erosion than the other crops, probably because it protects a greater fraction of the soil surface from raindrop impact during the later part of the year.

Table 12. Sensitivity to conservation practices.

Cultivation Practice	Yield at outlet (tons/yr)	Change from conventional soybeans
Soybeans, conventional tillage[1] (fall moldboard plow)	14,400	0.0%
Soybeans, conservation tillage (fall chisel plow)	13,300	-7.6%
Wheat, conventional tillage (fall moldboard plow)	12,500	-13%
Corn, conventional tillage (fall moldboard plow)	10,200	-29%
Corn, conservation tillage (fall chisel plow)	8,900	-38%

[1] Soybeans with conventional tillage were used to develop watershed-wide results (i.e. Table 11, Figure 24 and 25).

The post-processing of the AnnAGNPS output results for the period 2002-2005 with the VBA programming code allowed the estimation of approximate orders of magnitude for average aggradational (deposition) rates in the different reaches of the South Branch Buffalo River stream network. These results should not be considered a precise description of aggradation rates within the system, however, for several reasons. First, since we observed primarily sand and aggregated soil particles on the bed, we avoided the specification of extremely complicated (and locally undocumented) sediment flocculation and settling dynamics by disregarding the deposition of silt, clay , and small soil (silt size) aggregates on the bed. Nevertheless, it is possible that particles of silt size and smaller can deposit directly on the bed (i.e. not in the form of larger aggregate particles). Such processes are not included in the standard AnnAGNPS routing procedures and would need significant field and laboratory based study before they could be applied to the modeling of streams within the Red River Valley. Second, and perhaps more importantly, bed degradation during runoff events that do not cause much upland erosion was not accounted for in the post-processing code. Finally, the results presented in Figure 26 are sensitive to the slope computed for each reach from USGS DEM data. Consequently, it is possible that relatively small errors in elevation in the DEM can result in large slope errors for very short basins. This probably explains some of the extremely high aggradation rates predicted on reaches 14 and 44. Consequently, the results in Figure 26 represent what we consider to be upper bound estimates for aggradation within the system.

The aggradation rate results are useful for identifying in a relative way the locations of significant deposition within the system. Figure 26 shows that, in relative terms, the large amounts of sediment delivered from the steepest subbasins and first order streams can be routed downstream to the sand/silt transition coincident with the footprint of Lake Agassiz. This transition also corresponds to a significant decrease on channel bed streamwise slopes, therefore to an important reduction on the sediment transport capacity of the river system, which basically becomes choked with the sediment supplied from upstream. Moreover, aggradational rates are more dramatic in second and third order streams than in the main stem of the South Branch Buffalo River; most sediment produced upstream is deposited before reaching the main stem.

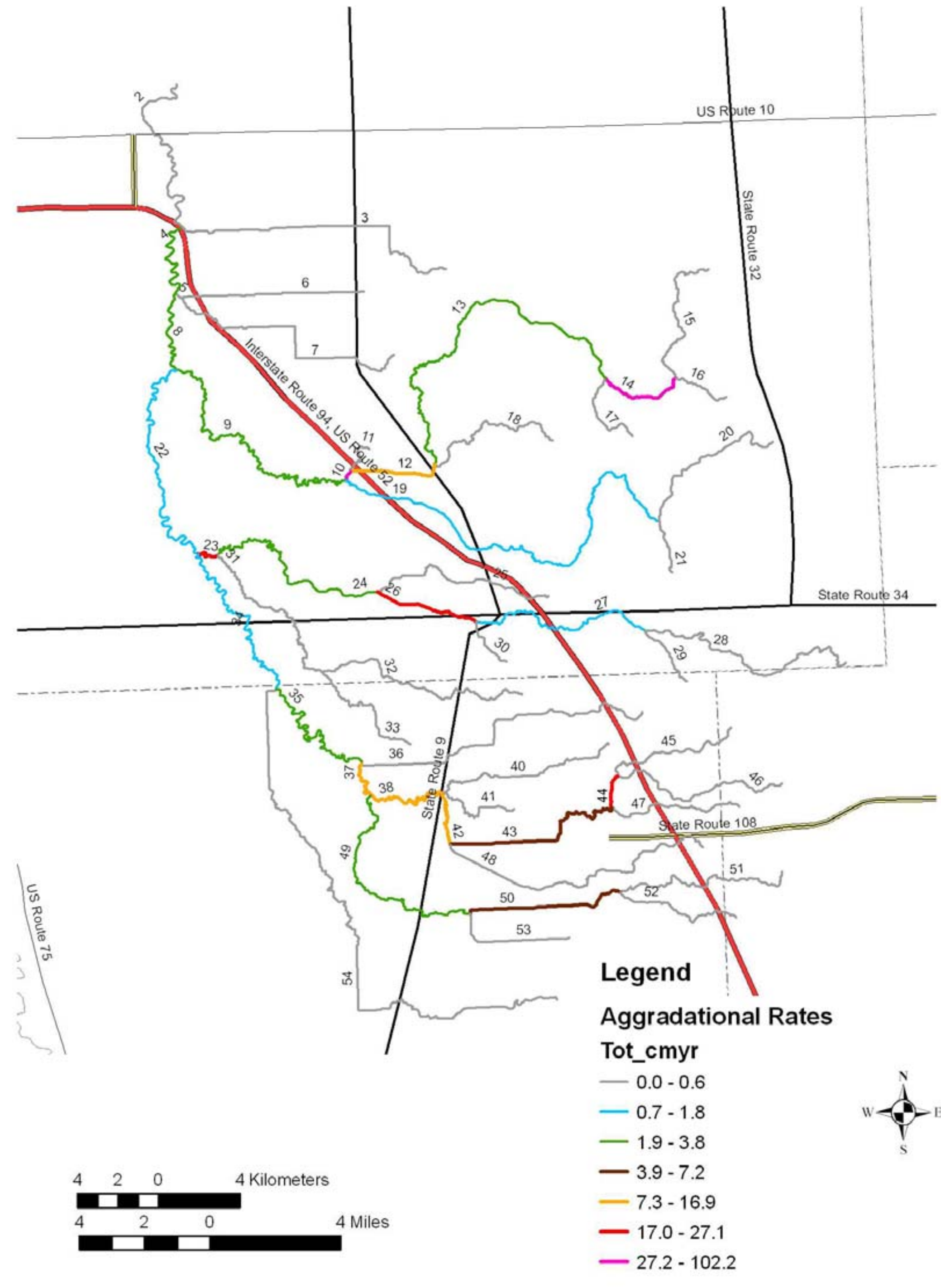


Figure 26. Order of magnitude of average aggradational rates in centimeters per year, cm/yr (sand and large aggregates).

7. Conclusions

The results of the modeling show that the sediment load at the mouth of the South Branch Buffalo River watershed is mainly supplied to the stream network from agricultural soils in the watershed. The fields supplying most of this sediment are probably located on steeper slopes in the northeastern part of the watershed.

A significant fraction of the bed of the low gradient channels within the lake plain of Glacial Lake Agassiz is composed of aggregated soil pellets whose diameters are in the sand size range. It is likely that these pellets are also the result of surface erosion of sediment within the watershed.

The most likely locations for sediment deposition in the watershed are probably in the vicinity of the sand/silt transitions that were observed near U.S. Highway 94 on both Stony and Hay Creeks. Similar transitions are probably present on the other major tributaries where they enter the historic bed of Lake Agassiz. The fact that sand does not travel beyond this point but is present on the bed upstream implies that any sand brought in from upstream goes into storage on the bed, raising the bed level and reducing channel capacity. If the capacity for sand transport decreases near the sand/silt transition, the capacity for the transport of the aggregated soil pellets also probably drops rapidly in this region, though perhaps somewhat downstream of the downstream-most sand deposits since the soil pellets are somewhat less dense and thus probably somewhat easier to move than sand.

Management of suspended sediment transport and turbidity levels within the watershed requires management of agricultural practices within the watershed. Suspended sediment supply from agricultural runoff is particularly sensitive to land conditions in early spring.

8. Future Work

The source of sand to the upper tributaries in the watershed is still somewhat unclear. The AnnAGNPS model does predict significant sand supply to many of the upstream channels. However, the rough bank erosion analysis in this region was not detailed enough to confidently determine the sand supply from streambanks. Bank material grain size distributions and better approximation of migration and possibly incision rates on first and second order streams would be required to improve the supply estimates from this source. Such a study would probably require long-term monitoring of first and second order channels using erosion pins, since it is not feasible to re-occupy cross sections on such small channels.

The source of aggregated soil pellets observed on the bed of the lower-gradient channels is not entirely clear. However, it is plausible but not certain that they originate on agricultural fields. Geochemical analysis of the pellets would perhaps shed some light on this question.

Calibration of the AnnAGNPS model for the South Branch was complicated by limited suspended sediment observations. The best observations available (1978) were made during a year with virtually no runoff after the spring snowmelt event. Longer term gauge data would add confidence to the model calibration. It would also greatly improve model calibration if long-term yield rates were computed from reservoir sedimentation studies of some of the closed basins within the uplands. The selection of future study sites should be made with the calibration requirements of the model in mind.

The model can be used to evaluate other additional land management alternatives in the basin. For instance, the model has the capability of incorporating contour plowing and strip cropping practices into the erosion rate predictions. It is more difficult to incorporate the presence of grass swales and buffer strips into the model since such features are below the resolution of the model.

The AnnAGNPS program has the capability of modeling nutrient fluxes from agricultural fields to the stream system. While we have not used the program for this purpose, it would be straightforward to make such predictions using the framework we have developed. While such predictions could be valuable in their own right, in combination with the fine sediment supply predictions made by the model, they could be used to develop a comprehensive model of stream turbidity that included both the fine sediment component and biotic (i.e. nutrient dependent) components of turbidity.

While our calibration and results are based on the assumption that the entire watershed is managed for conventional soybean production, it would be possible to perform multiple model runs assuming various management scenarios and then tabulate a weighted average the results to develop a gross erosion rate. However, the sensitivity we have shown to changes in land use as described in Table 12 may be sufficient for most management decisions.

References

Bigner, R.L., Theurer, R.L., and Yuan, Y., 2003. *AnnAGNPS Technical Processes: Documentation Version3.3.* United States Department of Agriculture.

Brigham, M.E., McCullough, C.J., and Wilkinson, P. (2001). Analysis of suspended-sediment concentrations and radioisotope levels in the Wild Rice River basin, northwest Minnesota, 1973-98. *USGS Water Resources Investigations*, Report WRI 01-4192: 21 pp.

Brooks, G.R. (2003). Alluvial deposits of a mud-dominated stream: the Red River, Manitoba, Canada. *Sedimentology*, 50(3): 441-458.

Brooks, G.R. (2005). Overbank deposition along the concave side of the Red River meanders, Manitoba, and its geomorphic significance. *Earth Surface Processes and Landforms*, 30(13): 1617-1632.

Fenton, M.M., Moran, S.R., Teller, J.T., and Clayton, L. (1983). Quaternary stratigraphy and history in the southern part of the Lake Agassiz basin. *Geological Association of Canada*, Special Paper 26: 49-74.

Griggs, R.F. (1906). The Buffalo River: An interesting meandering stream. *Bulletin of the American Geographical Society*, 38(3): 168-177.

Harris, K.L., Moran, S.R., and Lee, C. (1974). Late Quaternary stratigraphic nomenclature, Red River Valley, North Dakota and Minnesota. *North Dakota Geological Survey Miscellaneous Series*, 52: 47 pp.

Heerman, D.F., Harrington, G.J., and Stahl, K.M. (1985). Empirical estimation of daily clear sky solar radiation. *Journal of Climate and Applied Meteorology*, 24(3): 206-214.

Hughes, M.L., McDowell, P.F., and Marcus, W.A. (2006). Accuracy assessment of georectified aerial photographs: Implications for measuring lateral channel movement in a GIS. *Geomorphology*, 74(1-4): 1-16.

Lauer, J.W., and Parker, G. (2005). Net transfer of sediment from floodplain to channel on three southern US rivers. *EWRI 2005: Impacts of Global Climate Change*, ASCE.

Lawler, D.M. (1993). The measurement of river bank erosion and lateral channel change; a review. *Earth Surface Processes and Landforms*, 18(9): 777-821.

Maroulis, J.C., and Nanson, G.C. (1996). Bedload transport of aggregated muddy alluvium from Copper Creek, central Australia: a flume study. *Sedimentology*, 43(5): 771-790.

Maclay, R.W., Winter, T.C., and Bidwell, L.E. (1972). Water resources of the Red River of the North drainage basin in Minnesota. *USGS Water Resources Investigations*, Report WRI 72-0001: 129 pp.

Rust, B.R., and Nanson, G.C. (1989). Bedload transport of mud as pedogenic aggregates in modern and ancient rivers. *Sedimentology*, 36(2): 291-306.

Schwert, D.P. (2003). A geologist's perspective on the Red River of the North: History, geography, and planning/management issues. 16 pp.

Sether, B.A., Berkas, W.R., and Vecchia, A.V. (2004). Constituent loads and flow-weighted average concentrations for major subbasins of the upper Red River of the North basin, 1997-99. *USGS Scientific Investigations Report*, Report SIR 2004-5200: 62 pp.

Stoner, J.D., Lorenz, D.L., Wiche, G.J., and Goldstein, R.M. (1993). Red River of the North basin, Minnesota, North Dakota, and South Dakota. *AWRA Water Resources Bulletin*, 29(4): 575-615.

Teisseyre, A.K. (1989). Soil sand: Its origin, transportation and part played in the construction of mud-supported floodplains in a humid, temperate climate. *Geologia Sudetica*, XXIV(1-2): 285-292.

Teller, J.T., and Clayton, L. (1983). Glacial Lake Agassiz. *Geological Association of Canada*, Special Paper 26: 451 pp.

Teller, J.T., and Leverington, D.W. (2004). Glacial Lake Agassiz: A 5000 yr history of change and its relationship to the $\delta^{18}O$ record of Greenland. *Geological Society of America Bulletin*, 116(5-6): 729-742.

Theurer, F.D., and Clarke, C.D. (1991). Wash load component for sediment yield modeling. *Proceedings of the Fifth Interagency Sedimentation Conference*, 8 pp.

USDA (1997). Usual planting and harvesting dates for US field crops. *USDA National Agricultural Statistics Service*, Agricultural Handbook Number 628: 51 pp.

Appendix A: GIS-based AnnAGNPS Model Preparation

A.1 Introduction to the Appendix

This appendix is provided to help future watershed modelers prepare an AnnAGNPS watershed model. In general, model pre-processing follows the directions given in the USDA AnnAGNPS tutorials quite closely. However, some additional pointers are provided for the development of an input DEM and for the utilization of NRCS SSURGO soils data within AnnAGNPS.

At the time this project was completed, several tools were available to help with the development of AnnAGNPS input data from GIS. The most complete tool is that provided by the USDA ARS with the packaged AnnAGNPS software. This GIS pre-processor runs in ArcView 3.x and requires the Spatial Analyst extension.

We found the development of an adequate input DEM difficult using ArcView 3.x and the USDA pre-processor. Consequently, we recommend using ArcGIS 9.x for performing the initial DEM processing. Once adequately processed, the DEM can be used as input for the ArcView 3.x GIS pre-processor.

This appendix is not intended to provide documentation of every single step required for developing a useable AnnAGNPS model. The user is expected to have a solid understanding of the AnnAGNPS model structure and background assumptions (the AnnAGNPS user manual is a good reference for developing this understanding). Specifically, some of the assumptions regarding agricultural practices are not covered in detail. However, this appendix will cover the basic assumptions and data sources for the six major types of data used in an AnnAGNPS model intended for predicting soil erosion rates: Cell and Reach Data, Climate Data (using multiple stations), Soil Data, Crop and Management Data (at least rudimentary data sources), Runoff Curve Number Data.

A.2 Required Software

ArcGIS 8.x or 9.x
ArcView 3.x
AnnAGNPS ArcView 3.x PreProcessor
    Available online at
    http://www.ars.usda.gov/Research/docs.htm?docid=7000
Microsoft Access
Microsoft Excel

A.3 Development of Cell Data and Reach Data using a GIS Pre-processor

AnnAGNPS requires the specification of several types of data related to watershed and stream network geometry. These data can be input directly into AnnAGNPS using the input editor. However, measuring these parameters by hand would be tedious and time consuming. Many of these parameters (including the important slope length LS factors) can be developed easily from a digital elevation model of the watershed. The following section describes the development of this information and how it is imported into the AnnAGNPS input editor.

Step 1: Download and process DEM

Download 1 arc second second (~30 m) DEM data from the USGS. Note that while higher resolution DEMs (1/3 and 1/9 arc second) are available from this source, the spatial resolution is too large for the AnnAGNPS pre-processor to function adequately. It is possible that even lower resolution DEMs would also perform adequately, but this has not been tested.

Data are available online at:
http://seamless.usgs.gov/website/seamless/viewer.php
(done for Buffalo River project on June 15, 2005)

The data from this site are in geographic coordinates based on the WGS 84 datum, NAD83 Geographic.

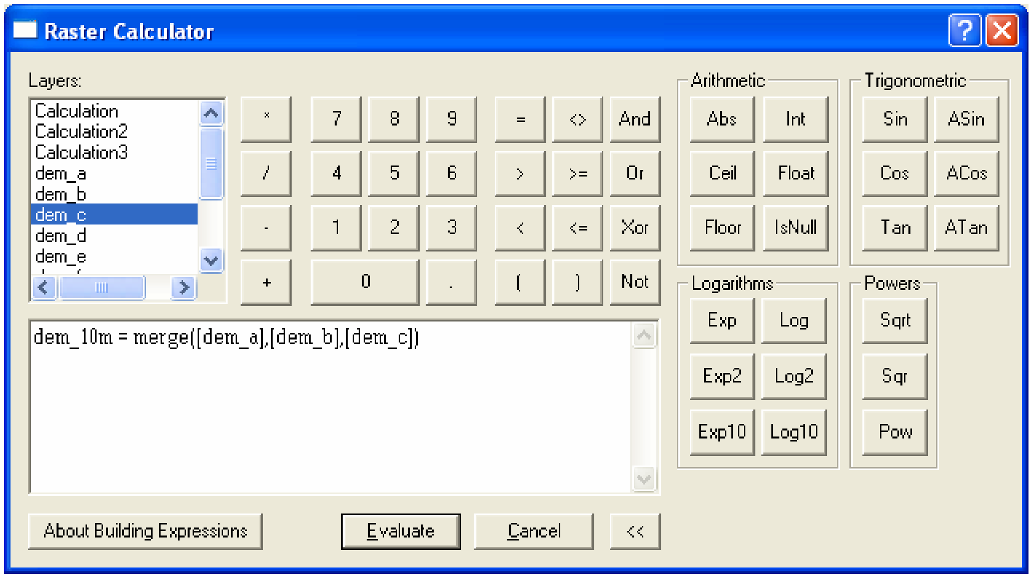
Step 2: Merge DEM data if it was provided in multiple tiles. This can be done in ArcMAP v. 9.x as follows:

Turn on the spatial analyst toolbar
Under the spatial analyst toolbar, choose “options”

Under the “General” tab, set a working directory, and set the analysis mask to none

Under the “Extent”tab, set the analysis extent to union of inputs
Under the “Cell size” tab, set the analysis cell size to the minimum of inputs

Under the spatial analyst toolbar, choose “raster calculator”



Type the line shown in the above window with the appropriate dem names, and click on evaluate.

Step 3: Convert the data to a projected coordinate system:

Open ArcToolbox from ArcCatalog

Under data management tools, projections, choose project wizard (coverages, grids)

Select the downloaded and merged DEM

Choose the predefined projected coordinate system of choice (recommend UTM zone 14, NAD83).

Use cubic spline interpolation, and allow the program to define the cell size.

Step 4: Clip the projected DEM using a predefined watershed boundary that does not include closed basins.

Add a watershed boundary shapefile to the table of contents

Under the options menu of the spatial analyst pulldown menu, set the analysis mask to be the watershed shapefile. Also set the extent to the extent of the shapefile and the cell size to be the same as the DEM.

Under the options menu of the spatial analyst pulldown menu, select the raster calculator, and double click on the projected dem. Hit enter. This will compute a new dem that is identical to the input dem but with nodata outside the analysis mask.

Make the new dem permanent by right clicking on its name in the table of contents and selecting make permanent.

Step 5: Fill sinks

DEMs generally have not been processes to ensure that each cell drains to another cell. In many cases, large portions of a DEM drain to closed sinks rather than to the appropriate drainage outlet. AnnAGNPS computes many watershed parameters based on the total upstream drainage area. Consequently, it is important to remove any unrealistic sinks from the DEM before allowing AnnAGNPS to compute these watershed parameters.

In ArcGIS 9.x, use the Fill Sinks tool available in ArcToolbox. Open ArcToolbox by pressing the Arctoolbox button, select Spatial Analyst Tools, Hydrology, and then the Fill tool). Provide the name of the input and output DEM's. Do not select a fill threshold. ArcMap will generate a new DEM with all sinks filled.

Step 6: Burn the USGS 1:24000 stream network into the partially processed DEM:

Most USGS DEM's do not adequately capture the real drainage network of a basin. However, the drainage network needs to be drawn correctly to ensure that parameters such as basin drainage area, channel slope, etc. are correct. The DEM can be modified using available vectorized stream data to ensure that the AnnAGNPS pre-processor accurately identifies the real network from the DEM.

Download USGS 1:24000 scale streams shapefile at
http://nhd.usgs.gov/data.html

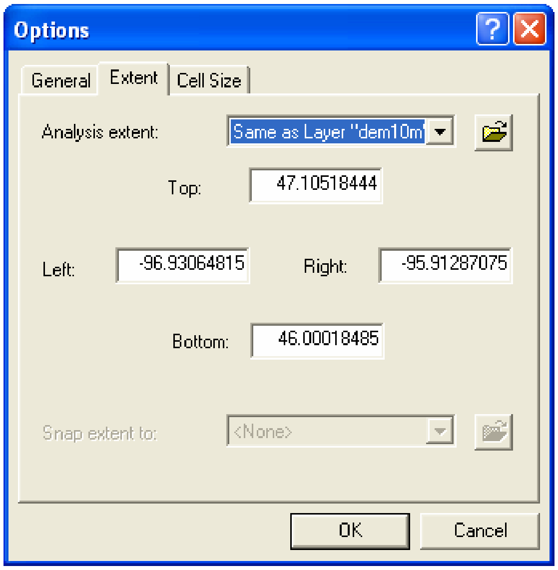
(done for buffalo on June 15, 2005)

Add the shapefile NHDFlowline.shp to the map.

Step 6.1: Convert vector streams coverage to raster with value of one:

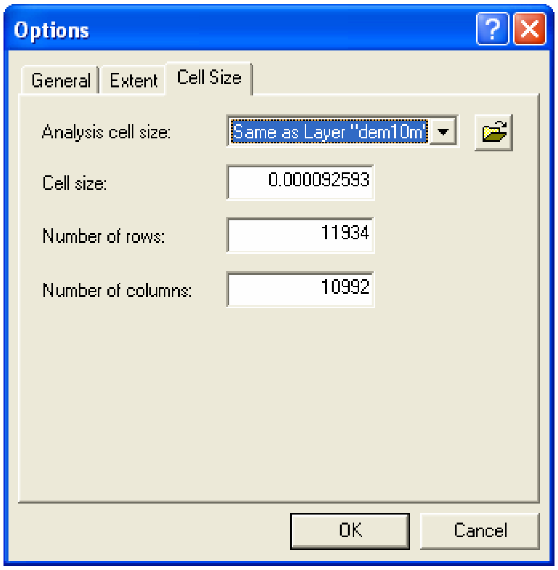
Under the options menu of the spatial analyst pulldown menu, select extents.

Set the extent to be the same as the merged dem

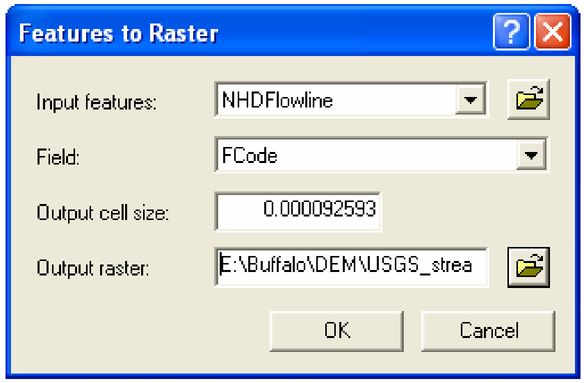


Under the options menu of the spatial analyst pulldown menu, select cell size.

Set the cell size to be the same as the merged dem

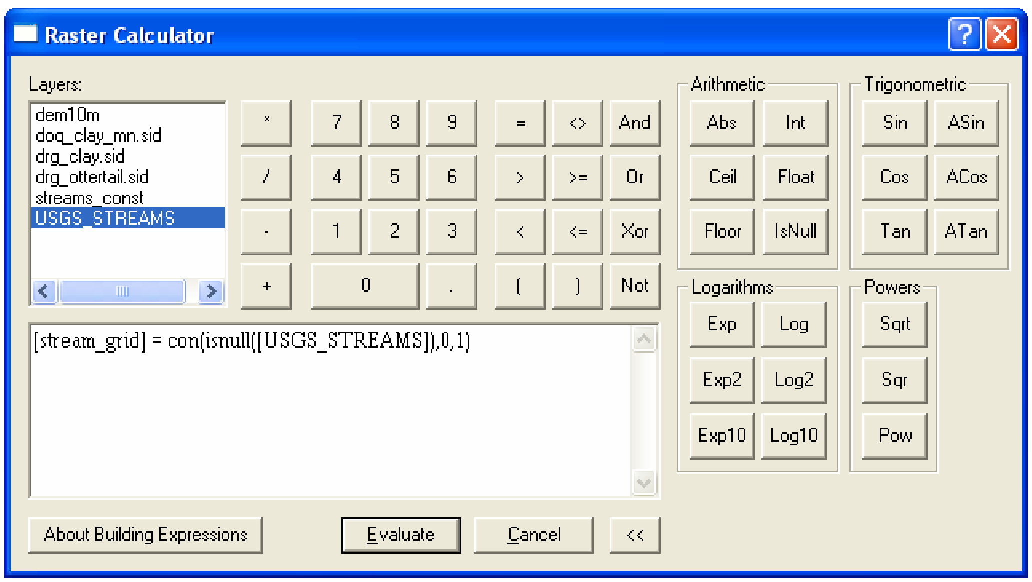


Under the convert menu of the spatial analyst pulldown menu, select features to raster. Choose the input features to be NHDFlowline, Field to be FCode, and select an appropriate name and file location.



Step 6.2: Convert the nodata cells in the streams raster to a value of zero:

Start the raster calculator from the spatial analyst pulldown menu. Enter the following expression:

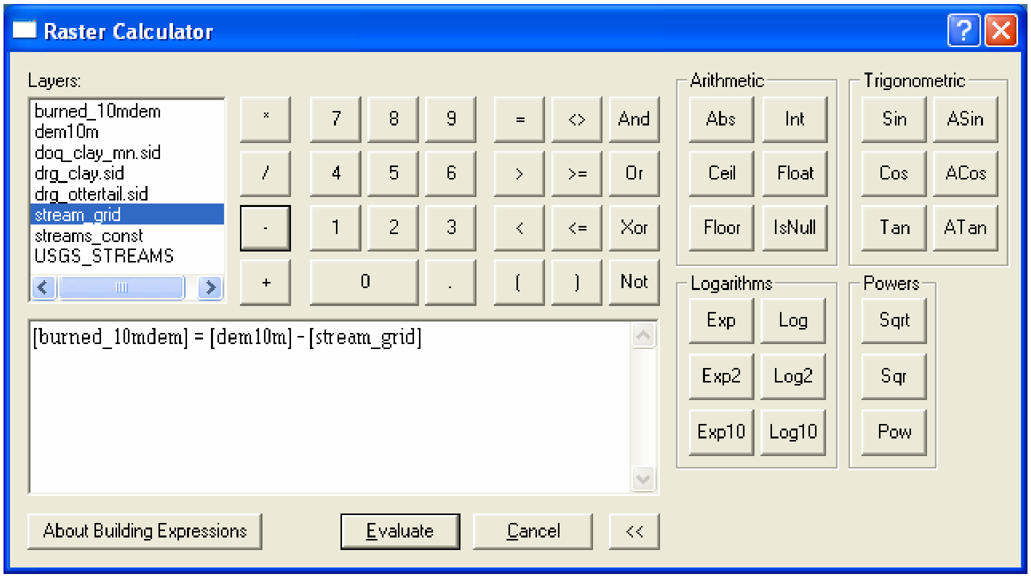


This will result in a grid with values of zero wherever no stream was present on the USGS streams shapefile and a value of 1 (or other appropriate depth) wherever a stream was present.

Right click on streams_grid in the table of contents and save it by selecting "make permanent"

Step 6.3: Reduce elevation in the partially processed DEM using the stream grid.

Start the raster calculator from the spatial analyst pulldown menu. Enter the following expression:



Right click on burned_dem in the table of contents and make it permanent.

The DEM should now be ready to run as input for the standard USDA AS ArcView 3.x based input processor. See the AnnAGNPS technical documentation for further direction on the use of this pre-processor. The ArcView 3.x preprocessor will generate a file called annagnps_cell.inp and another called annagnps_reach.inp. These can be opened using the "import flownet generator cell file" and "import flownet generator reach file" commands from the file menu of the AnnAGNPS input editor. This will bring most of the cell and reach geometric parameters into the model.

A.4 Implementation of multiple climate gauges in AnnAGNPS

Climate Data for AnnAGNPS can be entered by hand or provided as a set of separate climate station files. The latter approach is required if multiple gauges are to be included in the model.

A Microsoft Excel spreadsheet was developed to help format climate data into the AnnAGNPS input file format. The spreadsheet is called climate_preprocessor.xls. The spreadsheet includes worksheets titled "Data Processing", "Intermediate AGNPS format", "AGNPS format", and "Max Solar Rad.". To use the spreadsheet to format data into an AGNPS climate input data file, columns A-G representing daily values for daily maximum and minimum temperature, average wind speed, precipitation, average dew point, and percent possible sunshine must be filled in.

In general, historic daily precipitation and temperature data are available at the University of Minnesota Climate web server, www.climate.umn.edu .

One of the more difficult columns to collect is percent possible sunshine. However, modern agricultural climate stations (e.g. data from the North Dakota Agricultural Weather Network, NDAWN, at http://ndawn.ndsu.nodak.edu/) often record total daily solar radiation. If such data are available, they can be entered in columns I or J of the spreadsheet, and the percent of maximum expected daily solar radiation will be computed from the clear sky solar radiation curve of Heerman et al. (1985). Clear sky solar radiation is dependent upon latitude and average elevation, which can be entered on the "Max Solar Rad" worksheet.

