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A. Young

G. Morse

T. Daves

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Economics Department
Agricultural Experiment Station
South Dakota State University

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The Lincoln County Rural Water System: Growth Impacts

Arthur Young, George Morse, and Thomas Daves*

In November 1977, 26 South Dakota rural water systems delivered water to 9,438 hookups serving about 40,000 persons in rural areas and small towns.

Four additional systems have been organized and construction is in progress. They will serve an additional 29,000 persons at 5,825 hookups. Twenty other systems are organizing or await funding. These systems will serve an estimated 43,500 persons.

Altogether, when all these systems are completed, 112,500 persons, or approximately 16% of the South Dakota population, will be served. The locations and approximate geographic areas served by rural water systems are shown in Figure 1.

Such a system provides or is expected to provide good quality, dependable water in rural areas. Near urban areas the system has had a side effect, that of changing property values and population. This may spread as rural water systems surround more urban centers.

Usually only the direct benefits to customers are considered when a rural water system is evaluated. However, growth associated with the development of a water system may have an impact on other aspects of the economy such as the finances of local units of government. Taxable property values may change, as may the size, composition and public service demands of the population served by local units of government.

This report, which summarizes the results of a study of the Lincoln County Rural Water System, is focused on the question: Does a rural water system affect property values and population growth?

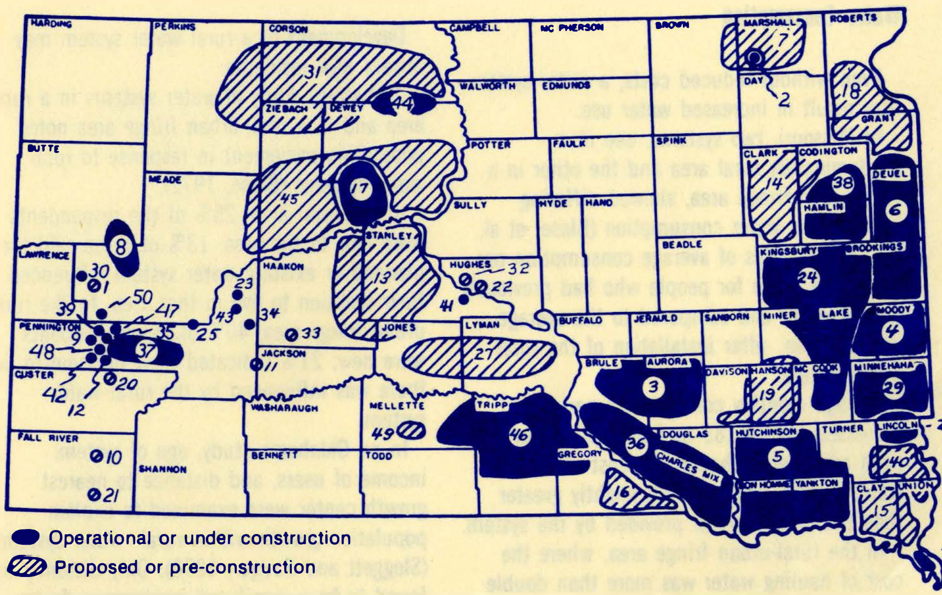

Fig. 1. Rural community water systems in South Dakota, 1978.

1. Alkali
2. Amherst
3. Aurora-Brule
4. Big Sioux
5. Bon Homme-Yankton
6. Brookings-Deuel
7. Brown & Marshall
8. Butte-Meade
9. Carriage Hills
10. Cascade
11. Cedar
12. Chapel Lane
13. Cheyenne
14. Clark
15. Clay
16. East Gregory
17. Fox Ridge
18. Grant-Roberts
19. Hanson
20. Hermosa
21. Horsehead
22. Hughes
23. Johnson
24. Kingbrook
25. Lakeside
26. Lincoln
27. Lyman-Jones
28. McCook Lake
29. Minnehaha
30. Murray
31. Northwestern
32. Oahe Plains
33. Old Trail
34. Peno Basin
35. Ponderosa
36. Randall
37. Rapid Valley
38. Sioux
39. Siphon Hill
40. South Lincoln
41. Spencer
42. Spring Canyon
43. Squaw Creek
44. TC&G
45. Tri-County
46. Tripp
47. Valley View
48. Whispering Pines
49. White River
50. Woodland Hills

Related Studies

Relationships between direct impacts of a rural water system and changes in property values and population have been explored in other research studies.

