Staff Papers Series

Staff Paper P78-15 September 1978

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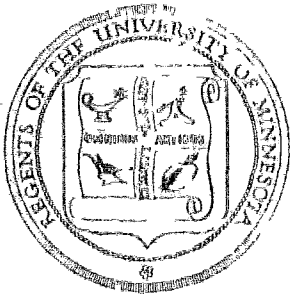

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September 1978

Staff papers are published without formal review within the Department of Agricultural and Applied Economics.

Prepared for the U.S. Army Corps of Engineers Contract, "Study of Movements of Bulk Commodities in the Upper Mississippi River Valley," Contract No. DACW37-77-C-0138.

This research was partially funded by United States Department of Agriculture Cooperative State Research Service, Research Agreement No. 701-15-37.

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INTRODUCTION

Barge traffic on the Upper Mississippi River is of vital importance to the economy of the Twin Cities and the Upper Midwest. For instance, a study by the Upper Mississippi Waterway Association concluded that the river system handled 56 percent of the area's grain exports, 41 percent of the area's fertilizer, and 28 percent of its refined petroleum products [6]. In addition about one of every three persons residing in the Upper Mississippi River Basin is served by electricity obtained from barged coal.

The volume of commodities barged to and from Twin Cities area terminals has increased some 2.3 and 10.3 percent per year, respectively, in the last decade and a half [6]. However, in spite of the importance of waterborne commerce to the Twin Cities and the surrounding area comprising the St. Paul District waterways, there has been little systematic study of current and future requirements for waterborne movements to and from the region.

Most recent studies of waterway commerce growth rates on the Upper Mississippi have focused on projecting volumes through Lock and Dam 26 at Alton, Illinois. These Lock and Dam 26 projections are based on a product mix inappropriate for the Upper Midwest and the Twin Cities because of the influence of industrial shipments from the Illinois River and the Chicago area. The Lock and Dam 26 volume projections have other shortcomings, one of which is the use of base periods which occurred prior to the OPEC oil embargo of 1973 and the Russian wheat sales in 1972 and 1973. Other problems with the projections for Lock and Dam 26 are the heavy reliance on demographic and industrial growth patterns, which are not likely to continue [5]. Growth in shipment volumes of bulk commodities such as coal and ore are generally from mine to

power plant or mine to smelter and not between major population centers. Similarly shipments of agricultural commodities originate in rural areas and not in population centers. A review of the literature on projections for the Upper Mississippi by Fruin, Young, Easter, and Jensen provides a comparison of these studies [4].

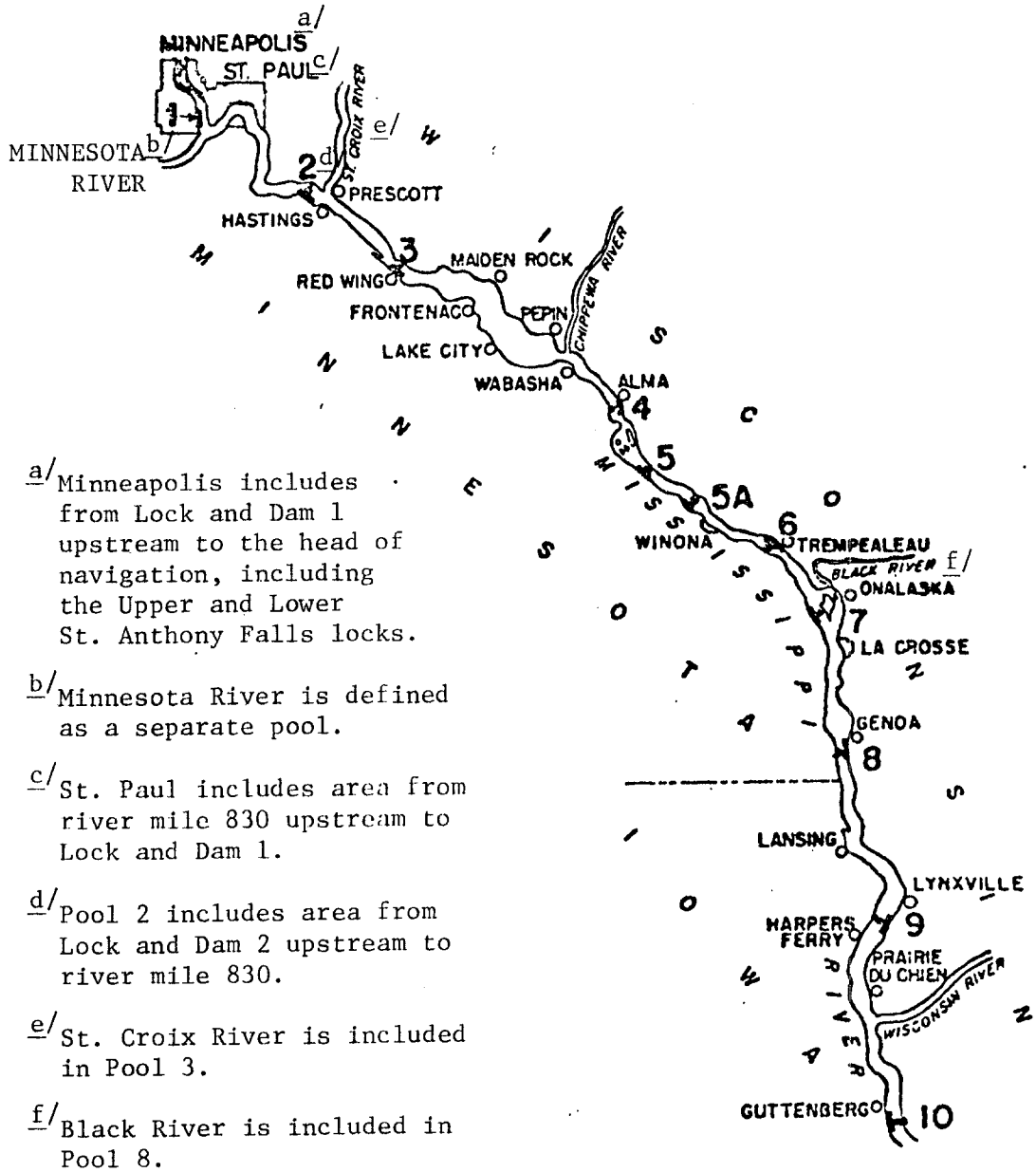
Subsequent to that review, the Upper Mississippi Waterway Association projected future barge traffic on the Upper Mississippi to the year 2000 for three major commodity groups [9]. The authors projected an average annual growth of 4 percent for energy commodities or a doubling of movements by the year 2000. Shipments of agricultural commodities were projected to increase at a rate of 3 percent and the movement of all other commodities were projected to increase at a rate of 1.7 percent to the year 2000. However, the Waterway Association study also was for the entire Upper Mississippi and did not delineate any differential growth in upbound and downbound movements.

Consequently this study was undertaken to determine the probable future movements of bulk commodities by barge to and from river ports in the U.S. Army Corps of Engineers' St. Paul District. The projected movements are analyzed in physical and economic terms useful to the formulation and evaluation of alternative river management plans by the Corps of Engineers and other interested agencies.

The study area is shown in Figure 1. It includes the Mississippi River from Lock and Dam 10 near Guttenberg, Iowa to the head of the 9 foot navigation channel near the Soo Line Bridge in north Minneapolis. Also included are the portions of the Minnesota, St. Croix, and Black Rivers with 9 foot navigation channels.

The study developed specific commodity projections for 1985 for St. Paul District ports. Projections were made for 21 commodities accounting for

FIGURE 1. Locations of Locks and Pools in the U.S. Army Corps of Engineers' St. Paul District



a/ Minneapolis includes from Lock and Dam 1 upstream to the head of navigation, including the Upper and Lower St. Anthony Falls locks.

b/ Minnesota River is defined as a separate pool.

c/ St. Paul includes area from river mile 830 upstream to Lock and Dam 1.

d/ Pool 2 includes area from Lock and Dam 2 upstream to river mile 830.

e/ St. Croix River is included in Pool 3.

f/ Black River is included in Pool 8.

over 97 percent of barged shipments to and from the Twin Cities area in 1976. Volume projections were made for a baseline case and six possible variations of the baseline case. Barge requirements, lockage requirements, and lockage utilizations were also projected. In addition, an analysis was performed on the effect of user charges on the total commercial barging bill for 1975.

Summary of Existing Conditions

Agricultural and energy related products account for nearly all the barge shipments made from the Twin Cities area [6]. The agricultural products, primarily corn, soybeans, wheat, and other small grains shipped from St. Paul District ports travel long distances, generally terminating in the New Orleans - Baton Rouge area of the lower Mississippi River. This may be substantiated by reference to Tables A-1 to A-4 of Appendix A.

Energy products are somewhat less consistent. Ports in the Twin Cities area serve as major rail to barge transshipping points for western coal from Montana and Wyoming. However, western coal shipments are largely intradistrict shipments to other district ports as shown in Table A-5 of Appendix A. Of 2.4 million tons of coal shipped from Twin Cities ports in 1975, over 1.8 million tons went to other terminals in the St. Paul District where they are counted as receipts. Another 3 million tons of coal from Midwestern sources such as Illinois or Kentucky entered the District by barge in 1975. Virtually all of this coal had to pass through Lock and Dam 26 at Alton, Illinois. The largest proportion of the Midwestern coal goes to the Allen S. King power plant on the St. Croix River in Pool 3. Large amounts of Midwestern coal are also received at power plants near Lansing, IA, and Genoa, WI, in Pool 9, at Alma, WI, in Pool 5, and the Blackdog plant on the Minnesota River.

There are also major intradistrict shipments of refined petroleum products. Tables A-8 and A-9 of Appendix A contain 1975 data on gasoline and distillate fuel oil shipments from District ports. These categories account for 97 percent of all District petroleum products shipments. Nearly all are from refineries on Pool 2 with about three-fourths of the shipments to terminals in St. Paul which do not require any lockages.

In the Twin Cities area, barge receipts of sand, gravel, and rock are second only to coal in volume. However, these categories consist of very short movements. Ninety-nine percent of all the shipments of sand, gravel, and rock from St. Paul District ports occur at Pool 2 terminals and three-fourths of these are intradistrict shipments to St. Paul terminals which do not require lockages. The remainder of sand and gravel goes short distances to other local terminals.

Simple tonnage figures, therefore, do not provide complete and accurate information on existing conditions for riverborne navigation in the St. Paul District. Some major movements do not require lockages while others traverse all 13 locks. In terms of lock capacity under existing conditions in the St. Paul District, the highest utilization occurs at Lock and Dam 2 near Hastings. During peak months of commercial recreational navigation, this lock reaches higher levels of utilization than any other in the district, being frequently occupied from 50 percent to 60 percent of the hours in each month. Lock and Dam 10 near Guttenberg is the next busiest, followed closely by Lock and Dam 3 at Red Wing. These locks are also occupied more than half the time during peak months.

At Lock and Dam 2, 45 percent of the tonnage locked through is farm products, and 40 percent is energy products. These percentage breakdowns are

roughly the same for Lock and Dam 10. The total tonnage through Lock and Dam 10 is 25 percent greater than what is locked through Lock and Dam 2, but the utilization is less due to fewer recreational craft. These locks, as potential bottlenecks, are a key factor in the economic infrastructure of the upper Midwest.

METHODOLOGY

The baseline projections for 1985 for St. Paul District ports are based primarily upon a previous analysis of Twin Cities area ports [6]. The selection of commodities and commodity groupings correspond to those developed for the Army Corps of Engineers Inland Navigation Systems Analysis (INSA) project [12,13]. A listing of the INSA categories and the commodities in each is presented in Appendix D.

Twenty-one INSA commodity classifications were selected for analysis. The criterion for selection was that each classification had 1975 movements in excess of 50,000 tons. These commodities represent 99 percent of the 1976 Twin Cities shipments, and 98 percent of the 1976 Twin Cities receipts. Projections were developed for 1985 based on a commodity-by-commodity analysis for each of the 21 selected commodities. These projections were done for each pool in the St. Paul District study area (see Figure 1). However, no projections were made for Pools 5A and 7 since these pools lack terminal facilities for handling bulk commodity shipments.

Twin Cities area data was assembled for a 14 year period from Waterborne Commerce of the U.S., Part 2, for the calendar years 1963 to 1976 inclusive [10]. Average annual rates of growth (or decline) were calculated for each commodity on a continuously compounded basis for at least four periods. The periods for these average annual growth rates are: (1) the entire 1963-1976 period; (2) the first

ten-year period, 1963-1973; (3) the last ten-year period, 1966-1976; (4) the period since the 1973 oil embargo, 1973-1976. For most of the commodities, a representative growth rate was selected from among the calculated rates of growth for the projections. The base value for the Twin Cities projections was calculated as the mean tonnage from 1973 through 1976. The rates of growth were projected to continue through 1985.

For downstream pools, data was collected from unpublished INSA sources [15]. Data from 1975 served as the base value for projecting downstream pools. The same representative growth rates as developed for each commodity from the Twin Cities data were used in making the projections for the downstream pools.

For a few commodities it was necessary to modify the representative growth rate. Modifications were made where appropriate after a review of the marketable surplus available for shipment and the probable requirements for receipts. This review was especially important in the case of farm products where a programming model provided upper limits on commodity volumes available for barge shipment on District waterways in 1985, and for coal when shifts from Midwestern to Western sources had to be individually considered.

The representative growth rates, base values, and necessary modifications were used to develop a 1985 baseline case projection on a commodity-by-commodity basis for each pool. The baseline case is considered the most likely outcome of bulk commodity flows in the District in 1985.

Alterations were then made in the baseline case projections in order to estimate the effect that various assumptions about future waterborne commodity flows would have in the St. Paul District. These variations are incorporated into Scenarios 1 through 5.

Scenario 1A projects a 50 percent increase in raw farm product shipments over the baseline case, while Scenario 1B calls for a 50 percent decline.

Scenarios 2 and 3 develop alternative coal movements pertaining to western vs. midwestern coal and the location of coal burning facilities. Scenario 4 combines the assumptions of Scenarios 1A and 2, while Scenario 5 assumes the elements of Scenarios 1A and 3.

User charges impact is assessed below as it would have affected 1975 barge movements in the St. Paul District. Tonmiles were calculated for 1975 product movement, and gallons of fuel consumption were estimated by allotting 400 tonmiles per gallon of fuel. User charges of 2, 4, 6, and 8 cents/gallon of fuel were then applied in order to derive total associated cost figures.

The trip/lockage requirements for barged traffic on the St. Paul District waterways were calculated using the data on barge requirements, and utilizing the capacity of the locks to handle dry cargo and liquid tank barges. The lockage requirements presented below are minimum possible outcomes based on the volume projections given above for the baseline case and the various scenarios. Furthermore, the requirements for raw farm products reflect an adjustment made to reduce the amount of empty barge lockages by assuming that empty dry cargo barges from upstream movement of coal and miscellaneous products are utilized for farm product shipments whenever possible. The analysis focuses on Lock and Dams 1, 2, 3, 10, and the Minnesota River.

Throughout the study there is a focus on three major commodity groupings: (1) coal, (2) raw farm products, and (3) miscellaneous products. Individual commodity projections not elsewhere presented in the text are available in Appendix B (shipments) and Appendix C (receipts).

BASELINE PROJECTIONS

Raw Farm Products

As reported in an earlier study, barge shipments of bulk commodities from the Twin Cities area are dominated by raw farm products, which accounted for more than 3/5 of the 1976 total [6]. However, the previous study was limited to the pools in the immediate vicinity of the Twin Cities, while the present study considers all pools in the St. Paul District, which extends to Lock and Dam 10 near Guttenberg, Iowa.

In the present study, the Twin Cities ports are projected to ship 8.2 million tons, or 76 percent of the projected 1985 District baseline barge shipments of raw farm products, including corn, wheat, soybeans, and oats. Minnesota River ports are projected to handle 5.9 million tons of raw farm products, nearly 3/4 of the Twin Cities volume, and over 1/2 of the District baseline total in 1985. The projected 1985 shipments of raw farm products are presented by pool in Table 1. The projections of the individual commodities in the group may be found in Appendix B.

The District baseline forecast for farm products is projected at 10.8 million tons, of which corn accounts for more than 1/2. Next is wheat with about 1/3 of the total, followed by soybeans with 15 percent and oats with only 1.3 percent of the District baseline total.