The user must also enter appropriate header information on the "Intermediate AGNPS format" spreadsheet, including the dates that the climate file is supposed to cover. The user should then activate the "AGNPS format" worksheet and use the Save As command to save it as a text file with the name dayclim.inp, which is the name of the climate data file AnnAGNPS will look for when running. The file should be stored in the appropriate location within the AnnAGNPS directory structure (i.e. within the "6_editor_datasets" folder within the "AGNPS_Watershed_Studies" folder). The user is advised to check the dayclim.inp file for minor typographic errors such as extra spaces between columns, as these can cause errors when AnnAGNPS runs.

If the user wishes to define multiple climate gauge files, the same procedure should be followed for generating each gauge input file, except that the files should be named dayclim_01.inp, dayclim_02.inp, dayclim_03.inp, for the first, second and third gauges, etc. The gauge used to drive each basin is specified in the Cell Data menu in the AnnAGNPS input editor.

A.5 Development of Soils Data

Soils data are available at the NRCS soil data mart web site, http://soildatamart.nrcs.usda.gov/. The data are provided as a shapefile defining the geographic position of NRCS soil map units and a Microsoft Access database that provides additional information for each map unit. The Access database can be imported by downloading the NRCS template database and then importing the downloaded data using the import command in the Access template database.

The map units in the SSURGO database are relatively small and need to be aggregated to determine a representative soil for each cell or sub-watershed used in the AGNPS model. This appendix will not provide detailed instructions for this, but any experienced GIS analyst should be able to perform such aggregation. In general, the aggregation is done by first intersecting the AGNPS cell polygon file with the SSURGO map unit shapefile using the appropriate geoprocessing tools for a given GIS. Area for each polygon of the intersected dataset can then be computed in the GIS.

This will result in a dataset with fields for map unit id (mukey in the SSURGO dataset), AGNPS sub-basin id, and the area of each polygon. It is likely that many polygons with identical map unit id's will be present within each sub-basin. These can be dissolved using the dissolve command in ArcToolbox so that each sub-basin contains only a single record for each map unit id. A new area should then be computed for each dissolved polygon. The table can be exported to Excel and sorted first by AGNPS sub basin and then by area. The dissolved polygon with the largest area in each basin represents the most appropriate soil type for that basin.

Once an appropriate map unit is identified for each basin, data from the Access database must be queried and then entered into the AnnAGNPS input editor (or, alternatively, the annagnps.inp textfile) by hand. The SSURGO database contains data that does not correspond precisely with the units required by AnnAGNPS. Consequently, it is suggested that the user export the primary data table from Access, chorizon, and create new columns with the correct units. The columns should be: clay ratio (= claytotal_r / 100), silt ratio (= silttotal_r/100), sand ratio (= sandtotal_r/100), rock ratio (= frag3to10_r/100), vfs ratio (=sandvf_r/100), Ksat mm/hr (=ksat_r / 3.6), field cap (=wthirdbar_r / 100), wilt pt (= wfifteenbar / 100), Organic M (= om_r / 100), and bottom depth (= hzdepb_r * 10). Once these new columns are added to the table in a spreadsheet, the table should be reimported to the Access database with the name AGNPS_units_chorizon. An example query that selects the correct data from the SSURGO database with the modified table is included below. To run the query, the text should be pasted into the SQL view window of a new Access query. Note that the example query uses mukey ids that are specific to the soil types used for the Buffalo River project. These should be updated to represent the soil map units identified for the new watershed using the aggregation process described above.

Once the query is created in access, a report can be generated using the report wizard in Access to display the appropriate soil information. A physical report is essential for efficient hand entry of the data to the AnnAGNPS editor or to the annagnps.inp data file.

Example SQL Query:

```
SELECT mapunit.musym, mapunit.muname, component.compname,
chorizon.hzname, component.hydgrp, chorizon.dbovendry_r, chorizon.kwfact,
chorizon.kffact, AGNPS_units_chorizon.[bottom depth],
AGNPS_units_chorizon.[clay ratio], AGNPS_units_chorizon.[silt ratio],
AGNPS_units_chorizon.[sand ratio], AGNPS_units_chorizon.[rock ratio],
AGNPS_units_chorizon.[vfs ratio], AGNPS_units_chorizon.[Ksat mm/hr],
AGNPS_units_chorizon.[field cap], AGNPS_units_chorizon.[wilt pt],
chorizon.ph1to1h2o_r, AGNPS_units_chorizon.[Organic M],
component.albedodry_r, mapunit.mukey, component.comppct_r
FROM mapunit INNER JOIN (chorizon INNER JOIN (component INNER JOIN
AGNPS_units_chorizon ON component.cokey = AGNPS_units_chorizon.cokey)
```

```
ON (chorizon.chkey = AGNPS_units_chorizon.chkey) AND (component.cokey =
chorizon.cokey)) ON mapunit.mukey = component.mukey
WHERE (((mapunit.mukey)="356932" Or (mapunit.mukey)="356950" Or
(mapunit.mukey)="356954" Or (mapunit.mukey)="356958" Or
(mapunit.mukey)="356960" Or (mapunit.mukey)="356975" Or
(mapunit.mukey)="356978" Or (mapunit.mukey)="356987" Or
(mapunit.mukey)="356988" Or (mapunit.mukey)="356990" Or
(mapunit.mukey)="356991" Or (mapunit.mukey)="356995" Or
(mapunit.mukey)="356997" Or ((mapunit.mukey)="357001" Or
(mapunit.mukey)="357001" Or (mapunit.mukey)="357005" Or
(mapunit.mukey)="357009" Or (mapunit.mukey)="357010" Or
(mapunit.mukey)="357016" Or (mapunit.mukey)="357018" Or
(mapunit.mukey)="357020" Or (mapunit.mukey)="357022" Or
(mapunit.mukey)="357023" Or (mapunit.mukey)="357027" Or
(mapunit.mukey)="357391" Or (mapunit.mukey)="357397" Or
(mapunit.mukey)="357398" Or (mapunit.mukey)="357399" Or
(mapunit.mukey)="357402" Or (mapunit.mukey)="357415" Or
(mapunit.mukey)="357416" Or (mapunit.mukey)="357417" Or
(mapunit.mukey)="357419" Or (mapunit.mukey)="357422" Or
(mapunit.mukey)="357425" Or (mapunit.mukey)="357435" Or
(mapunit.mukey)="357441" Or (mapunit.mukey)="357445" Or
(mapunit.mukey)="357449" Or (mapunit.mukey)="357459" Or
(mapunit.mukey)="357463" Or (mapunit.mukey)="357466" Or
(mapunit.mukey)="357468" Or (mapunit.mukey)="357470") Or
((mapunit.mukey)="435575" Or (mapunit.mukey)="435961" Or
(mapunit.mukey)="435964" Or (mapunit.mukey)="435969"))) OR
(((mapunit.mukey)="357003"));
```

A.6 Development of Crop and Management Data

Crop and management data are defined separately in AnnAGNPS. Management data define the sequence of field tillage, fertilizing, planting, and harvesting and other management operations. Crop data define crop specific parameters such as growth rates, leaf cover, biomass, etc.

Crop data for a set of specific crop types is available in the RUSLE file croplist.dat, provided with AnnAGNPS. Select management operations are provided in the file oplist.dat, again provided with AnnAGNPS. Assumptions specific to the current model are listed in the report text.

A.7 Development of Runoff Curve Number Data

Runoff curve number data are taken from the tables provided in USDA NRCS Technical Report 55 and were calibrated as described in the report text.

The relevant table from Technical Report 55 is provided below.

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

From United States Department of Agriculture. 1986. *Technical Report 55. Urban Hydrology for Small Watersheds.*

Appendix B: Use of VBA post-processor

B.1 Introduction to Appendix

This appendix is provided to help future watershed modelers post-process the output information of an AnnAGNPS watershed model. The main goal is to allow estimation of sediment yields from the subbasins to the receiving channels of the river system not only for (disaggregated) clays, silts and sands, but also for small and large aggregates. Another goal is to allow routing of the five classes of sediment referred to above and ultimately computing approximate orders of magnitude of bed aggradation (depositional) rates in the different reaches forming the stream network under study.

A programming code in MS Visual Basic for Applications (VBA) has been written with this purpose. The VBA program can be run under Microsoft Excel. The following sections describe the steps to follow for post-processing the output information from AnnAGNPS. The CD Rom enclosed contains the electronic file *post_processing_AnnAGNPS.xls*, which includes the VBA program.

B.2 AnnAGNPS output files

The following AnnAGNPS output files are required as input in the VBA program:

> *AnnAGNPS.inp* (input file prepared to run AnnAGNPS).
>
> *AnnAGNPS_txt_gauging_station_data.txt* (output file from AnnAGNPS).
>
> *AnnAGNPS_TXT_EV_Sediment_erosion_(mass).txt* (output file from AnnAGNPS).
>
> *AnnAGNPS_TXT_EV_Sediment_yield_(mass).txt* (output file from AnnAGNPS).
>
> *AnnAGNPS_txt_cche1d.txt* (output file from AnnAGNPS).
>
> *AnnAGNPS_txt_aa_sediment_yield_(mass).txt* (output file from AnnAGNPS).

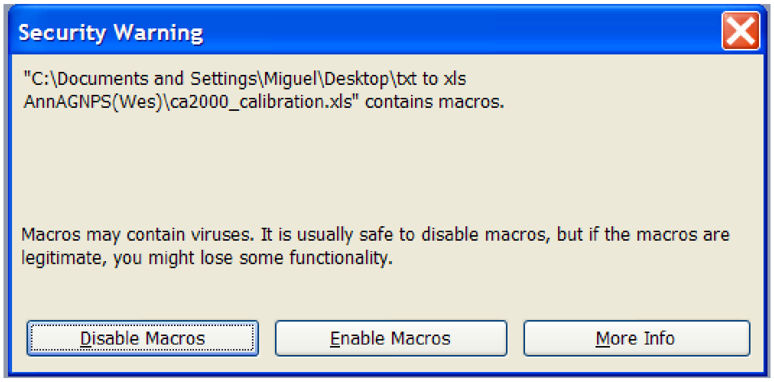
For the sake of simplicity, all these files should be copied to a given folder, which is suggested to have a name describing the type or period of simulation with AnnAGNPS.

B.3 Running the VBA program

The following steps must be followed:

> Open the workbook *post_processing_AnnAGNPS.xls* in Microsoft Excel.

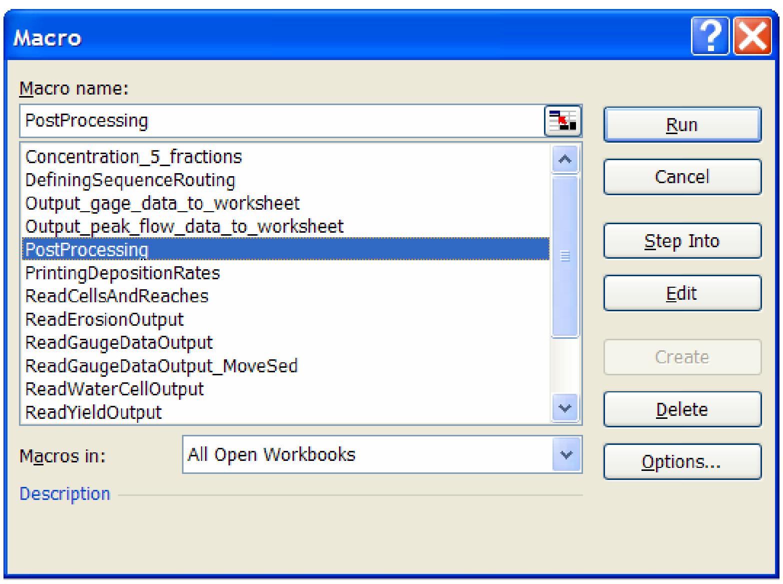
The message box below will appear



Left click on *Enable Macros*.

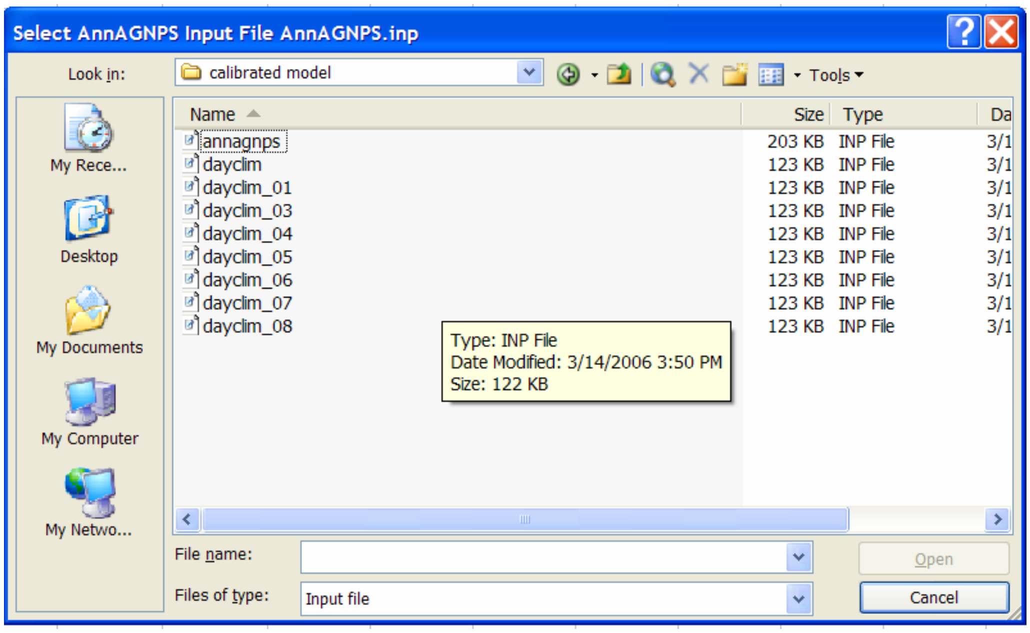
On the *Tools* menu, point to *Macro*, and then click *Macros*.

As indicated in the message box below, in the *Macro name* box enter the name of the macro *PostProcessing*.

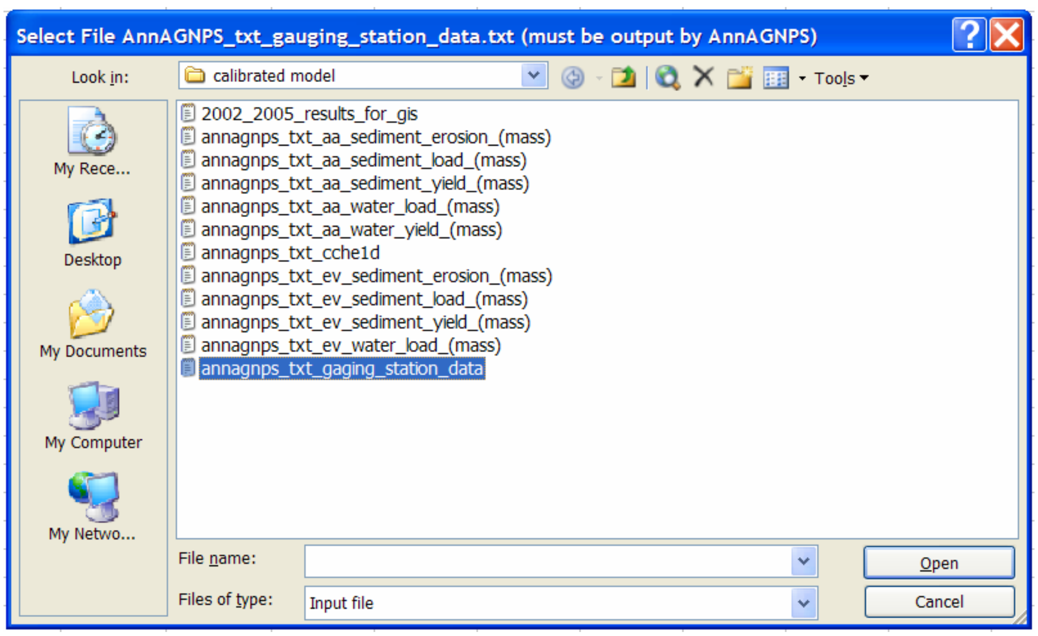


Left click on *Run*.

The post-processing with the VBA program will begin. It will begin asking for the input information listed in Section B.2 of this Appendix. Following are two examples of the seven input files asked to open (one of the AnnAGNPS is asked twice to open).



Double click on *annagnps.inp*. This allows reading the required general input information about the characteristics of the Subbasins (cells) and Reaches. The code sub-routine is *ReadCellsAndReaches()*.



Double click on *annagnps_txt_gaging_station_data.txt*. This allows reading the required input information that is specific for the simulation period. The code sub-routine is *ReadGaugeDataOutput()*.

The main results are presented in the Worksheets *Summary_annual yields* and *Deposition rates_Summary*.