Agricultural Production and Land Values

A rural water system often delivers water for livestock uses as well as domestic uses. Thus, a system may increase livestock production.

In one rural water system in Kansas, 43 farmers (over 90% of survey respondents who specialized in livestock production) indicated that they increased livestock numbers because of the rural water system (Smythe, 1969). The estimated value of the increases in all classes of livestock owned by the 43 farmers was over $150,000 in a 6-year period.

The same rural water system members estimated an average increase in land values resulting from development of the system of $26.47 per acre. Comparison of land sales with a nearby area showed fewer sales in the area served by the water system but at an average of $43.50 more per acre.

The difference of these two estimates is a result of different estimation procedures. Expanded livestock production capacity may partially explain the increases in land values.

Water Cost

In North Dakota, the cost of water provided by a rural water system was compared to the cost of water from various alternative supply sources.

At 5,000 gallons per month, the water system was found to be less expensive than

*Financial support for this research came from Title V of the 1972 Rural Development Act. Arthur Young was formerly a graduate research assistant in economics at SDSU. George W. Morse, currently Assistant Professor, Department of Agricultural Economics and Rural Sociology, Ohio State University, was formerly on the economics faculty at SDSU. Thomas E. Daves is Professor of Economics at SDSU.

wells which were 200 feet or deeper. At 10,000 gallons the rural water system charge was less than the cost of water from all wells of 300 feet or greater. Wells were estimated to be less expensive at 25,000 gallons or greater.

At all levels of water usage the rural water system charge was less than the estimated charge for commercial hauling (Nelson, et al, 1976).

Water Consumption

Even without reduced costs, a water system may result in increased water use.

In Missouri, two systems, one in a predominantly rural area and the other in a rural-urban fringe area, showed differing increases in water consumption (Blase, et al, 1972). Estimates of average consumption per user were made for people who had previously hauled water and compared to the average consumption after installation of the rural water system.

Average monthly consumption per user increased from 4,283 to 4,667 gallons in the rural areas, even though the cost of hauled water in that area was only slightly greater than the cost of water provided by the system.

In the rural-urban fringe area, where the cost of hauling water was more than double the cost of water from the rural water system, consumption increased 37%, from 2,218 to 3,031 gallons.

This change in water consumption can be related to reduced water costs. In the first case, however, where water costs were similar, the change in consumption appears to be related to greater convenience or improved water quality of the water system.

Water Related Appliances

If a water system delivers good water in a dependable and convenient way, then along with consuming more water, a greater number of residents may purchase new water using appliances.

In a water association in Kansas, 58 survery respondents indicated that they bought $135,000 worth of new water related appliances after the rural water system was installed (Smythe, 1969).

Home Improvements

Joining a rural water system may stimulate home improvements. These improvements, along with the value of the water system, may add to housing values.

A study in Missouri of two systems reported that, for members who made improvements, the average value was $672 in the rural area and $1,126 in the rural-urban fringe area (Blase, 1972).

In a North Dakota system, 20.6% of water system members remodeled their homes, compared to only 7.7% of non-members (Nelson, 1976).

Population

Development of a rural water system may attract new residents.

A Missouri study of water systems in a rural area and in a rural-urban fringe area noted population movement in response to rural water systems (Blase, 1972).

In the rural area, 25% of the respondents were new to the area; 13% of these said the planned or existing water system influenced their decision to live in that area. In the rural-urban fringe area, 40% of the respondents were new; 21% indicated their decision to live there was influenced by the rural water system.