The most important pools for raw farm product shipments in 1985, in descending order, are the Minnesota River, St. Paul, Pool 10 (McGregor and Clayton, IA), and Pool 6 (Winona, MN). These pools account for about 90 percent of the projected 1985 shipments of raw farm products from the District. However, the volume that is shipped from the Minnesota River and St. Paul pools dwarfs the amount barged in the other downstream pools. Twin Cities

area ports account for about 3-1/5 times the projected 1985 raw farm products shipments from all other ports in the District.

As evident in Table 1, the projected 1985 baseline forecast for raw farm products is nearly double the total shipments reported in 1975. The pools displaying the largest gains relative to 1975 are the Winona-LaCrosse pools, followed by the Minnesota River and Lock and Dam Pool 10, although in an absolute sense, the Minnesota River gains far more than any other pool or pools combined. In fact, the Minnesota River is projected to ship more in 1985 than the entire District shipped in 1975.

Table 2 shows the minimum number of barges required to ship the projected tonnages of raw farm products for the baseline case. Each barge is assumed to be loaded to capacity of 1450 tons. Consequently the 1975 barge requirements may differ from actual barge loads shipped to the extent that the 1975 farm product barges had a different capacity or were not filled. This commodity group is projected in the 1985 baseline case to require an additional 3500 barge loads or nearly double the 1975 number.

Coal

Unlike raw farm products, projection of coal movement by barge in the St. Paul District requires important distinctions between shipments and receipts, as well as the origins of the coal. Future coal movements are currently much more difficult to predict than other commodities due to uncertainties about the course of Federal energy policy and environmental requirements. The 1985 baseline projection assumes that any new power plants servicing Minnesota and western Wisconsin that come on line prior to the late 1980's will use western coal which will be received by unit train. Currently existing power plants in

the St. Paul District which are served by barge will continue to get both midwestern and western coal by water. The proportion of utility coal from the west will gradually increase as older boilers are replaced. However, the total amount of eastern coal required may increase slowly because of coal use by industry. Many industrial boilers require coal with specifications not available from western mines and are expected to rely on midwestern coal [7].

These projections do not include any large additional transshipping requirements. There has been speculation that the Twin Cities might become a major western coal transshipping port servicing a large part of the Upper Midwest. However, if this occurs, it is unlikely to happen before the late 1980's. Most of the current or planned mine capacity on the BN main line between Billings, MT and the Twin Cities is under contract. It is expected that most of the new mine capacity and coal production in the Powder River Basin will be in the Gillette, WY area near the Burlington Northern main line running across Nebraska rather than on the more northern routes through Minnesota. Consequently, the most economical movement to the major midwestern population centers, whether transshipped to barges or not, will be across Nebraska and Iowa, rather than Montana and Minnesota. (Increased lake shipments via Duluth will of course have to come across Minnesota.) The new coal mine construction activity is located on the southern route for a variety of reasons including the higher extraction tax in Montana, and environmental disputes. In addition, the distance to several major population centers gives a transportation cost advantage to the Gillette area.

Table 3 gives the projected requirements for midwestern coal by pool for the baseline case. The baseline case projection is quite similar to the pattern of midwestern coal receipts in 1975 and 1977, as shown in Appendix A.

There will continue to be requirements for the higher energy content midwestern coal by existing power plants and industrial users as well as the possibility of increased industrial use of midwestern coal. Some industrial users have coal burning facilities designed for midwestern coal that were used prior to natural gas. It is also possible that some western coal may be transshipped at southern locations such as St. Louis, MO or Keokuk, IA to the southern part of the district. However, such western coal would have the same impacts as midwestern coal for the purposes of this analysis.

The 1985 baseline coal projection calls for 3.1 million tons of midwestern coal receipts in the St. Paul District. Lock and Dam Pool 9 (Lansing/Genoa) will acquire 42 percent of this total, making it by far the largest recipient of midwestern coal by barge. In 1975, all receipts of midwestern coal in the District were slightly less than 3.0 million tons.

Table 4 contains the 1985 baseline projections by pool for shipments of western coal from ports in the St. Paul District. Note that some of the pools will have net receipts rather than shipments. These pools are indicated as having negative shipments of western coal. The total District shipments of western coal are projected at 3.0 million tons for the baseline case in 1985, whereas the net District shipments, i.e. only those shipments leaving the District, total less than 0.9 million tons. In comparison, the 1975 western coal shipments totaled 2.3 million tons, with 1,793,843 tons unloaded in the District and 514,691 tons leaving the District.

In 1975, Minneapolis and St. Paul were the only pools in the District serving as shipping points for western coal barges. The Minnesota River and the St. Croix River were the largest recipients of the western coal shipments in 1975, each receiving more than the out-of-District total. The 1985 base-

line projection calls for a similar alignment of western coal shipments and receipts among the pools, with the exception that extradistrict shipments will be about as great as shipments destined for any pool within the District. The baseline case projects a 71 percent increase in western coal shipments leaving the District.

Tables 5A and 5B contain the 1985 barge requirements for the baseline case for both western and midwestern coal by pool using 1450 tons per barge. Midwestern coal will not require empty barges for loading within the District, since the shipments originate below Lock and Dam Pool 10. It is projected, however, that about 2200 coal barges carrying midwestern coal will be unloading and available for backhauls at District ports in 1985, with Lock and Dam Pool 9 receiving the most midwestern coal barges, nearly 900.

Western coal shipments will originate mainly at St. Paul and Minneapolis ports. These two ports will need over 2000 barges for western coal shipments in 1985. However, since 1400 of these barges will be unloaded before passing Lock and Dam 10, only 600 loaded western coal barges will be leaving the District.

Tables 6 and 7 contain the total coal shipments and receipts, respectively, by pool for 1975 and 1985. These two tables combine the data, discussed above, on midwestern and western coal movements. The 1985 baseline projection for District coal shipments is 3.0 million tons, a 30 percent increase over 1975 shipments of 2.3 million tons. All District shipments are of western coal. The baseline projection for receipts is 5.2 million tons for the District in 1985 vs. 4.8 million in 1975. The baseline receipts are projected to be 60 percent midwestern coal and 40 percent coal from western sources. This is roughly equivalent to the 1975 shares by source.

Tables 8 and 9 present the barge situation due to coal movements in the District. In Table 8, the shipment requirements are presented, which are the same as those discussed above for western coal shipments. The District baseline projection is 477 barges greater than 1975 for shipments. For District receipts, Table 9 shows that total coal barges unloading at District ports in 1985 will be about 317 greater than 1975.

Miscellaneous Products

These commodities other than raw farm products and coal, with a 1975 volume of shipments or receipts exceeding 50,000 tons, are included in the category of miscellaneous products. The 1985 projections for miscellaneous barge shipments and receipts are presented in Tables 10A through 11B. Tables 10A and 10B present the projections for miscellaneous dry cargo and liquid tank shipments, respectively. Receipts, on the other hand, are presented in Tables 11A and 11B. The individual commodity projections for those commodities making up the miscellaneous category may be found in Appendix B for shipments and Appendix C for receipts.

Miscellaneous dry cargo shipments in the District are projected to increase by 40 percent over the 1975 total, while the liquid tank shipments are projected to remain unchanged from their 1975 level. The 2.4 million tons of dry cargo shipments projected for the District in 1985 is 685,811 tons greater than the 1975 volume. This increase is mainly attributable to projected increases of processed agricultural products. The liquid tank shipments are petroleum products, which are not anticipated to be any greater in 1985 than the 1.3 million tons shipped by barge 1975.

Miscellaneous dry cargo barge receipts in the District are projected at 2.9 million tons in 1985, a 15 percent increase over 1975. Miscellaneous

liquid tank barge receipts are projected to increase by about 8 percent to 2.4 million tons in 1985. The modest increase in liquid tank barge receipts of 174,011 tons indicates the declining importance of barges in handling petroleum products in the face of greatly increased demand for these products.

An interpool comparison of the projected 1985 miscellaneous commodity movements reveals that Lock and Dam Pool 2 will account for 48 percent of the dry cargo shipments and 99 percent of the liquid tank shipments. St. Paul will get 40 percent of the dry cargo receipts and 57 percent of the liquid tank receipts.

Most miscellaneous movements are intradistrict shipments. In fact, only 22 percent of 1975 miscellaneous barge shipments left the District. Furthermore, a majority of miscellaneous barge shipments are intrapool movements that do not require locking. Appendix A contains tables displaying the 1975 shipments of selected miscellaneous commodities by port of destination. It is of interest to note that all of the District sand, gravel, and rock shipments, which are 2/3 of the miscellaneous dry cargo total, originate in Lock and Dam Pool 2 and terminate upriver at St. Paul or Minneapolis ports. Furthermore, most of the liquid tanks, or petroleum products, follow a similar pattern. Thus, the net miscellaneous flows out of the District will be much less in 1985 than the shipment volumes reported in Tables 10A and 10B.

Table 12 presents a percentage breakdown by commodity of miscellaneous shipments and receipts. Two of the largest categories for both shipments and receipts, petroleum products and sand gravel and rock, are primarily intradistrict transfers, such that the net miscellaneous shipments and receipts into and out of the District are much lower. However, these movements are included in the analysis as they impact the supply of barges, require fleeting, the

interpool transfers require lockages, and the intrapool transfers are primarily in the heavily traveled Twin Cities area.

Barge requirements for miscellaneous products shipments and receipts are contained in Tables 10A through 11B. The miscellaneous dry cargo shipments in the District will require 1673 barges in 1985, and the liquid tank shipments will require 928. Lock and Dam Pool 2 will need about 1/2 of the dry cargo and nearly all of the liquid tank barge requirements. Miscellaneous receipts, on the other hand, will provide 1985 dry cargo and 1674 liquid tank barges in 1985, a majority of them at St. Paul ports.

All Commodities

Total barge shipments by pool for all commodities combined are presented in Table 13. The projected 1985 volume is 17.5 million tons, 59 percent greater than 1975. The difference between the 1975 and 1985 totals, 6.5 million tons, is due almost entirely to the increase in raw farm product shipments of 5.1 million tons. Table 14 contrasts the volume shares by commodity group. Raw farm products are projected at 61 percent of the 1985 total shipments for all commodities, up from 51 percent in 1975. Coal shipments are projected to remain at about 1/5 of total commodity shipments in the District. Miscellaneous products shipments will also be about 1/5 of all shipments in 1985, down from 28 percent in 1975.

In 1975, four pools/ports had roughly equal volumes of barge shipments, and together accounted for 88 percent of all shipments. The pools are all in the Twin Cities area - Minneapolis, Minnesota River, St. Paul, and Pool 2. Each of these pools had from 20 percent to 23 percent of the District total shipments for 1975. The Minnesota River is projected to handle 35 percent of

all commodities shipped in 1985. None of the pools downriver from Pool 2 are projected to handle more than 5 percent of the District shipments in 1985, and none had more than a 5 percent share in 1975.

Total shipments in the District in 1985 will require more than 12,000 barges. As shown in Table 15, about 7500 of these will be required by raw farm products, which is almost the number of barges required for District shipments in 1975. The Minnesota River will take over 1/3 of these for its shipments with 96 percent of these required for raw farm products. St. Paul will also require many more barges in 1985 than it utilized in 1975 for total shipments, primarily due to increased coal shipments.

Total receipts of all commodities are projected by pool in Table 16. The 1985 baseline projection calls for 10.5 million tons of receipts at all pools in the St. Paul District, which is 11 percent greater than 1975. The Twin Cities area is not as dominant in terms of total receipts as in total shipments because of the coal requirements of downstream utilities. St. Paul is projected to receive the largest volume of barge receipts, 2.9 million tons in the 1985 baseline case, or 28 percent of all District receipts. Pool 9 is projected to have the second largest share of District receipts, 17 percent or 1.8 million tons in 1985. Pool 3 and the Minnesota River will both have receipts of 1.3 million tons, but no other pool has as much as 1 million tons of receipts projected for 1985. The shares among the pools are projected to be very similar to the 1975 data.

In the case of receipts, there is an even 50-50 split between coal and miscellaneous commodities projected for the District in the 1985 baseline case. This is shown in Table 14. Receipts of raw farm products are not significant in the District, and were not projected for the 1985 baseline case.

Total barges available from receipts are presented in Table 17. The District, in total, will receive 688 additional barges from the projected 1985 baseline receipts than in 1975. Pool 9 is projected to have 300 additional barges due to increased receipts over 1975 levels.

SCENARIOS 1A AND 1B

Scenario 1A differs from the 1985 baseline case in that it is assumed that 1985 shipments of raw farm products will be 50 percent greater than the volume of farm products projected for the baseline case. Scenario 1B projects raw farm products shipments at 50 percent less than does the 1985 baseline case. Projections of coal and miscellaneous product movements by barge are the same in Scenario 1A and 1B as in the baseline case. The discussion of Scenarios 1A and 1B will focus on changes in raw farm products shipments and their effect on total commodity movements. Coal and miscellaneous products movement will be discussed only if they are impacted by the assumed changes in farm product movements.

Raw Farm Products

The commodity grouping of raw farm products includes projections of oats, wheat, corn, and soybeans shipments by barge. Table 1 contains the 1985 volumes of raw farm products projected for both Scenarios 1A and 1B. In the baseline case, 10.8 million tons are projected for District shipments, 91 percent above the 1975 amount. In Scenario 1A, 16.2 million tons of raw farm products shipments are projected for the District in 1985. This sum is nearly three times the amount shipped in 1975, and is 50 percent more than the baseline projections. The absolute difference between the volume shipped

out of the Minnesota River, 8.8 million tons in Scenario 1A, and the next most important pool, St. Paul, is greater than all raw farm products shipments made by the entire District in 1975. The raw farm product shipments from the Minnesota River in Scenario 1A are four times as large as all commodity shipments made from the Minnesota River in 1975.

Scenario 1B, although a 50 percent reduction from the baseline projection, is only a 4.7 percent reduction from actual farm product shipments in 1975. The Minnesota River is the only port that will ship more than 1 million tons under this scenario. St. Paul is projected at just under 1 million tons of raw farm products. Even though the District total for Scenario 1B and 1975 are not very different, there are shifts projected to occur among the ports. The Minnesota River will increase its volume of raw farm product shipments by 27 percent from 1975 to 1985 in Scenario 1B. Its share of District farm shipments under these conditions would increase from 41 percent in 1975 to 55 percent.

Table 2 presents the barge requirements for Scenarios 1A and 1B by pool for raw farm products. In Scenario 1A, over 11,000 barges will be required for these shipments in the District, 6000 of them by the Minnesota River. St. Paul is projected to require nearly 2000 barges under Scenario 1A. In Scenario 1B, the number of barges required for the District farm product shipments will be 187 less than the 1975 requirements. The Minnesota River, however, would still need over 2000 barges under Scenario 1B. The District barge requirements for farm products for Scenario 1B are projected at 3720, 50 percent less than the baseline requirements.

All Commodities

Commodity receipts in the District for Scenarios 1A and 1B are identical to the baseline case. The receipts for all commodities by pool for the baseline case appear in Table 16, and were discussed above. Shipments for all commodities, including farm products, under Scenarios 1A and 1B are presented in Table 13. For the District as a whole, Scenario 1A projects 5.4 million additional tons in 1985 than the baseline case. The 22.9 million tons of commodity shipments in 1A are 31 percent greater than the projected baseline total of 17.5 million tons and 108 percent greater than the 1975 shipments.

For the baseline case, raw farm products were projected to account for 61 percent of the total baseline shipments for all commodities, as shown in Table 14. This compares to 51 percent in 1975, and to 71 percent projected for the 1985 Scenario 1A. Under Scenario 1A, shipments of all commodities are projected at over 9 million tons for the Minnesota River, about 40 percent of the District total; St. Paul will ship about 24 percent; Pool 2, 11 percent; and Minneapolis, 8 percent. These four pools account for 83 percent of all District shipments in 1A.

In Scenario 1B, it is projected that total District shipments will be 12.2 million tons, 31 percent less than the 1985 baseline projection, but 10 percent greater than the 1975 total. Note that even if the baseline 1985 projections of raw farm product shipments are reduced by 50 percent, there would be 10 percent more shipments under the assumptions of Scenario 1B than there were shipped in 1975. Raw farm products are projected in Scenario 1B to account for 44 percent of the total commodity shipments for the District. St. Paul replaces the Minnesota River as the dominant shipping port under

Scenario 1B, with 3.5 million tons, or 29 percent of the District total. The Minnesota River is projected at 3.2 million tons, or 26 percent of the total District shipments.