B.4 VBA code

```
Option Explicit

Const DeltaT = 500

'Specific gravity of five sediment fractions
Const Gs_Clay = 2.6, Gs_Silt = 2.65, Gs_Sand = 2.65, Gs_SAgg = 1.8, Gs_LAgg = 1.6
'Settling velocity (mm/s) for five sediment fractions
Const sv_Clay = 0.00311, sv_Silt = 0.0802, sv_Sand = 23.1, sv_SAgg = 0.381, sv_LAgg =
16.5
'Equivalent sand sizes (mm) for five sediment fractions
Const Dp_Clay = 0.002, Dp_Silt = 0.01, Dp_Sand = 0.2, Dp_SAgg = 0.0351, Dp_LAgg = 0.5
'Coefficient k for five sediment fractions
Const k_Clay = 0.006242, k_Silt = 0.006053, k_Sand = 0.006053, k_SAgg = 0.012478, k_LAgg
= 0.016631
'Einstein constant for 3 out of 5 sediment fractions
Const Ae_Clay = 1, Ae_Silt = 1, Ae_SAgg = 1


Type reach_runoff_event_type
    'data taken from gauging station output file:
    'annagnps_txt_gaging_station_data.txt
    Date As String
    PeakDischargeUpper As Double 'cms
    PeakDischargeLower As Double
    TotalRunoffUpper As Double 'Mg
    TotalRunoffLower As Double

    TimeToBaseUpper As Double 's
    TimeToBaseLower As Double

    ClayTotalDischargeUpper As Double
    ClayTotalDischargeLower As Double
    SiltTotalDischargeUpper As Double
    SiltTotalDischargeLower As Double
    SandTotalDischargeUpper As Double
    SandTotalDischargeLower As Double
    AllSedimentTotalDischargeUpper As Double
    AllSedimentTotalDischargeLower As Double
    'TSSUpper and TSSLower are computed
    TSSUpper As Double
    TSSLower As Double

    Aux_Clay As Double
    Aux_Silt As Double
    Aux_Sand As Double
    Aux_SAgg As Double
    Aux_LAgg As Double
    Concentration_Clay As Double
    Concentration_Silt As Double
    Concentration_Sand As Double
    Concentration_SAgg As Double
    Concentration_LAgg As Double

    DepVol_Clay As Double
    DepVol_Silt As Double
    DepVol_Sand As Double
    DepVol_SAgg As Double
    DepVol_LAgg As Double
End Type

Type cell_runoff_event_type
    'data taken from sediment (mass) erosion and yield output files
    'Erosion: annagnps_txt_ev_sediment_erosion_(mass).txt
    'Yield: annagnps_txt__ev_sediment_yield_(mass).txt
    Date As String
    ErosionSheetAndRillTotal As Double
    YieldSheetAndRillTotal As Double
```

```
    ErosionSheetAndRillSand As Double
    ErosionSheetAndRillSilt As Double
    ErosionSheetAndRillClay As Double
    ErosionSheetAndRillSAgg As Double
    ErosionSheetAndRillLAgg As Double
    YieldSheetAndRillSand As Double
    YieldSheetAndRillSilt As Double
    YieldSheetAndRillClay As Double
    YieldSheetAndRillSAgg As Double
    YieldSheetAndRillLAgg As Double

    frac_ErosionSheetAndRillTotal As Double
    frac_ErosionSheetAndRillSand As Double
    frac_ErosionSheetAndRillSilt As Double
    frac_ErosionSheetAndRillClay As Double
    frac_ErosionSheetAndRillSAgg As Double
    frac_ErosionSheetAndRillLAgg As Double
    HUSLE_DeliveryRatio As Double

    WaterVolume As Double
    PeakDischarge As Double
    TimeToPeakDischarge As Double

    'TotalDurationHydrograph As Double
End Type

Type reach_type
    'read from input file:
    'annagnps.inp
    ID As String
    ReceivingReachID As String
    VegetationCode As Integer
    Elevation As Double
    Slope As Double
    ManningN As Double
    ChannelGeometryID As String
    Length As Double
    TopWidth As Double
    BankfullFlowDepth As Double
    ValleyWidth As Double
    ValleyN As Double
    ClayScourCode As Boolean
    SiltScourCode As Boolean
    SandScourCode As Boolean
    SmallAggregateScourCode As Boolean
    LargeAggregateScourCode As Boolean
    ValleyClayScourCode As Boolean
    ValleySiltScourCode As Boolean
    ValleySandScourCode As Boolean
    ValleySmallAggregateScourCode As Boolean
    ValleyLargeAggregateScourCode As Boolean
    ReachImpoundmentID As String

    'read from gauging station file:
    'annagnps_txt_gaging_station_data.txt
    DrainageAreaUpper As Double
    DrainageAreaLower As Double
    TimeOfConcentrationUpper As Double
    TimeOfConcentrationLower As Double

    ReachRunoffEvent() As reach_runoff_event_type
    ReachRunoffEventMoveSed() As reach_runoff_event_type

    ReachOrder As Integer
    AverageAggradation_Sand As Double
    AverageAggradation_LAgg As Double
    AverageAggradation_Total As Double
End Type

Type cell_type
    'read from gauging station file:
```

```
    'annagnps_txt_gaging_station_data.txt
    CellID As String
    SoilID As String
    ReceivingReachID As String
    DrainageArea As Double
    CellEvent() As cell_runoff_event_type

    Sum_Sand As Double
    Sum_Silt As Double
    Sum_Clay As Double
    Sum_SAgg As Double
    Sum_LAgg As Double
    Annual_YieldSheetAndRillSand As Double
    Annual_YieldSheetAndRillSilt As Double
    Annual_YieldSheetAndRillClay As Double
    Annual_YieldSheetAndRillSAgg As Double
    Annual_YieldSheetAndRillLAgg As Double
End Type

Dim NumberOfReaches As Integer
Dim NumberOfCells As Integer
Dim reach() As reach_type
Dim cell() As cell_type

Sub ReadCellsAndReaches()
    Const ForReading = 1, ForWriting = 2, ForAppending = 3
    Const TristateUseDefault = -2, TristateTrue = -1, TristateFalse = 0

    Dim fs As Object
    Dim f As Object
    Dim ts As Object
    Dim DataLine As String
    Dim fAnnAGNPSfile As String
    Dim i As Integer

    fAnnAGNPSfile = Application.GetOpenFilename("Input file (*.inp), *.inp", , "Select
AnnAGNPS Input File AnnAGNPS.inp")

    Set fs = CreateObject("Scripting.FileSystemObject")
    Set f = fs.GetFile(fAnnAGNPSfile)
    Set ts = f.OpenAsTextStream(ForReading, TristateFalse)

    Do
        DataLine = ts.readline

        If Left(DataLine, 10) = "CELL DATA:" Then
            NumberOfCells = Mid(DataLine, 41, 10)
            ReDim cell(NumberOfCells)

            For i = 1 To NumberOfCells
                With cell(i)
                    DataLine = ts.readline
                    .CellID = Trim(Mid(DataLine, 1, 10))
                    .SoilID = Mid(DataLine, 11, 10)
                    'This subroutine does not distinguish whether the connection of the
cell to the reach is at the u/s or at the d/s end,
                    'which is a problem in particular for first-order streams (in
general, the connection is at the d/s end of the reach);
                    'the subroutine Sub ReadWaterCellOutput() below corrects this
problem.
                    .ReceivingReachID = Mid(DataLine, 31, 10)
                    .DrainageArea = Mid(DataLine, 51, 10)
                    ReDim .CellEvent(0)
                End With

                DataLine = ts.readline
                DataLine = ts.readline
                DataLine = ts.readline
            Next i
        End If
```

```
        If Left(DataLine, 11) = "REACH DATA:" Then
            NumberOfReaches = Mid(DataLine, 41, 10)
            ReDim reach(NumberOfReaches)

            For i = 1 To NumberOfReaches
                With reach(i)
                    DataLine = ts.readline

                    .ID = Mid(DataLine, 1, 10)
                    .ReceivingReachID = Mid(DataLine, 11, 10)

                    If Trim(Mid(DataLine, 21, 10)) = "" Then
                        .VegetationCode = 1
                    Else
                        .VegetationCode = Trim(Mid(DataLine, 21, 10))
                    End If

                    .Elevation = Mid(DataLine, 31, 10)
                    .Slope = Mid(DataLine, 41, 10)

                    If Trim(Mid(DataLine, 51, 10)) = "" And Trim(Mid(DataLine, 21, 10)) =
"" Then
                        .ManningN = 0.04
                    ElseIf Trim(Mid(DataLine, 51, 10)) = "" And .VegetationCode = 0 Then
                        .ManningN = 0.02
                    ElseIf Trim(Mid(DataLine, 51, 10)) = "" And .VegetationCode = 2 Then
                        .ManningN = 0.02
                    Else
                        .ManningN = Trim(Mid(DataLine, 51, 10))
                    End If

                    DataLine = ts.readline

                    .ChannelGeometryID = Mid(DataLine, 11, 10)
                    If Trim(Mid(DataLine, 21, 10)) = "" Then
                        .Length = 0
                    Else
                        .Length = Mid(DataLine, 21, 10)
                    End If

                    If Trim(Mid(DataLine, 31, 10)) = "" Then
                        .TopWidth = 0
                    Else
                        .TopWidth = Mid(DataLine, 31, 10)
                    End If

                    If Trim(Mid(DataLine, 41, 10)) = "" Then
                        .BankfullFlowDepth = 0
                    Else
                        .BankfullFlowDepth = Mid(DataLine, 41, 10)
                    End If

                    If Trim(Mid(DataLine, 51, 10)) = "" Then
                        .ValleyWidth = 0
                    Else
                        .ValleyWidth = Mid(DataLine, 51, 10)
                    End If

                    If Trim(Mid(DataLine, 61, 10)) = "" Then
                        .ValleyN = 0.15
                    Else
                        .ValleyN = Mid(DataLine, 61, 10)
                    End If

                    DataLine = ts.readline

                    If Trim(Mid(DataLine, 41, 2)) = " N" Then
                        .ClayScourCode = False
                    Else
                        .ClayScourCode = True
                    End If
```

```
                If Trim(Mid(DataLine, 43, 2)) = " N" Then
                    .SiltScourCode = False
                Else
                    .SiltScourCode = True
                End If

                If Trim(Mid(DataLine, 45, 2)) = " N" Then
                    .SandScourCode = False
                Else
                    .SandScourCode = True
                End If

                If Trim(Mid(DataLine, 47, 2)) = " N" Then
                    .SmallAggregateScourCode = False
                Else
                    .SmallAggregateScourCode = True
                End If

                If Trim(Mid(DataLine, 49, 2)) = " N" Then
                    .LargeAggregateScourCode = False
                Else
                    .LargeAggregateScourCode = True
                End If

                If Trim(Mid(DataLine, 51, 2)) = " N" Then
                    .ValleyClayScourCode = False
                Else
                    .ValleyClayScourCode = True
                End If

                If Trim(Mid(DataLine, 53, 2)) = " N" Then
                    .ValleySiltScourCode = False
                Else
                    .ValleySiltScourCode = True
                End If

                If Trim(Mid(DataLine, 55, 2)) = " N" Then
                    .ValleySandScourCode = False
                Else
                    .ValleySandScourCode = True
                End If

                If Trim(Mid(DataLine, 57, 2)) = " N" Then
                    .ValleySmallAggregateScourCode = False
                Else
                    .ValleySmallAggregateScourCode = True
                End If

                If Trim(Mid(DataLine, 59, 2)) = " N" Then
                    .ValleyLargeAggregateScourCode = False
                Else
                    .ValleyLargeAggregateScourCode = True
                End If

                .ReachImpoundmentID = Mid(DataLine, 61, 10)

                ReDim .ReachRunoffEvent(0)
                ReDim .ReachRunoffEventMoveSed(0)
            End With
        Next i
    End If
Loop Until ts.atendofstream

ts.Close
End Sub

Sub ReadGaugeDataOutput()
    Const ForReading = 1, ForWriting = 2, ForAppending = 3
    Const TristateUseDefault = -2, TristateTrue = -1, TristateFalse = 0
```

```
    Dim fs As Object
    Dim f As Object
    Dim ts As Object
    Dim DataLine As String
    Dim fgaugefile As String
    Dim i, j As Integer
    Dim eventdate As String

    fgaugefile = Application.GetOpenFilename("Input file (*.txt), *.txt", , "Select File
AnnAGNPS_txt_gauging_station_data.txt (must be output by AnnAGNPS)")

    Set fs = CreateObject("Scripting.FileSystemObject")
    Set f = fs.GetFile(fgaugefile)
    Set ts = f.OpenAsTextStream(ForReading, TristateFalse)

    For i = 1 To 14
        DataLine = ts.readline
    Next i

    For i = 1 To NumberOfReaches
        With reach(i)
            DataLine = ts.readline
            .DrainageAreaUpper = Mid(DataLine, 23, 12)
            .DrainageAreaLower = Mid(DataLine, 35, 12)
            .BankfullFlowDepth = Mid(DataLine, 47, 12)
            .TopWidth = Mid(DataLine, 59, 12)
            .ValleyWidth = Mid(DataLine, 71, 12)
            .TimeOfConcentrationUpper = Mid(DataLine, 83, 12)
            .TimeOfConcentrationLower = Mid(DataLine, 95, 12)
        End With
    Next i

    DataLine = ts.readline
    DataLine = ts.readline
    DataLine = ts.readline
    DataLine = ts.readline
    DataLine = ts.readline
    DataLine = ts.readline

    Do
        DataLine = ts.readline

        eventdate = Trim(Mid(DataLine, 1, 11))
        If eventdate <> "" Then
            'This subroutine reads all runoff events, not only the ones that actually
move sediment above the threshold considered for calibration;
            'the subroutine Sub ReadGaugeDataOutput_MoveSed() below extracts the data
valid only for the runoff events moving sediment.
            For i = 1 To NumberOfReaches
                With reach(i)
                    j = UBound(.ReachRunoffEvent) + 1
                    ReDim Preserve .ReachRunoffEvent(j)
                    .ReachRunoffEvent(j).Date = eventdate
                    DataLine = ts.readline
                    .ReachRunoffEvent(j).PeakDischargeUpper = Mid(DataLine, 31, 12)
                    .ReachRunoffEvent(j).TotalRunoffUpper = Mid(DataLine, 43, 12)
                    'The coding lines below read only the yields computed by AnnAGNPS,
which "excludes" Small and Large AGGREGATES
                    .ReachRunoffEvent(j).ClayTotalDischargeUpper = Mid(DataLine, 55, 12)
                    .ReachRunoffEvent(j).SiltTotalDischargeUpper = Mid(DataLine, 67, 12)
                    .ReachRunoffEvent(j).SandTotalDischargeUpper = Mid(DataLine, 79, 12)
                    .ReachRunoffEvent(j).AllSedimentTotalDischargeUpper = Mid(DataLine,
91, 12)
                    If .ReachRunoffEvent(j).TotalRunoffUpper > 0 Then
                        .ReachRunoffEvent(j).TSSUpper =
.ReachRunoffEvent(j).AllSedimentTotalDischargeUpper /
.ReachRunoffEvent(j).TotalRunoffUpper * 1000000
                    Else
                        .ReachRunoffEvent(j).TSSUpper = -1
                    End If
```

```
                    DataLine = ts.readline
                    .ReachRunoffEvent(j).PeakDischargeLower = Mid(DataLine, 31, 12)
                    .ReachRunoffEvent(j).TotalRunoffLower = Mid(DataLine, 43, 12)
                    'The coding lines below read only the yields computed by AnnAGNPS,
which "excludes" Small and Large AGGREGATES
                    .ReachRunoffEvent(j).ClayTotalDischargeLower = Mid(DataLine, 55, 12)
                    .ReachRunoffEvent(j).SiltTotalDischargeLower = Mid(DataLine, 67, 12)
                    .ReachRunoffEvent(j).SandTotalDischargeLower = Mid(DataLine, 79, 12)
                    .ReachRunoffEvent(j).AllSedimentTotalDischargeLower = Mid(DataLine,
91, 12)
                    If .ReachRunoffEvent(j).TotalRunoffLower > 0 Then
                        .ReachRunoffEvent(j).TSSLower =
.ReachRunoffEvent(j).AllSedimentTotalDischargeLower /
.ReachRunoffEvent(j).TotalRunoffLower * 1000000
                    Else
                        .ReachRunoffEvent(j).TSSLower = -1
                    End If
                End With
            Next i
        End If
    Loop Until ts.atendofstream

    ts.Close
End Sub

Sub ReadErosionOutput()
    Const ForReading = 1, ForWriting = 2, ForAppending = 3
    Const TristateUseDefault = -2, TristateTrue = -1, TristateFalse = 0

    Dim fs As Object
    Dim f As Object
    Dim ts As Object
    Dim DataLine As String
    Dim fgaugefile As String
    Dim i, j As Integer
    Dim eventdate As String

    fgaugefile = Application.GetOpenFilename("Input file (*.txt), *.txt", , "Select File
AnnAGNPS_TXT_EV_Sediment_erosion_(mass).txt (must be output by AnnAGNPS)")

    Set fs = CreateObject("Scripting.FileSystemObject")
    Set f = fs.GetFile(fgaugefile)
    Set ts = f.OpenAsTextStream(ForReading, TristateFalse)

    For i = 1 To 7
        DataLine = ts.readline
    Next i

    Do
        DataLine = ts.readline

        eventdate = Mid(DataLine, 21, 10)
        If eventdate <> "" Then
            DataLine = ts.readline
            DataLine = ts.readline
            DataLine = ts.readline
            DataLine = ts.readline
            DataLine = ts.readline

            For i = 1 To NumberOfCells
                With cell(i)
                    j = UBound(.CellEvent) + 1
                    ReDim Preserve .CellEvent(j)
                    .CellEvent(j).Date = eventdate

                    .CellEvent(j).ErosionSheetAndRillClay = Mid(DataLine, 32, 12)
                    .CellEvent(j).ErosionSheetAndRillSilt = Mid(DataLine, 44, 12)
                    .CellEvent(j).ErosionSheetAndRillSand = Mid(DataLine, 56, 12)
                    .CellEvent(j).ErosionSheetAndRillSAgg = Mid(DataLine, 68, 12)
                    .CellEvent(j).ErosionSheetAndRillLAgg = Mid(DataLine, 80, 12)
                    .CellEvent(j).ErosionSheetAndRillTotal = Mid(DataLine, 92, 12)
```

```
                    DataLine = ts.readline
                    DataLine = ts.readline
                    DataLine = ts.readline
                    DataLine = ts.readline

                End With
            Next i

            Do
                DataLine = ts.readline
            Loop Until ts.atendofstream Or Mid(DataLine, 2, 2) = "**"
        End If
    Loop Until ts.atendofstream

    ts.Close
End Sub

Sub ReadYieldOutput()
    Const ForReading = 1, ForWriting = 2, ForAppending = 3
    Const TristateUseDefault = -2, TristateTrue = -1, TristateFalse = 0

    Dim fs As Object
    Dim f As Object
    Dim ts As Object
    Dim DataLine As String
    Dim fgaugefile As String
    Dim i, j As Integer
    Dim eventdate As String

    Dim count As Integer

    'This subroutine reads the fraction yields after AnnAGNPS has already converted Small
and Large AGG into clay, silt and sand;
    'the subroutine Sub Yield_5_fractions() goes one step back and re-computes yields for
each of the five fractions.
    fgaugefile = Application.GetOpenFilename("Input file (*.txt), *.txt", , "Select File
AnnAGNPS_TXT_EV_Sediment_yield_(mass).txt (must be output by AnnAGNPS)")

    Set fs = CreateObject("Scripting.FileSystemObject")
    Set f = fs.GetFile(fgaugefile)
    Set ts = f.OpenAsTextStream(ForReading, TristateFalse)

    For i = 1 To 7
        DataLine = ts.readline
    Next i

    Do
        DataLine = ts.readline

        eventdate = Mid(DataLine, 21, 10)
        If eventdate <> "" Then
            DataLine = ts.readline
            DataLine = ts.readline
            DataLine = ts.readline
            DataLine = ts.readline
            DataLine = ts.readline

            For i = 1 To NumberOfCells
                With cell(i)
                    For j = 1 To UBound(.CellEvent)
                        If .CellEvent(j).Date = eventdate Then
                            .CellEvent(j).YieldSheetAndRillClay = Mid(DataLine, 32, 12)
                            .CellEvent(j).YieldSheetAndRillSilt = Mid(DataLine, 44, 12)
                            .CellEvent(j).YieldSheetAndRillSand = Mid(DataLine, 56, 12)
                            .CellEvent(j).YieldSheetAndRillSAgg = Mid(DataLine, 68, 12)
                            .CellEvent(j).YieldSheetAndRillLAgg = Mid(DataLine, 80, 12)
                            .CellEvent(j).YieldSheetAndRillTotal = Mid(DataLine, 92, 12)

                            DataLine = ts.readline
                            DataLine = ts.readline
```

```
                            DataLine = ts.readline
                            DataLine = ts.readline
                        End If
                    Next j
                End With
            Next i

            Do
                DataLine = ts.readline
            Loop Until ts.atendofstream Or Mid(DataLine, 2, 2) = "**"
        End If
    Loop Until ts.atendofstream

    ts.Close
End Sub

Sub ReadWaterCellOutput()
    Const ForReading = 1, ForWriting = 2, ForAppending = 3
    Const TristateUseDefault = -2, TristateTrue = -1, TristateFalse = 0

    Dim fs As Object
    Dim f As Object
    Dim ts As Object
    Dim DataLine As String
    Dim foutputfile As String
    Dim i, j As Integer
    Dim eventcellID, eventdate As String

    Dim count As Integer

    foutputfile = Application.GetOpenFilename("Input file (*.txt), *.txt", , "Select File
AnnAGNPS_txt_cche1d.txt (must be output by AnnAGNPS)")

    Set fs = CreateObject("Scripting.FileSystemObject")
    Set f = fs.GetFile(foutputfile)
    Set ts = f.OpenAsTextStream(ForReading, TristateFalse)

    DataLine = ts.readline
    DataLine = ts.readline
    DataLine = ts.readline
    DataLine = ts.readline

    Do
        DataLine = ts.readline

        If Trim(Left(DataLine, 10)) = "" Then
            DataLine = ts.readline
        Else
            eventcellID = Trim(Left(DataLine, 10))
            eventdate = Mid(DataLine, 11, 10)

            For i = 1 To NumberOfCells
                With cell(i)
                    For j = 1 To UBound(.CellEvent)
                        If (.CellEvent(j).Date = eventdate) And (.CellID = eventcellID)
Then
                            .ReceivingReachID = Mid(DataLine, 41, 10)

                            DataLine = ts.readline

                            .CellEvent(j).WaterVolume = Mid(DataLine, 51, 10) * 1000000
                            'in m3
                            .CellEvent(j).PeakDischarge = Mid(DataLine, 61, 10)
                            'in m3/s
                            .CellEvent(j).TimeToPeakDischarge = Mid(DataLine, 71, 10)
                            'in hr

                            DataLine = ts.readline
                            DataLine = ts.readline
                            DataLine = ts.readline
                            DataLine = ts.readline
```

```
                            DataLine = ts.readline
                        End If
                    Next j
                End With
            Next i
        End If
    Loop Until ts.atendofstream

    ts.Close
End Sub

Sub ReadGaugeDataOutput_MoveSed()
    Dim i, j, k, l, m As Integer
    Dim count As Integer

    With cell(1)
        For j = 1 To UBound(.CellEvent)
            For k = 1 To UBound(reach(1).ReachRunoffEvent)
                If reach(1).ReachRunoffEvent(k).Date = cell(1).CellEvent(j).Date Then
                    For l = 1 To NumberOfReaches
                        With reach(l)
                            m = UBound(.ReachRunoffEventMoveSed) + 1
                            ReDim Preserve .ReachRunoffEventMoveSed(m)
                            .ReachRunoffEventMoveSed(m).Date = .ReachRunoffEvent(k).Date
                            .ReachRunoffEventMoveSed(m).PeakDischargeUpper =
.ReachRunoffEvent(k).PeakDischargeUpper
                            .ReachRunoffEventMoveSed(m).PeakDischargeLower =
.ReachRunoffEvent(k).PeakDischargeLower
                            .ReachRunoffEventMoveSed(m).TotalRunoffUpper =
.ReachRunoffEvent(k).TotalRunoffUpper
                            .ReachRunoffEventMoveSed(m).TotalRunoffLower =
.ReachRunoffEvent(k).TotalRunoffLower

                            If (.ReachRunoffEventMoveSed(m).PeakDischargeUpper <> 0) Then
                                .ReachRunoffEventMoveSed(m).TimeToBaseUpper = 2 *
(.ReachRunoffEventMoveSed(m).TotalRunoffUpper /
.ReachRunoffEventMoveSed(m).PeakDischargeUpper)
                            End If
                            If (.ReachRunoffEventMoveSed(m).PeakDischargeLower <> 0) Then
                                .ReachRunoffEventMoveSed(m).TimeToBaseLower = 2 *
(.ReachRunoffEventMoveSed(m).TotalRunoffLower /
.ReachRunoffEventMoveSed(m).PeakDischargeLower)
                            End If
                        End With
                    Next l
                End If
            Next k
        Next j
    End With

End Sub

Sub Yield_5_fractions()
    Dim i, j, ii As Integer
    Dim prodAux(5), frYield(5), Fraction(5), Yield(5) As Double
    Dim SumAux2, SumAux3 As Double
    Dim AuxCol3(5), Col3(5), AuxCol4(5), Col4(5), Col5(5), Col7(5) As Double
    Dim AuxTest As Double: Dim Test As Boolean
    Dim count As Integer

    prodAux(1) = Gs_Clay * sv_Clay * 1000
    prodAux(2) = Gs_Silt * sv_Silt * 1000
    prodAux(3) = Gs_Sand * sv_Sand * 1000
    prodAux(4) = Gs_SAgg * sv_SAgg * 1000
    prodAux(5) = Gs_LAgg * sv_LAgg * 1000

    For i = 1 To NumberOfCells
        With cell(i)
            For j = 1 To UBound(.CellEvent)
                If .CellEvent(j).ErosionSheetAndRillTotal <> 0 Then
```

```
                    .CellEvent(j).frac_ErosionSheetAndRillClay =
.CellEvent(j).ErosionSheetAndRillClay / .CellEvent(j).ErosionSheetAndRillTotal
                    .CellEvent(j).frac_ErosionSheetAndRillSilt =
.CellEvent(j).ErosionSheetAndRillSilt / .CellEvent(j).ErosionSheetAndRillTotal
                    .CellEvent(j).frac_ErosionSheetAndRillSand =
.CellEvent(j).ErosionSheetAndRillSand / .CellEvent(j).ErosionSheetAndRillTotal
                    .CellEvent(j).frac_ErosionSheetAndRillSAgg =
.CellEvent(j).ErosionSheetAndRillSAgg / .CellEvent(j).ErosionSheetAndRillTotal
                    .CellEvent(j).frac_ErosionSheetAndRillLAgg =
.CellEvent(j).ErosionSheetAndRillLAgg / .CellEvent(j).ErosionSheetAndRillTotal
                    .CellEvent(j).HUSLE_DeliveryRatio =
.CellEvent(j).YieldSheetAndRillTotal / .CellEvent(j).ErosionSheetAndRillTotal
                Else
                    .CellEvent(j).frac_ErosionSheetAndRillClay = 0
                    .CellEvent(j).frac_ErosionSheetAndRillSilt = 0
                    .CellEvent(j).frac_ErosionSheetAndRillSand = 0
                    .CellEvent(j).frac_ErosionSheetAndRillSAgg = 0
                    .CellEvent(j).frac_ErosionSheetAndRillLAgg = 0
                    .CellEvent(j).HUSLE_DeliveryRatio = 0
                End If
            Next j
        End With
    Next i

    For i = 1 To NumberOfCells
        With cell(i)
            For j = 1 To UBound(.CellEvent)
                If .CellEvent(j).HUSLE_DeliveryRatio <> 0 Then
                    frYield(1) = .CellEvent(j).frac_ErosionSheetAndRillClay
                    frYield(2) = .CellEvent(j).frac_ErosionSheetAndRillSilt
                    frYield(3) = .CellEvent(j).frac_ErosionSheetAndRillSand
                    frYield(4) = .CellEvent(j).frac_ErosionSheetAndRillSAgg
                    frYield(5) = .CellEvent(j).frac_ErosionSheetAndRillLAgg

                    For ii = 1 To 5
                        Fraction(ii) = frYield(ii)
                    Next ii

                    SumAux2 = 0
                    SumAux3 = 0
                    For ii = 1 To 5
                        SumAux2 = SumAux2 + Fraction(ii)
                        If Fraction(ii) > 0 Then
                            AuxCol3(ii) = prodAux(ii)
                        Else
                            AuxCol3(ii) = 0
                        End If
                        SumAux3 = SumAux3 + AuxCol3(ii)
                    Next ii

                    For ii = 1 To 5
                        Col3(ii) = AuxCol3(ii) / SumAux3
                        AuxCol4(ii) = (SumAux2 - .CellEvent(j).HUSLE_DeliveryRatio) *
Col3(ii)
                        If AuxCol4(ii) > Fraction(ii) Then
                            AuxCol4(ii) = Fraction(ii)
                        End If
                        Col4(ii) = AuxCol4(ii)
                        Col5(ii) = Fraction(ii) - Col4(ii)
                        Col7(ii) = Col5(ii) * .CellEvent(j).ErosionSheetAndRillTotal
                        Yield(ii) = Col7(ii)
                    Next ii

                    Do
                        For ii = 1 To 5
                            If Yield(ii) = 0 Then
                                Fraction(ii) = 0
                            End If
                        Next ii

                        SumAux2 = 0
```

```
                        SumAux3 = 0
                        For ii = 1 To 5
                            SumAux2 = SumAux2 + Fraction(ii)
                            If Fraction(ii) > 0 Then
                                AuxCol3(ii) = prodAux(ii)
                            Else
                                AuxCol3(ii) = 0
                            End If
                            SumAux3 = SumAux3 + AuxCol3(ii)
                        Next ii

                        For ii = 1 To 5
                            Col3(ii) = AuxCol3(ii) / SumAux3
                            AuxCol4(ii) = (SumAux2 - .CellEvent(j).HUSLE_DeliveryRatio) *
Col3(ii)
                            If AuxCol4(ii) > Fraction(ii) Then
                                AuxCol4(ii) = Fraction(ii)
                            End If
                            If AuxCol4(ii) > Col4(ii) Then
                                Col4(ii) = AuxCol4(ii)
                            End If
                            Col5(ii) = frYield(ii) - Col4(ii)
                            Col7(ii) = Col5(ii) * .CellEvent(j).ErosionSheetAndRillTotal
                            Yield(ii) = Col7(ii)
                        Next ii

                        AuxTest = 0
                        For ii = 1 To 5
                            AuxTest = AuxTest + Yield(ii)
                        Next ii
                        AuxTest = Abs(AuxTest - .CellEvent(j).YieldSheetAndRillTotal)
                        Test = AuxTest < 0.001
                    Loop Until Test = True

                    .CellEvent(j).YieldSheetAndRillClay = Yield(1)
                    .CellEvent(j).YieldSheetAndRillSilt = Yield(2)
                    .CellEvent(j).YieldSheetAndRillSand = Yield(3)
                    .CellEvent(j).YieldSheetAndRillSAgg = Yield(4)
                    .CellEvent(j).YieldSheetAndRillLAgg = Yield(5)

                End If
            Next j
        End With
    Next i

    'Printing output
    For i = 1 To NumberOfCells
        With cell(i)
            For j = 1 To UBound(.CellEvent)
                count = (j - 1) * NumberOfCells + 1
                If i = 1 Then
                    Worksheets("Mod_yields").Cells(count, 1).Value = .CellEvent(j).Date
                End If

                Worksheets("Mod_yields").Cells(count + i - 1, 2).Value = cell(i).CellID
                Worksheets("Mod_yields").Cells(count + i - 1, 3).Value =
cell(i).ReceivingReachID

                Worksheets("Mod_yields").Cells(count + i - 1, 4).Value =
cell(i).CellEvent(j).YieldSheetAndRillClay
                Worksheets("Mod_yields").Cells(count + i - 1, 5).Value =
cell(i).CellEvent(j).YieldSheetAndRillSilt
                Worksheets("Mod_yields").Cells(count + i - 1, 6).Value =
cell(i).CellEvent(j).YieldSheetAndRillSand
                Worksheets("Mod_yields").Cells(count + i - 1, 7).Value =
cell(i).CellEvent(j).YieldSheetAndRillSAgg
                Worksheets("Mod_yields").Cells(count + i - 1, 8).Value =
cell(i).CellEvent(j).YieldSheetAndRillLAgg
            Next j
        End With
    Next i
```

```
End Sub

Sub Summary_Annual_Yields()
    Const ForReading = 1, ForWriting = 2, ForAppending = 3
    Const TristateUseDefault = -2, TristateTrue = -1, TristateFalse = 0

    Dim fs As Object
    Dim f As Object
    Dim ts As Object
    Dim DataLine As String
    Dim fannualfile As String
    Dim i, j As Integer
    Dim eventdate As String

    Dim NumberOfYears As Double

    fannualfile = Application.GetOpenFilename("Input file (*.txt), *.txt", , "Select File
AnnAGNPS_txt_aa_sediment_yield_(mass).txt (must be output by AnnAGNPS)")

    Set fs = CreateObject("Scripting.FileSystemObject")
    Set f = fs.GetFile(fannualfile)
    Set ts = f.OpenAsTextStream(ForReading, TristateFalse)

    For i = 1 To 8
        DataLine = ts.readline
    Next i
    NumberOfYears = Trim(Mid(DataLine, 60, 6))

    For i = 1 To NumberOfCells
        With cell(i)
            .Sum_Clay = 0
            .Sum_Silt = 0
            .Sum_Sand = 0
            .Sum_SAgg = 0
            .Sum_LAgg = 0
            For j = 1 To UBound(.CellEvent)
                .Sum_Clay = .Sum_Clay + cell(i).CellEvent(j).YieldSheetAndRillClay
                .Sum_Silt = .Sum_Silt + cell(i).CellEvent(j).YieldSheetAndRillSilt
                .Sum_Sand = .Sum_Sand + cell(i).CellEvent(j).YieldSheetAndRillSand
                .Sum_SAgg = .Sum_SAgg + cell(i).CellEvent(j).YieldSheetAndRillSAgg
                .Sum_LAgg = .Sum_LAgg + cell(i).CellEvent(j).YieldSheetAndRillLAgg
            Next j
        End With
    Next i

    For i = 1 To NumberOfCells
        With cell(i)
            .Annual_YieldSheetAndRillClay = .Sum_Clay / NumberOfYears
            .Annual_YieldSheetAndRillSilt = .Sum_Silt / NumberOfYears
            .Annual_YieldSheetAndRillSand = .Sum_Sand / NumberOfYears
            .Annual_YieldSheetAndRillSAgg = .Sum_SAgg / NumberOfYears
            .Annual_YieldSheetAndRillLAgg = .Sum_LAgg / NumberOfYears
        End With
    Next i

    'Printing output
    Worksheets("Summary_annual yields").Cells(1, 1).Value = NumberOfYears

    For i = 1 To NumberOfCells
        With cell(i)
            Worksheets("Summary_annual yields").Cells(i + 1, 1).Value = .CellID

            Worksheets("Summary_annual yields").Cells(i + 1, 3).Value =
.Annual_YieldSheetAndRillClay
            Worksheets("Summary_annual yields").Cells(i + 1, 4).Value =
.Annual_YieldSheetAndRillSilt
            Worksheets("Summary_annual yields").Cells(i + 1, 5).Value =
.Annual_YieldSheetAndRillSand
            Worksheets("Summary_annual yields").Cells(i + 1, 6).Value =
.Annual_YieldSheetAndRillSAgg
```

```
            Worksheets("Summary_annual yields").Cells(i + 1, 7).Value =
.Annual_YieldSheetAndRillLAgg
        End With
    Next i
End Sub

Sub DefiningSequenceRouting()
    Dim i, j, k As Integer

    For i = 1 To NumberOfReaches
        With reach(i)
            .ReachOrder = 1
        End With
    Next i

    For k = 1 To 20
        For i = 1 To NumberOfReaches
            With reach(i)
                For j = 1 To NumberOfReaches
                    If (j <> i) And (reach(j).ReachOrder = k) And
(reach(j).ReceivingReachID = reach(i).ID) Then
                        reach(i).ReachOrder = k + 1
                        Exit For
                    End If
                Next j
            End With
        Next i
    Next k
End Sub

Sub Concentration_5_fractions()
    Dim i, j, k As Integer
    Dim count As Integer
    Dim ConnectionID_Cell, ConnectionID_Reach As String

    For k = 1 To NumberOfReaches
        With reach(k)
            ConnectionID_Reach = .ID

            For j = 1 To UBound(reach(1).ReachRunoffEventMoveSed)
                .ReachRunoffEventMoveSed(j).Aux_Clay = 0
                .ReachRunoffEventMoveSed(j).Aux_Silt = 0
                .ReachRunoffEventMoveSed(j).Aux_Sand = 0
                .ReachRunoffEventMoveSed(j).Aux_SAgg = 0
                .ReachRunoffEventMoveSed(j).Aux_LAgg = 0

                For i = 1 To NumberOfCells
                    With cell(i)
                        ConnectionID_Cell = .ReceivingReachID

                        If ConnectionID_Cell = ConnectionID_Reach Then
                            reach(k).ReachRunoffEventMoveSed(j).Aux_Clay =
reach(k).ReachRunoffEventMoveSed(j).Aux_Clay + .CellEvent(j).YieldSheetAndRillClay
                            reach(k).ReachRunoffEventMoveSed(j).Aux_Silt =
reach(k).ReachRunoffEventMoveSed(j).Aux_Silt + .CellEvent(j).YieldSheetAndRillSilt
                            reach(k).ReachRunoffEventMoveSed(j).Aux_Sand =
reach(k).ReachRunoffEventMoveSed(j).Aux_Sand + .CellEvent(j).YieldSheetAndRillSand
                            reach(k).ReachRunoffEventMoveSed(j).Aux_SAgg =
reach(k).ReachRunoffEventMoveSed(j).Aux_SAgg + .CellEvent(j).YieldSheetAndRillSAgg
                            reach(k).ReachRunoffEventMoveSed(j).Aux_LAgg =
reach(k).ReachRunoffEventMoveSed(j).Aux_LAgg + .CellEvent(j).YieldSheetAndRillLAgg
                        End If
                    End With
                Next i

                If (.ReachRunoffEventMoveSed(j).PeakDischargeUpper <> 0) Then
                    .ReachRunoffEventMoveSed(j).Concentration_Clay =
.ReachRunoffEventMoveSed(j).Aux_Clay / .ReachRunoffEventMoveSed(j).TotalRunoffUpper
                    .ReachRunoffEventMoveSed(j).Concentration_Silt =
.ReachRunoffEventMoveSed(j).Aux_Silt / .ReachRunoffEventMoveSed(j).TotalRunoffUpper
```

```
                    .ReachRunoffEventMoveSed(j).Concentration_Sand =
.ReachRunoffEventMoveSed(j).Aux_Sand / .ReachRunoffEventMoveSed(j).TotalRunoffUpper
                    .ReachRunoffEventMoveSed(j).Concentration_SAgg =
.ReachRunoffEventMoveSed(j).Aux_SAgg / .ReachRunoffEventMoveSed(j).TotalRunoffUpper
                    .ReachRunoffEventMoveSed(j).Concentration_LAgg =
.ReachRunoffEventMoveSed(j).Aux_LAgg / .ReachRunoffEventMoveSed(j).TotalRunoffUpper
                Else
                    .ReachRunoffEventMoveSed(j).Concentration_Clay = 0
                    .ReachRunoffEventMoveSed(j).Concentration_Silt = 0
                    .ReachRunoffEventMoveSed(j).Concentration_Sand = 0
                    .ReachRunoffEventMoveSed(j).Concentration_SAgg = 0
                    .ReachRunoffEventMoveSed(j).Concentration_LAgg = 0
                End If
            Next j
        End With
    Next k
End Sub

Sub Setting_Hydrograph_And_Hydraulics()
    Dim i, j, k As Long
    Dim ii, jj, kk As Long
    Dim count As Long

    Dim ChannelWidth, BedSlope, ManningCoef, ChannelLength, BedArea As Double
    Dim Qflow(500), UnitQflow(500), HydraulicRadius(500), FlowVelocity(500),
ShearStress(500), ShearVelocity(500) As Double

    Dim UnitQs_01_Clay(500), UnitQs_01_Silt(500), UnitQs_01_Sand(500),
UnitQs_01_SAgg(500), UnitQs_01_LAgg(500) As Double
    Dim UnitQs_02_Clay(500), UnitQs_02_Silt(500), UnitQs_02_Sand(500),
UnitQs_02_SAgg(500), UnitQs_02_LAgg(500) As Double
    Dim eta_Clay(500), eta_Silt(500), eta_Sand(500), eta_SAgg(500), eta_LAgg(500) As
Double
    Dim CapQs_Clay(500, 50, 200), CapQs_Silt(500, 50, 200), CapQs_Sand(500, 50, 200),
CapQs_SAgg(500, 50, 200), CapQs_LAgg(500, 50, 200) As Double

    Dim Nd_Clay(500), Nd_Silt(500), Nd_Sand(500), Nd_SAgg(500), Nd_LAgg(500) As Double
    Dim Ae_Sand(500), Ae_LAgg(500) As Double
    Dim aux1_Sand, aux1_LAgg As Double

    For k = 1 To 20
        For i = 1 To NumberOfReaches
            If reach(i).ReachOrder = k Then
                With reach(i)
                    ChannelWidth = .TopWidth
                    BedSlope = .Slope
                    ManningCoef = .ManningN
                    'ManningCoef = 0.045
                    ChannelLength = .Length
                    BedArea = ChannelWidth * ChannelLength

                    For j = 1 To UBound(reach(1).ReachRunoffEventMoveSed)
                    With .ReachRunoffEventMoveSed(j)
                        .DepVol_Clay = 0
                        .DepVol_Silt = 0
                        .DepVol_Sand = 0
                        .DepVol_SAgg = 0
                        .DepVol_LAgg = 0

                        For ii = 1 To DeltaT
                            If (.PeakDischargeUpper <> 0) Then
                                Qflow(ii) = ii / DeltaT * .PeakDischargeUpper
                                UnitQflow(ii) = Qflow(ii) / ChannelWidth

                                UnitQs_01_Clay(ii) = .Concentration_Clay * UnitQflow(ii)
                                UnitQs_01_Silt(ii) = .Concentration_Silt * UnitQflow(ii)
                                UnitQs_01_Sand(ii) = .Concentration_Sand * UnitQflow(ii)
                                UnitQs_01_SAgg(ii) = .Concentration_SAgg * UnitQflow(ii)
                                UnitQs_01_LAgg(ii) = .Concentration_LAgg * UnitQflow(ii)

                                If (k <> 1) Then
```

```
                                For jj = 1 To NumberOfReaches
                                    'If reach(jj).ReceivingReachID = reach(i).ID Then
                                    If (reach(jj).ReceivingReachID = reach(i).ID) And
(reach(i).ID <> 9) And (reach(i).ID <> 12) Then
                                        UnitQs_01_Clay(ii) = UnitQs_01_Clay(ii) +
CapQs_Clay(ii, j, jj)
                                        UnitQs_01_Silt(ii) = UnitQs_01_Silt(ii) +
CapQs_Silt(ii, j, jj)
                                        UnitQs_01_Sand(ii) = UnitQs_01_Sand(ii) +
CapQs_Sand(ii, j, jj)
                                        UnitQs_01_SAgg(ii) = UnitQs_01_SAgg(ii) +
CapQs_SAgg(ii, j, jj)
                                        UnitQs_01_LAgg(ii) = UnitQs_01_LAgg(ii) +
CapQs_LAgg(ii, j, jj)
                                    End If
                                Next jj
                            End If

                            HydraulicRadius(ii) = (ManningCoef ^ 0.6) *
(UnitQflow(ii) ^ 0.6) / (BedSlope ^ 0.3)
                            FlowVelocity(ii) = UnitQflow(ii) / HydraulicRadius(ii)
                            ShearStress(ii) = HydraulicRadius(ii) * BedSlope
                            ShearVelocity(ii) = (9.81 * HydraulicRadius(ii) *
BedSlope) ^ 0.5

                            eta_Clay(ii) = 0.322 * ((Gs_Clay - 1) / (ShearStress(ii)
/ Dp_Clay * 1000)) ^ 1.626
                            If eta_Clay(ii) > 1 Then eta_Clay(ii) = 1

                            eta_Silt(ii) = 0.322 * ((Gs_Silt - 1) / (ShearStress(ii)
/ Dp_Silt * 1000)) ^ 1.626
                            If eta_Silt(ii) > 1 Then eta_Silt(ii) = 1

                            eta_Sand(ii) = 0.322 * ((Gs_Sand - 1) / (ShearStress(ii)
/ Dp_Sand * 1000)) ^ 1.626
                            If eta_Sand(ii) > 1 Then eta_Sand(ii) = 1

                            eta_SAgg(ii) = 0.322 * ((Gs_SAgg - 1) / (ShearStress(ii)
/ Dp_SAgg * 1000)) ^ 1.626
                            If eta_SAgg(ii) > 1 Then eta_SAgg(ii) = 1

                            eta_LAgg(ii) = 0.322 * ((Gs_LAgg - 1) / (ShearStress(ii)
/ Dp_LAgg * 1000)) ^ 1.626
                            If eta_LAgg(ii) > 1 Then eta_LAgg(ii) = 1

                            CapQs_Clay(ii, j, i) = eta_Clay(ii) * k_Clay *
ShearStress(ii) * ((FlowVelocity(ii)) ^ 2) / sv_Clay * 1000
                            CapQs_Silt(ii, j, i) = eta_Silt(ii) * k_Silt *
ShearStress(ii) * ((FlowVelocity(ii)) ^ 2) / sv_Silt * 1000
                            CapQs_Sand(ii, j, i) = eta_Sand(ii) * k_Sand *
ShearStress(ii) * ((FlowVelocity(ii)) ^ 2) / sv_Sand * 1000
                            CapQs_SAgg(ii, j, i) = eta_SAgg(ii) * k_SAgg *
ShearStress(ii) * ((FlowVelocity(ii)) ^ 2) / sv_SAgg * 1000
                            CapQs_LAgg(ii, j, i) = eta_LAgg(ii) * k_LAgg *
ShearStress(ii) * ((FlowVelocity(ii)) ^ 2) / sv_LAgg * 1000

                            'For the sake of simplicity, and given our qualitative
assessment of in-channel
                            'sediment transport processes, bed scouring will not be
allowed.
                            'Hence only the bed deposition algorithm will be
implemented, when required.
                            If (UnitQs_01_Clay(ii) <= CapQs_Clay(ii, j, i)) Then
                                UnitQs_02_Clay(ii) = CapQs_Clay(ii, j, i)
                            Else
                                Nd_Clay(ii) = (sv_Clay / 1000) * ChannelLength /
UnitQflow(ii)
                                UnitQs_02_Clay(ii) = CapQs_Clay(ii, j, i) +
(UnitQs_01_Clay(ii) - CapQs_Clay(ii, j, i)) * Exp(-Nd_Clay(ii))
                            End If
```

```
                                If (UnitQs_01_Silt(ii) <= CapQs_Silt(ii, j, i)) Then
                                    UnitQs_02_Silt(ii) = CapQs_Silt(ii, j, i)
                                Else
                                    Nd_Silt(ii) = (sv_Silt / 1000) * ChannelLength /
UnitQflow(ii)
                                    UnitQs_02_Silt(ii) = CapQs_Silt(ii, j, i) +
(UnitQs_01_Silt(ii) - CapQs_Silt(ii, j, i)) * Exp(-Nd_Silt(ii))
                                End If

                                If (UnitQs_01_Sand(ii) <= CapQs_Sand(ii, j, i)) Then
                                    UnitQs_02_Sand(ii) = CapQs_Sand(ii, j, i)
                                Else
                                    aux1_Sand = (6 * sv_Sand / 1000) / (0.4 *
ShearVelocity(ii))
                                    Ae_Sand(ii) = aux1_Sand / (1 - Exp(-aux1_Sand))
                                    Nd_Sand(ii) = Ae_Sand(ii) * (sv_Sand / 1000) *
ChannelLength / UnitQflow(ii)
                                    UnitQs_02_Sand(ii) = CapQs_Sand(ii, j, i) +
(UnitQs_01_Sand(ii) - CapQs_Sand(ii, j, i)) * Exp(-Nd_Sand(ii))
                                End If

                                If (UnitQs_01_SAgg(ii) <= CapQs_SAgg(ii, j, i)) Then
                                    UnitQs_02_SAgg(ii) = CapQs_SAgg(ii, j, i)
                                Else
                                    Nd_SAgg(ii) = (sv_SAgg / 1000) * ChannelLength /
UnitQflow(ii)
                                    UnitQs_02_SAgg(ii) = CapQs_SAgg(ii, j, i) +
(UnitQs_01_SAgg(ii) - CapQs_SAgg(ii, j, i)) * Exp(-Nd_SAgg(ii))
                                End If

                                If (UnitQs_01_LAgg(ii) <= CapQs_LAgg(ii, j, i)) Then
                                    UnitQs_02_LAgg(ii) = CapQs_LAgg(ii, j, i)
                                Else
                                    aux1_LAgg = (6 * sv_LAgg / 1000) / (0.4 *
ShearVelocity(ii))
                                    Ae_LAgg(ii) = aux1_LAgg / (1 - Exp(-aux1_LAgg))
                                    Nd_LAgg(ii) = Ae_LAgg(ii) * (sv_LAgg / 1000) *
ChannelLength / UnitQflow(ii)
                                    UnitQs_02_LAgg(ii) = CapQs_LAgg(ii, j, i) +
(UnitQs_01_LAgg(ii) - CapQs_LAgg(ii, j, i)) * Exp(-Nd_LAgg(ii))
                                End If

                                If (UnitQs_01_Clay(ii) > CapQs_Clay(ii, j, i)) And
(ChannelLength <> 0) Then
                                    .DepVol_Clay = .DepVol_Clay + (UnitQs_01_Clay(ii) -
CapQs_Clay(ii, j, i)) * ChannelLength / Nd_Clay(ii) * (1 - Exp(-Nd_Clay(ii)))
                                End If
                                If (UnitQs_01_Silt(ii) > CapQs_Silt(ii, j, i)) And
(ChannelLength <> 0) Then
                                    .DepVol_Silt = .DepVol_Silt + (UnitQs_01_Silt(ii) -
CapQs_Silt(ii, j, i)) * ChannelLength / Nd_Silt(ii) * (1 - Exp(-Nd_Silt(ii)))
                                End If
                                If (UnitQs_01_Sand(ii) > CapQs_Sand(ii, j, i)) And
(ChannelLength <> 0) Then
                                    .DepVol_Sand = .DepVol_Sand + (UnitQs_01_Sand(ii) -
CapQs_Sand(ii, j, i)) * ChannelLength / Nd_Sand(ii) * (1 - Exp(-Nd_Sand(ii)))
                                End If
                                If (UnitQs_01_SAgg(ii) > CapQs_SAgg(ii, j, i)) And
(ChannelLength <> 0) Then
                                    .DepVol_SAgg = .DepVol_SAgg + (UnitQs_01_SAgg(ii) -
CapQs_SAgg(ii, j, i)) * ChannelLength / Nd_SAgg(ii) * (1 - Exp(-Nd_SAgg(ii)))
                                End If
                                If (UnitQs_01_LAgg(ii) > CapQs_LAgg(ii, j, i)) And
(ChannelLength <> 0) Then
                                    .DepVol_LAgg = .DepVol_LAgg + (UnitQs_01_LAgg(ii) -
CapQs_LAgg(ii, j, i)) * ChannelLength / Nd_LAgg(ii) * (1 - Exp(-Nd_LAgg(ii)))
                                End If
                            End If
                        Next ii

                        If (ChannelLength <> 0) Then
```