In an Oklahoma study, age of system, income of users, and distance to nearest growth center were examined to explain population growth within rural water systems (Sloggett and Badger, 1976). Only distance was found to be a significant explanatory factor.

Distance explained about 15% of the variation of growth between systems. The growth rate fell by .385% for each mile between the edge of the growth center and the edge of the area served by the rural water system.

Procedure

Study Area

The Lincoln Rural Water System is located to the south of Sioux Falls, South Dakota (Figure 2). It was chosen for study because it is close to Sioux Falls, a growing urban center, and because it is one of the older systems in the state. For comparison of land and home value changes, three nearby townships with a similar proximity to Sioux Falls were chosen: Split Rock, Benton, and Wayne.

Data Collection

Lists of the residents of the system area and the control townships were divided into farmer and non-farmer categories. The breakdown between the two groups was 41.5% farmers and 58.5% other rural residents.

Approximately 30% of the people in each group were selected randomly and sent a mail questionnaire. The questionnaire used is an approximation of a longitudinal study where respondents are asked for information for the years 1970 (the year the system was installed) and 1975.

For the system area, usable questionnaires were obtained from 62 out of 130 people surveyed, or 47.7%. Of the usable questionnaires, 30 (48%) were from farmers. In the control areas the completion rate was 34 out of 118, or 28.8%, with 15 (44%) being from farmers.

The overall completion rate was 96 out of 248, or 38.7%.

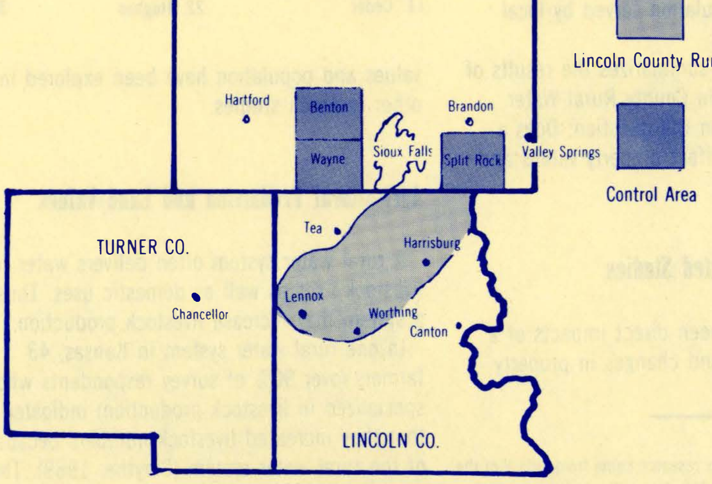

Fig. 2. Lincoln County Rural Water System and the control area, Benton, Split Rock and Wayne townships, Minnehaha County, South Dakota.

Analytical Procedures

Responses to the survey questions were tabulated and analyzed to determine typical responses and to identify differences between the responses from residents of the system area and from residents of the control area. Differences between responses from farmer and non-farmer respondents were also evaluated.

Chi-square analysis was used to test for statistically significant differences between responses from system and control area and from farm and non-farm respondents. The survey data were then used in regression analyses designed to yield estimates of the effects of the rural water system on relevant economic variables.

The descriptive analysis of the survey data was conducted to estimate the effects of the Lincoln County Rural Water System on agricultural and non-agricultural land values, housing values, residential location, the farm or non-farm character of new residents, and changes in the numbers of school-age children within the system area.

Changes in land and housing values attributable to the water system were estimated by two methods: 1) averaging value changes reported by the survey respondents, and 2) comparing averages from the system and control groups. Similar techniques were used to estimate the effects of the water system on residential growth, the occupations of residents, and changes in the numbers of school-age children.

As an alternative to (and check on) the direct estimation approach, regression analysis simultaneously taking into account both presence or absence of the water system and other possible explanatory variables was applied to the survey data on land and housing values.*

Property Values

Agricultural Land

Survey results indicate that rural water system development increased the value of agricultural land in the area of Lincoln Rural Water System.