Table 15 contains the barge requirements for all commodity shipments under Scenarios 1A and 1B. Scenario 1A is projected to require 3714 more barges than the baseline case in 1985. The total District requirements in Scenario 1A are 15,822 compared to 12,108 for the baseline case. The Minnesota River alone would need 6267 barges for the projected Scenario 1A shipments in 1985, 2030 more than in the baseline case. The total District barge requirements in Scenario 1A are more than double the 1975 requirements.

Scenario 1B needs only 8390 barges for all District shipping, which is 3718 less than the baseline case, but 764 more than the barges required for 1975. The Minnesota River will need only 2200 barges under Scenario 1B, about 1/3 as many as under Scenario 1A. St. Paul is projected to require the most barges under Scenario 1B, 2420 in 1985.

SCENARIOS 2 AND 3

In Scenarios 2 and 3, 1985 movements by barge of raw farm products and miscellaneous products are kept at the baseline level while the assumptions about coal movements are changed. Scenario 2 assumes that in addition to the baseline case coal burning facilities, an electric generating facility consisting of two 800 megawatt units will be located on or near the Mississippi River near Wabasha, MN (Pool 5) and that a similar facility is located on or near the river south of the St. Paul District. (Mile 600, which is 20 miles north of Dubuque, IA, was used as the location for computation purposes.) These generating units will be designed to burn western subbituminous coal

which will be mined in Montana and shipped to the Twin Cities area by unit train. The coal will be transferred to barges in or near the Twin Cities above Lock and Dam 2. Coal for one of the units will be transferred above Lock and Dam 1. Each of the four 800 megawatt units is projected to require 2,850,000 tons of coal annually [7].

Scenario 3 assumes the baseline case requirements and that additional electric generating facilities will be located as in Scenario 2. However, in Scenario 3 the plants are designed to use bituminous coal available from southern Illinois or Kentucky. This coal would be transferred to barges at St. Louis or more southerly points and require locking through Lock and Dam 26. Since this coal would have a higher energy (BTU) content than western coal, less fuel will be needed for an equivalent power output. Assuming 12,000 BTU per pound coal, the requirement for each 800 megawatt unit would be 2,140,000 tons of coal per year.

Coal

The projected receipts of midwestern coal for Scenarios 2 and 3 are presented in Table 3. Scenario 2 is the same as the baseline case. The projection for Scenario 3 has an additional 4,280,000 tons of midwestern coal required in Pool 5. An additional 4.3 million tons of midwestern coal is required below the St. Paul District at mile 600 in Scenario 3. This would not affect District traffic but might have a favorable impact on barge availability.

All pools are projected at the same levels in Scenario 2 as in the baseline case. Pool 9 will receive about 42 percent of all the District midwestern coal receipts. In Scenario 3, however, Pool 9 would receive 18 percent. Under Scenario 3, Pool 5 is projected to get about 61 percent of all District midwestern coal receipts.

Western coal shipments by pool for Scenarios 2 and 3 are presented in Table 4. Scenario 2 shows 11,416,000 more tons of western coal shipments from Twin Cities area ports than in the baseline case. However, only 1/2 of these additional shipments will leave the District. Table 4 shows 2,854,000 tons of the additional western coal being shipped from Minneapolis and 8,562,000 tons being shipped from St. Paul or Pool 2 for illustrative purposes. Current physical restrictions and environmental considerations will preclude this quantity of coal being transshipped unless substantial investments in coal handling terminals are made [8]. Scenario 3 does not project any differences in western coal shipments from the baseline projections.

Table 6 contains total coal shipments by pool, for western and midwestern coal combined. Similarly, Table 7 presents total coal receipts. Total coal shipments are the same as the western coal shipments. Of the 11 million tons of coal receipts projected in Scenario 2, 29 percent is midwestern coal and 71 percent is western coal. Scenario 2 total coal receipts are more than double the baseline projection. Scenario 3 projects 9.5 million tons of coal receipts, 78 percent midwestern and 22 percent western. This is about 1.4 million tons less than Scenario 2, but still is more than double the 1975 District coal receipts.

Tables 5A and 5B contain the coal barge requirements by pool for Scenarios 2 and 3. Positive signs indicate that barges are required for loading coal. Minus signs indicate that coal barges are emptied at terminals on the pool and may be available for return shipments of coal, or for cargo such as grain after cleaning. This is especially true of barges involved in long distance movements. Barges used for short hauls within the Twin Cities

area or within the District are likely to be dedicated equipment that is returned empty. The cost of moving empty coal barges to locations where cleaning can be performed, and the actual costs of cleaning make short backhauls uneconomical.

Tables 5A and 5B indicate that 2153 barges will come into District ports loaded with midwestern coal in either the baseline case or in Scenario 2. Of these 965 are destined for the Twin Cities. This is a slight increase over 1975 shipments. These barges have all had long line hauls and are a potential source of backhauls. In Scenario 3 there will be 5105 barges shipped into the District with midwestern coal, an increase of 137 percent over the baseline case. The big increase in empty barges would occur below the Twin Cities area. If used for backhauls the barges would probably be moved to the Twin Cities empty. Furthermore, under Scenario 3 an addition 2952 coal barges would be off-loaded in Pool 11, about 250 miles below St. Paul that could be a source of empty barges for shipments from the District.

Tables 5A and 5B indicate that 2069 barges will be needed to transport western coal from Twin Cities ports in the baseline case and Scenario 3. However, 1035 of these barges would be required for movement within the Twin Cities area to the Minnesota and St. Croix River ports, and another 418 barges would be required for shipments of western coal to downstream ports in the St. Paul District. Only 606 barges are projected for shipments out of the District. This compares with approximately 355 barges required for out-of-District movements in 1975.

Under Scenario 2, the total barges required for western coal movement would be 9942 of which 4543 are sent out of the District. However, since the increases in western coal shipments are to Pool 5 and 11, the use of dedica-

ted equipment is likely. This will greatly increase the number of lockages of empty coal barges being returned in the St. Paul District but will have little effect on river operations below Pool 11.

In summary, in the baseline case the total number of barges of western coal shipped will approximately equal the number of barges of midwestern coal received in the District. Since 71 percent of the western coal is destined for District ports, it is likely that these western coal barges will be dedicated and returned empty. It is probable then, that over 1500 line haul barges which carried midwestern coal into the District will be available for hauling other commodities downriver in the baseline case.

Under Scenario 2 there is a requirement for almost 10,000 barges for western coal. However, these barges will be primarily destined for terminals in the St. Paul District and Upper Mississippi, and probably will be dedicated to coal movements on that stretch. Whether the empty barges from the midwestern coal movement are used for other commodities, or western coal, would depend on circumstances such as ownership, cleaning costs, and relative terminal locations. Under most circumstances, the small movement of midwestern coal will be complimentary to downbound traffic.

Under Scenario 3, over 5100 upbound midwestern coal barges will be emptied in the District, and another 2952 will be emptied at mile 600. Only 600 line-haul downbound western coal barges will be required for out-of-district movements. Consequently, from 4500 to 7500 coal barges will have to be sent south empty or loaded with another commodity as a backhaul. Since most of these barges would be emptied below the Twin Cities, terminals in Pools 5 to 11 and below would be ideally located to utilize these barges provided adequate cleaning and terminal facilities were available.

All Commodities

Barge shipments by pool for all commodities in Scenarios 2 and 3 are shown in Table 13. Scenario 2 calls for nearly 29 million tons of commodity shipments from the District, 11.4 million tons greater than the baseline projection, or a 65 percent increase. Raw farm products are projected to account for 37 percent of the Scenario 2 shipments; miscellaneous products, 13 percent; and coal, 50 percent. The corresponding baseline scenario shares are: raw farm products, 61 percent; miscellaneous products, 21 percent; and coal, 18 percent. Total receipts in Scenario 2 are projected at 16,244,126 tons, which is 54 percent greater than the baseline scenario receipts for the District. About one-third of the projected Scenario 2 receipts are miscellaneous products receipts, and 2/3 are coal receipts. In the baseline scenario, the receipts of miscellaneous commodities and coal are about equally divided.

Total Scenario 3 shipments of all commodities in 1985 are projected at 17.5 million tons for the District which is the same as the baseline scenario. Scenario 3 receipts, however, are projected at 141 percent of the baseline receipts, or 14.8 million tons. This is 1.4 million tons less than the projected receipts for Scenario 2, since midwestern coal has a higher energy content. Slightly more than 1/3 of the Scenario 3 receipts are miscellaneous products, and the remainder are coal receipts.

In Scenario 2, coal dominates District shipments, accounting for 67 percent of total District shipments, or 14 million tons. It should be stressed that current conditions in the Twin Cities area would not allow such volumes to be shipped without capital investment. But if Scenario 2 actually develops, then coal terminals will account for more shipments in 1985 than the entire District had in 1975. In terms of receipts, Pool 5 would become the most

prominent in Scenario 2, with 6.2 million tons or 38 percent of the District total receipts because of increased western coal receipts. Pool 5 receipts in Scenario 2 are 12 times the baseline projection.

For Scenario 3, the shipments by pool are identical to the baseline scenario. For receipts, however, there are 4,280,000 additional tons of midwestern coal projected for Pool 5, so that a situation similar to Scenario 2 arises where Pool 5 is projected to receive more barged tonnage than any other pool, or 32 percent of the District total. In the baseline case, Pool 5 is projected to receive only 5 percent of all receipts. The receipts at Pool 5 for Scenario 3 are over nine times the baseline receipts projected for 1985.

Barge requirements for all commodity shipments under Scenarios 2 and 3 are presented in Table 15. The total required for shipments in Scenario 2 is 19,981 barges for the District, nearly 9000 at St. Paul ports. In Scenario 2, St. Paul requires 5905 more barges than in the baseline projection. Minneapolis will require 1968 more barges for Scenario 2 shipments than for the baseline scenario. For the total District, 7873 more barges are required in Scenario 2 than the baseline scenario. There are no additional barge requirements from the baseline scenario for shipments in Scenario 3.

The empty barges available from receipts are presented in Table 17. The differences among Scenario 2 and 3 and the baseline case is primarily due to Pool 5 coal receipts. Scenario 2 projects 4284 barges at Pool 5 which 3936 greater than the baseline. Scenario 3 shows 3300 barges at Pool 5 which is 2952 greater than the baseline case. The District total from Scenario 2 receipts is 11,211 barges and from Scenario 3 is 10,227 barges. However, it should be recognized that in case of Scenario 2, most of the increased number of empty barges would not be available for backhauls while many of the additional barges in Scenario 3 would.

SCENARIOS 4 AND 5

Scenario 4 combines the assumptions of Scenario 1A and Scenario 2, i.e. shipments of raw farm products will be 50 percent greater than the baseline projections, and western coal shipments will be required for four 800 megawatt electric generating plants, each requiring 2,850,000 tons of coal. Scenario 5 differs from Scenario 4 in that it combines Scenarios 1A and 3 rather than Scenarios 1A and 2. Scenario 5, therefore, assumes that raw farm product shipments will be 50 percent greater than the baseline projection, and that midwestern coal will be used at the four 800 megawatt electric generating plants. Miscellaneous commodity movements by barge remain at their projected 1985 baseline levels in both Scenarios 4 and 5. Scenario 4 represents the largest foreseeable demand for District shipments in 1985. Scenario 5 contains more complimentary elements, with upstream movement of coal barges and downstream raw farm product barge movement.

All Commodities

Shipments by pool for all commodities in Scenarios 4 and 5 are contained in the last two columns of Table 13. Scenario 4 projects 34.3 million tons of commodity shipments for the District in 1985. This is 16.8 million tons greater than the projected 1985 baseline shipments. It is nearly double the baseline case and is more than three times the 1975 level of shipments. As shown in Table 14, the Scenario 4 shipments are divided among the three major commodity groupings as follows: raw farm products, 47 percent or 16.2 million tons; miscellaneous products, 11 percent or 3.8 million tons; coal, 42 percent or 14.4 million tons. The shipments projected for Scenario 4 are by far the greatest of any possible scenario. St. Paul alone would account

for about 14 million tons of commodity shipments under Scenario 4, which would be 41 percent of the District total.

The Minnesota River and St. Paul together would contribute 2/3 of all shipments in Scenario 4, or 23.1 million tons. This is attributable to the importance of the Minnesota River ports for the projected farm product shipments, and of the St. Paul ports for the projected western coal shipments.

Scenario 5 shipments are projected at the same levels as in Scenario 1A, which has been discussed above. The total amount of shipments projected for the District, 22,931,493 tons, is comprised of 71 percent raw farm products, 16 percent miscellaneous products, and 13 percent coal. Shipments are 31 percent greater than the baseline projection, and are more than double the 1975 level.

In comparing Scenario 4 and 5 shipments in Table 13, it is apparent that only two ports differ. These differences are due to a single commodity, coal. The District total for Scenario 4 shipments is 11.4 million tons greater than Scenario 5, all of it western coal shipments.

Total receipts for Scenarios 4 and 5 are presented in Table 16. Scenario 4 receipts are identical to those for Scenario 2, and Scenario 5 receipts are the same as for Scenario 3. The Scenario 4 total is 16.2 million tons of projected receipts, and the Scenario 5 total is 14.8 million tons. These totals are 54 percent and 41 percent greater than the projected 1985 baseline receipts, respectively. The former is 6.7 million tons greater than the total 1975 receipts, while the latter is 5.3 million tons greater than 1975 receipts. The breakdown by commodity group of total District receipts is given in the last two columns of Table 14. Scenario 4 receipts are 33 percent miscellaneous products, 67 percent coal and 0 percent raw farm products;

Scenario 5 receipts are 36 percent miscellaneous products, 64 percent coal, and 0 percent raw farm products. Although 1.4 million tons more of coal is required in Pool 5 for Scenario 4 than for Scenario 5, the primary difference is the origin of the coal.

Scenario 4 projects requirements for 23,695 barges for total District shipments in 1985. This is nearly twice the baseline requirements and is substantially greater than any other scenario. Receipts for Scenario 4 are projected to provide only 11,211 barges, so that the gap between barges received and barges shipped is quite large. Because of the great demand for barges for shipments under Scenario 4, serious shortages could develop. As stated earlier, Scenario 5 is much more complimentary, with barge requirements at 15,822 for shipments and availability from receipts at 10,227.

USER CHARGE IMPACTS

Background

Commercial waterway carriers do not pay any fees toward the operation and maintenance (O&M) of the inland navigation system. By maintaining the system on a toll free basis, the Federal government provides a cost advantage to barge transportation relative to other bulk commodity modes of transportation. The legislative proposal to levy user charges arises from charges that the Federal government ought not to be subsidizing the water mode by providing the navigation channel at no cost. The railroads furnish and pay taxes on their roadbeds while trucks pay substantial license and fuel taxes which are dedicated to highway expenditures.

The Mississippi River enjoys the lowest O&M cost per ton mile of any segment of the inland waterway system, less than half the system average. It

has been estimated that if user charges are assessed on the basis of O&M recovery for each segment, there would be virtually no change in volume flows on the Mississippi [2]. However, if the user charge is assessed as a system-wide average, then there may be some small effect on waterborne commerce of the upper Mississippi. The percentage increase in the total transportation bill would be small, and barge rates would increase some 15-20 percent on the average [1]. Surprisingly, the effect of user charges, on whatever basis, may be to increase the barge traffic on the upper Mississippi by diverting it from high cost segments of the inland navigation system such as the Missouri.

Pending legislation would impose an initial user charge of $.02 per gallon of fuel consumed in barge traffic on all inland waterways. The user charge would then be periodically raised by $.02 increments to $.08 per gallon, which would recover about half of current O&M costs for the system-wide average.

Assuming a movement of 400 net ton miles per gallon, the levy of a $.02 per gallon user charge results in $.00005 per ton mile, substantially below levels which could affect traffic flows in the upper Mississippi. On the assumption that the additional costs would be passed through the marketing channels, the increase in the total transportation bill is estimated below for the movements of major commodity groups associated with the St. Paul District waterways.

Impacts

The impact of the assessment of user charges upon barged traffic in the St. Paul District, is discussed using actual 1975 movements as an example. The dollar amounts are derived by calculating actual tonmiles of 1975 barge traffic and applying a 400 tonmile/gallon figure to obtain the gallons required

by major commodity group. Table 18 presents the total estimated cost of user charges assessed at 2, 4, 6, and 8 cents per gallon in 1975. The total estimated for the 2 cent assessment is $.8 million, of which $.5 million would have fallen on shipments going out of the District, $.3 million on receipts entering from out of District, and $10,074 on movements within the District. For $.08/gallon charges, 1975 product movements would have resulted in a total of $3.2 million cost to barge shipping, $2 million of it to shipments leaving the District.