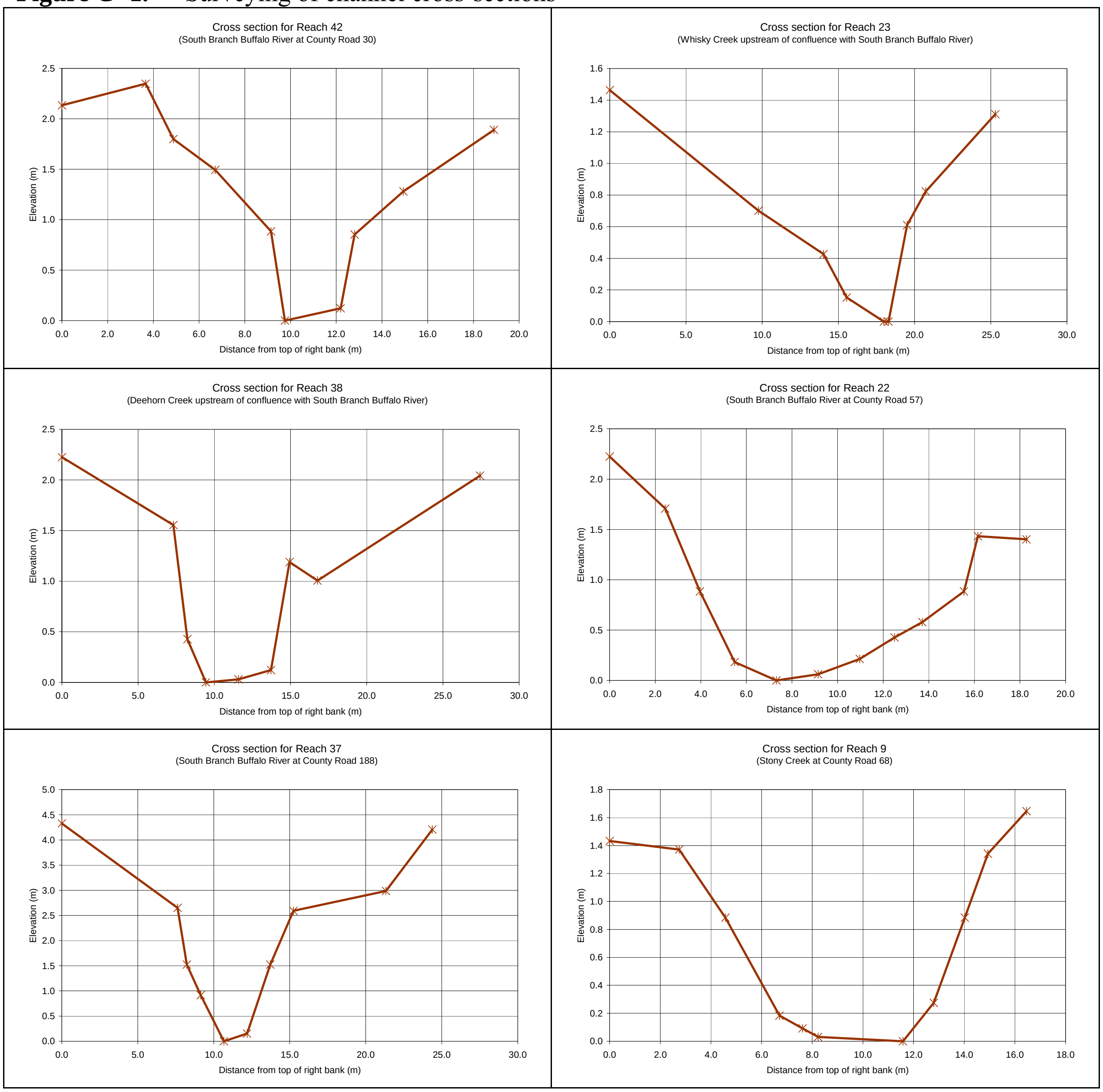
```
                            .DepVol_Clay = .DepVol_Clay * .TimeToBaseUpper / DeltaT /
BedArea
                            .DepVol_Silt = .DepVol_Silt * .TimeToBaseUpper / DeltaT /
BedArea
                            .DepVol_Sand = .DepVol_Sand * .TimeToBaseUpper / DeltaT /
BedArea
                            .DepVol_SAgg = .DepVol_SAgg * .TimeToBaseUpper / DeltaT /
BedArea
                            .DepVol_LAgg = .DepVol_LAgg * .TimeToBaseUpper / DeltaT /
BedArea
                        End If
                    End With
                    Next j
                End With
            End If
        Next i
    Next k
End Sub

Sub PrintingDepositionRates()
    Const ForReading = 1, ForWriting = 2, ForAppending = 3
    Const TristateUseDefault = -2, TristateTrue = -1, TristateFalse = 0

    Dim fs As Object
    Dim f As Object
    Dim ts As Object
    Dim DataLine As String
    Dim fannualfile As String
    Dim i, j, k As Integer
    Dim eventdate As String

    Dim NumberOfYears As Double

    fannualfile = Application.GetOpenFilename("Input file (*.txt), *.txt", , "Select File
AnnAGNPS_txt_aa_sediment_yield_(mass).txt (must be output by AnnAGNPS)")

    Set fs = CreateObject("Scripting.FileSystemObject")
    Set f = fs.GetFile(fannualfile)
    Set ts = f.OpenAsTextStream(ForReading, TristateFalse)

    For i = 1 To 8
        DataLine = ts.readline
    Next i
    NumberOfYears = Trim(Mid(DataLine, 60, 6))

    For i = 1 To NumberOfReaches
        With reach(i)
            .AverageAggradation_Sand = 0
            .AverageAggradation_LAgg = 0
            .AverageAggradation_Total = 0

            For j = 1 To UBound(reach(1).ReachRunoffEventMoveSed)
                With .ReachRunoffEventMoveSed(j)
                    reach(i).AverageAggradation_Sand = reach(i).AverageAggradation_Sand +
.DepVol_Sand
                    reach(i).AverageAggradation_LAgg = reach(i).AverageAggradation_LAgg +
.DepVol_LAgg
                End With
            Next j

            'Aggradational rates computed on cm/yr
            .AverageAggradation_Sand = .AverageAggradation_Sand * 100 / NumberOfYears
            .AverageAggradation_LAgg = .AverageAggradation_LAgg * 100 / NumberOfYears
            .AverageAggradation_Total = .AverageAggradation_Sand +
.AverageAggradation_LAgg
        End With
    Next i

    For i = 1 To NumberOfReaches
        Worksheets("Deposition rates_Summary").Cells(i + 6, 1).Value = reach(i).ID
```

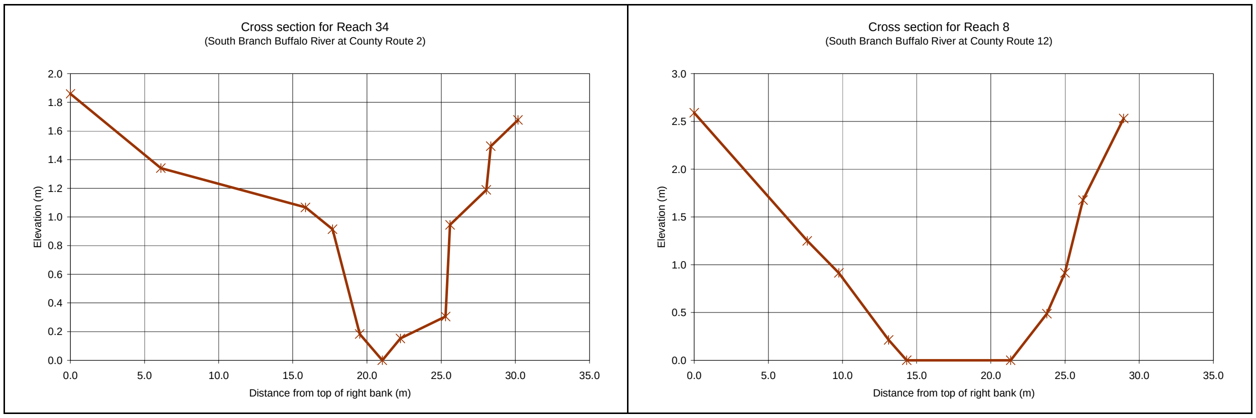
```
        Worksheets("Deposition rates_Summary").Cells(i + 6, 2).Value =
reach(i).AverageAggradation_Sand
        Worksheets("Deposition rates_Summary").Cells(i + 6, 3).Value =
reach(i).AverageAggradation_LAgg
        Worksheets("Deposition rates_Summary").Cells(i + 6, 4).Value =
reach(i).AverageAggradation_Total
    Next i

End Sub

Sub PostProcessing()
    ReadCellsAndReaches
    ReadGaugeDataOutput
    ReadErosionOutput
    ReadYieldOutput
    Yield_5_fractions

    Summary_Annual_Yields

    ReadWaterCellOutput
    ReadGaugeDataOutput_MoveSed

    DefiningSequenceRouting
    Concentration_5_fractions

    Setting_Hydrograph_And_Hydraulics

    PrintingDepositionRates
End Sub
```

Appendix C: Hydraulic Geometry Analysis

A topographic survey was conducted by Wes Lauer on September 26, 2005. The survey included eight cross sections (Figure C-1) of the river channel, five of them in the South Branch Buffalo River and the other three in its main tributaries. This information was used to define the channel dimensions (top width and height) that correspond to bankfull conditions at these eight locations.

Figure C- 1. Surveying of channel cross-sections





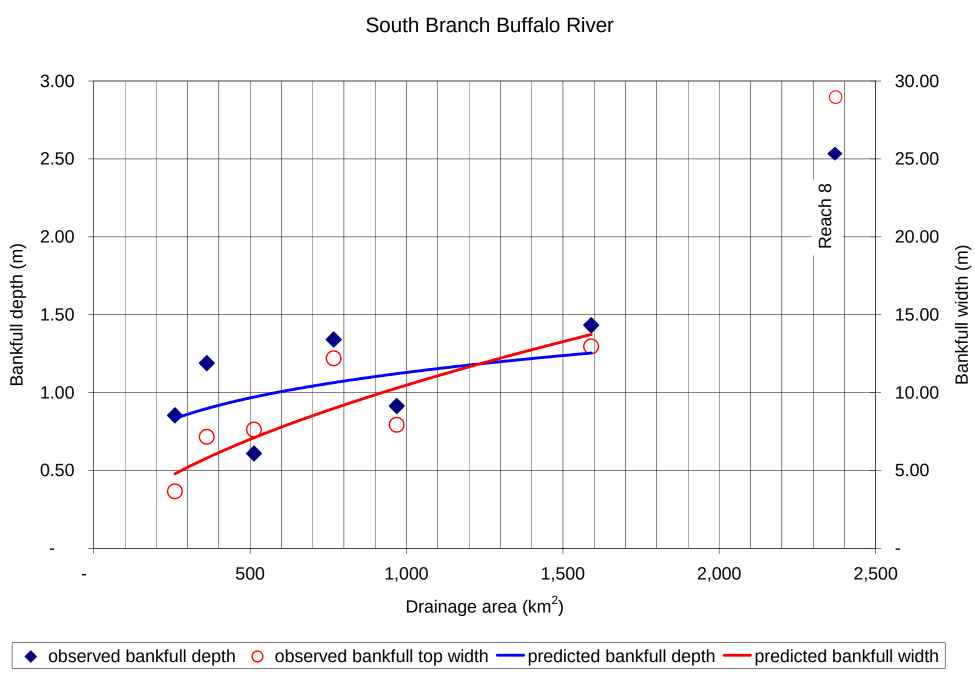
Subsequently, a regression analysis of these geometric characteristics of the river channel versus the associated drainage area of the reach was performed. When the information of the cross section for reach 8 is not included, the two regression relations obtained are:

$$H_{bf} = 0.24A_d^{0.23} \qquad (1)$$

$$B_{bf} = 0.19A_d^{0.58} \qquad (2)$$

In the relations above, Ad = drainage area (km2); Hbf = water depth at bankfull conditions (m); and Bbf = top width at bankfull conditions (m). Tabulation of these relations (1) and (2) for all reaches included in the analysis (except for Reaches 1, 2, 4 and 8) is presented in Table C-1 below. The reason for not including reach 8 in the regression analysis for the upstream reaches is evident in Figure C-2.

Figure C- 2. Bankfull dimensions as a function of drainage area



When the information of the cross section for reach 8 is included, the two regression relations obtained are:

$$H_{bf} = 0.08A_d^{0.41} \quad (3)$$

$$B_{bf} = 0.07A_d^{0.74} \quad (4)$$

Table C- 1. Bankfull dimensions as a function of drainage area.

Reach	Drainage area (km^2)	Bankfull depth (m)	Bankfull width (m)	Valley width (m)	Reach	Drainage area (km^2)	Bankfull depth (m)	Bankfull width (m)	Valley width (m)
1	2,734	1.97	24.80	1,000	28	89	0.65	2.57	200
2	2,734	1.97	24.80	1,000	29	26	0.50	1.26	200
3	101	0.67	2.76	200	30	23	0.48	1.16	200
4	2,566	1.92	23.67	1,000	31	148	0.73	3.45	200
5	155	0.74	3.54	200	32	55	0.59	1.94	200
6	47	0.57	1.77	200	33	45	0.56	1.72	200
7	107	0.68	2.86	200	34	969	1.12	10.29	500
8	2,370	1.86	22.32	1,000	35	741	1.06	8.80	200
9	768	1.06	8.99	500	36	69	0.62	2.21	200
10	431	0.93	6.43	200	37	626	1.02	7.98	200
11	19	0.46	1.03	200	38	362	0.90	5.80	200
12	412	0.92	6.26	200	39	89	0.65	2.57	200
13	327	0.88	5.47	200	40	55	0.59	1.93	200
14	137	0.72	3.30	200	41	34	0.53	1.47	200
15	78	0.63	2.37	200	42	260	0.83	4.78	200
16	37	0.54	1.54	200	43	172	0.76	3.77	200
17	23	0.48	1.17	200	44	105	0.68	2.82	200
18	64	0.61	2.11	200	45	49	0.57	1.80	200
19	242	0.82	4.59	200	46	52	0.58	1.87	200
20	71	0.62	2.26	200	47	29	0.51	1.33	200
21	42	0.55	1.65	200	48	79	0.64	2.40	200
22	1,591	1.25	13.73	500	49	241	0.82	4.58	200
23	513	0.97	7.10	200	50	88	0.65	2.54	200
24	360	0.90	5.78	200	51	49	0.57	1.81	200
25	45	0.56	1.72	200	52	32	0.52	1.42	200
26	192	0.78	4.01	200	53	44	0.56	1.70	200
27	147	0.73	3.43	200	54	178	0.77	3.84	500

Appendix D: Hay Creek Gauging Station Data

Flow and SSC observations

DATE	TIME	ELEV.	TOTAL Q (CFS)	MEAN VEL.	ELEV.	Stage	C	Qs (Mg/d)
5/10/2006		91.0	23.75	1.05	91.0	1.15	40	2.32
5/17/2006	17:00	91.8	44.90	1.43	91.8	1.95	139	15.27
5/31/2006	15:30	91.8	48.43	1.44	91.8	1.95	139	16.47
6/6/2006	10:30	92.6	84.21	1.60	92.6	2.75	69	14.22
6/7/2006	12:00	92.6	76.73	1.57	92.6	2.75	76	14.27
6/8/2006	12:00	93.6	120.26	1.86	93.6	3.75	185	54.44
6/9/2006	15:00	94.2	142.89	1.95	94.2	4.35	103	36.01
6/10/2006	18:00	93.6			93.6	3.75		
6/13/2006	9:15	95.5			95.5	5.65		
6/14/2006	14:30	96.2			96.2	6.35		
6/16/2006	16:30	94.8	168.86	1.58	94.8	4.95	66	27.27
6/20/2006	14:00	92.2	66.12	1.13	92.2	2.35	56	9.06
6/27/2006	10:30	90.7	22.36	0.89	90.7	0.85	81	4.43
7/21/2006	11:00	90.1	3.80	0.40	90.1	0.25	64	0.60
Elevation 100 is road deck								

Pressure transducer data

Date / Time	Depth	WSE (Bridge 100)	Stage	Discharge (cfs)	Q (cms)	
4/8/2005	2.51	91.71	1.86	48.4	1.37	
4/8/2005	2.59	91.79	1.94	51.1	1.45	
4/8/2005	2.62	91.82	1.97	52.1	1.47	
4/8/2005	2.6	91.8	1.95	51.4	1.46	
4/8/2005	2.59	91.79	1.94	51.1	1.45	
4/8/2005	2.58	91.78	1.93	50.7	1.44	
4/8/2005	2.56	91.76	1.91	50.1	1.42	
4/8/2005	2.55	91.75	1.9	49.7	1.41	
4/8/2005	2.55	91.75	1.9	49.7	1.41	
4/8/2005	2.54	91.74	1.89	49.4	1.40	
4/8/2005	2.54	91.74	1.89	49.4	1.40	
4/8/2005	2.52	91.72	1.87	48.7	1.38	
4/8/2005	2.51	91.71	1.86	48.4	1.37	
4/8/2005	2.51	91.71	1.86	48.4	1.37	
4/8/2005	2.51	91.71	1.86	48.4	1.37	
4/8/2005	2.5	91.7	1.85	48.1	1.36	
4/8/2005	2.5	91.7	1.85	48.1	1.36	
4/8/2005	2.5	91.7	1.85	48.1	1.36	
4/8/2005	2.48	91.68	1.83	47.4	1.34	
4/8/2005	2.49	91.69	1.84	47.8	1.35	
4/8/2005	2.48	91.68	1.83	47.4	1.34	
4/8/2005	2.47	91.67	1.82	47.1	1.33	
4/8/2005	2.49	91.69	1.84	47.8	1.35	
4/8/2005	2.49	91.69	1.84	47.8	1.35	
4/8/2005	2.5	91.7	1.85	48.1	1.36	
4/8/2005	2.5	91.7	1.85	48.1	1.36	
4/8/2005	2.5	91.7	1.85	48.1	1.36	
4/8/2005	2.49	91.69	1.84	47.8	1.35	
4/8/2005	2.49	91.69	1.84	47.8	1.35	
4/8/2005	2.48	91.68	1.83	47.4	1.34	
4/8/2005	2.48	91.68	1.83	47.4	1.34	
4/8/2005	2.47	91.67	1.82	47.1	1.33	
4/8/2005	2.47	91.67	1.82	47.1	1.33	
4/8/2005	2.46	91.66	1.81	46.8	1.32	
4/8/2005	2.47	91.67	1.82	47.1	1.33	
4/8/2005	2.46	91.66	1.81	46.8	1.32	
4/8/2005	2.47	91.67	1.82	47.1	1.33	
4/8/2005	2.46	91.66	1.81	46.8	1.32	
4/8/2005 Average					1.37	4/8/2005 Average
4/9/2005	2.46	91.66	1.81	46.8	1.32	
4/9/2005	2.46	91.66	1.81	46.8	1.32	
4/9/2005	2.46	91.66	1.81	46.8	1.32	
4/9/2005	2.46	91.66	1.81	46.8	1.32	

4/9/2005	2.45	91.65	1.8	46.5	1.32
4/9/2005	2.45	91.65	1.8	46.5	1.32
4/9/2005	2.45	91.65	1.8	46.5	1.32
4/9/2005	2.45	91.65	1.8	46.5	1.32
4/9/2005	2.44	91.64	1.79	46.1	1.31
4/9/2005	2.43	91.63	1.78	45.8	1.30
4/9/2005	2.43	91.63	1.78	45.8	1.30
4/9/2005	2.43	91.63	1.78	45.8	1.30
4/9/2005	2.42	91.62	1.77	45.5	1.29
4/9/2005	2.42	91.62	1.77	45.5	1.29
4/9/2005	2.42	91.62	1.77	45.5	1.29
4/9/2005	2.42	91.62	1.77	45.5	1.29
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.36	91.56	1.71	43.5	1.23
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.37	91.57	1.72	43.9	1.24
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.41	91.61	1.76	45.1	1.28
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.4	91.6	1.75	44.8	1.27
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.39	91.59	1.74	44.5	1.26
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.38	91.58	1.73	44.2	1.25
4/9/2005	2.37	91.57	1.72	43.9	1.24

4/9/2005	2.37	91.57	1.72	43.9	1.24	
4/9/2005	2.36	91.56	1.71	43.5	1.23	
4/9/2005	2.36	91.56	1.71	43.5	1.23	
4/9/2005	2.36	91.56	1.71	43.5	1.23	
4/9/2005	2.36	91.56	1.71	43.5	1.23	
4/9/2005	2.36	91.56	1.71	43.5	1.23	
4/9/2005	2.35	91.55	1.7	43.2	1.22	
4/9/2005	2.35	91.55	1.7	43.2	1.22	
4/9/2005	2.36	91.56	1.71	43.5	1.23	
4/9/2005	2.35	91.55	1.7	43.2	1.22	
4/9/2005 Average					1.27	4/9/2005 Average
4/10/2005	2.35	91.55	1.7	43.2	1.22	
4/10/2005	2.36	91.56	1.71	43.5	1.23	
4/10/2005	2.36	91.56	1.71	43.5	1.23	
4/10/2005	2.35	91.55	1.7	43.2	1.22	
4/10/2005	2.35	91.55	1.7	43.2	1.22	
4/10/2005	2.35	91.55	1.7	43.2	1.22	
4/10/2005	2.35	91.55	1.7	43.2	1.22	
4/10/2005	2.34	91.54	1.69	42.9	1.21	
4/10/2005	2.35	91.55	1.7	43.2	1.22	
4/10/2005	2.34	91.54	1.69	42.9	1.21	
4/10/2005	2.34	91.54	1.69	42.9	1.21	
4/10/2005	2.34	91.54	1.69	42.9	1.21	
4/10/2005	2.34	91.54	1.69	42.9	1.21	
4/10/2005	2.34	91.54	1.69	42.9	1.21	
4/10/2005	2.33	91.53	1.68	42.6	1.21	
4/10/2005	2.33	91.53	1.68	42.6	1.21	
4/10/2005	2.33	91.53	1.68	42.6	1.21	
4/10/2005	2.33	91.53	1.68	42.6	1.21	
4/10/2005	2.33	91.53	1.68	42.6	1.21	
4/10/2005	2.33	91.53	1.68	42.6	1.21	
4/10/2005	2.32	91.52	1.67	42.2	1.20	
4/10/2005	2.32	91.52	1.67	42.2	1.20	
4/10/2005	2.32	91.52	1.67	42.2	1.20	
4/10/2005	2.32	91.52	1.67	42.2	1.20	
4/10/2005	2.32	91.52	1.67	42.2	1.20	
4/10/2005	2.32	91.52	1.67	42.2	1.20	
4/10/2005	2.32	91.52	1.67	42.2	1.20	
4/10/2005	2.32	91.52	1.67	42.2	1.20	
4/10/2005	2.32	91.52	1.67	42.2	1.20	
4/10/2005	2.31	91.51	1.66	41.9	1.19	
4/10/2005	2.31	91.51	1.66	41.9	1.19	
4/10/2005	2.31	91.51	1.66	41.9	1.19	
4/10/2005	2.31	91.51	1.66	41.9	1.19	
4/10/2005	2.31	91.51	1.66	41.9	1.19	
4/10/2005	2.31	91.51	1.66	41.9	1.19	
4/10/2005	2.31	91.51	1.66	41.9	1.19	
4/10/2005	2.31	91.51	1.66	41.9	1.19	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.29	91.49	1.64	41.3	1.17	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.29	91.49	1.64	41.3	1.17	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.29	91.49	1.64	41.3	1.17	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.3	91.5	1.65	41.6	1.18	
4/10/2005	2.29	91.49	1.64	41.3	1.17	
4/10/2005	2.29	91.49	1.64	41.3	1.17	
4/10/2005	2.29	91.49	1.64	41.3	1.17	
4/10/2005	2.29	91.49	1.64	41.3	1.17	
4/10/2005	2.29	91.49	1.64	41.3	1.17	
4/10/2005	2.29	91.49	1.64	41.3	1.17	
4/10/2005	2.28	91.48	1.63	41.0	1.16	