Eighty-four percent of the respondents who were members of the system and were involved in farming indicated that their farmland had increased in value. The average proportion of the farm land affected was reported to be 53%. For this portion, 31% of the change in the value of this farmland was attributed to the rural water system.

A comparison of perceived changes in agricultural land values in the area served by the water system with changes reported by respondents from the control area also indicated that the water system increased land values. Reported market values and value changes per acre of agricultural land from 1970 to 1975 were:

	Value 1970	Value 1975	Change in Value 1970 - 1975	
System area	$465	$907	$442	95%
Control area	$563	$1,012	$449	80%

Although the reported value of agricultural land increased slightly more in absolute terms in the control area than in the Lincoln Water System area, the value change in percentage terms was 15 points higher in the system area.

Results of an analysis using the regression model designed to estimate the simultaneous impacts of the water system, distance from Sioux Falls, and distance from the nearest small town on agricultural land values were inconclusive. None of these factors was found to be statistically significant (at the 20% level).

These results cast doubt on the direct estimates of water system impacts described in the previous two paragraphs and, as well, strongly suggest that the issue of rural water system impacts on property cannot be resolved without a better data base.

They also underline the wisdom of scepticism with respect to perceptions by water system members and others regarding the effects of a rural water system on the marketable value of agricultural land.

Residential Acreages

When asked how much the value of unimproved land being converted to rural residential use had increased from 1970 to 1975, the 44 respondents from the water system area reported a mean increase of $1200 per acre. The 20 respondents from the control area reported an increase of $662 per acre.

A t-test indicated that the difference between these two means was highly significant. Thus the estimated influence of the water system on unimproved rural acreage values was $538 per acre.

Water system residents' estimates of the proportion of acreage value increases attributable to the water system averaged 37%. Based on their average estimate that acreage values increased by $1200 per acre, the amount attributable to the rural water system was $444 per acre over a 5-year period.

As distance from Sioux Falls and from neighboring small towns are likely to influence

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* The regression equations used in this study were:

(1) $Y_a = a + b_1X_1 + b_2X_2 + b_3X_3$

where Y_a = the 1970-1975 change in value per acre of agricultural land in dollars.

X_1 = a dummy variable; taking a value of 0 if the data were from water system respondents, 1 if the data were from a control area respondent.

X_2 = the distance of the respondent's house from Sioux Falls, in miles.

X_3 = the distance of the respondent's house from the nearest small town, in miles.

Expected signs of the regression coefficients (b's) were:

b_1 - positive (availability of dependable good quality water was expected to enhance land values); b_2 - negative (agricultural land close to Sioux Falls was expected to increase in value faster than land further out because of the greater possibility for supplementing farm income through employment in the urban center by one or more family members); and b_3 - no hypothesis.

(2) $Y_{na} = A + b_1X_1 + b_2X_2 + b_3X_3$

where Y_{na} = the 1970-1975 change in value per acre of non-agricultural land (rural residential acreages), in dollars.

$X_1X_2X_3$ = defined as in equation 1 with expected signs of b_1 and b_2 also the same as in equation 1. The expected sign for b_3 is negative because it was hypothesized that persons wanting to live in a rural environment but employed in an urban job would not want to be located too near a small town, within the limited distances (5-10 miles) between towns in and near the Lincoln Water System area.

(3) $Y_h = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4$

where Y_h = the 1970-1975 change in the values of rural farm and non-farm homes, in percent.

$X_1 X_2 X_3$ = defined as in equations 1 and 2, with expected signs of b_1, b_2 and b_3 the same as in equation 2.

X_4 = age of the house in years; with the expected sign of b_4 being negative; an older house would not be as attractive to new rural residents as would newer ones.

the price of rural acreages, the changes in value per acre of rural residential acreages reported by survey respondents was regressed on the independent variables of membership in a rural water system, the distance from Sioux Falls in miles, and the distance from the nearest small town in miles. Results were significant at the 20% level or better and were consistent with results of the other two estimation procedures.