The breakdown of $.02 user charges by commodity group is presented in Tables 19 through 22. Table 19 also provides a useful comparison of tonmiles among the three major commodity groups by shipments and receipts. In 1975 there were 10.3 billion tonmiles of shipments from District ports, 8.8 billion of it raw farm products. On the other hand, miscellaneous products accounted for the largest share of tonmile receipts in 1975, 3.4 of 5.8 billion tonmiles. Coal had 2.4 billion tonmiles in 1975 receipts.

The $.02/gallon charge would have fallen most heavily upon raw farm product movements in 1975, costing $440,942 or more than 1/2 of the total user charge, as shown in Table 20. Nearly all of this cost would have been assessed on shipments locking through to destinations outside of the District. In Table 21 the $.02/gallon charge would have meant $218,140 cost to miscellaneous products movement, most of it on receipts originating from outside District. For coal, Table 22 shows a $134,359 cost at $.02/gallon in 1975, most of it on receipts from extradistrict origins.

LOCKAGE CONSIDERATIONS

The trip/lockage requirements for barged traffic on the St. Paul District waterways was calculated using the data on barge requirements. The lockage requirements presented below are the minimum possible outcomes given the

volume projections for the baseline case and the various scenarios. All lockages were assumed to be double lockages of 15 barges except for lockages of dedicated tows made up of eight barges (intra-district traffic only) and at Lock and Dam 1 where tows consisted of two barges. Trips on the Minnesota River were computed using four barges per tow. Furthermore, the requirements for raw farm products reflect an adjustment made to reduce the number of empty barge lockages by assuming that empty dry cargo barges from upstream movement of coal and miscellaneous products are utilized for downstream farm product shipments whenever possible. The analysis focuses on Lock and Dams 1, 2, 3, 10, and the Minnesota River. Locks 4 through 9 normally have somewhat less traffic than Locks 3 and 10.

Raw Farm Products

For raw farm products, two tables are presented, providing a comparison of adjusted vs. unadjusted lockage requirements. The unadjusted lockages show the total requirements when empty dry cargo barges must be shipped from upstream in order to accommodate each pool's farm product shipments. Table 23 contains the unadjusted figures, with 994 lockages required at Lock and Dam 10 in the baseline case. However, after adjusting for the potential available empty dry cargo barges used for other commodities, Table 24 indicates that only 770 lockages will be required in the baseline case at Lock and Dam 10. The actual requirement will probably be between the two tables.

Table 24 is pertinent to the discussion of lockage requirements for raw farm products. In 1975, 322 lockages were required at Lock and Dam 10 for shipments of raw farm products. In 1985, 448 additional lockages will be required in the baseline case for these products. The biggest increase, how-

ever, is projected for the Minnesota River where the commodity group required 802 trips in 1975 and will require an additional 1230 trips in the baseline case for raw farm products. Scenario 1A calls for a further 1000 trips for raw farm products in the Minnesota River over the 1985 baseline case. This would raise the total required for raw farm products on the Minnesota River to 3050 trips. At Lock and Dam 2, 478 more raw farm products lockages are required under Scenario 1A than in the baseline case, and at Lock and Dam 10 the figure is 496 more lockages for raw farm products. The number of lockages required at Lock and Dam 10 will then be more than 1200 for Scenario 1A, and at Lock and Dam 2 there will be about 1100 lockages for farm products required in 1985. In Scenario 1B, the Minnesota River is projected to require more than 1000 trips for raw farm products, while all locks shown would actually require less lockages than in 1975 for farm products.

Coal

Total lockages required for coal at each lock were composed of the lockages required for downbound western coal movements, an equal number of lockages of upbound empty barges for western coal and the number of lockages required to bring midwestern coal up river. It was assumed that empty midwestern coal barges were cleaned and used to backhaul other commodities. An exception to this is at Lock and Dam 1, where it is assumed that midwestern coal barges emptied in Minneapolis would be used for the downbound coal movement when possible.

The lockage requirements for coal barges appear in Table 25. For the 1985 baseline case, nearly 700 lockages will be required at Lock and Dam 1, most of them for western coal barges. This is about 1/2 the 1975 total.

Similarly, for the Minnesota River, about 500 trips will be required, mostly for western coal. The 1985 baseline case is slightly less than 1975. Other locks shown in the table, Lock and Dam 2, Lock and Dam 3, and Lock and Dam 10, will have 335,202 and 224 lockages for the 1985 baseline case, respectively. At Lock and Dam 2, the baseline projection calls for a 50 percent increase in the number of lockages required for 1975. Nearly all of these lockages are required for western coal. Only Lock and Dam 10 will require more baseline lockages for midwestern than for western coal. Lock and Dam 3 and Lock and Dam 10 will register only mild increases from 1975 to 1985 in baseline lockages required for coal.

The largest potential bottlenecks from projected coal barges occur in Scenario 2 and Scenario 4. Any analysis of barge activity in the Twin Cities is quite sensitive to the assumptions about locations of 1985 rail to barge coal transfer facilities. Existing coal transfer facilities in the Twin Cities cannot handle the volumes of western coal required under Scenario 2 without capital improvements [4]. Existing permits and state and federal air quality regulations may preclude expansion of coal handling facilities and require rail to barge coal transfers to take place at locations further downstream. This would have the effect of reducing congestion at Locks 1, 2, and 3 and probably reduce fleeting needs in the Twin Cities metro area.

Under Scenario 2 and Scenario 4 assumptions, coal barge traffic at Lock and Dam 1 would increase by 285 percent over the projected 1985 baseline case, requiring 2658 lockages. Minnesota River traffic would remain about the same. Double lockages at Lock and Dam 2 would be about 8-1/2 times the baseline coal case in 1985, and single lockages would be the same as in the baseline scenario. Six times more coal lockages would be required at Lock and Dam 3.

Lock and Dam 10 coal lockages would be 235 percent greater than the 1985 baseline projections.

In Scenario 3, coal traffic by barge is projected at about the same level as for the baseline case for locks above Pool 5. At Lock and Dam 10 the projections call for lockages of coal barges in Scenarios 3 and 5 at 227 percent of the 1975 level, and 187 percent of the 1985 baseline case.

Miscellaneous Products

Table 26A compares trip/lockage requirements of 1975 and 1985 barge movement for miscellaneous dry cargo barges. Liquid tank requirements are presented in Table 26B. Lock and Dam 1 will require over 700 lockages for miscellaneous products in 1985, 644 for dry cargo. The projected dry cargo lockages are 44 percent greater than 1975 levels. The Minnesota River will handle an additional 88 dry cargo lockages in 1985, a 57 percent increase, with no increase projected for lockages of liquid tank barges. Lock and Dam 2 is projected to increase dry cargo lockages by 86 percent to 177 lockages in 1985, with 198 liquid tank barge lockages required. Lock and Dam 10 had 105 dry cargo and 228 liquid tank lockages in 1975, and is projected to increase the former to 198 and the latter to 258 required lockages in 1985.

All Commodities

The trip-lockage requirements for both shipments and receipts and for all commodity classifications are presented in Table 27. For the 1985 baseline case, the largest number of trips will occur in the Minnesota River. Lock and Dam 1 will require about 1700 lockages for all commodities in the baseline case, down from 2200 in 1975. For Lock and Dam 2, Lock and Dam 3,

and Lock and Dam 10, the largest increase in lockage requirements for the baseline case will occur at Lock and Dam 10. The 1450 lockages projected for the baseline case at Lock and Dam 10 are 610 greater than the 1975 requirements. Lock and Dam 2 will increase total lockage requirements for the baseline case from 526 to 1360, and Lock and Dam 3 from 464 to 1204 lockages.

Total trip/lockage requirements for Scenarios 1A and 1B are also presented in Table 27. Under Scenario 1A, the Minnesota River requires 1018 additional trips than in the baseline projection, bringing the total trips required to 3828. In 1B, the Minnesota River requirements are 1014 less than the baseline case, or 1796 in total. Under 1A, the requirement for lockages at Lock and Dam 10 is nearly 2000 lockages in 1985. This is about 500 greater than the baseline case. Lock and Dam 1 is close behind Lock and Dam 10 in Scenario 1A with 1832 lockage requirements, up 140 over the baseline projection. The total lockages for Lock and Dam 2 and Lock and Dam 3 in Scenario 1A are the least of the locks shown, with 1700 for Lock and Dam 2 and 1500 for Lock and Dam 3. Under Scenario 1B, the Lock and Dam 1 lockage requirements are 142 less than the baseline case at 1550. None of the other locks is projected to require more than 1000 lockages under Scenario 1B in 1985.

Scenario 2 calls for 3660 lockages at Lock and Dam 1, 1492 greater than in 1975, and 1968 above the baseline figure for 1985. Trips in the Minnesota River are projected in Scenario 2 at the same level as in the baseline case. Locks and Dams 2 and 3 will require 1050 lockages above their baseline levels, and Lock and Dam 10 will require 526 additional lockages. Compared to 1975 lockage requirements, the greatest increase in lockages under Scenario 2 will occur at Lock and Dam 2, although Lock and Dam 3 and 1 also have large increases. Under Scenario 3, the lockage requirements for

Lock and Dam 3 are identical to the baseline case because the increase in midwestern coal movements only increases traffic from Pool 10 through Pool 5.

Scenario 4 will require 3800 lockages at Lock and Dam 1, 2000 more than Scenario 5, which is projected at only 140 more than the baseline case. The trips required on the Minnesota River for Scenarios 4 and 5 are identical at 1018 greater than the baseline projection. Locks 2, 3, and 10 are all projected to require fewer lockages in Scenario 5 than in Scenario 4. The differences are 1050 lockages each at Lock and Dam 2 and 3, and 526 lockages each at Lock and Dam 10. Among these three locks, Scenario 4 will require more lockages at Lock and Dam 2 than at 3 or 10, while Scenario 5 will require more at Lock and Dam 10 than at 2 or 3.

Scenario 4 places many more requirements on all the District locks than any other scenario. On the other hand, in terms of lockage requirements, Scenario 5 is much closer to the baseline case, differing only by the increased coal barge traffic at Locks 5 through 10.

Total Utilizations

Table 28 shows the projected time spent in lockages for the month of August for the various scenarios. The lock utilization as a percentage of the total hours in a month is also given. The lock utilization figure includes not only the commercial requirements discussed above, but also anticipated increases in recreational craft lockages. It should be emphasized that the total time computed for lockages of commercial tows is the minimum possible under current USCOE locking procedures. It was assumed that all barges were full, that all single tows had eight barges and that all double tows had 15 barges (empty or full). Consequently, commercial lockages required less time

for the 1985 baseline projection than for 1977 because more lockages were required in 1977 due to fewer barges per lockage. An estimate of the 1985 lockage utilization by recreational craft was obtained by increasing the 1977 recreational craft locking time at each lock by 50 percent [11].

In August 1977, the greatest utilization occurred at Lock and Dam 2 at 51.3 percent capacity. This was the site of the largest load of commercial traffic. Lock and Dam 3 had the most recreational utilization in 1977. Among the projections made for 1985, the highest percentage utilization in all cases occurs at Lock and Dam 2. In Scenario 4, projected traffic at this lock would actually require more hours than are available in a month. Lock and Dam 2 is almost at 100 percent capacity in Scenario 2, and is at 3/4 capacity in Scenarios 1A and 5. In the baseline case, Lock and Dam 2 total utilization is projected at 65.6 percent of capacity. This is the most severe potential bottleneck in the District.

SUMMARY AND CONCLUSIONS

1. The projected 1985 baseline volumes are considered the most likely level of barge shipments. This results in an increase in total barge shipments of 59 percent over 1975 levels, primarily in raw farm products. An analysis of the baseline scenario indicates no major new problems although existing problems such as fleeting area pressures and locking queue time will intensify due to the increased traffic. Although, under most circumstances, the requirements for fleeting do not increase as rapidly as traffic, the disproportionate increase in downbound farm product traffic under the baseline case and Scenarios 1A, 2, 4, and 5 will undoubtedly require additional barge storage areas, especially during weak grain markets. The increased farm product export scenario (1A)

presents problems similar to those of the baseline case, but of a greater magnitude. On the other hand, traffic in the low farm product export scenario (1B) is at about the same level as in 1975.

2. The effect of increased coal movements by barge will depend on whether the coal is western coal moving south or midwestern coal coming north. Major movements of western coal will require a greatly increased number of lockages and additional barges as well as fleeting areas. Because of these requirements, it is recommended that any major new western coal transfer facility be located below Lock and Dam 3. On the other hand, upbound midwestern coal movements are generally complimentary with downbound grain movements if adequate cleaning facilities are available.

3. Under existing (1975) traffic patterns, revenues from the proposed fuel tax would amount to $ .8 million at the $.02/gallon level and $2.4 million at a $.06/gallon level for all commodities shipped into or out of the St. Paul District. User charges at a $.02 to $.08 level will increase costs to shippers but should not cause a significant reduction in barge shipments. Grain shipments would have accounted for over half the total fuel tax revenues.

4. Lock congestion at Lock and Dam 2 may become a serious problem in the near future. Under Scenario 4, the required time for projected August lockages exceeded hours in the month. It is recommended that detailed study of commercial and recreational lockage requirements of both Lock and Dam 2 and Lock and Dam 3 be undertaken.

TABLE 1

Raw Farm Products Shipments by Pool
(short tons)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	467,979	409,525	614,288	204,763
Minnesota River	2,317,247	5,886,583	8,829,876	2,943,293
St. Paul	1,544,300	1,900,113	2,850,171	950,058
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	309,414	486,474	729,712	243,238
Pool 5	0	0	0	0
Pool 6	347,879	922,910	1,384,365	461,455
Pool 8	80,526	236,611	354,917	118,306
Pool 9	0	0	0	0
Pool 10	588,472	936,406	1,404,610	468,204
TOTAL	5,655,817	10,778,622	16,167,939	5,389,317

TABLE 2

Raw Farm Products Barge Requirements
(1450 tons per barge)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	326	283	424	142
Minnesota River	1,599	4,060	6,090	2,031
St. Paul	1,066	1,311	1,966	655
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	214	337	504	168
Pool 5	0	0	0	0
Pool 6	240	637	955	318
Pool 8	56	164	245	83
Pool 9	0	0	0	0
Pool 10	406	646	968	323
TOTAL	3,907	7,438	11,152	3,720

TABLE 3

Midwestern Coal Receipts by Pool
(tons)

	1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
Minneapolis	28,350	250,000	250,000	250,000
Minnesota River	253,379	250,000	250,000	250,000
St. Paul	248,746	400,000	400,000	400,000
Pool 2	0	0	0	0
Pool 3	1,145,312	500,000	500,000	500,000
Pool 4	12,032	50,000	50,000	50,000
Pool 5	396,783	250,000	250,000	4,530,000
Pool 6	1,478	50,000	50,000	50,000
Pool 8	30,047	50,000	50,000	50,000
Pool 9	871,489	1,300,000	1,300,000	1,300,000
Pool 10	0	25,000	25,000	25,000
TOTAL St. Paul District	2,987,616	3,125,000	3,125,000	7,405,000
Pool 11				4,280,000 add.

TABLE 4

Western Coal Shipments by Pool
(tons)

	1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
Minneapolis	1,935,331	1,000,000	3,854,000	1,000,000
Minnesota River	-603,537[a]	-600,000	-600,000	-600,000
St. Paul	373,203	2,000,000	10,562,000	2,000,000
Pool 2	0	0	0	0
Pool 3	-543,893	-900,000	-900,000	-900,000
Pool 4	0	0	0	0
Pool 5	-214,817	-200,000	-5,908,000	-200,000
Pool 6	0	-20,000	-20,000	-20,000
Pool 8	0	0	0	0
Pool 9	-431,596	-400,000	-400,000	-400,000
Pool 10	0	0	0	0
TOTAL Western Coal Shipments	2,308,534	3,000,000	14,416,000	3,000,000
TOTAL Out of District Shipments	514,691	880,000	6,588,000	880,000

[a]Minus sign indicates net receipts.