4/10/2005	2.28	91.48	1.63	41.0	1.16	
4/10/2005	2.28	91.48	1.63	41.0	1.16	
4/10/2005	2.27	91.47	1.62	40.7	1.15	
4/10/2005	2.28	91.48	1.63	41.0	1.16	
4/10/2005	2.27	91.47	1.62	40.7	1.15	
4/10/2005	2.27	91.47	1.62	40.7	1.15	
4/10/2005	2.26	91.46	1.61	40.3	1.14	
4/10/2005	2.26	91.46	1.61	40.3	1.14	
4/10/2005	2.26	91.46	1.61	40.3	1.14	
4/10/2005	2.26	91.46	1.61	40.3	1.14	
4/10/2005	2.26	91.46	1.61	40.3	1.14	
4/10/2005	2.27	91.47	1.62	40.7	1.15	
4/10/2005	2.26	91.46	1.61	40.3	1.14	
4/10/2005	2.26	91.46	1.61	40.3	1.14	
4/10/2005	2.25	91.45	1.6	40.0	1.13	
4/10/2005	2.25	91.45	1.6	40.0	1.13	
4/10/2005	2.25	91.45	1.6	40.0	1.13	
4/10/2005	2.25	91.45	1.6	40.0	1.13	
4/10/2005	2.25	91.45	1.6	40.0	1.13	
4/10/2005	2.25	91.45	1.6	40.0	1.13	
4/10/2005	2.25	91.45	1.6	40.0	1.13	
4/10/2005	2.25	91.45	1.6	40.0	1.13	
4/10/2005	2.24	91.44	1.59	39.7	1.12	
4/10/2005	2.24	91.44	1.59	39.7	1.12	
4/10/2005	2.24	91.44	1.59	39.7	1.12	
4/10/2005 Average					1.18	4/10/2005 Average
4/11/2005	2.24	91.44	1.59	39.7	1.12	
4/11/2005	2.24	91.44	1.59	39.7	1.12	
4/11/2005	2.23	91.43	1.58	39.4	1.12	
4/11/2005	2.23	91.43	1.58	39.4	1.12	
4/11/2005	2.22	91.42	1.57	39.1	1.11	
4/11/2005	2.24	91.44	1.59	39.7	1.12	
4/11/2005	2.26	91.46	1.61	40.3	1.14	
4/11/2005	2.27	91.47	1.62	40.7	1.15	
4/11/2005	2.28	91.48	1.63	41.0	1.16	
4/11/2005	2.28	91.48	1.63	41.0	1.16	
4/11/2005	2.28	91.48	1.63	41.0	1.16	
4/11/2005	2.29	91.49	1.64	41.3	1.17	
4/11/2005	2.31	91.51	1.66	41.9	1.19	
4/11/2005	2.32	91.52	1.67	42.2	1.20	
4/11/2005	2.32	91.52	1.67	42.2	1.20	
4/11/2005	2.34	91.54	1.69	42.9	1.21	
4/11/2005	2.35	91.55	1.7	43.2	1.22	
4/11/2005	2.36	91.56	1.71	43.5	1.23	
4/11/2005	2.36	91.56	1.71	43.5	1.23	
4/11/2005	2.38	91.58	1.73	44.2	1.25	
4/11/2005	2.39	91.59	1.74	44.5	1.26	
4/11/2005	2.41	91.61	1.76	45.1	1.28	
4/11/2005	2.42	91.62	1.77	45.5	1.29	
4/11/2005	2.44	91.64	1.79	46.1	1.31	
4/11/2005	2.46	91.66	1.81	46.8	1.32	
4/11/2005	2.48	91.68	1.83	47.4	1.34	
4/11/2005	2.5	91.7	1.85	48.1	1.36	
4/11/2005	2.51	91.71	1.86	48.4	1.37	
4/11/2005	2.54	91.74	1.89	49.4	1.40	
4/11/2005	2.55	91.75	1.9	49.7	1.41	
4/11/2005	2.57	91.77	1.92	50.4	1.43	
4/11/2005	2.59	91.79	1.94	51.1	1.45	
4/11/2005	2.61	91.81	1.96	51.7	1.47	
4/11/2005	2.62	91.82	1.97	52.1	1.47	
4/11/2005	2.63	91.83	1.98	52.4	1.48	
4/11/2005	2.66	91.86	2.01	53.4	1.51	
4/11/2005	2.68	91.88	2.03	54.1	1.53	
4/11/2005	2.69	91.89	2.04	54.4	1.54	
4/11/2005	2.72	91.92	2.07	55.4	1.57	
4/11/2005	2.74	91.94	2.09	56.1	1.59	
4/11/2005	2.77	91.97	2.12	57.1	1.62	
4/11/2005	2.8	92	2.15	58.2	1.65	
4/11/2005	2.82	92.02	2.17	58.8	1.67	
4/11/2005	2.84	92.04	2.19	59.5	1.69	
4/11/2005	2.86	92.06	2.21	60.2	1.71	
4/11/2005	2.89	92.09	2.24	61.2	1.73	
4/11/2005	2.91	92.11	2.26	61.9	1.75	
4/11/2005	2.94	92.14	2.29	63.0	1.78	
4/11/2005	2.95	92.15	2.3	63.3	1.79	
4/11/2005	2.96	92.16	2.31	63.7	1.80	
4/11/2005	2.98	92.18	2.33	64.4	1.82	
4/11/2005	3	92.2	2.35	65.1	1.84	
4/11/2005	3.02	92.22	2.37	65.8	1.86	
4/11/2005	3.04	92.24	2.39	66.5	1.88	
4/11/2005	3.05	92.25	2.4	66.8	1.89	

4/11/2005	3.06	92.26	2.41	67.2	1.90	
4/11/2005	3.07	92.27	2.42	67.5	1.91	
4/11/2005	3.09	92.29	2.44	68.2	1.93	
4/11/2005	3.1	92.3	2.45	68.6	1.94	
4/11/2005	3.11	92.31	2.46	69.0	1.95	
4/11/2005	3.12	92.32	2.47	69.3	1.96	
4/11/2005	3.13	92.33	2.48	69.7	1.97	
4/11/2005	3.14	92.34	2.49	70.0	1.98	
4/11/2005	3.16	92.36	2.51	70.7	2.00	
4/11/2005	3.16	92.36	2.51	70.7	2.00	
4/11/2005	3.18	92.38	2.53	71.4	2.02	
4/11/2005	3.19	92.39	2.54	71.8	2.03	
4/11/2005	3.2	92.4	2.55	72.2	2.04	
4/11/2005 Average					1.53	4/11/2005 Average
4/12/2005	3.79	92.99	3.14	93.9	2.66	
4/12/2005	3.79	92.99	3.14	93.9	2.66	
4/12/2005	3.81	93.01	3.16	94.6	2.68	
4/12/2005	3.82	93.02	3.17	95.0	2.69	
4/12/2005	4.02	93.22	3.37	102.7	2.91	
4/12/2005	4	93.2	3.35	101.9	2.89	
4/12/2005	3.96	93.16	3.31	100.4	2.84	
4/12/2005	3.94	93.14	3.29	99.6	2.82	
4/12/2005	3.93	93.13	3.28	99.2	2.81	
4/12/2005	3.93	93.13	3.28	99.2	2.81	
4/12/2005	3.92	93.12	3.27	98.8	2.80	
4/12/2005	3.93	93.13	3.28	99.2	2.81	
4/12/2005	3.94	93.14	3.29	99.6	2.82	
4/12/2005	3.95	93.15	3.3	100.0	2.83	
4/12/2005	3.97	93.17	3.32	100.7	2.85	
4/12/2005	3.98	93.18	3.33	101.1	2.86	
4/12/2005	4	93.2	3.35	101.9	2.89	
4/12/2005	4.01	93.21	3.36	102.3	2.90	
4/12/2005	4.02	93.22	3.37	102.7	2.91	
4/12/2005	4.04	93.24	3.39	103.4	2.93	
4/12/2005	4.06	93.26	3.41	104.2	2.95	
4/12/2005	4.07	93.27	3.42	104.6	2.96	
4/12/2005	4.09	93.29	3.44	105.4	2.98	
4/12/2005	4.12	93.32	3.47	106.5	3.02	
4/12/2005	4.14	93.34	3.49	107.3	3.04	
4/12/2005	4.16	93.36	3.51	108.1	3.06	
4/12/2005	4.16	93.36	3.51	108.1	3.06	
4/12/2005	4.18	93.38	3.53	108.9	3.08	
4/12/2005	4.2	93.4	3.55	109.6	3.11	
4/12/2005	4.21	93.41	3.56	110.0	3.12	
4/12/2005	4.22	93.42	3.57	110.4	3.13	
4/12/2005	4.23	93.43	3.58	110.8	3.14	
4/12/2005	4.24	93.44	3.59	111.2	3.15	
4/12/2005	4.26	93.46	3.61	112.0	3.17	
4/12/2005	4.26	93.46	3.61	112.0	3.17	
4/12/2005	4.27	93.47	3.62	112.4	3.18	
4/12/2005	4.29	93.49	3.64	113.2	3.20	
4/12/2005	4.3	93.5	3.65	113.6	3.22	
4/12/2005	4.3	93.5	3.65	113.6	3.22	
4/12/2005	4.32	93.52	3.67	114.3	3.24	
4/12/2005	4.33	93.53	3.68	114.7	3.25	
4/12/2005 Average					2.97	4/12/2005 Average
4/13/2005	4.34	93.54	3.69	115.1	3.26	
4/13/2005	4.35	93.55	3.7	115.5	3.27	
4/13/2005	4.36	93.56	3.71	115.9	3.28	
4/13/2005	4.37	93.57	3.72	116.3	3.29	
4/13/2005	4.39	93.59	3.74	117.1	3.32	
4/13/2005	4.4	93.6	3.75	117.5	3.33	
4/13/2005	4.4	93.6	3.75	117.5	3.33	
4/13/2005	4.41	93.61	3.76	117.9	3.34	
4/13/2005	4.42	93.62	3.77	118.3	3.35	
4/13/2005	4.43	93.63	3.78	118.7	3.36	
4/13/2005	4.44	93.64	3.79	119.1	3.37	
4/13/2005	4.46	93.66	3.81	119.9	3.40	
4/13/2005	4.47	93.67	3.82	120.3	3.41	
4/13/2005	4.47	93.67	3.82	120.3	3.41	
4/13/2005	4.48	93.68	3.83	120.7	3.42	
4/13/2005	4.47	93.67	3.82	120.3	3.41	
4/13/2005	4.48	93.68	3.83	120.7	3.42	
4/13/2005	4.51	93.71	3.86	121.9	3.45	
4/13/2005	4.51	93.71	3.86	121.9	3.45	
4/13/2005	4.49	93.69	3.84	121.1	3.43	
4/13/2005	4.49	93.69	3.84	121.1	3.43	
4/13/2005	4.5	93.7	3.85	121.5	3.44	
4/13/2005	4.49	93.69	3.84	121.1	3.43	
4/13/2005	4.5	93.7	3.85	121.5	3.44	

4/13/2005	4.5	93.7	3.85	121.5	3.44	
4/13/2005	4.5	93.7	3.85	121.5	3.44	
4/13/2005	4.51	93.71	3.86	121.9	3.45	
4/13/2005	4.48	93.68	3.83	120.7	3.42	
4/13/2005	4.45	93.65	3.8	119.5	3.38	
4/13/2005	4.39	93.59	3.74	117.1	3.32	
4/13/2005	4.36	93.56	3.71	115.9	3.28	
4/13/2005	4.37	93.57	3.72	116.3	3.29	
4/13/2005	4.36	93.56	3.71	115.9	3.28	
4/13/2005	4.36	93.56	3.71	115.9	3.28	
4/13/2005	4.36	93.56	3.71	115.9	3.28	
4/13/2005	4.39	93.59	3.74	117.1	3.32	
4/13/2005	4.37	93.57	3.72	116.3	3.29	
4/13/2005	4.37	93.57	3.72	116.3	3.29	
4/13/2005	4.36	93.56	3.71	115.9	3.28	
4/13/2005	4.34	93.54	3.69	115.1	3.26	
4/13/2005	4.38	93.58	3.73	116.7	3.31	
4/13/2005	4.35	93.55	3.7	115.5	3.27	
4/13/2005	4.32	93.52	3.67	114.3	3.24	
4/13/2005	4.32	93.52	3.67	114.3	3.24	
4/13/2005	4.31	93.51	3.66	114.0	3.23	
4/13/2005	4.33	93.53	3.68	114.7	3.25	
4/13/2005	4.33	93.53	3.68	114.7	3.25	
4/13/2005	4.35	93.55	3.7	115.5	3.27	
4/13/2005 Average					3.34	4/13/2005 Average
					0.00	0
5/17/2005	2.6	91.8	1.95	51.4	1.46	
5/17/2005	2.58	91.78	1.93	50.7	1.44	
5/17/2005	2.58	91.78	1.93	50.7	1.44	
5/17/2005 Average					1.44	5/17/2005 Average
					0.00	0
7/28/2005	1.36	90.56	0.71	14.3	0.41	
7/28/2005	1.36	90.56	0.71	14.3	0.41	
7/28/2005	1.36	90.56	0.71	14.3	0.41	
7/28/2005	1.36	90.56	0.71	14.3	0.41	
7/28/2005	1.36	90.56	0.71	14.3	0.41	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.34	90.54	0.69	13.8	0.39	
7/28/2005	1.34	90.54	0.69	13.8	0.39	
7/28/2005	1.34	90.54	0.69	13.8	0.39	
7/28/2005	1.34	90.54	0.69	13.8	0.39	
7/28/2005	1.34	90.54	0.69	13.8	0.39	
7/28/2005	1.34	90.54	0.69	13.8	0.39	
7/28/2005	1.34	90.54	0.69	13.8	0.39	
7/28/2005	1.33	90.53	0.68	13.6	0.38	
7/28/2005	1.33	90.53	0.68	13.6	0.38	
7/28/2005	1.33	90.53	0.68	13.6	0.38	
7/28/2005	1.33	90.53	0.68	13.6	0.38	
7/28/2005	1.34	90.54	0.69	13.8	0.39	
7/28/2005	1.35	90.55	0.7	14.1	0.40	
7/28/2005	1.36	90.56	0.71	14.3	0.41	
7/28/2005	1.38	90.58	0.73	14.8	0.42	
7/28/2005	1.38	90.58	0.73	14.8	0.42	
7/28/2005	1.39	90.59	0.74	15.1	0.43	
7/28/2005	1.39	90.59	0.74	15.1	0.43	
7/28/2005	1.39	90.59	0.74	15.1	0.43	
7/28/2005	1.39	90.59	0.74	15.1	0.43	
7/28/2005	1.39	90.59	0.74	15.1	0.43	
7/28/2005	1.39	90.59	0.74	15.1	0.43	
7/28/2005	1.39	90.59	0.74	15.1	0.43	
7/28/2005	1.38	90.58	0.73	14.8	0.42	
7/28/2005	1.38	90.58	0.73	14.8	0.42	
7/28/2005	1.37	90.57	0.72	14.6	0.41	
7/28/2005	1.37	90.57	0.72	14.6	0.41	
7/28/2005	1.37	90.57	0.72	14.6	0.41	
7/28/2005	1.36	90.56	0.71	14.3	0.41	
7/28/2005 Average					0.40	7/28/2005 Average
7/29/2005	1.36	90.56	0.71	14.3	0.41	
7/29/2005	1.36	90.56	0.71	14.3	0.41	
7/29/2005	1.36	90.56	0.71	14.3	0.41	

7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.37	90.57	0.72	14.6	0.41
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.38	90.58	0.73	14.8	0.42
7/29/2005	1.39	90.59	0.74	15.1	0.43
7/29/2005	1.39	90.59	0.74	15.1	0.43
7/29/2005	1.39	90.59	0.74	15.1	0.43
7/29/2005	1.39	90.59	0.74	15.1	0.43
7/29/2005	1.4	90.6	0.75	15.4	0.43
7/29/2005	1.4	90.6	0.75	15.4	0.43
7/29/2005	1.4	90.6	0.75	15.4	0.43
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.43	90.63	0.78	16.1	0.46
7/29/2005	1.43	90.63	0.78	16.1	0.46
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.42	90.62	0.77	15.9	0.45
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44
7/29/2005	1.41	90.61	0.76	15.6	0.44

7/29/2005	1.42	90.62	0.77	15.9	0.45	
7/29/2005	1.42	90.62	0.77	15.9	0.45	
7/29/2005	1.43	90.63	0.78	16.1	0.46	
7/29/2005	1.43	90.63	0.78	16.1	0.46	
7/29/2005	1.43	90.63	0.78	16.1	0.46	
7/29/2005	1.44	90.64	0.79	16.4	0.46	
7/29/2005	1.44	90.64	0.79	16.4	0.46	
7/29/2005	1.45	90.65	0.8	16.7	0.47	
7/29/2005	1.46	90.66	0.81	16.9	0.48	
7/29/2005	1.46	90.66	0.81	16.9	0.48	
7/29/2005	1.47	90.67	0.82	17.2	0.49	
7/29/2005 Average					0.44	7/29/2005 Average
7/30/2005	1.48	90.68	0.83	17.5	0.49	
7/30/2005	1.48	90.68	0.83	17.5	0.49	
7/30/2005	1.48	90.68	0.83	17.5	0.49	
7/30/2005	1.48	90.68	0.83	17.5	0.49	
7/30/2005	1.49	90.69	0.84	17.7	0.50	
7/30/2005	1.49	90.69	0.84	17.7	0.50	
7/30/2005	1.49	90.69	0.84	17.7	0.50	
7/30/2005	1.5	90.7	0.85	18.0	0.51	
7/30/2005	1.5	90.7	0.85	18.0	0.51	
7/30/2005	1.5	90.7	0.85	18.0	0.51	
7/30/2005	1.5	90.7	0.85	18.0	0.51	
7/30/2005	1.5	90.7	0.85	18.0	0.51	
7/30/2005	1.51	90.71	0.86	18.3	0.52	
7/30/2005	1.51	90.71	0.86	18.3	0.52	
7/30/2005	1.51	90.71	0.86	18.3	0.52	
7/30/2005	1.51	90.71	0.86	18.3	0.52	
7/30/2005	1.52	90.72	0.87	18.5	0.52	
7/30/2005	1.52	90.72	0.87	18.5	0.52	
7/30/2005	1.53	90.73	0.88	18.8	0.53	
7/30/2005	1.53	90.73	0.88	18.8	0.53	
7/30/2005	1.53	90.73	0.88	18.8	0.53	
7/30/2005	1.53	90.73	0.88	18.8	0.53	
7/30/2005	1.53	90.73	0.88	18.8	0.53	
7/30/2005	1.53	90.73	0.88	18.8	0.53	
7/30/2005	1.53	90.73	0.88	18.8	0.53	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005	1.53	90.73	0.88	18.8	0.53	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005	1.54	90.74	0.89	19.1	0.54	
7/30/2005 Average					0.52	7/30/2005 Average
					0.00	0
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.9	91.1	1.25	29.3	0.83	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	

8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.91	91.11	1.26	29.6	0.84	
8/22/2005	1.92	91.12	1.27	29.9	0.85	
8/22/2005	1.92	91.12	1.27	29.9	0.85	
8/22/2005	1.92	91.12	1.27	29.9	0.85	
8/22/2005	1.93	91.13	1.28	30.2	0.85	
8/22/2005	1.93	91.13	1.28	30.2	0.85	
8/22/2005 Average					0.84	8/22/2005 Average
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.94	91.14	1.29	30.5	0.86	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.92	91.12	1.27	29.9	0.85	
8/23/2005	1.92	91.12	1.27	29.9	0.85	
8/23/2005	1.92	91.12	1.27	29.9	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.94	91.14	1.29	30.5	0.86	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.93	91.13	1.28	30.2	0.85	
8/23/2005	1.92	91.12	1.27	29.9	0.85	
8/23/2005	1.91	91.11	1.26	29.6	0.84	
8/23/2005	1.91	91.11	1.26	29.6	0.84	
8/23/2005	1.9	91.1	1.25	29.3	0.83	
8/23/2005	1.9	91.1	1.25	29.3	0.83	
8/23/2005	1.89	91.09	1.24	29.0	0.82	
8/23/2005	1.88	91.08	1.23	28.7	0.81	
8/23/2005	1.88	91.08	1.23	28.7	0.81	
8/23/2005	1.89	91.09	1.24	29.0	0.82	
8/23/2005 Average					0.85	8/23/2005 Average
8/24/2005	1.9	91.1	1.25	29.3	0.83	
8/24/2005	1.91	91.11	1.26	29.6	0.84	
8/24/2005	1.91	91.11	1.26	29.6	0.84	
8/24/2005	1.91	91.11	1.26	29.6	0.84	

8/24/2005	1.92	91.12	1.27	29.9	0.85	
8/24/2005	1.92	91.12	1.27	29.9	0.85	
8/24/2005	1.91	91.11	1.26	29.6	0.84	
8/24/2005	1.91	91.11	1.26	29.6	0.84	
8/24/2005	1.9	91.1	1.25	29.3	0.83	
8/24/2005	1.9	91.1	1.25	29.3	0.83	
8/24/2005	1.9	91.1	1.25	29.3	0.83	
8/24/2005	1.91	91.11	1.26	29.6	0.84	
8/24/2005	1.9	91.1	1.25	29.3	0.83	
8/24/2005	1.9	91.1	1.25	29.3	0.83	
8/24/2005	1.88	91.08	1.23	28.7	0.81	
8/24/2005	1.88	91.08	1.23	28.7	0.81	
8/24/2005	1.87	91.07	1.22	28.4	0.80	
8/24/2005	1.86	91.06	1.21	28.1	0.80	
8/24/2005	1.85	91.05	1.2	27.8	0.79	
8/24/2005	1.84	91.04	1.19	27.5	0.78	
8/24/2005	1.83	91.03	1.18	27.2	0.77	
8/24/2005	1.83	91.03	1.18	27.2	0.77	
8/24/2005	1.83	91.03	1.18	27.2	0.77	
8/24/2005	1.83	91.03	1.18	27.2	0.77	
8/24/2005 Average					0.82	8/24/2005 Average
8/25/2005	1.82	91.02	1.17	26.9	0.76	
8/25/2005	1.82	91.02	1.17	26.9	0.76	
8/25/2005	1.83	91.03	1.18	27.2	0.77	
8/25/2005	1.84	91.04	1.19	27.5	0.78	
8/25/2005	1.84	91.04	1.19	27.5	0.78	
8/25/2005	1.84	91.04	1.19	27.5	0.78	
8/25/2005	1.83	91.03	1.18	27.2	0.77	
8/25/2005	1.82	91.02	1.17	26.9	0.76	
8/25/2005	1.82	91.02	1.17	26.9	0.76	
8/25/2005	1.81	91.01	1.16	26.7	0.75	
8/25/2005	1.81	91.01	1.16	26.7	0.75	
8/25/2005	1.81	91.01	1.16	26.7	0.75	
8/25/2005	1.81	91.01	1.16	26.7	0.75	
8/25/2005	1.87	91.07	1.22	28.4	0.80	
8/25/2005	1.92	91.12	1.27	29.9	0.85	
8/25/2005	1.94	91.14	1.29	30.5	0.86	
8/25/2005	1.97	91.17	1.32	31.4	0.89	
8/25/2005	2.07	91.27	1.42	34.4	0.97	
8/25/2005	2.29	91.49	1.64	41.3	1.17	
8/25/2005	2.83	92.03	2.18	59.2	1.68	
8/25/2005	3.57	92.77	2.92	85.6	2.43	
8/25/2005	4.04	93.24	3.39	103.4	2.93	
8/25/2005	4.21	93.41	3.56	110.0	3.12	
8/25/2005	4.26	93.46	3.61	112.0	3.17	
8/25/2005 Average					1.20	8/25/2005 Average
8/26/2005	4.24	93.44	3.59	111.2	3.15	
8/26/2005	4.31	93.51	3.66	114.0	3.23	
8/26/2005	4.41	93.61	3.76	117.9	3.34	
8/26/2005	4.47	93.67	3.82	120.3	3.41	
8/26/2005	4.54	93.74	3.89	123.1	3.49	
8/26/2005	4.61	93.81	3.96	125.9	3.57	
8/26/2005	4.61	93.81	3.96	125.9	3.57	
8/26/2005	4.49	93.69	3.84	121.1	3.43	
8/26/2005	4.58	93.78	3.93	124.7	3.53	
8/26/2005	4.68	93.88	4.03	128.7	3.65	
8/26/2005	4.81	94.01	4.16	134.0	3.79	
8/26/2005	4.81	94.01	4.16	134.0	3.79	
8/26/2005	4.79	93.99	4.14	133.2	3.77	
8/26/2005	4.78	93.98	4.13	132.8	3.76	
8/26/2005	4.76	93.96	4.11	132.0	3.74	
8/26/2005	4.74	93.94	4.09	131.1	3.71	
8/26/2005	4.72	93.92	4.07	130.3	3.69	
8/26/2005	4.69	93.89	4.04	129.1	3.66	
8/26/2005	4.68	93.88	4.03	128.7	3.65	
8/26/2005	4.65	93.85	4	127.5	3.61	
8/26/2005	4.64	93.84	3.99	127.1	3.60	
8/26/2005	4.61	93.81	3.96	125.9	3.57	
8/26/2005	4.59	93.79	3.94	125.1	3.54	
8/26/2005	4.58	93.78	3.93	124.7	3.53	
8/26/2005 Average					3.57	8/26/2005 Average
8/27/2005	4.57	93.77	3.92	124.3	3.52	
8/27/2005	4.55	93.75	3.9	123.5	3.50	
8/27/2005	4.54	93.74	3.89	123.1	3.49	
8/27/2005	4.5	93.7	3.85	121.5	3.44	
8/27/2005	4.49	93.69	3.84	121.1	3.43	
8/27/2005	4.47	93.67	3.82	120.3	3.41	
8/27/2005	4.44	93.64	3.79	119.1	3.37	
8/27/2005	4.42	93.62	3.77	118.3	3.35	

8/27/2005	4.4	93.6	3.75	117.5	3.33	
8/27/2005	4.38	93.58	3.73	116.7	3.31	
8/27/2005	4.35	93.55	3.7	115.5	3.27	
8/27/2005	4.32	93.52	3.67	114.3	3.24	
8/27/2005	4.29	93.49	3.64	113.2	3.20	
8/27/2005	4.28	93.48	3.63	112.8	3.19	
8/27/2005	4.25	93.45	3.6	111.6	3.16	
8/27/2005	4.22	93.42	3.57	110.4	3.13	
8/27/2005	4.19	93.39	3.54	109.3	3.09	
8/27/2005	4.16	93.36	3.51	108.1	3.06	
8/27/2005	4.13	93.33	3.48	106.9	3.03	
8/27/2005	4.09	93.29	3.44	105.4	2.98	
8/27/2005	4.06	93.26	3.41	104.2	2.95	
8/27/2005	4.02	93.22	3.37	102.7	2.91	
8/27/2005	3.99	93.19	3.34	101.5	2.87	
8/27/2005	3.94	93.14	3.29	99.6	2.82	
8/27/2005 Average					3.21	8/27/2005 Average
8/28/2005	3.88	93.08	3.23	97.3	2.76	
8/28/2005	3.77	92.97	3.12	93.1	2.64	
8/28/2005	3.59	92.79	2.94	86.4	2.45	
8/28/2005	3.42	92.62	2.77	80.1	2.27	
8/28/2005	3.32	92.52	2.67	76.5	2.17	
8/28/2005	3.26	92.46	2.61	74.3	2.10	
8/28/2005	3.22	92.42	2.57	72.9	2.06	
8/28/2005	3.19	92.39	2.54	71.8	2.03	
8/28/2005	3.16	92.36	2.51	70.7	2.00	
8/28/2005	3.13	92.33	2.48	69.7	1.97	
8/28/2005	3.1	92.3	2.45	68.6	1.94	
8/28/2005	3.07	92.27	2.42	67.5	1.91	
8/28/2005	3.05	92.25	2.4	66.8	1.89	
8/28/2005	3.02	92.22	2.37	65.8	1.86	
8/28/2005	3	92.2	2.35	65.1	1.84	
8/28/2005	2.97	92.17	2.32	64.0	1.81	
8/28/2005	2.95	92.15	2.3	63.3	1.79	
8/28/2005	2.93	92.13	2.28	62.6	1.77	
8/28/2005	2.91	92.11	2.26	61.9	1.75	
8/28/2005	2.9	92.1	2.25	61.6	1.74	
8/28/2005	2.88	92.08	2.23	60.9	1.72	
8/28/2005	2.87	92.07	2.22	60.6	1.72	
8/28/2005	2.86	92.06	2.21	60.2	1.71	
8/28/2005	2.85	92.05	2.2	59.9	1.70	
8/28/2005 Average					1.98	8/28/2005 Average
8/29/2005	2.84	92.04	2.19	59.5	1.69	
8/29/2005	2.83	92.03	2.18	59.2	1.68	
8/29/2005	2.83	92.03	2.18	59.2	1.68	
8/29/2005	2.82	92.02	2.17	58.8	1.67	
8/29/2005	2.83	92.03	2.18	59.2	1.68	
8/29/2005	2.82	92.02	2.17	58.8	1.67	
8/29/2005	2.83	92.03	2.18	59.2	1.68	
8/29/2005	2.82	92.02	2.17	58.8	1.67	
8/29/2005	2.82	92.02	2.17	58.8	1.67	
8/29/2005	2.83	92.03	2.18	59.2	1.68	
8/29/2005	2.83	92.03	2.18	59.2	1.68	
8/29/2005	2.84	92.04	2.19	59.5	1.69	
8/29/2005	2.84	92.04	2.19	59.5	1.69	
8/29/2005	2.84	92.04	2.19	59.5	1.69	
8/29/2005	2.85	92.05	2.2	59.9	1.70	
8/29/2005	2.85	92.05	2.2	59.9	1.70	
8/29/2005	2.85	92.05	2.2	59.9	1.70	
8/29/2005	2.85	92.05	2.2	59.9	1.70	
8/29/2005	2.85	92.05	2.2	59.9	1.70	
8/29/2005	2.86	92.06	2.21	60.2	1.71	
8/29/2005	2.85	92.05	2.2	59.9	1.70	
8/29/2005	2.87	92.07	2.22	60.6	1.72	
8/29/2005	2.87	92.07	2.22	60.6	1.72	
8/29/2005	2.88	92.08	2.23	60.9	1.72	
8/29/2005 Average					1.69	8/29/2005 Average
8/30/2005	2.87	92.07	2.22	60.6	1.72	
8/30/2005	2.89	92.09	2.24	61.2	1.73	
8/30/2005	2.88	92.08	2.23	60.9	1.72	
8/30/2005	2.89	92.09	2.24	61.2	1.73	
8/30/2005	2.89	92.09	2.24	61.2	1.73	
8/30/2005	2.9	92.1	2.25	61.6	1.74	
8/30/2005	2.9	92.1	2.25	61.6	1.74	
8/30/2005	2.89	92.09	2.24	61.2	1.73	
8/30/2005	2.89	92.09	2.24	61.2	1.73	
8/30/2005	2.88	92.08	2.23	60.9	1.72	
8/30/2005	2.88	92.08	2.23	60.9	1.72	
8/30/2005	2.88	92.08	2.23	60.9	1.72	