TABLE 5A

Barges from Midwestern Coal Receipts
(1450 tons per barge)

	1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
Minneapolis	20	172	172	172
Minnesota River	175	172	172	172
St. Paul	172	276	276	276
Pool 2	0	0	0	0
Pool 3	790	345	345	345
Pool 4	8	34	34	34
Pool 5	274	172	172	3,124
Pool 6	1	34	34	34
Pool 8	21	34	34	34
Pool 9	601	897	897	897
Pool 10	0	17	17	17
TOTAL Barges from Out of District Locations	2,062	2,153	2,153	5,105

TABLE 5B

Barge Requirements for Western Coal Shipments
(1450 tons per barge)

	1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
Minneapolis	1,335	690	2,658	690
Minnesota River	-416[a]	-414	-414	-414
St. Paul	257	1,379	7,284	1,379
Pool 2	0	0	0	0
Pool 3	-375	-621	-621	-621
Pool 4	0	0	0	0
Pool 5	-148	-138	-4,074	-138
Pool 6	0	-14	-14	-14
Pool 8	0	0	0	0
Pool 9	-298	-276	-276	-276
Pool 10	0	0	0	0
TOTAL Barges Loaded in District	1,592	2,069	9,942	2,069
TOTAL Barges to Out of District Locations	355	606	4,543	606

[a] Minus sign indicates net number of barges unloaded in pool.

TABLE 6

Total Coal Shipments by Pool
(tons)

	1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
Minneapolis	1,935,331	1,000,000	3,854,000	1,000,000
Minnesota River	0	0	0	0
St. Paul	373,203	2,000,000	10,562,000	2,000,000
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	2,308,534	3,000,000	14,416,000	3,000,000

TABLE 7

Total Coal Receipts by Pool
(tons)

	1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
Minneapolis	28,350	250,000	250,000	250,000
Minnesota River	856,916	850,000	850,000	850,000
St. Paul	248,746	400,000	400,000	400,000
Pool 2	0	0	0	0
Pool 3	1,689,205	1,400,000	1,400,000	1,400,000
Pool 4	12,032	50,000	50,000	50,000
Pool 5	611,600	450,000	6,158,000	4,730,000
Pool 6	1,478	70,000	70,000	70,000
Pool 8	30,047	50,000	50,000	50,000
Pool 9	1,303,085	1,700,000	1,700,000	1,700,000
Pool 10	0	25,000	25,000	25,000
TOTAL	4,781,459	5,245,000	10,953,000	9,525,000

TABLE 8

Barge Requirements for Coal Shipments
(1450 tons per barge)

	1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
Minneapolis	1,335	690	2,658	690
Minnesota River	0	0	0	0
St. Paul	257	1,379	7,284	1,379
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	1,592	2,069	9,942	2,069

TABLE 9

Barges from Coal Receipts
(1450 tons per barge)

	1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
Minneapolis	20	172	172	172
Minnesota River	591	586	586	586
St. Paul	172	276	276	276
Pool 2	0	0	0	0
Pool 3	1,165	966	966	966
Pool 4	8	34	34	34
Pool 5	422	310	4,246	3,262
Pool 6	1	48	48	48
Pool 8	21	34	34	34
Pool 9	899	1,173	1,173	1,173
Pool 10	0	17	17	17
TOTAL	3,299	3,616	7,552	6,568

TABLE 10A

Miscellaneous Products Shipments and Dry Cargo Barge Requirements by Pool

	1975		Projected 1985 Baseline	
	Shipments (tons)	Barge Requirements (1450 tons per barge)	Shipments (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	115,053	80	295,362	205
Minnesota River	85,838	60	255,368	177
St. Paul	251,243	174	541,425	375
Pool 2	1,229,374	848	1,159,897	800
Pool 3	1,575	1	1,186	1
Pool 4	44,911	31	149,777	103
Pool 5	0	0	0	0
Pool 6	4,783	4	15,951	11
Pool 8	1,530	1	1,152	1
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	1,734,307	1,199	2,420,118	1,673

TABLE 10B

Miscellaneous Products Shipments and Tank Barge Requirements by Pool

	1975		Projected 1985 Baseline	
	Shipments (tons)	Barge Requirements (1450 tons per barge)	Shipments (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	0	0	0	0
St. Paul	14,427	11	14,427	11
Pool 2	1,325,106	914	1,325,106	914
Pool 3	3,903	3	3,903	3
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	1,343,436	928	1,343,436	928

TABLE 11A

Miscellaneous Products Receipts and Dry Cargo Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	528,153	365	634,568	438
Minnesota River	348,703	241	432,249	298
St. Paul	1,052,445	726	1,145,816	791
Pool 2	252,427	175	223,584	154
Pool 3	1,976	1	1,738	2
Pool 4	47,017	33	71,971	50
Pool 5	0	0	0	0
Pool 6	129,473	90	157,293	108
Pool 8	128,075	89	166,848	116
Pool 9	0	0	0	0
Pool 10	22,602	16	40,860	28
TOTAL	2,510,871	1,736	2,874,927	1,985

TABLE 11B

Miscellaneous Products Receipts and Tank Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	83,118	59	102,217	72
Minnesota River	107,438	74	109,706	76
St. Paul	1,395,294	964	1,374,477	949
Pool 2	394,705	274	466,682	324
Pool 3	6,318	5	6,107	4
Pool 4	532	1	630	1
Pool 5	22,527	16	54,316	38
Pool 6	95,347	66	94,116	66
Pool 8	100,741	70	120,741	84
Pool 9	36,168	25	87,207	60
Pool 10	0	0	0	0
TOTAL	2,242,188	1,554	2,416,199	1,674

TABLE 12

Miscellaneous Commodities as Percentage of 1985 Miscellaneous Total; Receipts and Shipments

Miscellaneous Commodity	% of 1985 Miscellaneous Total	
	Receipts	Shipments
Sand, Gravel, and Rock	24	27
Coke, Pitch, and Asphalt	5	7
Processed Agricultural Products	2	29
Building Cement	4	--[b]
Iron and Steel	3	--
Ores, Metal, and Scrap	--	1
Non-Metallic Minerals	15	--
Chemical Products	7	--
Petroleum Products	30	36
--Gasoline	17	26
--Distillate Fuel Oil	6	9
--Residual Fuel Oil	2	1
--Jet Fuel & Kerosene	2	--
--Crude Petroleum	4	--
Fertilizer	9	--
--Nitrogenous	2	--
--Phosphatic	2	--
--Other	5	--
	99[a]	100

[a] The total percentage does not equal 100 due to errors in rounding.

[b] A dash indicates no projection has been made for a commodity movement.

TABLE 13

Total Shipments by Pool
(tons)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B	1985 Scenario 2	1985 Scenario 3	1985 Scenario 4	1985 Scenario 5
Minneapolis	2,518,363	1,704,887	1,909,650	1,500,125	4,558,887	1,704,887	4,763,650	1,909,650
Minnesota River	2,403,085	6,141,951	9,085,244	3,198,661	6,141,951	6,141,951	9,085,244	9,085,244
St. Paul	2,183,173	4,455,965	5,406,023	3,505,910	13,017,965	4,455,965	13,968,023	5,406,023
Pool 2	2,554,480	2,485,003	2,485,003	2,485,003	2,485,003	2,485,003	2,485,003	2,485,003
Pool 3	5,478	5,089	5,089	5,089	5,089	5,089	5,089	5,089
Pool 4	354,325	636,251	879,489	393,015	636,251	636,251	879,489	879,489
Pool 5	0	0	0	0	0	0	0	0
Pool 6	352,662	938,861	1,400,316	477,406	938,861	938,861	1,400,316	1,400,316
Pool 8	82,056	237,763	356,069	119,458	237,763	237,763	356,069	356,069
Pool 9	0	0	0	0	0	0	0	0
Pool 10	588,472	936,406	1,404,610	468,204	936,406	936,406	1,404,610	1,404,610
TOTAL	11,042,094	17,542,176	22,931,493	12,152,871	28,958,176	17,542,176	34,347,493	22,931,493

TABLE 14

Volume Shares by Commodity Group

TOTAL SHIPMENTS

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B	1985 Scenario 2	1985 Scenario 3	1985 Scenario 4	1985 Scenario 5
Raw Farm Products	51	61	71	44	37	61	47	71
Misc. Products	28	21	16	31	13	21	11	16
Coal	21	18	13	25	50	18	42	13
TOTAL	100	100	100	100	100	100	100	100

TOTAL RECEIPTS

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B	1985 Scenario 2	1985 Scenario 3	1985 Scenario 4	1985 Scenario 5
Raw Farm Products	0	0	0	0	0	0	0	0
Misc. Products	50	50	50	50	33	36	33	36
Coal	50	50	50	50	67	64	67	64
TOTAL	100	100	100	100	100	100	100	100

TABLE 15

Barge Requirements for All Commodity Shipments
(1450 tons per barge)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B	1985 Scenario 2	1985 Scenario 3	1985 Scenario 4	1985 Scenario 5
Minneapolis	1,741	1,178	1,319	1,037	3,146	1,178	3,287	1,319
Minnesota River	1,659	4,237	6,267	2,208	4,237	4,237	6,267	6,267
St. Paul	1,508	3,076	3,731	2,420	8,981	3,076	9,636	3,731
Pool 2	1,762	1,714	1,714	1,714	1,714	1,714	1,714	1,714
Pool 3	4	4	4	4	4	4	4	4
Pool 4	245	440	607	271	440	440	607	607
Pool 5	0	0	0	0	0	0	0	0
Pool 6	244	648	966	329	648	648	966	966
Pool 8	57	165	246	84	165	165	246	246
Pool 9	0	0	0	0	0	0	0	0
Pool 10	406	646	968	323	646	646	968	968
TOTAL	7,626	12,108	15,822	8,390	19,981	12,108	23,695	15,822

TABLE 16

Total Receipts by Pool
(tons)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B	1985 Scenario 2	1985 Scenario 3	1985 Scenario 4	1985 Scenario 5
Minneapolis	639,621	986,785	986,785	986,785	986,785	986,785	986,785	986,785
Minnesota River	1,313,057	1,391,955	1,391,955	1,391,955	1,391,955	1,391,955	1,391,955	1,391,955
St. Paul	2,696,485	2,920,293	2,920,293	2,920,293	2,920,293	2,920,293	2,920,293	2,920,293
Pool 2	647,132	690,266	690,266	690,266	690,266	690,266	690,266	690,266
Pool 3	1,697,499	1,407,845	1,407,845	1,407,845	1,407,845	1,407,845	1,407,845	1,407,845
Pool 4	59,581	122,601	122,601	122,601	122,601	122,601	122,601	122,601
Pool 5	634,127	504,316	504,316	504,316	6,212,316	4,784,316	6,212,316	4,784,316
Pool 6	226,298	321,409	321,409	321,409	321,409	321,409	321,409	321,409
Pool 8	258,863	337,589	337,589	337,589	337,589	337,589	337,589	337,589
Pool 9	1,339,253	1,787,207	1,787,207	1,787,207	1,787,207	1,787,207	1,787,207	1,787,207
Pool 10	22,602	65,860	65,860	65,860	65,860	65,860	65,860	65,860
TOTAL	9,534,518	10,536,126	10,536,126	10,536,126	16,224,126	14,816,126	16,244,126	14,816,126

TABLE 17

Barges from All Commodity Receipts
(1450 tons per barge)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B	1985 Scenario 2	1985 Scenario 3	1985 Scenario 4	1985 Scenario 5
Minneapolis	442	682	682	682	682	682	682	682
Minnesota River	906	960	960	960	960	960	960	960
St. Paul	1,862	2,016	2,016	2,016	2,016	2,061	2,016	2,016
Pool 2	449	478	478	478	478	478	478	478
Pool 3	1,171	972	972	972	972	972	972	972
Pool 4	42	85	85	85	85	85	85	85
Pool 5	438	348	348	348	4,284	3,300	4,284	3,300
Pool 6	157	222	222	222	222	222	222	222
Pool 8	180	234	234	234	234	234	234	234
Pool 9	924	1,233	1,233	1,233	1,233	1,233	1,233	1,233
Pool 10	16	45	45	45	45	45	45	45
TOTAL	6,587	7,275	7,275	7,275	11,211	10,227	11,211	10,227

TABLE 18

1975 User Charges

TOTAL PRODUCT MOVEMENTS

	2¢ per gallon	4¢ per gallon	6¢ per gallon	8¢ per gallon
Shipments to Out District Ports	$ 503,151.22	$1,006,302.43	$1,509,453.65	$2,012,604.86
Receipts from Out District Ports	280,215.22	560,430.44	840,645.66	1,120,860.88
Intra-District Movements	10,074.39	20,148.78	30,223.17	40,297.56
TOTAL	$ 793,440.83	$1,586,881.65	$2,380,322.48	$3,173,763.30

TABLE 19

1975 User Charge Analysis

COAL, RAW FARM PRODUCTS AND MISCELLANEOUS PRODUCTS

Total Ton Mile Shipments from St. Paul District Ports:		
Coal	458,240,149	
Raw Farm Products	8,811,352,785	
Miscellaneous Products	994,919,210	
TOTAL		10,264,512,144
Total Ton Mile Receipts into St. Paul District Ports:		
Coal	2,371,555,089	
Raw Farm Products	9,281,955	
Miscellaneous Products	3,424,955,180	
TOTAL		5,805,792,224
Intra-District Shipments:		
From Minneapolis	130,385,942	
From Minnesota River	1,608,519	
From St. Paul	20,755,803	
From Pool 2	48,096,965	
From Pool 4	298,320	
From Pool 6	267,794	
From Pool 8	74,460	
		201,487,803
Ton Mile Shipments to Ports Outside District		10,063,024,341
Ton Mile Receipts from Ports Outside District		5,604,304,421
User Charge - 2¢ per gallon	$ 503,151.22	
	280,215.22	
	10,074.39	
		$ 793,440.83

TABLE 20. 1975 User Charge Analysis

RAW FARM PRODUCTS

Total Ton Mile Shipments from St. Paul District Ports:		
Corn	4,519,408,347	
Wheat	3,069,567,771	
Soybeans	1,067,208,724	
Oats	155,167,943	
TOTAL		8,811,352,785
Total Ton Mile Receipts into St. Paul District Ports:		
Corn	4,691,100	
Wheat	4,575,752	
Soybeans	15,103	
Oats	0	
TOTAL		9,281,955
Intra-District Shipments		
From Minneapolis	176,250	
From Minnesota River	623,386	
From St. Paul	702,484	
From Pool 4	298,320	
		1,800,440
Ton Mile Shipments to Ports Outside District		8,809,552,345
Ton Mile Receipts from Ports Outside District		7,481,515
User Charge - 2¢ per gallon	$440,477.61	
	374.08	
	90.02	
		$ 440,941.71

TABLE 21

1975 User Charge Analysis

MISCELLANEOUS PRODUCTS

Total Ton Mile Shipments from St. Paul District Ports		994,919,210
Total Ton Mile Receipts into St. Paul District Ports		3,424,955,180
Intra-District Shipments:		
From St. Paul	8,804,777	
From Pool 2	48,096,965	
From Pool 6	96,672	
From Pool 8	74,460	
		57,072,874
Ton Mile Shipments to Ports Outside District		937,846,336
Ton Mile Receipts from Ports Outside District		3,367,882,306
User Charge - 2¢ per gallon	$ 46,892.32	
	168,394.11	
	2,853.65	
		$ 218,140.08

TABLE 22

1975 User Charge Analysis

COAL

Total Ton Mile Shipments from St. Paul District Ports		458,240,149
Total Ton Mile Receipts into St. Paul District Ports		2,371,555,089
Intra-District Shipments		
From Minneapolis	130,209,692	
From Minnesota River	985,133	
From St. Paul	11,248,542	
From Pool 6	171,122	
	142,614,489	
Ton Mile Shipments to Ports Outside District		315,625,660
Ton Mile Receipts from Ports Outside District		2,228,940,600
User Charge - 2¢ per gallon	$ 15,781.29	
	111,447.03	
	7,130.73	
	$ 134,359.05	

TABLE 23

Trip/Lockage Requirements for Raw Farm Products Barges

		1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Lock & Dam 1	Up River (loaded)	1	0	0	0
(2 barges)	(empty)	163	143	213	72
	Down River (loaded)	164	143	213	72
TOTAL Lockages		328	286	426	144
Minnesota River	Up River (loaded)	1	0	0	0
(4 barges)	(empty)	400	1,016	1,525	509
	Down River (loaded)	401	1,016	1,525	509
TOTAL Trips		802	2,032	3,050	1,018
Lock & Dam 2	Up River (loaded)	2	0	0	0
(15 barges)	(empty)	199	378	567	190
	Down River (loaded)	201	378	567	190
TOTAL Lockages		402	756	1,134	380
Lock & Dam 10	Up River (loaded)	2	0	0	0
(15 barges)	(empty)	257	497	745	250
	Down River (loaded)	259	497	745	250
TOTAL Lockages		518	994	1,490	500

TABLE 24

Trip/Lockage Requirements for Raw Farm Products Barges (Adjusted)

		1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Lock & Dam 1	Up River (loaded)	1	0	0	0
(2 barges)	(empty)	163	143	213	72
	Down River (loaded)	164	143	213	72
TOTAL Lockages		328	286	426	144
Minnesota River	Up River (loaded)	1	0	0	0
(4 barges)	(empty)	400	1,016	1,525	509
	Down River (loaded)	401	1,016	1,525	509
TOTAL Trips		802	2,032	3,050	1,018
Lock & Dam 2	Up River (loaded)	2	0	0	0
(15 barges)	(empty) 1/	128	272	461	84
	Down River (loaded)	201	378	567	190
TOTAL Lockages		331	650	1,028	274
Lock & Dam 10	Up River (loaded)	2	0	0	0
(15 barges)	(empty) 1/	61	273	521	26
	Down River (loaded)	259	497	745	250
TOTAL Lockages		322	770	1,266	276

1/ Adjusted to reflect availability of empty dry cargo barges used for other commodities (coal and miscellaneous dry cargo) in upstream movement.

TABLE 25

Trip/Lockage Requirements for Coal Barges

		1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
Lock & Dam 1					
(2 barges)	Midwestern up	10	86	86	86
	Western down	667	345	1,329	345
	Western up (empties)	657	259	1,243	259
TOTAL Lockages		1,334	690	2,658	690
Minnesota River					
(4 barges)	Midwestern up	44	43	43	43
(4 barges)	Midwestern down (empties)	44	43	43	43
(2 barges)	Western down	225	207	207	207
(2 barges)	Western up (empties)	225	207	207	207
TOTAL 1 way trips		538	500	500	500
Lock & Dam 2					
(15 barges)	Midwestern up	24	41	41	41
	Midwestern down	--	--	--	--
	Western down (in district)	29	29	291	29
	Western down (out district)	24	40	303	40
	Western up (in district) (empties)	29	29	291	29
	Western up (out district) (empties)	24	40	303	40
(8 barges) St.	Western down	47	78	78	18
(8 barges) Croix	Western up (empties)	47	78	78	78
TOTAL Double Lockages		130	179	1,344	179
TOTAL Single Lockages		94	156	156	156
Lock & Dam 3					
(15 barges	Midwestern up	77	64	64	64
(15 barges	Midwestern down	--	--	--	--
(15 barges)	Western down (in district)	29	29	291	29
	Western down (out district)	24	40	303	40

CONTINUED

TABLE 25. Continued

		1975	1985 Baseline	1985 Scenario 2	1985 Scenario 3
(15 barges)	Western up (in district) (empties)	29	29	291	29
	Western up (out district) (empties)	24	40	303	40
		183	202	1,252	202
Lock & Dam 10					
(15 barges)	Midwestern up	137	144	144	340
(15 barges)	Midwestern down	--	--	--	--
(15 barges)	Western down	24	40	303	40
(15 barges)	Western up (empties)	24	40	303	40
		185	224	750	420

TABLE 26A

Trip/Lockage Requirements for Miscellaneous Products Dry Cargo Barges

		1975	1985 Baseline
Lock & Dam 1	Up River (loaded)	183	219
(2 barges)	(empty)	40	103
	Down River (loaded)	40	103
	(empty)	183	219
TOTAL Lockages		446	644
Minnesota River	Up River (loaded)	61	75
(4 barges)	(empty)	15	45
	Down River (loaded)	15	45
	(empty)	61	75
TOTAL Lockages		152	240
Lock & Dam 2	Up River (loaded)	47	65
(15 barges)	(empty)	24	56
	Down River (loaded)	24	56
	(empty)	0	0
TOTAL Lockages		95	177
Lock & Dam 10	Up River (loaded)	59	80
(15 barges)	(empty)	23	59
	Down River (loaded)	23	59
	(empty)	0	0
TOTAL Lockages		105	198

TABLE 26B

Trip/Lockage Requirements for Miscellaneous Products Tank Barges

		1975	1985 Baseline
Lock & Dam 1	Up River (loaded)	30	36
(2 barges)	(empty)	0	0
	Down River (loaded)	0	0
	(empty)	30	36
TOTAL Lockages		60	72
Minnesota River	Up River (loaded)	19	19
(4 barges)	(empty)	0	0
	Down River (loaded)	0	0
	(empty)	19	19
TOTAL Lockages		38	38
Lock & Dam 2	Up River (loaded)	75	82
(8 barges)	(empty)	17	17
	Down River (loaded)	17	17
	(empty)	75	82
TOTAL Lockages		184	198
Lock & Dam 10	Up River (loaded)	96	111
(8 barges)	(empty)	18	18
	Down River (loaded)	18	18
	(empty)	96	111
TOTAL Lockages		228	258

TABLE 27

Total Trip/Lockage Requirements

		1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B	1985 Scenario 2	1985 Scenario 3	1985 Scenario 4	1985 Scenario 5
Lock & Dam 1 (2 barges)	Up River (loaded)	881	600	600	600	1,584	600	1,584	600
	(empty)	203	246	316	175	246	246	316	316
	Down River (loaded)	204	246	316	175	246	246	316	316
	(empty)	880	600	600	600	1,584	600	1,584	600
TOTAL Lockages		2,168	1,692	1,832	1,550	3,660	1,692	3,800	1,832
Minnesota River (4 barges)	Up River (loaded)	350	344	344	344	344	344	344	344
	(empty)	415	1,061	1,570	554	1,061	1,061	1,570	1,570
	Down River (loaded)	416	1,061	1,570	554	1,061	1,061	1,570	1,570
	(empty)	349	344	344	344	344	344	344	344
TOTAL Trips		1,530	2,810	3,828	1,796	2,810	2,810	3,828	3,828
Lock & Dam 2 (15 dry cargo, 8 tank barges)	Up River (loaded)	258	335	335	335	860	335	860	335
	(empty)	159	345	534	157	345	345	534	534
	Down River (loaded)	242	451	640	263	451	451	640	640
	(empty)	175	229	229	229	754	229	754	229
TOTAL Lockages		834	1,360	1,738	984	2,410	1,360	2,788	1,738
Lock & Dam 3 (15 dry cargo, 8 tank barges)	Up River (loaded)	264	280	280	280	805	280	805	280
	(empty)	106	322	511	134	322	322	511	511
	Down River (loaded)	242	451	640	263	451	451	640	640
	(empty)	128	151	151	151	676	151	676	151
TOTAL Lockages		740	1,204	1,582	828	2,254	1,204	2,632	1,582
Lock & Dam 10 (15 dry cargo, 8 tank barges)	Up River (loaded)	328	375	375	375	638	571	638	571
	(empty)	92	350	598	103	350	154	598	402
	Down River (loaded)	300	574	822	327	574	574	822	822
	(empty)	120	151	151	151	414	151	414	151
TOTAL Lockages		840	1,450	1,946	956	1,976	1,450	2,472	1,946

TABLE 28

Time Spent in Lockages for the Month of August
(hours)

		1977 PMS[b]	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B	1985 Scenario 2	1985 Scenario 3	1985 Scenario 4	1985 Scenario 5
Lock & Dam 1	Recreational	107.7	161.6	161.6	161.6	161.6	161.6	161.6	161.6
	Commercial	191.8	132.0	141.8	120.9	284.9	132.0	294.8	141.8
	Total	299.5	293.6	303.4	282.5	446.5	293.6	456.4	303.4
Lock Utilization[a]		40.3	39.5	40.8	38.0	60.0	39.5	61.3	40.8
Lock & Dam 2	Recreational	153.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9
	Commercial	227.7	257.2	342.4	172.0	498.6	257.2	583.8	342.4
	Total	381.6	488.1	573.3	402.9	729.5	488.1	814.7	573.3
Lock Utilization[a]		51.3	65.6	77.1	54.2	98.1	65.6	109.5	77.1
Lock & Dam 3	Recreational	166.6	249.9	249.9	249.9	249.9	249.9	249.9	249.9
	Commercial	170.9	192.0	260.8	123.2	381.2	192.0	447.1	260.8
	Total	337.5	441.9	510.7	373.1	631.1	441.9	697.0	510.7
Lock Utilization[a]		45.4	59.4	68.6	50.1	84.8	59.4	93.7	68.6
Lock & Dam 10	Recreational	156.8	235.2	235.2	235.2	235.2	235.2	235.2	235.2
	Commercial	200.8	239.8	334.4	145.3	340.5	239.8	432.0	334.4
	Total	357.6	475.0	569.6	380.5	575.7	475.0	667.2	569.6
Lock Utilization[a]		48.1	63.8	76.6	51.1	77.4	63.8	89.7	76.6

[a]Lock utilization represents the percentage of time spent in the lockage out of 744 total hours in August.

[b]Data from U.S. Army Corps of Engineers Performance Monitoring System (PMS).

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APPENDIX A

1975 Actual Commodity Movements

Tables showing tonnages and ports of origin and destination for selected commodity movements in 1975 are presented in Appendix A. Tonnage figures are shown for 1975 receipts of coal, and for 1975 shipments of the following commodities: (1) corn; (2) wheat; (3) soybeans; (4) oats; (5) coal; (6) gasoline; (7) distillate fuel oil; and (8) sand, gravel, and rock.

APPENDIX A

TABLE A-1

Destination of 1975 Corn Shipments by Barge from St. Paul District Ports:

Port of Destination by Port of Origin

	Tons		
Minneapolis to:			
(302)[a] Pool 27	1,379		
(500) Florence	1,426		
(1330) Guntersville	4,317		
(2600) Mississippi River/Mobile Bay	1,494		
(2620) Mobile Harbor	4,381		
(1320) Wheeler Pool	1,623		
(405) New Orleans	18,944		
(410) Lower Mississippi 2	27,594		
(415) Baton Rouge	5,982		
(400) Lower Mississippi 1	7,548		
(2800) Vicksburg	2,977		
Subtotal beyond St. Paul District		77,665	
TOTAL Minneapolis Shipments			77,665
Minnesota River to:			
(1330) Guntersville	9,985		
(1345) Chattanooga	2,799		
(2725) Calcasieu Lake/Sabine	1,615		
(2740) Corpus Christi/W. End	23,279		
(2800) Vicksburg	3,071		
(2620) Mobile Harbor	17,374		
(410) Lower Mississippi 2	396,597		
(415) Baton Rouge	129,749		
(480) Memphis	4,021		
(405) New Orleans	344,252		
(400) Lower Mississippi 1	96,936		
Subtotal beyond St. Paul District		1,029,678	
TOTAL Minnesota River Shipments			1,029,678
St. Paul to:			
(302) Pool 27	1,492		
(2620) Mobile Harbor	34,157		
(410) Lower Mississippi 2	393,531		
(435) Lower Mississippi 5	2,613		
(480) Memphis	2,842		
(1330) Guntersville	12,907		
(415) Baton Rouge	62,940		
(400) Lower Mississippi 1	70,509		
(405) New Orleans	91,840		
Subtotal beyond St. Paul District		672,831	
TOTAL St. Paul Shipments			672,831

TABLE A-1 (continued)

Pool 4 to:			
(405) New Orleans	35,863		
(415) Baton Rouge	20,962		
(1330) Guntersville	4,222		
(2620) Mobile Harbor	4,400		
(1345) Chattanooga	1,462		
(1320) Wheeler Pool	1,424		
(410) Lower Mississippi 2	122,261		
(400) Lower Mississippi 1	79,686		
Subtotal beyond St. Paul District		270,280	
TOTAL Pool 4 Shipments			270,280
Pool 6 to:			
(1330) Guntersville	1,468		
(2620) Mobile Harbor	4,129		
(500) Florence	1,437		
(410) Lower Mississippi 2	206,836		
(415) Baton Rouge	1,613		
(405) New Orleans	33,987		
Subtotal beyond St. Paul District		249,470	
TOTAL Pool 6 Shipments			249,470
Pool 8 to:			
(326) Pool 15	1,523		
(410) Lower Mississippi 2	7,080		
(480) Memphis	1,370		
(415) Baton Rouge	20,723		
(405) New Orleans	13,791		
(400) Lower Mississippi 1	2,839		
Subtotal beyond St. Paul District		47,326	
TOTAL Pool 8 Shipments			47,326
Pool 10 to:			
(405) New Orleans	68,422		
(415) Baton Rouge	37,214		
(2800) Vicksburg	1,560		
(410) Lower Mississippi 2	318,176		
(400) Lower Mississippi 1	31,699		
Subtotal beyond St. Paul District		457,071	
TOTAL Pool 10 Shipments			457,071
TOTAL St. Paul District Shipments			2,804,321
Subtotal within District	0		
Subtotal out of District	2,804,321		

[a]Parenthesized numbers correspond to Port Equivalents (PE) as defined by the Inland Navigation Systems Analysis. The PE is included to eliminate any confusion associated

TABLE A-2

Destination of 1975 Wheat Shipments by Barge from St. Paul District Ports: Port of Destination by Port of Origin

	Tons		
Minneapolis to:			
(344)[a] Pool 6	1,410		
Subtotal within St. Paul District		1,410	
(304) St. Louis 2	35,301		
(301) St. Louis 1	4,434		
(302) Pool 27	34,156		
(480) Memphis	1,345		
(1320) Wheeler Pool	15,571		
(1330) Guntersville	2,787		
(1370) Knoxville	1,383		
(2600) Mississippi River/Mobile Bay	18,632		
(2620) Mobile Harbor	47,701		
(1345) Chattanooga	28,791		
(415) Baton Rouge	1,477		
(400) Lower Mississippi 1	8,573		
(405) New Orleans	64,546		
(410) Lower Mississippi 2	89,967		
(216) Mount Vernon	2,834		
Subtotal beyond St. Paul District		357,498	
TOTAL Minneapolis Shipments			358,908
Minnesota River to:			
(344) Pool 6	5,881		
Subtotal within St. Paul District		5,881	
(326) Pool 15	2,745		
(302) Pool 27	30,094		
(304) St. Louis 2	14,498		
(301) St. Louis 1	13,221		
(415) Baton Rouge	43,359		
(480) Memphis	3,035		
(1320) Wheeler Pool	23,147		
(1345) Chattanooga	76,072		
(1370) Knoxville	1,415		
(2600) Mississippi River/Mobile Bay	9,007		
(2715) Atch R./Verm Lk	1,369		
(2725) Calcasieu Lake/Sabine	5,906		
(2620) Mobile Harbor	75,874		
(1330) Guntersville	4,269		
(410) Lower Mississippi 2	372,353		
(400) Lower Mississippi 1	25,868		
(405) New Orleans	267,993		
(216) Mount Vernon	37,409		
Subtotal beyond St. Paul District		1,007,634	
TOTAL Minnesota River Shipments			1,013,515

TABLE A-2 (continued)

St. Paul to:			
(344) Pool 6	5,834		
Subtotal within St. Paul District		5,834	
(320) Pool 18	1,412		
(304) St. Louis 2	2,868		
(302) Pool 27	82,379		
(2725) Calcasieu Lake/Sabine	17,630		
(2620) Mobile Harbor	77,431		
(405) New Orleans	86,564		
(410) Lower Mississippi 2	264,933		
(415) Baton Rouge	18,680		
(1320) Wheeler Pool	2,794		
(1345) Chattanooga	70,732		
(2600) Mississippi River/Mobile Bay	9,222		
(216) Mount Vernon	5,691		
Subtotal beyond St. Paul District		640,336	
TOTAL St. Paul Shipments			646,170
Pool 4 to:			
(344) Pool 6	4,520		
Subtotal within St. Paul District		4,520	
(415) Baton Rouge	2,919		
(1345) Chattanooga	1,414		
(410) Lower Mississippi River 2	1,496		
(405) New Orleans	1,512		
Subtotal beyond St. Paul District		7,341	
TOTAL Pool 4 Shipments			11,861
Pool 6 to:			
(410) Lower Mississippi 2	1,300		
Subtotal beyond St. Paul District		1,300	
TOTAL Pool 6 Shipments			1,300
TOTAL St. Paul District Shipments			2,031,754
Subtotal within District	17,645		
Subtotal out of District	2,014,109		

[a]Parenthesized numbers correspond to Port Equivalents (PE) as defined by the Inland Navigation Systems Analysis. The PE is included to eliminate any confusion associated with pool identification.