8/30/2005	2.89	92.09	2.24	61.2	1.73	
8/30/2005	2.88	92.08	2.23	60.9	1.72	
8/30/2005	2.87	92.07	2.22	60.6	1.72	
8/30/2005	2.87	92.07	2.22	60.6	1.72	
8/30/2005	2.87	92.07	2.22	60.6	1.72	
8/30/2005	2.85	92.05	2.2	59.9	1.70	
8/30/2005	2.86	92.06	2.21	60.2	1.71	
8/30/2005	2.85	92.05	2.2	59.9	1.70	
8/30/2005	2.85	92.05	2.2	59.9	1.70	
8/30/2005	2.84	92.04	2.19	59.5	1.69	
8/30/2005	2.83	92.03	2.18	59.2	1.68	
8/30/2005	2.82	92.02	2.17	58.8	1.67	
8/30/2005 Average					1.72	8/30/2005 Average
8/31/2005	2.81	92.01	2.16	58.5	1.66	
8/31/2005	2.8	92	2.15	58.2	1.65	
8/31/2005	2.8	92	2.15	58.2	1.65	
8/31/2005	2.79	91.99	2.14	57.8	1.64	
8/31/2005	2.78	91.98	2.13	57.5	1.63	
8/31/2005	2.77	91.97	2.12	57.1	1.62	
8/31/2005	2.76	91.96	2.11	56.8	1.61	
8/31/2005	2.75	91.95	2.1	56.4	1.60	
8/31/2005	2.74	91.94	2.09	56.1	1.59	
8/31/2005	2.73	91.93	2.08	55.8	1.58	
8/31/2005	2.72	91.92	2.07	55.4	1.57	
8/31/2005	2.7	91.9	2.05	54.8	1.55	
8/31/2005	2.69	91.89	2.04	54.4	1.54	
8/31/2005	2.67	91.87	2.02	53.7	1.52	
8/31/2005	2.66	91.86	2.01	53.4	1.51	
8/31/2005	2.64	91.84	1.99	52.7	1.49	
8/31/2005	2.62	91.82	1.97	52.1	1.47	
8/31/2005	2.6	91.8	1.95	51.4	1.46	
8/31/2005	2.58	91.78	1.93	50.7	1.44	
8/31/2005	2.56	91.76	1.91	50.1	1.42	
8/31/2005	2.55	91.75	1.9	49.7	1.41	
8/31/2005	2.53	91.73	1.88	49.1	1.39	
8/31/2005	2.52	91.72	1.87	48.7	1.38	
8/31/2005	2.51	91.71	1.86	48.4	1.37	
8/31/2005 Average					1.53	8/31/2005 Average
9/1/2005	2.5	91.7	1.85	48.1	1.36	
9/1/2005	2.48	91.68	1.83	47.4	1.34	
9/1/2005	2.47	91.67	1.82	47.1	1.33	
9/1/2005	2.46	91.66	1.81	46.8	1.32	
9/1/2005	2.44	91.64	1.79	46.1	1.31	
9/1/2005	2.43	91.63	1.78	45.8	1.30	
9/1/2005	2.42	91.62	1.77	45.5	1.29	
9/1/2005	2.41	91.61	1.76	45.1	1.28	
9/1/2005	2.39	91.59	1.74	44.5	1.26	
9/1/2005	2.38	91.58	1.73	44.2	1.25	
9/1/2005	2.37	91.57	1.72	43.9	1.24	
9/1/2005	2.35	91.55	1.7	43.2	1.22	
9/1/2005	2.33	91.53	1.68	42.6	1.21	
9/1/2005	2.32	91.52	1.67	42.2	1.20	
9/1/2005	2.3	91.5	1.65	41.6	1.18	
9/1/2005	2.28	91.48	1.63	41.0	1.16	
9/1/2005	2.26	91.46	1.61	40.3	1.14	
9/1/2005	2.25	91.45	1.6	40.0	1.13	
9/1/2005	2.22	91.42	1.57	39.1	1.11	
9/1/2005	2.2	91.4	1.55	38.4	1.09	
9/1/2005	2.2	91.4	1.55	38.4	1.09	
9/1/2005	2.18	91.38	1.53	37.8	1.07	
9/1/2005	2.16	91.36	1.51	37.2	1.05	
9/1/2005	2.15	91.35	1.5	36.9	1.04	
9/1/2005 Average					1.21	9/1/2005 Average
9/2/2005	2.14	91.34	1.49	36.6	1.04	
9/2/2005	2.14	91.34	1.49	36.6	1.04	
9/2/2005	2.14	91.34	1.49	36.6	1.04	
9/2/2005	2.16	91.36	1.51	37.2	1.05	
9/2/2005	2.15	91.35	1.5	36.9	1.04	
9/2/2005	2.15	91.35	1.5	36.9	1.04	
9/2/2005	2.14	91.34	1.49	36.6	1.04	
9/2/2005	2.13	91.33	1.48	36.3	1.03	
9/2/2005	2.12	91.32	1.47	36.0	1.02	
9/2/2005	2.11	91.31	1.46	35.6	1.01	
9/2/2005	2.09	91.29	1.44	35.0	0.99	
9/2/2005	2.08	91.28	1.43	34.7	0.98	
9/2/2005	2.08	91.28	1.43	34.7	0.98	
9/2/2005	2.06	91.26	1.41	34.1	0.97	
9/2/2005	2.05	91.25	1.4	33.8	0.96	
9/2/2005	2.04	91.24	1.39	33.5	0.95	
9/2/2005	2.03	91.23	1.38	33.2	0.94	

9/2/2005	2.02	91.22	1.37	32.9	0.93	
9/2/2005	2.01	91.21	1.36	32.6	0.92	
9/2/2005	2	91.2	1.35	32.3	0.91	
9/2/2005	1.99	91.19	1.34	32.0	0.91	
9/2/2005	1.99	91.19	1.34	32.0	0.91	
9/2/2005	1.98	91.18	1.33	31.7	0.90	
9/2/2005	1.98	91.18	1.33	31.7	0.90	
9/2/2005 Average					0.98	9/2/2005 Average
9/3/2005	1.98	91.18	1.33	31.7	0.90	
9/3/2005	1.98	91.18	1.33	31.7	0.90	
9/3/2005	1.98	91.18	1.33	31.7	0.90	
9/3/2005	1.98	91.18	1.33	31.7	0.90	
9/3/2005	1.98	91.18	1.33	31.7	0.90	
9/3/2005	1.98	91.18	1.33	31.7	0.90	
9/3/2005	1.99	91.19	1.34	32.0	0.91	
9/3/2005	2	91.2	1.35	32.3	0.91	
9/3/2005	2	91.2	1.35	32.3	0.91	
9/3/2005	2	91.2	1.35	32.3	0.91	
9/3/2005	2.05	91.25	1.4	33.8	0.96	
9/3/2005	2.07	91.27	1.42	34.4	0.97	
9/3/2005	2.16	91.36	1.51	37.2	1.05	
9/3/2005	2.4	91.6	1.75	44.8	1.27	
9/3/2005	2.38	91.58	1.73	44.2	1.25	
9/3/2005	2.27	91.47	1.62	40.7	1.15	
9/3/2005	2.2	91.4	1.55	38.4	1.09	
9/3/2005	2.16	91.36	1.51	37.2	1.05	
9/3/2005	2.13	91.33	1.48	36.3	1.03	
9/3/2005	2.1	91.3	1.45	35.3	1.00	
9/3/2005	2.08	91.28	1.43	34.7	0.98	
9/3/2005	2.06	91.26	1.41	34.1	0.97	
9/3/2005	2.05	91.25	1.4	33.8	0.96	
9/3/2005	2.04	91.24	1.39	33.5	0.95	
9/3/2005 Average					0.99	9/3/2005 Average
9/4/2005	2.03	91.23	1.38	33.2	0.94	
9/4/2005	2.04	91.24	1.39	33.5	0.95	
9/4/2005	2.05	91.25	1.4	33.8	0.96	
9/4/2005	2.06	91.26	1.41	34.1	0.97	
9/4/2005	2.06	91.26	1.41	34.1	0.97	
9/4/2005	2.06	91.26	1.41	34.1	0.97	
9/4/2005	2.05	91.25	1.4	33.8	0.96	
9/4/2005	2.05	91.25	1.4	33.8	0.96	
9/4/2005	2.05	91.25	1.4	33.8	0.96	
9/4/2005	2.05	91.25	1.4	33.8	0.96	
9/4/2005	2.04	91.24	1.39	33.5	0.95	
9/4/2005	2.04	91.24	1.39	33.5	0.95	
9/4/2005	2.03	91.23	1.38	33.2	0.94	
9/4/2005	2.02	91.22	1.37	32.9	0.93	
9/4/2005	2.01	91.21	1.36	32.6	0.92	
9/4/2005	2	91.2	1.35	32.3	0.91	
9/4/2005	1.98	91.18	1.33	31.7	0.90	
9/4/2005	1.97	91.17	1.32	31.4	0.89	
9/4/2005	1.96	91.16	1.31	31.1	0.88	
9/4/2005	1.95	91.15	1.3	30.8	0.87	
9/4/2005	1.94	91.14	1.29	30.5	0.86	
9/4/2005	1.93	91.13	1.28	30.2	0.85	
9/4/2005	1.94	91.14	1.29	30.5	0.86	
9/4/2005	1.94	91.14	1.29	30.5	0.86	
9/4/2005 Average					0.92	9/4/2005 Average
9/5/2005	1.94	91.14	1.29	30.5	0.86	
9/5/2005	1.93	91.13	1.28	30.2	0.85	
9/5/2005	1.94	91.14	1.29	30.5	0.86	
9/5/2005	1.95	91.15	1.3	30.8	0.87	
9/5/2005	1.97	91.17	1.32	31.4	0.89	
9/5/2005	1.97	91.17	1.32	31.4	0.89	
9/5/2005	1.97	91.17	1.32	31.4	0.89	
9/5/2005	1.96	91.16	1.31	31.1	0.88	
9/5/2005	1.96	91.16	1.31	31.1	0.88	
9/5/2005	1.95	91.15	1.3	30.8	0.87	
9/5/2005	1.94	91.14	1.29	30.5	0.86	
9/5/2005	1.94	91.14	1.29	30.5	0.86	
9/5/2005	1.93	91.13	1.28	30.2	0.85	
9/5/2005	1.92	91.12	1.27	29.9	0.85	
9/5/2005	1.91	91.11	1.26	29.6	0.84	
9/5/2005	1.9	91.1	1.25	29.3	0.83	
9/5/2005	1.88	91.08	1.23	28.7	0.81	
9/5/2005	1.87	91.07	1.22	28.4	0.80	
9/5/2005	1.86	91.06	1.21	28.1	0.80	
9/5/2005	1.92	91.12	1.27	29.9	0.85	
9/5/2005	1.91	91.11	1.26	29.6	0.84	
9/5/2005	1.9	91.1	1.25	29.3	0.83	
9/5/2005	1.93	91.13	1.28	30.2	0.85	
9/5/2005	1.97	91.17	1.32	31.4	0.89	

9/5/2005 Average					0.85	9/5/2005 Average
9/6/2005	2.05	91.25	1.4	33.8	0.96	
9/6/2005	2.13	91.33	1.48	36.3	1.03	
9/6/2005	2.21	91.41	1.56	38.8	1.10	
9/6/2005	2.24	91.44	1.59	39.7	1.12	
9/6/2005	2.29	91.49	1.64	41.3	1.17	
9/6/2005	2.3	91.5	1.65	41.6	1.18	
9/6/2005	2.28	91.48	1.63	41.0	1.16	
9/6/2005	2.21	91.41	1.56	38.8	1.10	
9/6/2005	2.22	91.42	1.57	39.1	1.11	
9/6/2005	2.24	91.44	1.59	39.7	1.12	
9/6/2005	2.28	91.48	1.63	41.0	1.16	
9/6/2005	2.31	91.51	1.66	41.9	1.19	
9/6/2005	2.3	91.5	1.65	41.6	1.18	
9/6/2005	2.29	91.49	1.64	41.3	1.17	
9/6/2005	2.26	91.46	1.61	40.3	1.14	
9/6/2005	2.25	91.45	1.6	40.0	1.13	
9/6/2005	2.24	91.44	1.59	39.7	1.12	
9/6/2005	2.22	91.42	1.57	39.1	1.11	
9/6/2005	2.2	91.4	1.55	38.4	1.09	
9/6/2005	2.18	91.38	1.53	37.8	1.07	
9/6/2005	2.17	91.37	1.52	37.5	1.06	
9/6/2005	2.15	91.35	1.5	36.9	1.04	
9/6/2005	2.13	91.33	1.48	36.3	1.03	
9/6/2005	2.13	91.33	1.48	36.3	1.03	
9/6/2005 Average					1.11	9/6/2005 Average
9/7/2005	2.13	91.33	1.48	36.3	1.03	
9/7/2005	2.12	91.32	1.47	36.0	1.02	
9/7/2005	2.12	91.32	1.47	36.0	1.02	
9/7/2005	2.12	91.32	1.47	36.0	1.02	
9/7/2005	2.12	91.32	1.47	36.0	1.02	
9/7/2005	2.11	91.31	1.46	35.6	1.01	
9/7/2005	2.1	91.3	1.45	35.3	1.00	
9/7/2005	2.1	91.3	1.45	35.3	1.00	
9/7/2005	2.08	91.28	1.43	34.7	0.98	
9/7/2005	2.08	91.28	1.43	34.7	0.98	
9/7/2005	2.08	91.28	1.43	34.7	0.98	
9/7/2005	2.08	91.28	1.43	34.7	0.98	
9/7/2005	2.07	91.27	1.42	34.4	0.97	
9/7/2005	2.06	91.26	1.41	34.1	0.97	
9/7/2005	2.05	91.25	1.4	33.8	0.96	
9/7/2005	2.05	91.25	1.4	33.8	0.96	
9/7/2005	2.04	91.24	1.39	33.5	0.95	
9/7/2005	2.03	91.23	1.38	33.2	0.94	
9/7/2005	2.01	91.21	1.36	32.6	0.92	
9/7/2005	2	91.2	1.35	32.3	0.91	
9/7/2005	1.99	91.19	1.34	32.0	0.91	
9/7/2005	1.99	91.19	1.34	32.0	0.91	
9/7/2005	1.99	91.19	1.34	32.0	0.91	
9/7/2005	2	91.2	1.35	32.3	0.91	
9/7/2005 Average					0.97	9/7/2005 Average
9/8/2005	2	91.2	1.35	32.3	0.91	
9/8/2005	2.02	91.22	1.37	32.9	0.93	
9/8/2005	2.05	91.25	1.4	33.8	0.96	
9/8/2005	2.07	91.27	1.42	34.4	0.97	
9/8/2005	2.08	91.28	1.43	34.7	0.98	
9/8/2005	2.08	91.28	1.43	34.7	0.98	
9/8/2005	2.08	91.28	1.43	34.7	0.98	
9/8/2005	2.08	91.28	1.43	34.7	0.98	
9/8/2005	2.08	91.28	1.43	34.7	0.98	
9/8/2005	2.08	91.28	1.43	34.7	0.98	
9/8/2005	2.08	91.28	1.43	34.7	0.98	
9/8/2005	2.07	91.27	1.42	34.4	0.97	
9/8/2005	2.07	91.27	1.42	34.4	0.97	
9/8/2005	2.07	91.27	1.42	34.4	0.97	
9/8/2005	2.05	91.25	1.4	33.8	0.96	
9/8/2005	2.05	91.25	1.4	33.8	0.96	
9/8/2005	2.03	91.23	1.38	33.2	0.94	
9/8/2005	2.02	91.22	1.37	32.9	0.93	
9/8/2005	2.01	91.21	1.36	32.6	0.92	
9/8/2005	2	91.2	1.35	32.3	0.91	
9/8/2005	1.99	91.19	1.34	32.0	0.91	
9/8/2005	2.01	91.21	1.36	32.6	0.92	
9/8/2005	2.02	91.22	1.37	32.9	0.93	
9/8/2005	2.02	91.22	1.37	32.9	0.93	
9/8/2005 Average					0.95	9/8/2005 Average
9/9/2005	2.02	91.22	1.37	32.9	0.93	
9/9/2005	2.03	91.23	1.38	33.2	0.94	
9/9/2005	2.04	91.24	1.39	33.5	0.95	
9/9/2005	2.06	91.26	1.41	34.1	0.97	
9/9/2005	2.08	91.28	1.43	34.7	0.98	
9/9/2005	2.09	91.29	1.44	35.0	0.99	

9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.1	91.3	1.45	35.3	1.00	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.09	91.29	1.44	35.0	0.99	
9/9/2005	2.1	91.3	1.45	35.3	1.00	
9/9/2005	2.1	91.3	1.45	35.3	1.00	
9/9/2005	2.1	91.3	1.45	35.3	1.00	
9/9/2005	2.11	91.31	1.46	35.6	1.01	
9/9/2005	2.13	91.33	1.48	36.3	1.03	
9/9/2005	2.14	91.34	1.49	36.6	1.04	
9/9/2005 Average					0.99	9/9/2005 Average
9/10/2005	2.16	91.36	1.51	37.2	1.05	
9/10/2005	2.17	91.37	1.52	37.5	1.06	
9/10/2005	2.19	91.39	1.54	38.1	1.08	
9/10/2005	2.21	91.41	1.56	38.8	1.10	
9/10/2005	2.22	91.42	1.57	39.1	1.11	
9/10/2005	2.22	91.42	1.57	39.1	1.11	
9/10/2005	2.22	91.42	1.57	39.1	1.11	
9/10/2005	2.23	91.43	1.58	39.4	1.12	
9/10/2005	2.24	91.44	1.59	39.7	1.12	
9/10/2005	2.24	91.44	1.59	39.7	1.12	
9/10/2005	2.25	91.45	1.6	40.0	1.13	
9/10/2005	2.25	91.45	1.6	40.0	1.13	
9/10/2005	2.25	91.45	1.6	40.0	1.13	
9/10/2005	2.25	91.45	1.6	40.0	1.13	
9/10/2005	2.24	91.44	1.59	39.7	1.12	
9/10/2005	2.24	91.44	1.59	39.7	1.12	
9/10/2005	2.23	91.43	1.58	39.4	1.12	
9/10/2005	2.23	91.43	1.58	39.4	1.12	
9/10/2005	2.22	91.42	1.57	39.1	1.11	
9/10/2005	2.22	91.42	1.57	39.1	1.11	
9/10/2005	2.21	91.41	1.56	38.8	1.10	
9/10/2005	2.22	91.42	1.57	39.1	1.11	
9/10/2005	2.22	91.42	1.57	39.1	1.11	
9/10/2005	2.22	91.42	1.57	39.1	1.11	
9/10/2005 Average					1.11	9/10/2005 Average
9/11/2005	2.23	91.43	1.58	39.4	1.12	
9/11/2005	2.24	91.44	1.59	39.7	1.12	
9/11/2005	2.25	91.45	1.6	40.0	1.13	
9/11/2005	2.26	91.46	1.61	40.3	1.14	
9/11/2005	2.27	91.47	1.62	40.7	1.15	
9/11/2005	2.27	91.47	1.62	40.7	1.15	
9/11/2005	2.26	91.46	1.61	40.3	1.14	
9/11/2005	2.25	91.45	1.6	40.0	1.13	
9/11/2005	2.25	91.45	1.6	40.0	1.13	
9/11/2005	2.25	91.45	1.6	40.0	1.13	
9/11/2005	2.25	91.45	1.6	40.0	1.13	
9/11/2005	2.25	91.45	1.6	40.0	1.13	
9/11/2005	2.24	91.44	1.59	39.7	1.12	
9/11/2005	2.24	91.44	1.59	39.7	1.12	
9/11/2005	2.23	91.43	1.58	39.4	1.12	
9/11/2005	2.23	91.43	1.58	39.4	1.12	
9/11/2005	2.24	91.44	1.59	39.7	1.12	
9/11/2005	2.23	91.43	1.58	39.4	1.12	
9/11/2005	2.24	91.44	1.59	39.7	1.12	
9/11/2005	2.22	91.42	1.57	39.1	1.11	
9/11/2005	2.22	91.42	1.57	39.1	1.11	
9/11/2005	2.22	91.42	1.57	39.1	1.11	
9/11/2005	2.23	91.43	1.58	39.4	1.12	
9/11/2005	2.23	91.43	1.58	39.4	1.12	
9/11/2005 Average					1.13	9/11/2005 Average
9/12/2005	2.23	91.43	1.58	39.4	1.12	
9/12/2005	2.23	91.43	1.58	39.4	1.12	
9/12/2005	2.23	91.43	1.58	39.4	1.12	
9/12/2005	2.23	91.43	1.58	39.4	1.12	
9/12/2005	2.24	91.44	1.59	39.7	1.12	
9/12/2005	2.24	91.44	1.59	39.7	1.12	
9/12/2005	2.23	91.43	1.58	39.4	1.12	
9/12/2005	2.23	91.43	1.58	39.4	1.12	
9/12/2005	2.21	91.41	1.56	38.8	1.10	
9/12/2005	2.22	91.42	1.57	39.1	1.11	
9/12/2005	2.19	91.39	1.54	38.1	1.08	

9/12/2005	2.2	91.4	1.55	38.4	1.09	
9/12/2005	2.2	91.4	1.55	38.4	1.09	
9/12/2005	2.19	91.39	1.54	38.1	1.08	
9/12/2005	2.19	91.39	1.54	38.1	1.08	
9/12/2005	2.19	91.39	1.54	38.1	1.08	
9/12/2005	2.18	91.38	1.53	37.8	1.07	
9/12/2005	2.17	91.37	1.52	37.5	1.06	
9/12/2005	2.16	91.36	1.51	37.2	1.05	
9/12/2005	2.14	91.34	1.49	36.6	1.04	
9/12/2005	2.16	91.36	1.51	37.2	1.05	
9/12/2005	2.15	91.35	1.5	36.9	1.04	
9/12/2005	2.17	91.37	1.52	37.5	1.06	
9/12/2005	2.17	91.37	1.52	37.5	1.06	
9/12/2005 Average					1.09	9/12/2005 Average
9/13/2005	2.16	91.36	1.51	37.2	1.05	
9/13/2005	2.16	91.36	1.51	37.2	1.05	
9/13/2005	2.18	91.38	1.53	37.8	1.07	
9/13/2005	2.19	91.39	1.54	38.1	1.08	
9/13/2005	2.19	91.39	1.54	38.1	1.08	
9/13/2005	2.16	91.36	1.51	37.2	1.05	
9/13/2005	2.15	91.35	1.5	36.9	1.04	
9/13/2005	2.13	91.33	1.48	36.3	1.03	
9/13/2005	2.08	91.28	1.43	34.7	0.98	
9/13/2005	2.12	91.32	1.47	36.0	1.02	
9/13/2005	2.09	91.29	1.44	35.0	0.99	
9/13/2005	2.12	91.32	1.47	36.0	1.02	
9/13/2005	2.1	91.3	1.45	35.3	1.00	
9/13/2005	2.1	91.3	1.45	35.3	1.00	
9/13/2005	2.09	91.29	1.44	35.0	0.99	
9/13/2005	2.07	91.27	1.42	34.4	0.97	
9/13/2005	2.06	91.26	1.41	34.1	0.97	
9/13/2005	2.05	91.25	1.4	33.8	0.96	
9/13/2005	2.04	91.24	1.39	33.5	0.95	
9/13/2005	2.03	91.23	1.38	33.2	0.94	
9/13/2005	2.02	91.22	1.37	32.9	0.93	
9/13/2005	2.02	91.22	1.37	32.9	0.93	
9/13/2005	2.02	91.22	1.37	32.9	0.93	
9/13/2005	2.06	91.26	1.41	34.1	0.97	
9/13/2005 Average					1.00	9/13/2005 Average
9/14/2005	2.12	91.32	1.47	36.0	1.02	
9/14/2005	2.16	91.36	1.51	37.2	1.05	
9/14/2005	2.17	91.37	1.52	37.5	1.06	
9/14/2005	2.18	91.38	1.53	37.8	1.07	
9/14/2005	2.2	91.4	1.55	38.4	1.09	
9/14/2005	2.21	91.41	1.56	38.8	1.10	
9/14/2005	2.23	91.43	1.58	39.4	1.12	
9/14/2005	2.24	91.44	1.59	39.7	1.12	
9/14/2005	2.24	91.44	1.59	39.7	1.12	
9/14/2005	2.25	91.45	1.6	40.0	1.13	
9/14/2005	2.25	91.45	1.6	40.0	1.13	
9/14/2005	2.24	91.44	1.59	39.7	1.12	
9/14/2005	2.23	91.43	1.58	39.4	1.12	
9/14/2005	2.23	91.43	1.58	39.4	1.12	
9/14/2005	2.22	91.42	1.57	39.1	1.11	
9/14/2005	2.22	91.42	1.57	39.1	1.11	
9/14/2005	2.21	91.41	1.56	38.8	1.10	
9/14/2005	2.21	91.41	1.56	38.8	1.10	
9/14/2005	2.2	91.4	1.55	38.4	1.09	
9/14/2005	2.19	91.39	1.54	38.1	1.08	
9/14/2005	2.19	91.39	1.54	38.1	1.08	
9/14/2005	2.2	91.4	1.55	38.4	1.09	
9/14/2005	2.22	91.42	1.57	39.1	1.11	
9/14/2005	2.24	91.44	1.59	39.7	1.12	
9/14/2005 Average					1.10	9/14/2005 Average
9/15/2005	2.26	91.46	1.61	40.3	1.14	
9/15/2005	2.28	91.48	1.63	41.0	1.16	
9/15/2005	2.29	91.49	1.64	41.3	1.17	
9/15/2005	2.29	91.49	1.64	41.3	1.17	
9/15/2005	2.31	91.51	1.66	41.9	1.19	
9/15/2005	2.31	91.51	1.66	41.9	1.19	
9/15/2005	2.32	91.52	1.67	42.2	1.20	
9/15/2005	2.32	91.52	1.67	42.2	1.20	
9/15/2005	2.32	91.52	1.67	42.2	1.20	
9/15/2005	2.31	91.51	1.66	41.9	1.19	
9/15/2005	2.31	91.51	1.66	41.9	1.19	
9/15/2005	2.31	91.51	1.66	41.9	1.19	
9/15/2005	2.31	91.51	1.66	41.9	1.19	
9/15/2005	2.31	91.51	1.66	41.9	1.19	
9/15/2005	2.31	91.51	1.66	41.9	1.19	

9/15/2005	2.31	91.51	1.66	41.9	1.19	
9/15/2005	2.3	91.5	1.65	41.6	1.18	
9/15/2005	2.3	91.5	1.65	41.6	1.18	
9/15/2005	2.29	91.49	1.64	41.3	1.17	
9/15/2005	2.29	91.49	1.64	41.3	1.17	
9/15/2005	2.29	91.49	1.64	41.3	1.17	
9/15/2005	2.29	91.49	1.64	41.3	1.17	
9/15/2005	2.29	91.49	1.64	41.3	1.17	
9/15/2005	2.29	91.49	1.64	41.3	1.17	
9/15/2005 Average					1.18	9/15/2005 Average
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.29	91.49	1.64	41.3	1.17	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.28	91.48	1.63	41.0	1.16	
9/16/2005	2.29	91.49	1.64	41.3	1.17	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.3	91.5	1.65	41.6	1.18	
9/16/2005	2.31	91.51	1.66	41.9	1.19	
9/16/2005 Average					1.17	9/16/2005 Average
9/17/2005	2.31	91.51	1.66	41.9	1.19	
9/17/2005	2.32	91.52	1.67	42.2	1.20	
9/17/2005	2.33	91.53	1.68	42.6	1.21	
9/17/2005	2.33	91.53	1.68	42.6	1.21	
9/17/2005	2.34	91.54	1.69	42.9	1.21	
9/17/2005	2.33	91.53	1.68	42.6	1.21	
9/17/2005	2.33	91.53	1.68	42.6	1.21	
9/17/2005	2.32	91.52	1.67	42.2	1.20	
9/17/2005	2.31	91.51	1.66	41.9	1.19	
9/17/2005	2.3	91.5	1.65	41.6	1.18	
9/17/2005	2.3	91.5	1.65	41.6	1.18	
9/17/2005	2.3	91.5	1.65	41.6	1.18	
9/17/2005	2.3	91.5	1.65	41.6	1.18	
9/17/2005	2.31	91.51	1.66	41.9	1.19	
9/17/2005	2.32	91.52	1.67	42.2	1.20	
9/17/2005	2.32	91.52	1.67	42.2	1.20	
9/17/2005	2.33	91.53	1.68	42.6	1.21	
9/17/2005	2.34	91.54	1.69	42.9	1.21	
9/17/2005	2.35	91.55	1.7	43.2	1.22	
9/17/2005	2.36	91.56	1.71	43.5	1.23	
9/17/2005	2.37	91.57	1.72	43.9	1.24	
9/17/2005	2.38	91.58	1.73	44.2	1.25	
9/17/2005	2.38	91.58	1.73	44.2	1.25	
9/17/2005	2.39	91.59	1.74	44.5	1.26	
9/17/2005 Average					1.21	9/17/2005 Average
9/18/2005	2.4	91.6	1.75	44.8	1.27	
9/18/2005	2.41	91.61	1.76	45.1	1.28	
9/18/2005	2.41	91.61	1.76	45.1	1.28	
9/18/2005	2.41	91.61	1.76	45.1	1.28	
9/18/2005	2.41	91.61	1.76	45.1	1.28	
9/18/2005	2.42	91.62	1.77	45.5	1.29	
9/18/2005	2.42	91.62	1.77	45.5	1.29	
9/18/2005	2.42	91.62	1.77	45.5	1.29	
9/18/2005	2.42	91.62	1.77	45.5	1.29	
9/18/2005	2.43	91.63	1.78	45.8	1.30	
9/18/2005	2.44	91.64	1.79	46.1	1.31	
9/18/2005	2.45	91.65	1.8	46.5	1.32	
9/18/2005	2.45	91.65	1.8	46.5	1.32	
9/18/2005	2.46	91.66	1.81	46.8	1.32	
9/18/2005	2.46	91.66	1.81	46.8	1.32	
9/18/2005	2.47	91.67	1.82	47.1	1.33	
9/18/2005	2.47	91.67	1.82	47.1	1.33	
9/18/2005	2.47	91.67	1.82	47.1	1.33	
9/18/2005	2.47	91.67	1.82	47.1	1.33	

9/18/2005	2.48	91.68	1.83	47.4	1.34	
9/18/2005	2.48	91.68	1.83	47.4	1.34	
9/18/2005	2.48	91.68	1.83	47.4	1.34	
9/18/2005	2.48	91.68	1.83	47.4	1.34	
9/18/2005	2.49	91.69	1.84	47.8	1.35	
9/18/2005 Average					1.31	9/18/2005 Average
9/19/2005	2.48	91.68	1.83	47.4	1.34	
9/19/2005	2.48	91.68	1.83	47.4	1.34	
9/19/2005	2.48	91.68	1.83	47.4	1.34	
9/19/2005	2.49	91.69	1.84	47.8	1.35	
9/19/2005	2.5	91.7	1.85	48.1	1.36	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.5	91.7	1.85	48.1	1.36	
9/19/2005	2.48	91.68	1.83	47.4	1.34	
9/19/2005	2.46	91.66	1.81	46.8	1.32	
9/19/2005	2.5	91.7	1.85	48.1	1.36	
9/19/2005	2.5	91.7	1.85	48.1	1.36	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.51	91.71	1.86	48.4	1.37	
9/19/2005	2.5	91.7	1.85	48.1	1.36	
9/19/2005	2.5	91.7	1.85	48.1	1.36	
9/19/2005	2.5	91.7	1.85	48.1	1.36	
9/19/2005 Average					1.36	9/19/2005 Average
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.5	91.7	1.85	48.1	1.36	
9/20/2005	2.49	91.69	1.84	47.8	1.35	
9/20/2005	2.49	91.69	1.84	47.8	1.35	
9/20/2005	2.49	91.69	1.84	47.8	1.35	
9/20/2005	2.49	91.69	1.84	47.8	1.35	
9/20/2005	2.49	91.69	1.84	47.8	1.35	
9/20/2005 Average					1.36	9/20/2005 Average
9/21/2005	2.49	91.69	1.84	47.8	1.35	
9/21/2005	2.49	91.69	1.84	47.8	1.35	
9/21/2005	2.49	91.69	1.84	47.8	1.35	
9/21/2005	2.5	91.7	1.85	48.1	1.36	
9/21/2005	2.5	91.7	1.85	48.1	1.36	
9/21/2005	2.5	91.7	1.85	48.1	1.36	
9/21/2005	2.5	91.7	1.85	48.1	1.36	
9/21/2005	2.49	91.69	1.84	47.8	1.35	
9/21/2005	2.49	91.69	1.84	47.8	1.35	
9/21/2005	2.49	91.69	1.84	47.8	1.35	
9/21/2005	2.49	91.69	1.84	47.8	1.35	
9/21/2005	2.48	91.68	1.83	47.4	1.34	
9/21/2005	2.48	91.68	1.83	47.4	1.34	
9/21/2005	2.47	91.67	1.82	47.1	1.33	
9/21/2005	2.47	91.67	1.82	47.1	1.33	
9/21/2005	2.47	91.67	1.82	47.1	1.33	
9/21/2005	2.47	91.67	1.82	47.1	1.33	
9/21/2005	2.48	91.68	1.83	47.4	1.34	
9/21/2005	2.48	91.68	1.83	47.4	1.34	
9/21/2005	2.48	91.68	1.83	47.4	1.34	
9/21/2005	2.49	91.69	1.84	47.8	1.35	
9/21/2005	2.5	91.7	1.85	48.1	1.36	
9/21/2005	2.51	91.71	1.86	48.4	1.37	

9/21/2005	2.52	91.72	1.87	48.7	1.38	
9/21/2005 Average					1.35	9/21/2005 Average
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.53	91.73	1.88	49.1	1.39	
9/22/2005	2.53	91.73	1.88	49.1	1.39	
9/22/2005	2.53	91.73	1.88	49.1	1.39	
9/22/2005	2.53	91.73	1.88	49.1	1.39	
9/22/2005	2.53	91.73	1.88	49.1	1.39	
9/22/2005	2.53	91.73	1.88	49.1	1.39	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.52	91.72	1.87	48.7	1.38	
9/22/2005	2.53	91.73	1.88	49.1	1.39	
9/22/2005	2.53	91.73	1.88	49.1	1.39	
9/22/2005	2.53	91.73	1.88	49.1	1.39	
9/22/2005	2.54	91.74	1.89	49.4	1.40	
9/22/2005	2.54	91.74	1.89	49.4	1.40	
9/22/2005	2.55	91.75	1.9	49.7	1.41	
9/22/2005	2.56	91.76	1.91	50.1	1.42	
9/22/2005 Average					1.39	9/22/2005 Average
9/23/2005	2.56	91.76	1.91	50.1	1.42	
9/23/2005	2.57	91.77	1.92	50.4	1.43	
9/23/2005	2.58	91.78	1.93	50.7	1.44	
9/23/2005	2.58	91.78	1.93	50.7	1.44	
9/23/2005	2.59	91.79	1.94	51.1	1.45	
9/23/2005	2.6	91.8	1.95	51.4	1.46	
9/23/2005	2.61	91.81	1.96	51.7	1.47	
9/23/2005	2.6	91.8	1.95	51.4	1.46	
9/23/2005	2.6	91.8	1.95	51.4	1.46	
9/23/2005	2.6	91.8	1.95	51.4	1.46	
9/23/2005	2.6	91.8	1.95	51.4	1.46	
9/23/2005	2.6	91.8	1.95	51.4	1.46	
9/23/2005	2.6	91.8	1.95	51.4	1.46	
9/23/2005	2.6	91.8	1.95	51.4	1.46	
9/23/2005	2.61	91.81	1.96	51.7	1.47	
9/23/2005	2.61	91.81	1.96	51.7	1.47	
9/23/2005	2.61	91.81	1.96	51.7	1.47	
9/23/2005	2.62	91.82	1.97	52.1	1.47	
9/23/2005	2.62	91.82	1.97	52.1	1.47	
9/23/2005	2.62	91.82	1.97	52.1	1.47	
9/23/2005	2.62	91.82	1.97	52.1	1.47	
9/23/2005	2.62	91.82	1.97	52.1	1.47	
9/23/2005	2.62	91.82	1.97	52.1	1.47	
9/23/2005	2.62	91.82	1.97	52.1	1.47	
9/23/2005 Average					1.46	9/23/2005 Average
9/24/2005	2.62	91.82	1.97	52.1	1.47	
9/24/2005	2.63	91.83	1.98	52.4	1.48	
9/24/2005	2.63	91.83	1.98	52.4	1.48	
9/24/2005	2.64	91.84	1.99	52.7	1.49	
9/24/2005	2.67	91.87	2.02	53.7	1.52	
9/24/2005	2.67	91.87	2.02	53.7	1.52	
9/24/2005	2.69	91.89	2.04	54.4	1.54	
9/24/2005	2.68	91.88	2.03	54.1	1.53	
9/24/2005	2.67	91.87	2.02	53.7	1.52	
9/24/2005	2.68	91.88	2.03	54.1	1.53	
9/24/2005	2.7	91.9	2.05	54.8	1.55	
9/24/2005	2.69	91.89	2.04	54.4	1.54	
9/24/2005	2.7	91.9	2.05	54.8	1.55	
9/24/2005	2.7	91.9	2.05	54.8	1.55	
9/24/2005	2.71	91.91	2.06	55.1	1.56	
9/24/2005	2.71	91.91	2.06	55.1	1.56	
9/24/2005	2.71	91.91	2.06	55.1	1.56	
9/24/2005	2.7	91.9	2.05	54.8	1.55	
9/24/2005	2.71	91.91	2.06	55.1	1.56	
9/24/2005	2.7	91.9	2.05	54.8	1.55	
9/24/2005	2.7	91.9	2.05	54.8	1.55	
9/24/2005	2.7	91.9	2.05	54.8	1.55	
9/24/2005	2.72	91.92	2.07	55.4	1.57	
9/24/2005	2.7	91.9	2.05	54.8	1.55	
9/24/2005 Average					1.54	9/24/2005 Average
9/25/2005	2.7	91.9	2.05	54.8	1.55	
9/25/2005	2.69	91.89	2.04	54.4	1.54	

9/25/2005	2.69	91.89	2.04	54.4	1.54	
9/25/2005	2.7	91.9	2.05	54.8	1.55	
9/25/2005	2.71	91.91	2.06	55.1	1.56	
9/25/2005	2.71	91.91	2.06	55.1	1.56	
9/25/2005	2.7	91.9	2.05	54.8	1.55	
9/25/2005	2.69	91.89	2.04	54.4	1.54	
9/25/2005	2.69	91.89	2.04	54.4	1.54	
9/25/2005	2.69	91.89	2.04	54.4	1.54	
9/25/2005	2.69	91.89	2.04	54.4	1.54	
9/25/2005	2.7	91.9	2.05	54.8	1.55	
9/25/2005	2.7	91.9	2.05	54.8	1.55	
9/25/2005	2.71	91.91	2.06	55.1	1.56	
9/25/2005	2.72	91.92	2.07	55.4	1.57	
9/25/2005	2.71	91.91	2.06	55.1	1.56	
9/25/2005	2.7	91.9	2.05	54.8	1.55	
9/25/2005	2.73	91.93	2.08	55.8	1.58	
9/25/2005	2.72	91.92	2.07	55.4	1.57	
9/25/2005	2.74	91.94	2.09	56.1	1.59	
9/25/2005	2.72	91.92	2.07	55.4	1.57	
9/25/2005	2.72	91.92	2.07	55.4	1.57	
9/25/2005	2.71	91.91	2.06	55.1	1.56	
9/25/2005	2.71	91.91	2.06	55.1	1.56	
9/25/2005 Average					1.56	9/25/2005 Average
9/26/2005	2.69	91.89	2.04	54.4	1.54	
9/26/2005	2.68	91.88	2.03	54.1	1.53	
9/26/2005	2.67	91.87	2.02	53.7	1.52	
9/26/2005	2.67	91.87	2.02	53.7	1.52	
9/26/2005	2.66	91.86	2.01	53.4	1.51	
9/26/2005	2.65	91.85	2	53.1	1.50	
9/26/2005	2.63	91.83	1.98	52.4	1.48	
9/26/2005	2.6	91.8	1.95	51.4	1.46	
9/26/2005	2.57	91.77	1.92	50.4	1.43	
9/26/2005	2.57	91.77	1.92	50.4	1.43	
9/26/2005	2.61	91.81	1.96	51.7	1.47	
9/26/2005	2.64	91.84	1.99	52.7	1.49	
9/26/2005	2.63	91.83	1.98	52.4	1.48	
9/26/2005	2.63	91.83	1.98	52.4	1.48	
9/26/2005	2.63	91.83	1.98	52.4	1.48	
9/26/2005	2.63	91.83	1.98	52.4	1.48	
9/26/2005	2.59	91.79	1.94	51.1	1.45	
9/26/2005	2.54	91.74	1.89	49.4	1.40	
9/26/2005	2.5	91.7	1.85	48.1	1.36	
9/26/2005	2.44	91.64	1.79	46.1	1.31	
9/26/2005	2.39	91.59	1.74	44.5	1.26	
9/26/2005	2.35	91.55	1.7	43.2	1.22	
9/26/2005	2.3	91.5	1.65	41.6	1.18	
9/26/2005	2.29	91.49	1.64	41.3	1.17	
9/26/2005 Average					1.42	9/26/2005 Average
9/27/2005	2.27	91.47	1.62	40.7	1.15	
9/27/2005	2.26	91.46	1.61	40.3	1.14	
9/27/2005	2.28	91.48	1.63	41.0	1.16	
9/27/2005	2.31	91.51	1.66	41.9	1.19	
9/27/2005	2.33	91.53	1.68	42.6	1.21	
9/27/2005	2.37	91.57	1.72	43.9	1.24	
9/27/2005	2.38	91.58	1.73	44.2	1.25	
9/27/2005	2.36	91.56	1.71	43.5	1.23	
9/27/2005	2.39	91.59	1.74	44.5	1.26	
9/27/2005	2.35	91.55	1.7	43.2	1.22	
9/27/2005	2.41	91.61	1.76	45.1	1.28	
9/27/2005	2.44	91.64	1.79	46.1	1.31	
9/27/2005	2.42	91.62	1.77	45.5	1.29	
9/27/2005	2.43	91.63	1.78	45.8	1.30	
9/27/2005	2.43	91.63	1.78	45.8	1.30	
9/27/2005	2.43	91.63	1.78	45.8	1.30	
9/27/2005	2.43	91.63	1.78	45.8	1.30	
9/27/2005	2.42	91.62	1.77	45.5	1.29	
9/27/2005	2.42	91.62	1.77	45.5	1.29	
9/27/2005	2.42	91.62	1.77	45.5	1.29	
9/27/2005	2.43	91.63	1.78	45.8	1.30	
9/27/2005	2.45	91.65	1.8	46.5	1.32	
9/27/2005	2.47	91.67	1.82	47.1	1.33	
9/27/2005	2.49	91.69	1.84	47.8	1.35	
9/27/2005 Average					1.26	9/27/2005 Average
9/28/2005	2.5	91.7	1.85	48.1	1.36	
9/28/2005	2.5	91.7	1.85	48.1	1.36	
9/28/2005	2.51	91.71	1.86	48.4	1.37	
9/28/2005	2.51	91.71	1.86	48.4	1.37	
9/28/2005	2.51	91.71	1.86	48.4	1.37	
9/28/2005	2.5	91.7	1.85	48.1	1.36	

9/28/2005	2.5	91.7	1.85	48.1	1.36	
9/28/2005	2.5	91.7	1.85	48.1	1.36	
9/28/2005	2.49	91.69	1.84	47.8	1.35	
9/28/2005	2.49	91.69	1.84	47.8	1.35	
9/28/2005	2.48	91.68	1.83	47.4	1.34	
9/28/2005	2.48	91.68	1.83	47.4	1.34	
9/28/2005	2.48	91.68	1.83	47.4	1.34	
9/28/2005	2.47	91.67	1.82	47.1	1.33	
9/28/2005	2.47	91.67	1.82	47.1	1.33	
9/28/2005	2.47	91.67	1.82	47.1	1.33	
9/28/2005	2.47	91.67	1.82	47.1	1.33	
9/28/2005	2.47	91.67	1.82	47.1	1.33	
9/28/2005	2.47	91.67	1.82	47.1	1.33	
9/28/2005	2.47	91.67	1.82	47.1	1.33	
9/28/2005	2.47	91.67	1.82	47.1	1.33	
9/28/2005	2.49	91.69	1.84	47.8	1.35	
9/28/2005	2.5	91.7	1.85	48.1	1.36	
9/28/2005	2.5	91.7	1.85	48.1	1.36	
9/28/2005 Average					1.35	9/28/2005 Average
9/29/2005	2.5	91.7	1.85	48.1	1.36	
9/29/2005	2.51	91.71	1.86	48.4	1.37	
9/29/2005	2.52	91.72	1.87	48.7	1.38	
9/29/2005	2.54	91.74	1.89	49.4	1.40	
9/29/2005	2.55	91.75	1.9	49.7	1.41	
9/29/2005	2.56	91.76	1.91	50.1	1.42	
9/29/2005	2.57	91.77	1.92	50.4	1.43	
9/29/2005	2.57	91.77	1.92	50.4	1.43	
9/29/2005	2.57	91.77	1.92	50.4	1.43	
9/29/2005	2.58	91.78	1.93	50.7	1.44	
9/29/2005	2.58	91.78	1.93	50.7	1.44	
9/29/2005	2.58	91.78	1.93	50.7	1.44	
9/29/2005	2.58	91.78	1.93	50.7	1.44	
9/29/2005	2.59	91.79	1.94	51.1	1.45	
9/29/2005	2.58	91.78	1.93	50.7	1.44	
9/29/2005	2.59	91.79	1.94	51.1	1.45	
9/29/2005	2.59	91.79	1.94	51.1	1.45	
9/29/2005	2.57	91.77	1.92	50.4	1.43	
9/29/2005	2.51	91.71	1.86	48.4	1.37	
9/29/2005	2.46	91.66	1.81	46.8	1.32	
9/29/2005	2.42	91.62	1.77	45.5	1.29	
9/29/2005	2.38	91.58	1.73	44.2	1.25	
9/29/2005	2.39	91.59	1.74	44.5	1.26	
9/29/2005	2.44	91.64	1.79	46.1	1.31	
9/29/2005 Average					1.39	9/29/2005 Average
9/30/2005	2.48	91.68	1.83	47.4	1.34	
9/30/2005	2.5	91.7	1.85	48.1	1.36	
9/30/2005	2.53	91.73	1.88	49.1	1.39	
9/30/2005	2.54	91.74	1.89	49.4	1.40	
9/30/2005	2.56	91.76	1.91	50.1	1.42	
9/30/2005	2.57	91.77	1.92	50.4	1.43	
9/30/2005	2.58	91.78	1.93	50.7	1.44	
9/30/2005	2.58	91.78	1.93	50.7	1.44	
9/30/2005	2.58	91.78	1.93	50.7	1.44	
9/30/2005	2.59	91.79	1.94	51.1	1.45	
9/30/2005	2.59	91.79	1.94	51.1	1.45	
9/30/2005	2.59	91.79	1.94	51.1	1.45	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.6	91.8	1.95	51.4	1.46	
9/30/2005	2.61	91.81	1.96	51.7	1.47	
9/30/2005	2.61	91.81	1.96	51.7	1.47	
9/30/2005 Average					1.44	9/30/2005 Average
10/1/2005	2.61	91.81	1.96	51.7	1.47	
10/1/2005	2.61	91.81	1.96	51.7	1.47	
10/1/2005	2.61	91.81	1.96	51.7	1.47	
10/1/2005	2.61	91.81	1.96	51.7	1.47	
10/1/2005	2.61	91.81	1.96	51.7	1.47	
10/1/2005	2.61	91.81	1.96	51.7	1.47	
10/1/2005	2.61	91.81	1.96	51.7	1.47	
10/1/2005	2.61	91.81	1.96	51.7	1.47	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	

10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005	2.6	91.8	1.95	51.4	1.46	
10/1/2005 Average					1.46	10/1/2005 Average
10/2/2005	2.6	91.8	1.95	51.4	1.46	
10/2/2005	2.6	91.8	1.95	51.4	1.46	
10/2/2005	2.6	91.8	1.95	51.4	1.46	
10/2/2005	2.59	91.79	1.94	51.1	1.45	
10/2/2005	2.58	91.78	1.93	50.7	1.44	
10/2/2005	2.56	91.76	1.91	50.1	1.42	
10/2/2005	2.56	91.76	1.91	50.1	1.42	
10/2/2005	2.55	91.75	1.9	49.7	1.41	
10/2/2005	2.55	91.75	1.9	49.7	1.41	
10/2/2005	2.54	91.74	1.89	49.4	1.40	
10/2/2005	2.53	91.73	1.88	49.1	1.39	
10/2/2005	2.53	91.73	1.88	49.1	1.39	
10/2/2005	2.53	91.73	1.88	49.1	1.39	
10/2/2005	2.54	91.74	1.89	49.4	1.40	
10/2/2005	2.53	91.73	1.88	49.1	1.39	
10/2/2005	2.52	91.72	1.87	48.7	1.38	
10/2/2005	2.52	91.72	1.87	48.7	1.38	
10/2/2005	2.52	91.72	1.87	48.7	1.38	
10/2/2005	2.52	91.72	1.87	48.7	1.38	
10/2/2005	2.5	91.7	1.85	48.1	1.36	
10/2/2005	2.43	91.63	1.78	45.8	1.30	
10/2/2005	2.38	91.58	1.73	44.2	1.25	
10/2/2005	2.35	91.55	1.7	43.2	1.22	
10/2/2005	2.34	91.54	1.69	42.9	1.21	
10/2/2005 Average					1.38	10/2/2005 Average
10/3/2005	2.33	91.53	1.68	42.6	1.21	
10/3/2005	2.33	91.53	1.68	42.6	1.21	
10/3/2005	2.35	91.55	1.7	43.2	1.22	
10/3/2005	2.37	91.57	1.72	43.9	1.24	
10/3/2005	2.39	91.59	1.74	44.5	1.26	
10/3/2005	2.41	91.61	1.76	45.1	1.28	
10/3/2005	2.43	91.63	1.78	45.8	1.30	
10/3/2005	2.44	91.64	1.79	46.1	1.31	
10/3/2005	2.45	91.65	1.8	46.5	1.32	
10/3/2005	2.46	91.66	1.81	46.8	1.32	
10/3/2005	2.47	91.67	1.82	47.1	1.33	
10/3/2005	2.47	91.67	1.82	47.1	1.33	
10/3/2005	2.47	91.67	1.82	47.1	1.33	
10/3/2005	2.47	91.67	1.82	47.1	1.33	
10/3/2005	2.46	91.66	1.81	46.8	1.32	
10/3/2005	2.47	91.67	1.82	47.1	1.33	
10/3/2005	2.77	91.97	2.12	57.1	1.62	
10/3/2005	2.64	91.84	1.99	52.7	1.49	
10/3/2005	2.48	91.68	1.83	47.4	1.34	
10/3/2005	2.39	91.59	1.74	44.5	1.26	
10/3/2005	2.33	91.53	1.68	42.6	1.21	
10/3/2005	2.3	91.5	1.65	41.6	1.18	
10/3/2005	2.28	91.48	1.63	41.0	1.16	
10/3/2005	2.28	91.48	1.63	41.0	1.16	
10/3/2005 Average					1.29	10/3/2005 Average
10/4/2005	2.29	91.49	1.64	41.3	1.17	
10/4/2005	2.3	91.5	1.65	41.6	1.18	
10/4/2005	2.3	91.5	1.65	41.6	1.18	
10/4/2005	2.31	91.51	1.66	41.9	1.19	
10/4/2005	2.31	91.51	1.66	41.9	1.19	
10/4/2005	2.3	91.5	1.65	41.6	1.18	
10/4/2005	2.3	91.5	1.65	41.6	1.18	
10/4/2005	2.3	91.5	1.65	41.6	1.18	
10/4/2005	2.27	91.47	1.62	40.7	1.15	
10/4/2005	2.32	91.52	1.67	42.2	1.20	
10/4/2005	2.35	91.55	1.7	43.2	1.22	
10/4/2005	2.33	91.53	1.68	42.6	1.21	
10/4/2005	2.31	91.51	1.66	41.9	1.19	
10/4/2005	2.27	91.47	1.62	40.7	1.15	

10/4/2005	2.29	91.49	1.64	41.3	1.17	
10/4/2005	2.29	91.49	1.64	41.3	1.17	
10/4/2005	2.24	91.44	1.59	39.7	1.12	
10/4/2005	2.21	91.41	1.56	38.8	1.10	
10/4/2005	2.37	91.57	1.72	43.9	1.24	
10/4/2005	2.41	91.61	1.76	45.1	1.28	
10/4/2005	2.39	91.59	1.74	44.5	1.26	
10/4/2005	2.39	91.59	1.74	44.5	1.26	
10/4/2005	2.37	91.57	1.72	43.9	1.24	
10/4/2005	2.39	91.59	1.74	44.5	1.26	
10/4/2005 Average					1.19	10/4/2005 Average
10/5/2005	2.41	91.61	1.76	45.1	1.28	
10/5/2005	2.46	91.66	1.81	46.8	1.32	
10/5/2005	2.56	91.76	1.91	50.1	1.42	
10/5/2005	2.63	91.83	1.98	52.4	1.48	
10/5/2005	2.83	92.03	2.18	59.2	1.68	
10/5/2005	2.96	92.16	2.31	63.7	1.80	
10/5/2005	3.03	92.23	2.38	66.1	1.87	
10/5/2005	3.1	92.3	2.45	68.6	1.94	
10/5/2005	3.23	92.43	2.58	73.2	2.07	
10/5/2005	3.36	92.56	2.71	77.9	2.21	
10/5/2005	3.48	92.68	2.83	82.3	2.33	
10/5/2005	3.53	92.73	2.88	84.2	2.38	
10/5/2005	3.56	92.76	2.91	85.3	2.41	
10/5/2005	3.55	92.75	2.9	84.9	2.40	
10/5/2005	3.57	92.77	2.92	85.6	2.43	
10/5/2005	3.59	92.79	2.94	86.4	2.45	
10/5/2005	3.59	92.79	2.94	86.4	2.45	
10/5/2005	3.59	92.79	2.94	86.4	2.45	
10/5/2005	3.58	92.78	2.93	86.0	2.44	
10/5/2005	3.54	92.74	2.89	84.5	2.39	
10/5/2005	3.48	92.68	2.83	82.3	2.33	
10/5/2005	3.4	92.6	2.75	79.4	2.25	
10/5/2005	3.34	92.54	2.69	77.2	2.19	
10/5/2005	3.3	92.5	2.65	75.8	2.15	
10/5/2005 Average					2.09	10/5/2005 Average
10/6/2005	3.26	92.46	2.61	74.3	2.10	
10/6/2005	3.22	92.42	2.57	72.9	2.06	
10/6/2005	3.19	92.39	2.54	71.8	2.03	
10/6/2005	3.17	92.37	2.52	71.1	2.01	
10/6/2005	3.15	92.35	2.5	70.4	1.99	
10/6/2005	3.13	92.33	2.48	69.7	1.97	
10/6/2005	3.12	92.32	2.47	69.3	1.96	
10/6/2005	3.11	92.31	2.46	69.0	1.95	
10/6/2005	3.09	92.29	2.44	68.2	1.93	
10/6/2005	3.09	92.29	2.44	68.2	1.93	
10/6/2005	3.08	92.28	2.43	67.9	1.92	
10/6/2005	3.09	92.29	2.44	68.2	1.93	
10/6/2005	3.09	92.29	2.44	68.2	1.93	
10/6/2005	3.11	92.31	2.46	69.0	1.95	
10/6/2005	3.1	92.3	2.45	68.6	1.94	
10/6/2005	3.1	92.3	2.45	68.6	1.94	
10/6/2005	3.1	92.3	2.45	68.6	1.94	
10/6/2005	3.11	92.31	2.46	69.0	1.95	
10/6/2005	3.11	92.31	2.46	69.0	1.95	
10/6/2005	3.11	92.31	2.46	69.0	1.95	
10/6/2005	3.11	92.31	2.46	69.0	1.95	
10/6/2005	3.11	92.31	2.46	69.0	1.95	
10/6/2005	3.1	92.3	2.45	68.6	1.94	
10/6/2005	3.1	92.3	2.45	68.6	1.94	
10/6/2005 Average					1.97	10/6/2005 Average
10/7/2005	3.09	92.29	2.44	68.2	1.93	
10/7/2005	3.09	92.29	2.44	68.2	1.93	
10/7/2005	3.08	92.28	2.43	67.9	1.92	
10/7/2005	3.08	92.28	2.43	67.9	1.92	
10/7/2005	3.07	92.27	2.42	67.5	1.91	
10/7/2005	3.06	92.26	2.41	67.2	1.90	
10/7/2005	3.05	92.25	2.4	66.8	1.89	
10/7/2005	3.04	92.24	2.39	66.5	1.88	
10/7/2005	3.03	92.23	2.38	66.1	1.87	
10/7/2005	3.03	92.23	2.38	66.1	1.87	
10/7/2005	3.02	92.22	2.37	65.8	1.86	
10/7/2005	3.01	92.21	2.36	65.4	1.85	
10/7/2005	3	92.2	2.35	65.1	1.84	
10/7/2005	2.99	92.19	2.34	64.7	1.83	
10/7/2005	2.98	92.18	2.33	64.4	1.82	
10/7/2005	2.97	92.17	2.32	64.0	1.81	
10/7/2005	2.96	92.16	2.31	63.7	1.80	
10/7/2005	2.95	92.15	2.3	63.3	1.79	

10/7/2005	2.94	92.14	2.29	63.0	1.78	
10/7/2005	2.93	92.13	2.28	62.6	1.77	
10/7/2005	2.92	92.12	2.27	62.3	1.76	
10/7/2005	2.91	92.11	2.26	61.9	1.75	
10/7/2005	2.9	92.1	2.25	61.6	1.74	
10/7/2005	2.89	92.09	2.24	61.2	1.73	
10/7/2005 Average					1.84	10/7/2005 Average
10/8/2005	2.88	92.08	2.23	60.9	1.72	
10/8/2005	2.87	92.07	2.22	60.6	1.72	
10/8/2005	2.86	92.06	2.21	60.2	1.71	
10/8/2005	2.85	92.05	2.2	59.9	1.70	
10/8/2005	2.85	92.05	2.2	59.9	1.70	
10/8/2005	2.84	92.04	2.19	59.5	1.69	
10/8/2005	2.84	92.04	2.19	59.5	1.69	
10/8/2005	2.82	92.02	2.17	58.8	1.67	
10/8/2005	2.83	92.03	2.18	59.2	1.68	
10/8/2005	2.82	92.02	2.17	58.8	1.67	
10/8/2005	2.81	92.01	2.16	58.5	1.66	
10/8/2005	2.8	92	2.15	58.2	1.65	
10/8/2005	2.8	92	2.15	58.2	1.65	
10/8/2005	2.8	92	2.15	58.2	1.65	
10/8/2005	2.8	92	2.15	58.2	1.65	
10/8/2005	2.8	92	2.15	58.2	1.65	
10/8/2005	2.79	91.99	2.14	57.8	1.64	
10/8/2005	2.79	91.99	2.14	57.8	1.64	
10/8/2005	2.79	91.99	2.14	57.8	1.64	
10/8/2005	2.79	91.99	2.14	57.8	1.64	
10/8/2005	2.79	91.99	2.14	57.8	1.64	
10/8/2005	2.79	91.99	2.14	57.8	1.64	
10/8/2005	2.79	91.99	2.14	57.8	1.64	
10/8/2005	2.79	91.99	2.14	57.8	1.64	
10/8/2005 Average					1.66	10/8/2005 Average
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.79	91.99	2.14	57.8	1.64	
10/9/2005	2.79	91.99	2.14	57.8	1.64	
10/9/2005	2.79	91.99	2.14	57.8	1.64	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.8	92	2.15	58.2	1.65	
10/9/2005	2.79	91.99	2.14	57.8	1.64	
10/9/2005	2.79	91.99	2.14	57.8	1.64	
10/9/2005	2.79	91.99	2.14	57.8	1.64	
10/9/2005 Average					1.64	10/9/2005 Average
10/10/2005	2.79	91.99	2.14	57.8	1.64	
10/10/2005	2.79	91.99	2.14	57.8	1.64	
10/10/2005	2.79	91.99	2.14	57.8	1.64	
10/10/2005	2.79	91.99	2.14	57.8	1.64	
10/10/2005	2.77	91.97	2.12	57.1	1.62	
10/10/2005	2.75	91.95	2.1	56.4	1.60	
10/10/2005	2.74	91.94	2.09	56.1	1.59	
10/10/2005	2.74	91.94	2.09	56.1	1.59	
10/10/2005	2.73	91.93	2.08	55.8	1.58	
10/10/2005	2.73	91.93	2.08	55.8	1.58	
10/10/2005	2.72	91.92	2.07	55.4	1.57	
10/10/2005	2.73	91.93	2.08	55.8	1.58	
10/10/2005	2.72	91.92	2.07	55.4	1.57	
10/10/2005	2.72	91.92	2.07	55.4	1.57	
10/10/2005	2.72	91.92	2.07	55.4	1.57	
10/10/2005	2.72	91.92	2.07	55.4	1.57	
10/10/2005	2.71	91.91	2.06	55.1	1.56	
10/10/2005	2.71	91.91	2.06	55.1	1.56	
10/10/2005	2.71	91.91	2.06	55.1	1.56	
10/10/2005	2.7	91.9	2.05	54.8	1.55	
10/10/2005	2.7	91.9	2.05	54.8	1.55	
10/10/2005	2.69	91.89	2.04	54.4	1.54	