TABLE A-3

Destination of 1975 Soybean Shipments by Barge from St. Paul District Ports: Port of Destination by Port of Origin

	Tons		
Minneapolis to:			
(415)[a] Baton Rouge	1,416		
Subtotal beyond St. Paul District		1,416	
TOTAL Minneapolis Shipments			1,416
Minnesota River to:			
(2620) Mobile Harbor	1,470		
(415) Baton Rouge	38,698		
(480) Memphis	4,471		
(2600) Mississippi River/Mobile Bay	7,322		
(405) New Orleans	105,364		
(410) Lower Mississippi 2	65,397		
(400) Lower Mississippi 1	3,232		
Subtotal beyond St. Paul District		225,954	
TOTAL Minnesota River Shipments			225,954
St. Paul to:			
(358-360) Minneapolis	1,373		
Subtotal within St. Paul District		1,373	
(2620) Mobile Harbor	1,451		
(2600) Mississippi River/Mobile Bay	13,218		
(410) Lower Mississippi 2	90,212		
(415) Baton Rouge	22,472		
(480) Memphis	2,852		
(400) Lower Mississippi 1	7,524		
(405) New Orleans	30,976		
Subtotal beyond St. Paul District		168,705	
TOTAL St. Paul Shipments			170,078
Pool 4 to:			
(480) Memphis	1,501		
(2600) Mississippi River/Mobile Bay	1,595		
(410) Lower Mississippi 2	13,253		
(415) Baton Rouge	1,502		
(405) New Orleans	3,016		
(400) Lower Mississippi 1	3,038		
Subtotal beyond St. Paul District		23,905	
TOTAL Pool 4 Shipments			23,905

TABLE A-3 (continued)

Pool 6 to:			
(415) Baton Rouge	10,086		
(2620) Mobile Harbor	11,927		
(2600) Mississippi River/Mobile Bay	8,624		
(405) New Orleans	14,900		
(410) Lower Mississippi 2	48,652		
(400) Lower Mississippi 1	2,920		
Subtotal beyond St. Paul District		97,109	
TOTAL Pool 6 Shipments			97,109
Pool 8 to:			
(320) Pool 18	1,502		
(410) Lower Mississippi 2	4,282		
(415) Baton Rouge	8,562		
(480) Memphis	2,917		
(405) New Orleans	4,324		
(400) Lower Mississippi 1	3,226		
Subtotal beyond St. Paul District		24,813	
TOTAL Pool 8 Shipments			24,813
Pool 10 to:			
(410) Lower Mississippi 2	45,329		
(415) Baton Rouge	45,050		
(2600) Mississippi River/Mobile Bay	5,276		
(405) New Orleans	30,054		
(400) Lower Mississippi 1	5,692		
Subtotal beyond St. Paul District		131,401	
TOTAL Pool 10 Shipments			131,401
TOTAL St. Paul District Shipments			674,676
Subtotal within District	1,373		
Subtotal out of District	673,303		

[a]Parenthesized numbers correspond to Port Equivalents (PE) as defined by the Inland Navigation Systems Analysis. The PE is included to eliminate any confusion associated with pool identification.

TABLE A-4

Destination of 1975 Oats Shipments by Barge from St. Paul District Ports: Port of Destination by Port of Origin

	Tons		
Minneapolis to:			
(302)[a] Pool 27	9,546		
(415) Baton Rouge	5,128		
(1345) Chattanooga	1,206		
(2800) Vicksburg	11,486		
(1330) Guntersville	1,360		
(405) New Orleans	1,264		
Subtotal beyond St. Paul District		29,990	
TOTAL Minneapolis Shipments			29,990
Minnesota River to:			
(302) Pool 27	6,930		
(480) Memphis	5,712		
(1330) Guntersville	14,261		
(1345) Chattanooga	9,768		
(2800) Vicksburg	1,437		
(405) New Orleans	1,384		
(415) Baton Rouge	8,608		
Subtotal beyond St. Paul District		48,100	
TOTAL Minnesota River Shipments			48,100
St. Paul to:			
(302) Pool 27	41,140		
(480) Memphis	1,415		
(1330) Guntersville	5,856		
(1345) Chattanooga	1,342		
(2800) Vicksburg	1,500		
(405) New Orleans	2,632		
(445) Lower Mississippi 6	1,336		
Subtotal beyond St. Paul District		55,221	
TOTAL St. Paul Shipments			55,221
Pool 4 to:			
(1345) Chattanooga	2,696		
(480) Memphis	672		
Subtotal beyond St. Paul District		3,368	
TOTAL Pool 4 Shipments			3,368

TABLE A-4 (continued)

Pool 8 to :			
(1330) Guntersville	4,142		
(415) Baton Rouge	1,419		
(405) New Orleans	2,826		
Subtotal beyond St. Paul District		8,387	
TOTAL Pool 8 Shipments			8,387
TOTAL St. Paul District Shipments			145,066
Subtotal within District	0		
Subtotal out of District	145,066		

[a]Parenthesized numbers correspond to Port Equivalents (PE) as defined by the Inland Navigation Systems Analysis. The PE is included to eliminate any confusion associated with pool identification.

TABLE A-5

Destination of 1975 Coal Shipments by Barge from St. Paul District

Port of Destination by Port of Origin

	Tons		
Minneapolis to:			
(357)[a] Minnesota River	652,671		
(352) Pool 3	545,387		
(348) Pool 5	199,067		
(338) Pool 9	372,165		
Subtotal within St. Paul District		1,769,290	
(334) Pool 11	1,205		
(328) Pool 14	30,773		
(324) Pool 16	1,450		
(530) North Pekin	132,613		
Subtotal beyond St. Paul District		166,041	
TOTAL Minneapolis Shipments			1,935,331
Minnesota River to:			
(338) Pool 9	5,899		
Subtotal within St. Paul District		5,899	
(332) Pool 12	7,417		
(328) Pool 14	19,314		
(530) North Pekin	16,504		
Subtotal beyond St. Paul District		43,235	
TOTAL Minnesota River Shipments			49,134
St. Paul to:			
(348) Pool 5	15,750		
(338) Pool 9	53,532		
Subtotal within St. Paul District		69,282	
(332) Pool 12	18,086		
(328) Pool 14	105,406		
(301) St. Louis	1,550		
(530) North Pekin	178,879		
Subtotal beyond St. Paul District		303,921	
TOTAL St. Paul Shipments			373,203

TABLE A-5 (continued)

Pool 3 to:			
(328) Pool 14	1,494		
Subtotal beyond St. Paul District		1,494	
TOTAL Pool 3 Shipments			1,494
Pool 5 to:			
(358) Minneapolis	1,361		
Subtotal within St. Paul District		1,361	
TOTAL Pool 5 Shipments			1,361
Pool 6 to:			
(356) St. Paul	1,438		
Subtotal within St, Paul District		1,438	
TOTAL Pool 6 Shipments			1,438
Pool 9 to:			
(358-360) Minneapolis	1,378		
Subtotal within St. Paul District		1,378	
TOTAL Pool 9 Shipments			1,378
TOTAL St. Paul District Shipments			2,363,339
Subtotal within District	1,848,648		
Subtotal out of District	514,691		

[a]Parenthesized numbers correspond to Port Equivalents (PE) as defined by the Inland Navigation Systems Analysis. The PE is included to eliminate any confusion associated with pool identification.

TABLE A-6

Origin of 1975 Coal Receipts by Barge into St. Paul District Ports:
Port of Origin by Port of Destination

	Tons		
Minneapolis from:			
(348)[a] Pool 5	1,378		
(338) Pool 9	1,361		
Subtotal within St. Paul District		2,739	
(1010) Green River - Pool 2	2,966		
(232) Louisville	18,384		
(246) Huntington	4,261		
Subtotal beyond St. Paul District		25,611	
TOTAL Minneapolis Receipts			28,350
Minnesota River from:			
(358-360) Minneapolis	652,671		
Subtotal within St. Paul District		652,671	
(302) Pool 27	4,208		
(301) St. Louis	123,730		
(300) Upper Mississippi	121,410		
(232) Louisville	2,431		
(250) Gallipolis	1,600		
Subtotal beyond St. Paul District		253,379	
TOTAL Minnesota River Receipts			906,050
St. Paul from:			
(344) Pool 6	1,438		
Subtotal within St. Paul District		1,438	
(310) Pool 24	1,372		
(302) Pool 27	8,375		
(301) St. Louis	104,275		
(300) Upper Mississippi River	83,457		
(515) Havana	2,851		
(232) Louisville	2,671		
(244) Greenup Pool	4,220		
(250) Gallipolis	4,836		
(1303) Kentucky Pool 1	24,770		
(1010) Green River Pool 2	9,073		
(800) Kanawha	1,408		
Subtotal beyond St. Paul District		247,308	
TOTAL St. Paul Receipts			248,746

TABLE A-6 (continued)

Pool 3 from:			
(358-360) Minneapolis	545,387		
Subtotal within St. Paul District		545,387	
(302) Pool 27	17,549		
(301) St. Louis	409,469		
(300) Upper Mississippi River	603,311		
(515) Havana	21,552		
(232) Louisville	4,906		
(226) Pool 46	8,760		
(208) Pool 51	11,140		
(1010) Green River Pool 2	68,625		
Subtotal beyond St. Paul District		1,145,312	
TOTAL Pool 3 Receipts			1,690,699
Pool 4 from:			
(300) Upper Mississippi River	4,515		
(1303) Kentucky River Pool 1	7,517		
Subtotal beyond St. Paul District		12,032	
TOTAL Pool 4 Receipts			12,032
Pool 5 from:			
(358-360) Minneapolis	199,067		
(356) St. Paul	15,750		
Subtotal within St. Paul District		214,817	
(302) Pool 27	33,814		
(301) St. Louis	156,600		
(300) Upper Mississippi River	29,976		
(242) Meldahl Pool	4,650		
(244) Greenup Pool	1,745		
(1010) Green River Pool 2	171,376		
Subtotal beyond St. Paul District		398,161	
TOTAL Pool 5 Receipts			612,978
Pool 6 from:			
(300) Upper Mississippi River	1,478		
Subtotal beyond St. Paul District		1,478	
TOTAL Pool 6 Receipts			1,478

TABLE A-6 (continued)

Pool 8 from:			
(1303) Kentucky Pool 1	25,183		
(1010) Green River Pool 2	4,864		
Subtotal beyond St. Paul District		30,047	
TOTAL Pool 8 Receipts			30,047
Pool 9 from:			
(358-360) Minneapolis	372,165		
(357) Minnesota River	5,899		
(356) St. Paul	53,532		
Subtotal within St. Paul District		431,596	
(302) Pool 27	62,345		
(301) St. Louis	152,677		
(300) Upper Mississippi River	229,730		
(208) Pool 51	18,625		
(226) Pool 46	8,149		
(242) Meldahl Pool	3,450		
(1010) Green River Pool 2	399,312		
Subtotal beyond St. Paul District		874,288	
TOTAL Pool 9 Receipts			1,305,884
TOTAL St. Paul District Shipments			4,836,264
Subtotal within District	1,848,648		
Subtotal out of District	2,987,616		

[a]Parenthesized numbers correspond to Port Equivalents (PE) as defined by the Inland Navigation Systems Analysis. The PE is included to eliminate any confusion associated with pool identification.

TABLE A-7

Destination of 1975 Sand, Gravel, and Rock Shipments by Barge from St. Paul District Ports:

Port of Destination by Port of Origin

		Tons		
Pool 2 to:				
(358-360)	Minneapolis	267,658		
(356)	St. Paul	908,705		
Subtotal within St. Paul District			1,176,363	
TOTAL Pool 2 Shipments				1,176,363

TABLE A-8

Destination of 1975 Gasoline Shipments by Barge from St. Paul District Ports: Port of Destination by Port of Origin

	Tons		
St. Paul to:			
(570)[a] Chic San Ship Cl	6,200		
Subtotal beyond St. Paul District		6,200	
TOTAL St. Paul Shipments			6,200
Pool 2 to:			
(356) St. Paul	729,588		
(352) Pool 3	4,565		
(340) Pool 8	17,927		
Subtotal in St. Paul District		752,080	
(332) Pool 12	79,539		
(326) Pool 15	14,231		
(318) Pool 19	11,976		
(302) Pool 27	35,289		
(301) St. Louis 1	50,101		
(300) Upper Mississippi River	4,747		
(480) Memphis	9,022		
(570) Chic San Ship Cl	5,290		
Subtotal beyond St. Paul District		210,195	
TOTAL Pool 2 Shipments			962,275
Pool 3 to:			
(326) Pool 15	1,100		
(301) St. Louis 1	2,803		
Subtotal beyond St. Paul District		3,903	
TOTAL Pool 3 Shipments			3,903
TOTAL St. Paul District Shipments			972,378
Subtotal within District	752,080		
Subtotal out of District	220,298		

[a]Parenthesized numbers correspond to Port Equivalents (PE as defined by the Inland Navigation Systems Analysis. The PE is included to eliminate any confusion associated with pool identification.

TABLE A-9

Destination of 1975 Distillate Fuel Oil Shipments by Barge from St. Paul District Ports:

Port of Destination by Port of Origin

St. Paul to:	Tons		
(332)[a] Pool 12	2,900		
(301) St. Louis 1	2,439		
(220) Pool 48	2,888		
Subtotal beyond St. Paul District		8,227	
TOTAL St. Paul Shipments			8,227
Pool 2 to:			
(358-360) Minneapolis	30,777		
St. Paul	209,818		
Pool 8	4,383		
Subtotal within St. Paul District		244,978	
(332) Pool 12	39,679		
(326) Pool 15	7,346		
(302) Pool 27	7,900		
(301) St. Louis 1	28,347		
Subtotal beyond St. Paul District		83,272	
TOTAL Pool 2 Shipments			328,250
TOTAL St. Paul District Shipments			336,477
Subtotal Within District	244,978		
Subtotal Out of District	91,499		

[a]Parenthesized numbers correspond to Port Equivalents (PE) as defined by the Inland Navigation Systems Analysis. The PE is included to eliminate any confusion associated with pool identification.

APPENDIX B

1985 Barge Shipment Projections

Appendix B contains the projections of commodity shipments for 1985. There are eight tables relating to the raw farm product category, two each for the following commodities: corn, wheat, soybeans, and oats. For these commodities, there is one table for projected tonnage, and another for resulting barge requirements. Projections were made for the baseline case, and Scenarios 1A and 1B.

There are seven tables presented which contain the individual commodity projections comprising the miscellaneous shipments category. There is one table each for the following seven commodity classifications: (1) sand, gravel, and rocks; (2) coke and petroleum coke; (3) processed agricultural products; (4) ores, metal, and scrap; (5) gasoline; (6) distillate fuel oil; and (7) residual fuel oil. Tonnage and barge requirements are combined on these tables, with projections made for the baseline case only.