10/10/2005	2.69	91.89	2.04	54.4	1.54	
10/10/2005	2.69	91.89	2.04	54.4	1.54	
10/10/2005 Average					1.58	10/10/2005 Average
10/11/2005	2.68	91.88	2.03	54.1	1.53	
10/11/2005	2.68	91.88	2.03	54.1	1.53	
10/11/2005	2.67	91.87	2.02	53.7	1.52	
10/11/2005	2.67	91.87	2.02	53.7	1.52	
10/11/2005	2.67	91.87	2.02	53.7	1.52	
10/11/2005	2.67	91.87	2.02	53.7	1.52	
10/11/2005	2.67	91.87	2.02	53.7	1.52	
10/11/2005	2.66	91.86	2.01	53.4	1.51	
10/11/2005	2.65	91.85	2	53.1	1.50	
10/11/2005	2.65	91.85	2	53.1	1.50	
10/11/2005	2.65	91.85	2	53.1	1.50	
10/11/2005	2.64	91.84	1.99	52.7	1.49	
10/11/2005	2.64	91.84	1.99	52.7	1.49	
10/11/2005	2.63	91.83	1.98	52.4	1.48	
10/11/2005	2.63	91.83	1.98	52.4	1.48	
10/11/2005	2.63	91.83	1.98	52.4	1.48	
10/11/2005	2.62	91.82	1.97	52.1	1.47	
10/11/2005	2.62	91.82	1.97	52.1	1.47	
10/11/2005	2.62	91.82	1.97	52.1	1.47	
10/11/2005	2.61	91.81	1.96	51.7	1.47	
10/11/2005	2.61	91.81	1.96	51.7	1.47	
10/11/2005	2.6	91.8	1.95	51.4	1.46	
10/11/2005	2.6	91.8	1.95	51.4	1.46	
10/11/2005	2.59	91.79	1.94	51.1	1.45	
10/11/2005 Average					1.49	10/11/2005 Average
10/12/2005	2.59	91.79	1.94	51.1	1.45	
10/12/2005	2.58	91.78	1.93	50.7	1.44	
10/12/2005	2.58	91.78	1.93	50.7	1.44	
10/12/2005	2.57	91.77	1.92	50.4	1.43	
10/12/2005	2.57	91.77	1.92	50.4	1.43	
10/12/2005	2.57	91.77	1.92	50.4	1.43	
10/12/2005	2.56	91.76	1.91	50.1	1.42	
10/12/2005	2.56	91.76	1.91	50.1	1.42	
10/12/2005	2.55	91.75	1.9	49.7	1.41	
10/12/2005	2.55	91.75	1.9	49.7	1.41	
10/12/2005	2.55	91.75	1.9	49.7	1.41	
10/12/2005	2.54	91.74	1.89	49.4	1.40	
10/12/2005	2.54	91.74	1.89	49.4	1.40	
10/12/2005	2.54	91.74	1.89	49.4	1.40	
10/12/2005	2.54	91.74	1.89	49.4	1.40	
10/12/2005	2.55	91.75	1.9	49.7	1.41	
10/12/2005	2.55	91.75	1.9	49.7	1.41	
10/12/2005	2.55	91.75	1.9	49.7	1.41	
10/12/2005	2.56	91.76	1.91	50.1	1.42	
10/12/2005	2.57	91.77	1.92	50.4	1.43	
10/12/2005	2.59	91.79	1.94	51.1	1.45	
10/12/2005	2.6	91.8	1.95	51.4	1.46	
10/12/2005	2.6	91.8	1.95	51.4	1.46	
10/12/2005	2.61	91.81	1.96	51.7	1.47	
10/12/2005 Average					1.42	10/12/2005 Average
10/13/2005	2.61	91.81	1.96	51.7	1.47	
10/13/2005	2.61	91.81	1.96	51.7	1.47	
10/13/2005	2.61	91.81	1.96	51.7	1.47	
10/13/2005	2.61	91.81	1.96	51.7	1.47	
10/13/2005	2.61	91.81	1.96	51.7	1.47	
10/13/2005	2.61	91.81	1.96	51.7	1.47	
10/13/2005	2.61	91.81	1.96	51.7	1.47	
10/13/2005	2.6	91.8	1.95	51.4	1.46	
10/13/2005	2.6	91.8	1.95	51.4	1.46	
10/13/2005	2.6	91.8	1.95	51.4	1.46	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005	2.58	91.78	1.93	50.7	1.44	
10/13/2005	2.59	91.79	1.94	51.1	1.45	
10/13/2005 Average					1.45	10/13/2005 Average
10/14/2005	2.59	91.79	1.94	51.1	1.45	

10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.59	91.79	1.94	51.1	1.45	
10/14/2005	2.54	91.74	1.89	49.4	1.40	
10/14/2005	2.52	91.72	1.87	48.7	1.38	
10/14/2005	2.51	91.71	1.86	48.4	1.37	
10/14/2005	2.5	91.7	1.85	48.1	1.36	
10/14/2005	2.5	91.7	1.85	48.1	1.36	
10/14/2005	2.49	91.69	1.84	47.8	1.35	
10/14/2005	2.49	91.69	1.84	47.8	1.35	
10/14/2005	2.48	91.68	1.83	47.4	1.34	
10/14/2005	2.48	91.68	1.83	47.4	1.34	
10/14/2005	2.48	91.68	1.83	47.4	1.34	
10/14/2005	2.47	91.67	1.82	47.1	1.33	
10/14/2005	2.46	91.66	1.81	46.8	1.32	
10/14/2005	2.46	91.66	1.81	46.8	1.32	
10/14/2005 Average					1.40	10/14/2005 Average
10/15/2005	2.46	91.66	1.81	46.8	1.32	
10/15/2005	2.46	91.66	1.81	46.8	1.32	
10/15/2005	2.46	91.66	1.81	46.8	1.32	
10/15/2005	2.45	91.65	1.8	46.5	1.32	
10/15/2005	2.45	91.65	1.8	46.5	1.32	
10/15/2005	2.45	91.65	1.8	46.5	1.32	
10/15/2005	2.44	91.64	1.79	46.1	1.31	
10/15/2005	2.44	91.64	1.79	46.1	1.31	
10/15/2005	2.43	91.63	1.78	45.8	1.30	
10/15/2005	2.43	91.63	1.78	45.8	1.30	
10/15/2005	2.42	91.62	1.77	45.5	1.29	
10/15/2005	2.42	91.62	1.77	45.5	1.29	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.42	91.62	1.77	45.5	1.29	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005	2.41	91.61	1.76	45.1	1.28	
10/15/2005 Average					1.29	10/15/2005 Average
10/16/2005	2.41	91.61	1.76	45.1	1.28	
10/16/2005	2.41	91.61	1.76	45.1	1.28	
10/16/2005	2.41	91.61	1.76	45.1	1.28	
10/16/2005	2.4	91.6	1.75	44.8	1.27	
10/16/2005	2.4	91.6	1.75	44.8	1.27	
10/16/2005	2.4	91.6	1.75	44.8	1.27	
10/16/2005	2.4	91.6	1.75	44.8	1.27	
10/16/2005	2.4	91.6	1.75	44.8	1.27	
10/16/2005	2.39	91.59	1.74	44.5	1.26	
10/16/2005	2.39	91.59	1.74	44.5	1.26	
10/16/2005	2.38	91.58	1.73	44.2	1.25	
10/16/2005	2.38	91.58	1.73	44.2	1.25	
10/16/2005	2.37	91.57	1.72	43.9	1.24	
10/16/2005	2.37	91.57	1.72	43.9	1.24	
10/16/2005	2.37	91.57	1.72	43.9	1.24	
10/16/2005	2.36	91.56	1.71	43.5	1.23	
10/16/2005	2.36	91.56	1.71	43.5	1.23	
10/16/2005	2.36	91.56	1.71	43.5	1.23	
10/16/2005	2.36	91.56	1.71	43.5	1.23	
10/16/2005	2.35	91.55	1.7	43.2	1.22	
10/16/2005	2.36	91.56	1.71	43.5	1.23	
10/16/2005	2.37	91.57	1.72	43.9	1.24	
10/16/2005	2.39	91.59	1.74	44.5	1.26	
10/16/2005	2.41	91.61	1.76	45.1	1.28	
10/16/2005 Average					1.25	10/16/2005 Average
10/17/2005	2.42	91.62	1.77	45.5	1.29	
10/17/2005	2.43	91.63	1.78	45.8	1.30	
10/17/2005	2.44	91.64	1.79	46.1	1.31	
10/17/2005	2.45	91.65	1.8	46.5	1.32	
10/17/2005	2.45	91.65	1.8	46.5	1.32	

10/17/2005	2.44	91.64	1.79	46.1	1.31	
10/17/2005	2.43	91.63	1.78	45.8	1.30	
10/17/2005	2.43	91.63	1.78	45.8	1.30	
10/17/2005	2.42	91.62	1.77	45.5	1.29	
10/17/2005	2.42	91.62	1.77	45.5	1.29	
10/17/2005	2.41	91.61	1.76	45.1	1.28	
10/17/2005	2.4	91.6	1.75	44.8	1.27	
10/17/2005	2.4	91.6	1.75	44.8	1.27	
10/17/2005	2.39	91.59	1.74	44.5	1.26	
10/17/2005	2.39	91.59	1.74	44.5	1.26	
10/17/2005	2.38	91.58	1.73	44.2	1.25	
10/17/2005	2.37	91.57	1.72	43.9	1.24	
10/17/2005	2.37	91.57	1.72	43.9	1.24	
10/17/2005	2.36	91.56	1.71	43.5	1.23	
10/17/2005	2.35	91.55	1.7	43.2	1.22	
10/17/2005	2.35	91.55	1.7	43.2	1.22	
10/17/2005	2.34	91.54	1.69	42.9	1.21	
10/17/2005	2.34	91.54	1.69	42.9	1.21	
10/17/2005	2.33	91.53	1.68	42.6	1.21	
10/17/2005 Average					1.27	10/17/2005 Average
10/18/2005	2.33	91.53	1.68	42.6	1.21	
10/18/2005	2.34	91.54	1.69	42.9	1.21	
10/18/2005	2.34	91.54	1.69	42.9	1.21	
10/18/2005	2.35	91.55	1.7	43.2	1.22	
10/18/2005	2.37	91.57	1.72	43.9	1.24	
10/18/2005	2.38	91.58	1.73	44.2	1.25	
10/18/2005	2.39	91.59	1.74	44.5	1.26	
10/18/2005	2.38	91.58	1.73	44.2	1.25	
10/18/2005	2.39	91.59	1.74	44.5	1.26	
10/18/2005	2.39	91.59	1.74	44.5	1.26	
10/18/2005	2.38	91.58	1.73	44.2	1.25	
10/18/2005	2.38	91.58	1.73	44.2	1.25	
10/18/2005	2.38	91.58	1.73	44.2	1.25	
10/18/2005	2.37	91.57	1.72	43.9	1.24	
10/18/2005	2.37	91.57	1.72	43.9	1.24	
10/18/2005	2.37	91.57	1.72	43.9	1.24	
10/18/2005	2.36	91.56	1.71	43.5	1.23	
10/18/2005	2.36	91.56	1.71	43.5	1.23	
10/18/2005	2.35	91.55	1.7	43.2	1.22	
10/18/2005	2.34	91.54	1.69	42.9	1.21	
10/18/2005	2.34	91.54	1.69	42.9	1.21	
10/18/2005	2.33	91.53	1.68	42.6	1.21	
10/18/2005	2.33	91.53	1.68	42.6	1.21	
10/18/2005	2.34	91.54	1.69	42.9	1.21	
10/18/2005 Average					1.23	10/18/2005 Average
10/19/2005	2.35	91.55	1.7	43.2	1.22	
10/19/2005	2.36	91.56	1.71	43.5	1.23	
10/19/2005	2.36	91.56	1.71	43.5	1.23	
10/19/2005	2.36	91.56	1.71	43.5	1.23	
10/19/2005	2.36	91.56	1.71	43.5	1.23	
10/19/2005	2.38	91.58	1.73	44.2	1.25	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005	2.41	91.61	1.76	45.1	1.28	
10/19/2005	2.41	91.61	1.76	45.1	1.28	
10/19/2005	2.41	91.61	1.76	45.1	1.28	
10/19/2005	2.41	91.61	1.76	45.1	1.28	
10/19/2005	2.41	91.61	1.76	45.1	1.28	
10/19/2005	2.41	91.61	1.76	45.1	1.28	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005	2.39	91.59	1.74	44.5	1.26	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005	2.39	91.59	1.74	44.5	1.26	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005	2.4	91.6	1.75	44.8	1.27	
10/19/2005 Average					1.26	10/19/2005 Average
10/20/2005	2.41	91.61	1.76	45.1	1.28	
10/20/2005	2.42	91.62	1.77	45.5	1.29	
10/20/2005	2.42	91.62	1.77	45.5	1.29	
10/20/2005	2.42	91.62	1.77	45.5	1.29	
10/20/2005	2.42	91.62	1.77	45.5	1.29	
10/20/2005	2.41	91.61	1.76	45.1	1.28	
10/20/2005	2.4	91.6	1.75	44.8	1.27	
10/20/2005	2.4	91.6	1.75	44.8	1.27	
10/20/2005	2.39	91.59	1.74	44.5	1.26	

10/20/2005	2.39	91.59	1.74	44.5	1.26	
10/20/2005	2.38	91.58	1.73	44.2	1.25	
10/20/2005	2.38	91.58	1.73	44.2	1.25	
10/20/2005	2.38	91.58	1.73	44.2	1.25	
10/20/2005	2.38	91.58	1.73	44.2	1.25	
10/20/2005	2.38	91.58	1.73	44.2	1.25	
10/20/2005	2.37	91.57	1.72	43.9	1.24	
10/20/2005	2.37	91.57	1.72	43.9	1.24	
10/20/2005	2.37	91.57	1.72	43.9	1.24	
10/20/2005	2.37	91.57	1.72	43.9	1.24	
10/20/2005	2.37	91.57	1.72	43.9	1.24	
10/20/2005	2.37	91.57	1.72	43.9	1.24	
10/20/2005	2.37	91.57	1.72	43.9	1.24	
10/20/2005	2.37	91.57	1.72	43.9	1.24	
10/20/2005	2.37	91.57	1.72	43.9	1.24	
10/20/2005 Average					1.26	10/20/2005 Average
10/21/2005	2.38	91.58	1.73	44.2	1.25	
10/21/2005	2.38	91.58	1.73	44.2	1.25	
10/21/2005	2.38	91.58	1.73	44.2	1.25	
10/21/2005	2.38	91.58	1.73	44.2	1.25	
10/21/2005	2.38	91.58	1.73	44.2	1.25	
10/21/2005	2.37	91.57	1.72	43.9	1.24	
10/21/2005	2.37	91.57	1.72	43.9	1.24	
10/21/2005	2.37	91.57	1.72	43.9	1.24	
10/21/2005	2.36	91.56	1.71	43.5	1.23	
10/21/2005	2.36	91.56	1.71	43.5	1.23	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.34	91.54	1.69	42.9	1.21	
10/21/2005	2.34	91.54	1.69	42.9	1.21	
10/21/2005	2.34	91.54	1.69	42.9	1.21	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005	2.35	91.55	1.7	43.2	1.22	
10/21/2005 Average					1.23	10/21/2005 Average
10/22/2005	2.35	91.55	1.7	43.2	1.22	
10/22/2005	2.36	91.56	1.71	43.5	1.23	
10/22/2005	2.36	91.56	1.71	43.5	1.23	
10/22/2005	2.37	91.57	1.72	43.9	1.24	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.38	91.58	1.73	44.2	1.25	
10/22/2005	2.39	91.59	1.74	44.5	1.26	
10/22/2005	2.39	91.59	1.74	44.5	1.26	
10/22/2005	2.4	91.6	1.75	44.8	1.27	
10/22/2005	2.4	91.6	1.75	44.8	1.27	
10/22/2005	2.41	91.61	1.76	45.1	1.28	
10/22/2005	2.41	91.61	1.76	45.1	1.28	
10/22/2005	2.41	91.61	1.76	45.1	1.28	
10/22/2005	2.41	91.61	1.76	45.1	1.28	
10/22/2005	2.41	91.61	1.76	45.1	1.28	
10/22/2005	2.41	91.61	1.76	45.1	1.28	
10/22/2005 Average					1.26	10/22/2005 Average
10/23/2005	2.41	91.61	1.76	45.1	1.28	
10/23/2005	2.41	91.61	1.76	45.1	1.28	
10/23/2005	2.42	91.62	1.77	45.5	1.29	
10/23/2005	2.43	91.63	1.78	45.8	1.30	
10/23/2005	2.43	91.63	1.78	45.8	1.30	
10/23/2005	2.43	91.63	1.78	45.8	1.30	
10/23/2005	2.44	91.64	1.79	46.1	1.31	
10/23/2005	2.45	91.65	1.8	46.5	1.32	
10/23/2005	2.45	91.65	1.8	46.5	1.32	
10/23/2005	2.45	91.65	1.8	46.5	1.32	
10/23/2005	2.45	91.65	1.8	46.5	1.32	
10/23/2005	2.45	91.65	1.8	46.5	1.32	
10/23/2005	2.46	91.66	1.81	46.8	1.32	

10/23/2005	2.46	91.66	1.81	46.8	1.32	
10/23/2005	2.46	91.66	1.81	46.8	1.32	
10/23/2005	2.47	91.67	1.82	47.1	1.33	
10/23/2005	2.47	91.67	1.82	47.1	1.33	
10/23/2005	2.48	91.68	1.83	47.4	1.34	
10/23/2005	2.49	91.69	1.84	47.8	1.35	
10/23/2005	2.51	91.71	1.86	48.4	1.37	
10/23/2005	2.53	91.73	1.88	49.1	1.39	
10/23/2005	2.54	91.74	1.89	49.4	1.40	
10/23/2005	2.54	91.74	1.89	49.4	1.40	
10/23/2005	2.55	91.75	1.9	49.7	1.41	
10/23/2005 Average					1.33	10/23/2005 Average
10/24/2005	2.56	91.76	1.91	50.1	1.42	
10/24/2005	2.57	91.77	1.92	50.4	1.43	
10/24/2005	2.57	91.77	1.92	50.4	1.43	
10/24/2005	2.59	91.79	1.94	51.1	1.45	
10/24/2005	2.59	91.79	1.94	51.1	1.45	
10/24/2005	2.6	91.8	1.95	51.4	1.46	
10/24/2005	2.61	91.81	1.96	51.7	1.47	
10/24/2005	2.61	91.81	1.96	51.7	1.47	
10/24/2005	2.6	91.8	1.95	51.4	1.46	
10/24/2005	2.59	91.79	1.94	51.1	1.45	
10/24/2005	2.59	91.79	1.94	51.1	1.45	
10/24/2005	2.58	91.78	1.93	50.7	1.44	
10/24/2005	2.58	91.78	1.93	50.7	1.44	
10/24/2005	2.57	91.77	1.92	50.4	1.43	
10/24/2005	2.57	91.77	1.92	50.4	1.43	
10/24/2005	2.57	91.77	1.92	50.4	1.43	
10/24/2005	2.56	91.76	1.91	50.1	1.42	
10/24/2005	2.56	91.76	1.91	50.1	1.42	
10/24/2005	2.56	91.76	1.91	50.1	1.42	
10/24/2005	2.56	91.76	1.91	50.1	1.42	
10/24/2005	2.56	91.76	1.91	50.1	1.42	
10/24/2005	2.57	91.77	1.92	50.4	1.43	
10/24/2005	2.57	91.77	1.92	50.4	1.43	
10/24/2005	2.58	91.78	1.93	50.7	1.44	
10/24/2005 Average					1.43	10/24/2005 Average
10/25/2005	2.58	91.78	1.93	50.7	1.44	
10/25/2005	2.59	91.79	1.94	51.1	1.45	
10/25/2005	2.59	91.79	1.94	51.1	1.45	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.61	91.81	1.96	51.7	1.47	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.61	91.81	1.96	51.7	1.47	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.59	91.79	1.94	51.1	1.45	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.59	91.79	1.94	51.1	1.45	
10/25/2005	2.59	91.79	1.94	51.1	1.45	
10/25/2005	2.59	91.79	1.94	51.1	1.45	
10/25/2005	2.59	91.79	1.94	51.1	1.45	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.59	91.79	1.94	51.1	1.45	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005	2.6	91.8	1.95	51.4	1.46	
10/25/2005 Average					1.45	10/25/2005 Average
10/26/2005	2.6	91.8	1.95	51.4	1.46	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.62	91.82	1.97	52.1	1.47	
10/26/2005	2.62	91.82	1.97	52.1	1.47	
10/26/2005	2.63	91.83	1.98	52.4	1.48	
10/26/2005	2.63	91.83	1.98	52.4	1.48	
10/26/2005	2.62	91.82	1.97	52.1	1.47	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.6	91.8	1.95	51.4	1.46	
10/26/2005	2.6	91.8	1.95	51.4	1.46	
10/26/2005	2.6	91.8	1.95	51.4	1.46	
10/26/2005	2.6	91.8	1.95	51.4	1.46	
10/26/2005	2.6	91.8	1.95	51.4	1.46	

10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.6	91.8	1.95	51.4	1.46	
10/26/2005	2.6	91.8	1.95	51.4	1.46	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005	2.61	91.81	1.96	51.7	1.47	
10/26/2005 Average					1.46	10/26/2005 Average
10/27/2005	2.61	91.81	1.96	51.7	1.47	
10/27/2005	2.61	91.81	1.96	51.7	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.63	91.83	1.98	52.4	1.48	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.62	91.82	1.97	52.1	1.47	
10/27/2005	2.63	91.83	1.98	52.4	1.48	
10/27/2005	2.63	91.83	1.98	52.4	1.48	
10/27/2005	2.63	91.83	1.98	52.4	1.48	
10/27/2005	2.63	91.83	1.98	52.4	1.48	
10/27/2005	2.63	91.83	1.98	52.4	1.48	
10/27/2005 Average					1.48	10/27/2005 Average
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.62	91.82	1.97	52.1	1.47	
10/28/2005	2.62	91.82	1.97	52.1	1.47	
10/28/2005	2.62	91.82	1.97	52.1	1.47	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.62	91.82	1.97	52.1	1.47	
10/28/2005	2.62	91.82	1.97	52.1	1.47	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005	2.63	91.83	1.98	52.4	1.48	
10/28/2005 Average					1.48	10/28/2005 Average
10/29/2005	2.62	91.82	1.97	52.1	1.47	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.62	91.82	1.97	52.1	1.47	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.62	91.82	1.97	52.1	1.47	
10/29/2005	2.62	91.82	1.97	52.1	1.47	
10/29/2005	2.62	91.82	1.97	52.1	1.47	
10/29/2005	2.62	91.82	1.97	52.1	1.47	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.62	91.82	1.97	52.1	1.47	
10/29/2005	2.62	91.82	1.97	52.1	1.47	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.63	91.83	1.98	52.4	1.48	
10/29/2005	2.64	91.84	1.99	52.7	1.49	
10/29/2005	2.64	91.84	1.99	52.7	1.49	

10/29/2005	2.64	91.84	1.99	52.7	1.49	
10/29/2005	2.64	91.84	1.99	52.7	1.49	
10/29/2005	2.64	91.84	1.99	52.7	1.49	
10/29/2005 Average					1.48	10/29/2005 Average
10/30/2005	2.64	91.84	1.99	52.7	1.49	
10/30/2005	2.64	91.84	1.99	52.7	1.49	
10/30/2005	2.65	91.85	2	53.1	1.50	
10/30/2005	2.64	91.84	1.99	52.7	1.49	
10/30/2005	2.65	91.85	2	53.1	1.50	
10/30/2005	2.65	91.85	2	53.1	1.50	
10/30/2005	2.64	91.84	1.99	52.7	1.49	
10/30/2005	2.63	91.83	1.98	52.4	1.48	
10/30/2005	2.63	91.83	1.98	52.4	1.48	
10/30/2005	2.63	91.83	1.98	52.4	1.48	
10/30/2005	2.62	91.82	1.97	52.1	1.47	
10/30/2005	2.62	91.82	1.97	52.1	1.47	
10/30/2005	2.62	91.82	1.97	52.1	1.47	
10/30/2005	2.62	91.82	1.97	52.1	1.47	
10/30/2005	2.62	91.82	1.97	52.1	1.47	
10/30/2005	2.62	91.82	1.97	52.1	1.47	
10/30/2005	2.63	91.83	1.98	52.4	1.48	
10/30/2005	2.63	91.83	1.98	52.4	1.48	
10/30/2005	2.63	91.83	1.98	52.4	1.48	
10/30/2005	2.64	91.84	1.99	52.7	1.49	
10/30/2005	2.64	91.84	1.99	52.7	1.49	
10/30/2005	2.64	91.84	1.99	52.7	1.49	
10/30/2005	2.65	91.85	2	53.1	1.50	
10/30/2005	2.64	91.84	1.99	52.7	1.49	
10/30/2005 Average					1.49	10/30/2005 Average
10/31/2005	2.64	91.84	1.99	52.7	1.49	
10/31/2005	2.64	91.84	1.99	52.7	1.49	
10/31/2005	2.64	91.84	1.99	52.7	1.49	
10/31/2005	2.63	91.83	1.98	52.4	1.48	
10/31/2005	2.63	91.83	1.98	52.4	1.48	
10/31/2005	2.63	91.83	1.98	52.4	1.48	
10/31/2005	2.63	91.83	1.98	52.4	1.48	
10/31/2005	2.63	91.83	1.98	52.4	1.48	
10/31/2005	2.62	91.82	1.97	52.1	1.47	
10/31/2005	2.62	91.82	1.97	52.1	1.47	
10/31/2005	2.62	91.82	1.97	52.1	1.47	
10/31/2005	2.62	91.82	1.97	52.1	1.47	
10/31/2005	2.62	91.82	1.97	52.1	1.47	
10/31/2005	2.63	91.83	1.98	52.4	1.48	
10/31/2005	2.63	91.83	1.98	52.4	1.48	
10/31/2005	2.63	91.83	1.98	52.4	1.48	
10/31/2005	2.64	91.84	1.99	52.7	1.49	
10/31/2005	2.64	91.84	1.99	52.7	1.49	
10/31/2005	2.65	91.85	2	53.1	1.50	
10/31/2005	2.65	91.85	2	53.1	1.50	
10/31/2005	2.65	91.85	2	53.1	1.50	
10/31/2005	2.66	91.86	2.01	53.4	1.51	
10/31/2005	2.66	91.86	2.01	53.4	1.51	
10/31/2005	2.66	91.86	2.01	53.4	1.51	
10/31/2005 Average					1.49	10/31/2005 Average
11/1/2005	2.65	91.85	2	53.1	1.50	
11/1/2005	2.65	91.85	2	53.1	1.50	
11/1/2005	2.65	91.85	2	53.1	1.50	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.63	91.83	1.98	52.4	1.48	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.63	91.83	1.98	52.4	1.48	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.64	91.84	1.99	52.7	1.49	
11/1/2005	2.65	91.85	2	53.1	1.50	
11/1/2005	2.65	91.85	2	53.1	1.50	
11/1/2005	2.65	91.85	2	53.1	1.50	
11/1/2005	2.65	91.85	2	53.1	1.50	
11/1/2005 Average					1.50	11/1/2005 Average

11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.66	91.86	2.01	53.4	1.51	
11/2/2005	2.66	91.86	2.01	53.4	1.51	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.65	91.85	2	53.1	1.50	
11/2/2005	2.66	91.86	2.01	53.4	1.51	
11/2/2005	2.66	91.86	2.01	53.4	1.51	
11/2/2005	2.66	91.86	2.01	53.4	1.51	
11/2/2005	2.67	91.87	2.02	53.7	1.52	
11/2/2005	2.67	91.87	2.02	53.7	1.52	
11/2/2005	2.67	91.87	2.02	53.7	1.52	
11/2/2005	2.68	91.88	2.03	54.1	1.53	
11/2/2005	2.68	91.88	2.03	54.1	1.53	
11/2/2005	2.68	91.88	2.03	54.1	1.53	
11/2/2005	2.68	91.88	2.03	54.1	1.53	
11/2/2005	2.68	91.88	2.03	54.1	1.53	
11/2/2005 Average					1.51	11/2/2005 Average
11/3/2005	2.69	91.89	2.04	54.4	1.54	
11/3/2005	2.68	91.88	2.03	54.1	1.53	
11/3/2005	2.68	91.88	2.03	54.1	1.53	
11/3/2005	2.68	91.88	2.03	54.1	1.53	
11/3/2005	2.68	91.88	2.03	54.1	1.53	
11/3/2005	2.68	91.88	2.03	54.1	1.53	
11/3/2005	2.67	91.87	2.02	53.7	1.52	
11/3/2005	2.67	91.87	2.02	53.7	1.52	
11/3/2005	2.67	91.87	2.02	53.7	1.52	
11/3/2005	2.67	91.87	2.02	53.7	1.52	
11/3/2005	2.66	91.86	2.01	53.4	1.51	
11/3/2005	2.66	91.86	2.01	53.4	1.51	
11/3/2005	2.66	91.86	2.01	53.4	1.51	
11/3/2005 Average					1.52	11/3/2005 Average
Grand Average					1.36	