TABLE B-1

Corn Shipments by Pool
(short tons)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	77,665	82,665	123,998	41,333
Minnesota River	1,029,678	2,499,118	3,748,677	1,249,559
St. Paul	672,831	913,467	1,370,201	456,734
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	270,280	419,737	629,606	209,869
Pool 5	0	0	0	0
Pool 6	249,470	681,480	1,022,220	340,740
Pool 8	47,326	170,370	255,555	85,185
Pool 9	0	0	0	0
Pool 10	457,071	709,817	1,064,726	354,909
TOTAL St. Paul District	2,804,321	5,476,654	8,214,983	2,738,329

TABLE B-2

Wheat Shipments by Pool
(short tons)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	358,908	279,728	419,592	139,864
Minnesota River	1,013,515	2,572,063	3,858,095	1,286,032
St. Paul	646,170	661,005	991,508	330,503
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	11,861	22,900	34,350	11,450
Pool 5	0	0	0	0
Pool 6	1,300	2,510	3,765	1,255
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL St. Paul District	2,031,754	3,538,206	5,307,310	1,769,104

TABLE B-3

1985 Soybean Shipments by Pool
(short tons)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	1,416	21,186	31,779	10,593
Minnesota River	225,954	776,079	1,164,119	388,040
St. Paul	170,078	263,587	395,381	131,794
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	23,905	41,222	61,833	20,611
Pool 5	0	0	0	0
Pool 6	97,109	238,920	358,380	119,460
Pool 8	24,813	59,730	89,595	29,865
Pool 9	0	0	0	0
Pool 10	131,401	226,589	339,884	113,295
TOTAL St. Paul District	674,676	1,627,313	2,440,971	813,658

TABLE B-4

Oats Shipments by Pool
(short tons)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	29,990	25,946	38,919	12,973
Minnesota River	48,100	39,323	58,985	19,662
St. Paul	55,221	62,054	93,081	31,027
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	3,368	2,615	3,923	1,308
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	8,387	6,511	9,767	3,256
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL St. Paul District	145,066	136,449	204,675	68,226

TABLE B-5

Corn Barge Requirements
(1,450 tons per barge)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	54	57	86	29
Minnesota River	710	1,724	2,585	862
St. Paul	465	630	945	315
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	187	290	434	145
Pool 5	0	0	0	0
Pool 6	172	470	705	235
Pool 8	33	118	176	59
Pool 9	0	0	0	0
Pool 10	315	490	734	245
TOTAL	1,936	3,779	5,665	1,890

TABLE B-6

Wheat Barge Requirements
(1,450 tons per barge)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	249	193	289	96
Minnesota River	699	1,774	2,661	887
St. Paul	446	456	684	228
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	8	16	24	8
Pool 5	0	0	0	0
Pool 6	1	2	3	1
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	1,403	2,441	3,661	1,220

TABLE B-7

Soybean Barge Requirements

(1,450 tons per barge)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	1	15	22	8
Minnesota River	156	535	803	268
St. Paul	117	182	273	91
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	16	29	43	14
Pool 5	0	0	0	0
Pool 6	67	165	247	82
Pool 8	17	41	62	21
Pool 9	0	0	0	0
Pool 10	91	156	234	78
TOTAL	465	1,123	1,684	562

TABLE B-8

Oat Barge Requirements
(1,450 tons per barge)

	1975	1985 Baseline	1985 Scenario 1A	1985 Scenario 1B
Minneapolis	22	18	27	9
Minnesota River	34	27	41	14
St. Paul	38	43	64	21
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	3	2	3	1
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	6	5	7	3
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	103	95	142	48

TABLE B-9

Sand, Gravel, and Rock Shipments and Barge Requirements by Pool

	1975		Projected 1985 Baseline	
	Shipments (tons)	Barge Requirements (1450 tons per barge)	Shipments (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	0	0	0	0
St. Paul	0	0	0	0
Pool 2	1,176,363	811	1,032,079	712
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	1,176,363	811	1,032,079	712

TABLE B-10

Coke and Petroleum Coke Shipments and Barge Requirements by Pool

	1975		Projected 1985 Baseline	
	Shipments (tons)	Barge Requirements (1450 tons per barge)	Shipments (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	0	0	0	0
St. Paul	77,892	54	142,674	99
Pool 2	53,011	37	127,818	88
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	130,903	91	270,492	187

TABLE B-11

Processed Agricultural Products Shipments and Barge Requirements by Pool

	1975		Projected 1985 Baseline	
	Shipments (tons)	Barge Requirements (1450 tons per barge)	Shipments (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	108,604	75	280,509	194
Minnesota River	80,482	56	253,567	175
St. Paul	158,242	109	389,647	269
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	44,911	31	149,777	103
Pool 5	0	0	0	0
Pool 6	4,783	4	15,951	11
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	397,022	275	1,089,451	752

TABLE B-12

Ores, Metal, and Scrap Shipments and Barge Requirements by Pool

	1975		Projected 1985 Baseline	
	Shipments (tons)	Barge Requirements (1450 tons per barge)	Shipments (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	6,449	5	14,853	11
Minnesota River	5,356	4	1,801	2
St. Paul	15,109	11	9,104	7
Pool 2	0	0	0	0
Pool 3	1,575	1	1,186	1
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	1,530	1	1,152	1
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	30,019	22	28,096	22

TABLE B-13

Gasoline Shipments and Barge Requirements by Pool

	1975		Projected 1985 Baseline	
	Shipments (tons)	Barge Requirements (1450 tons per barge)	Shipments (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	0	0	0	0
St. Paul	6,200	5	6,200	5
Pool 2	962,275	664	962,275	664
Pool 3	3,903	3	3,903	3
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	972,378	672	972,378	672

TABLE B-14

Distillate Fuel Oil Shipments and Barge Requirements by Pool

	1975		Projected 1985 Baseline	
	Shipments (tons)	Barge Requirements (1450 tons per barge)	Shipments (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	0	0	0	0
St. Paul	8,227	6	8,227	6
Pool 2	328,250	226	328,250	226
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	336,477	232	336,477	232

TABLE B-15

Residual Fuel Oil Shipments and Barge Requirements by Pool

	1975		Projected 1985 Baseline	
	Shipments (tons)	Barge Requirements (1450 tons per barge)	Shipments (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	0	0	0	0
St. Paul	0	0	0	0
Pool 2	34,581	24	34,581	24
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	34,581	24	34,581	24

APPENDIX C

1985 Projections of Barge Receipts

Appendix C contains fifteen tables, one each for the fifteen commodity classifications projected under the category of miscellaneous receipts. The tables present baseline projections for tonnage receipts and number of barges for the following commodity classifications: (1) sand, gravel, and rocks; (2) processed agricultural products; (3) building cement; (4) iron and steel; (5) non-metallic minerals; (6) chemical products; (7) pitch and asphalt; (8) gasoline; (9) distillate fuel oil; (10) residual fuel oil; (11) jet fuel and kerosene; (12) crude petroleum; (13) nitrogenous fertilizer; (14) phosphorus fertilizer; and (15) other fertilizers.

APPENDIX C

TABLE C-1

Sand, Gravel, and Rock Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	267,658	185	329,688	227
Minnesota River	0	0	0	0
St. Paul	915,683	632	958,342	661
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	2,679	2	2,350	2
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	1,186,020	819	1,290,380	890

TABLE C-2

Pitch and Asphalt Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	26,029	18	29,481	21
Minnesota River	48,043	33	46,348	32
St. Paul	62,766	44	72,418	50
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	22,527	16	54,316	38
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	36,168	25	87,207	60
Pool 10	0	0	0	0
TOTAL	195,533	136	289,770	201

TABLE C-3

Processed Agricultural Product Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	27,881	19	33,654	23
St. Paul	46,571	32	65,574	45
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	532	1	630	1
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	20,000*	14
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	74,984	52	119,858	83

* New plant using molasses for feed mix.

TABLE C-4

Building Cement Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	94,755	65	108,230	75
Minnesota River	0	0	0	0
St. Paul	0	0	7,586	6
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	75,772	52	75,772	52
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	170,527	117	191,588	133

TABLE C-5

Iron and Steel Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	22,533	16	47,978	33
Minnesota River	32,221	22	33,278	23
St. Paul	44,866	31	58,108	40
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	25,286	18	32,685	23
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	1,911	2	2,470	2
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	126,817	89	174,519	121

TABLE C-6

Non-Metallic Mineral Receipts and Barges from Receipts by Pool

	1975		Projected 1935 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	140,705	97	146,459	101
Minnesota River	206,779	143	301,902	208
St. Paul	75,331	52	107,131	74
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	21,731	15	39,286	27
Pool 5	0	0	0	0
Pool 6	46,337	32	83,768	58
Pool 8	47,713	33	86,256	60
Pool 9	0	0	0	0
Pool 10	22,602	16	40,860	28
TOTAL	561,198	388	805,662	556

TABLE C-7

Chemical Products Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	0	0	0	0
St. Paul	53,896	37	57,906	40
Pool 2	241,655	167	318,513	220
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	295,551	204	376,419	260

TABLE C-8

Gasoline Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	1,800	2	17,066	12
Minnesota River	0	0	0	0
St. Paul	816,222	563	754,906	521
Pool 2	12,802	9	12,802	9
Pool 3	4,565	3	4,565	3
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	49,649	34	49,649	34
Pool 8	46,198	32	46,198	32
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	931,236	643	885,186	611

TABLE C-9

Distillate Fuel Oil Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	30,777	22	31,158	22
Minnesota River	0	0	0	0
St. Paul	218,618	151	187,942	130
Pool 2	9,472	7	9,472	7
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	28,516	20	28,516	20
Pool 8	42,765	30	42,765	30
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	330,148	230	299,853	209

TABLE C-10

Residual Fuel Oil Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	16,486	12	16,486	12
St. Paul	14,576	10	14,576	10
Pool 2	60,198	42	60,198	42
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	11,778	8	11,778	8
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	103,038	72	103,038	72

TABLE C-11

Jet Fuel and Kerosene Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	0	0	0	0
St. Paul	41,183	29	79,781	55
Pool 2	0	0	0	0
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	6,958	5	6,958	5
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	48,141	34	86,739	60

TABLE C-12

Crude Petroleum Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	24,512	17	24,512	17
Minnesota River	0	0	0	0
St. Paul	140,734	97	140,734	97
Pool 2	30,048	21	30,048	21
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	0	0	0	0
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	195,294	135	195,294	135

TABLE C-13

Nitrogenous Fertilizer Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	31,975	22	28,124	19
St. Paul	1,549	1	1,362	1
Pool 2	86,235	60	75,848	52
Pool 3	3,729	3	3,280	3
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	21,754	15	19,134	13
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	145,242*	101	127,748	88

*Liquid nitrogen comprises 47 percent of total nitrogen shipments.

TABLE C-14

Phosphatic Fertilizer Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	0	0	0	0
Minnesota River	15,888	11	14,168	10
St. Paul	0	0	0	0
Pool 2	73,211	51	65,286	45
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	6,093	5	5,433	4
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	95,192	67	84,887	59

TABLE C-15

Other Fertilizer Receipts and Barges from Receipts by Pool

	1975		Projected 1985 Baseline	
	Receipts (tons)	Barge Requirements (1450 tons per barge)	Receipts (tons)	Barge Requirements (1450 tons per barge)
Minneapolis	2,502	2	2,213	2
Minnesota River	76,868	53	67,995	47
St. Paul	15,744	11	13,927	10
Pool 2	133,511	92	118,099	82
Pool 3	0	0	0	0
Pool 4	0	0	0	0
Pool 5	0	0	0	0
Pool 6	65,513	45	57,951	40
Pool 8	0	0	0	0
Pool 9	0	0	0	0
Pool 10	0	0	0	0
TOTAL	294,138	203	260,185	181

APPENDIX D

Inland Navigation Systems Analysis (INSA) Commodity Classifications

Commodity Group Number	Description	WCSC[a] Code	Description
1	Coal and lignite	1121	Coal and lignite
2	Petroleum products	2916	Lubricating oils and grease
		2921	Liquified petroleum gases, coal gases, natural gas, and natural gas liquids
		2991	Petroleum and coal products, not elsewhere classified
3	Crude petroleum	1311	Crude petroleum
4	Gasoline	2911	Gasoline, including natural gasoline
5	Jet fuel and kerosene	2912	Jet fuel
		2913	Kerosene
6	Distillate fuel oil	2914	Distillate fuel oil
7	Residual fuel oil	2915	Residual fuel oil
8	Coke, pitch, asphalt	2917	Naphtha, mineral spirits, solvents, not elsewhere classified
		2918	Asphalt, tar, and pitches
		2920	Coke, including petroleum coke
		2951	Asphalt building materials
		3313	Coke (coal and petroleum) petroleum pitches and asphalts, and naphtha and solvents
9	Chemicals and products	2818	Sulphuric acid
		2819	Basic chemicals and basic chemical products, not elsewhere classified
		2876	Insecticides, fungicides, pesticides, and disinfectants
		2891	Miscellaneous chemical products
10	Organic industrial chemicals	2811	Crude products from coal tar, petroleum, and natural gas, except benzene and toluene
		2812	Dyes, organic pigment, dyeing and tanning materials
		2813	Alcohols
		2817	Benzene and toluene, crude and commercially pure
11	Synthetics	2821	Plastic materials, regenerated cellulose and synthetic resins, including film, sheeting, and laminates
		2822	Synthetic rubber
		2823	Synthetic (man-made) fiber

Commodity Group Number	Description	WCSC[a] Code	Description
12	Drugs, soap, paint	2816	Radioactive and associated materials, including wastes
		2831	Drugs (biological products, medicinal chemicals, botanical products and pharmaceutical preparations)
		2841	Soap, detergents, and cleaning preparations, perfumes, cosmetics, and other toilet preparations
		2851	Paints, varnishes, lacquers, enamels, and allied products
		2861	Gum and wood chemicals
13	Inorganic industrial chemicals	2810	Sodium hydroxide (caustic soda)
14	Nitrogenous chemical fertilizers	2871	Nitrogenous chemical fertilizers, except mixtures
15	Potassic chemical fertilizers	2872	Potassic chemical fertilizers, except mixtures
16	Phosphatic chemical fertilizers	2873	Phosphatic chemical fertilizers, except mixtures
17	Other fertilizers	2879	Fertilizers and fertilizer materials, not elsewhere classified
18	Metallic ores	1021	Copper ore and concentrates
		1051	Bauxite and other aluminum ores and concentrates
		1061	Manganese ores and concentrates
		1091	Nonferrous metal ores and concentrates, not elsewhere classified
19	Iron ore	1011	Iron ore and concentrates
20	Primary iron and steel	3311	Pig iron
		3312	Slag
		3314	Iron and steel ingots, and other primary forms, including blanks for tube and pipe, and sponge iron
		3315	Iron and steel bars, rods, angles, shapes and sections, including sheet piling
		3316	Iron and steel plates and sheets
		3317	Iron and steel pipe and tube
		3318	Ferroalloys
		3319	Primary iron and steel products, not elsewhere classified, including castings in the rough

Commodity Group Number	Description	WCSC[a] Code	Description
21	Other primary metal	3321	Nonferrous metals primary smelter products, basic shapes, wire, castings and forgings, except copper, lead, zinc and aluminum
		3322	Copper and copper alloys, whether or not refined, unworked
		3323	Lead and zinc, including alloys, unworked
		3324	Aluminum and aluminum alloys, unworked
22	Fabricated metal products	3411	Fabricated metal products, except ordnance, machinery, and transportation equipment
23	Waste/scrap metal	4011	Iron and steel scrap
		4012	Nonferrous metal scrap
		4022	Textile waste, scrap, and sweepings
		4024	Paper waste and scrap
		4029	Waste and scrap, not elsewhere classified
24	Nonmetallic minerals	1412	Building stone, unworked
		1451	Clay, ceramic and refractory materials
		1479	Natural fertilizer materials, not elsewhere classified
		1494	Gypsum, crude and plasters
		1499	Nonmetallic minerals, except fuels, not elsewhere classified
25	Limestone flux, calcareous stone	1411	Limestone flux and calcareous stone
26	Sand, gravel, rock	1442	Sand, gravel and crushed rock
27	Phosphate rock	1471	Phosphate rock
28	Sulphur	1492	Sulphur, dry
		1493	Sulphur, liquid
29	Salt	1491	Salt
30	Stone, clay, glass	3211	Glass and glass products
		3251	Structural clay products, including refractories
		3281	Cut stone and stone products
		3291	Miscellaneous nonmetallic mineral products
31	Building cement	3241	Building cement
32	Lime	3271	Lime

Commodity Group Number	Description	WCSC[a] Code	Description
33	Fish, marine products	911	Fresh fish, except shellfish
		912	Shellfish, except prepared or preserved
		913	Menhaden
34	Marine shells	931	Marine shells, unmanufactured
35	Farm products	101	Cotton, raw
		105	Rice
		106	Sorghum grains
		119	Oilseeds, not elsewhere classified
		121	Tobacco, leaf
		122	Hay and fodder
		129	Field crops, not elsewhere classified
		131	Fresh fruits and tree nuts, except bananas and plantains
		132	Bananas and plantains
		133	Coffee, green and roasted (including instant)
		134	Cocoa beans
		141	Fresh and frozen vegetables
		151	Live animals (livestock), except zoo animals, cats, dogs, etc.
		161	Animals and animal products, not elsewhere classified
		191	Miscellaneous farm products
36	Corn	103	Corn
37	Wheat	107	Wheat
38	Soybeans	111	Soybeans
39	Oats	104	Oats
40	Barley (includes rye)	102	Barley and rye
41	Flaxseed	112	Flaxseed
42	Flour	2041	Wheat flour and semolina
43	Forest products	841	Crude rubber and allied gums
		861	Forest products, not elsewhere classified
44	Lumber/wood products	2411	Logs
		2412	Rafted logs
		2413	Fuel wood, charcoal, and wastes

(cont.)

Commodity Group Number	Description	WCSC[a] Code	Description
44	Lumber/wood products (cont.)	2414	Timber, posts, poles, piling, and other wood in the rough
		2415	Pulpwood, log
		2416	Wood chips, staves, moldings, and excelsior
		2421	Lumber
		2431	Veneer, plywood, and other worked wood
		2491	Wood manufactures, not elsewhere classified
45	Pulp/paper products	2611	Pulp
		2621	Standard newsprint paper
		2631	Paper and paperboard
		2691	Pulp, paper, and paperboard products, not elsewhere classified
46	Processed agricultural products	2091	Vegetable oils, all grades; margarine and shortening
		2062	Molasses
		20??	
47	Manufactured equipment and machinery		
48	Miscellaneous products		

[a]Waterborne Commerce Statistics Center