The effect of the rural water system was to raise the value per acre increase within the system by $497.

The regression results also indicated that as distance from Sioux Falls increased, the 5-year increase in the value per acre of unimproved rural acreages was reduced by $68 per mile. This estimate is reliable only in the range of the data collected, which was 1-14 miles from Sioux Falls.

And, as distance from the nearest small town increased, the change over 1970-1975 in acreage values increased by $71 per mile. This estimate, which covered a range of 1-8 miles, suggests that rural residents prefer to be close to a major urban center but still retain a rural environment by not being too close either to the urban center or to neighboring small towns.

Rural Housing

Reported increases in the value of water system area respondents' homes from 1970 to 1975 averaged 11% higher than did those of respondents from the control area. However, a t-test indicated that the probability that this result could be due to chance was greater than 25%.

When the percent change in housing values from 1970 to 1975 was regressed on membership in a rural water system, age of the house, distance to Sioux Falls, and distance to nearest small town, the system membership variable was found not significant at the 20% level.

Hence this analysis did not support the hypothesis that house values are increased by the availability of water from the rural water system. The other variables had positive coefficients that were statistically significant at the 20% level. (The distance from the nearest small town variable was significant at the 1% level.)

These results indicate that housing values increased more rapidly for old houses than for new ones and more rapidly as distance from Sioux Falls and from the nearest small town increased. An explanation of the inconsistency of rural housing (house) values increasing more rapidly with increased distance from Sioux Falls while the value of unimproved acreages increased more rapidly closer to Sioux Falls may be that house prices near Sioux Falls had already been pushed up by earlier urban sprawl pressure.

For the distance variables the applicability of the regression results is limited to the areas within 14 miles of Sioux Falls and 8 miles of the nearest small town.

Location of Residence

Results of the survey indicate that it is likely that the presence of the Lincoln Rural Water System did induce more rapid population increase within the system area than would have occurred had the system not been established.

The length of residency of respondents in the water system area averaged 10.7 years, as compared to 19.7 years in the control area. The difference in modes shows the same relationship, only to a greater extent. The modal length of residency within the system was 4 years, compared to 15 years for the control area. Both the mode and the median (5 years) residencies in the study area fell within the period since the start of the rural water system. This may imply that the system was attracting new residents to the area.

Responses by residents of the Lincoln Water System areas as to whether the rural water system influenced or is influencing their residency location decisions are summarized in Table 1.

Table 1. Influence of water system on residency location.

Type of Residency	No. of Responses	Percent Responding As To Whether The System Influenced Location: Yes	Maybe	No
Rural (Non-farm)				
New	24	58.4	4.1	37.6
Established	8	0.0	0.0	100.0
Weighted ave.	32	43.8	3.0	53.1
Farm				
New	10	0.0	0.0	100.0
Established	20	0.0	10.3	89.7
Weighted ave.	30	0.0	6.7	93.3
Total				
New	34	41.1	2.9	56.0
Established	28	0.0	7.3	92.7
Weighted ave.	62	23.0	4.8	72.2

New residents were defined as those respondents living in the area less than 5 years.

All respondents who indicated that the rural water system definitely influenced their decision to reside in the area were non-farm residents, 58% of whom reported that the rural water system influenced their residency decision.

Ten percent of the established farmers indicated that the presence of the system may influence them to maintain their current residence.

Altogether, 23% of the respondents gave some importance to the water system as having affected their location decision, 72% said it had no effect.

School-Age Children

The influence of a rural water system on the number of children of primary and secondary school age was explored by taking the respondents' number of children per household and categorizing them by type of residency and influence of rural water system on residency location. Results of this classification are shown in Table 2.

Table 2. Influence of system on residency location of families with school-age children.

Type of Residency	Number of School-Age Children Per Household Responding As To Whether The System Influenced Location: Yes	Maybe	No
Rural (Non-farm)			
New	2.2	3.0	1.2
Established	—	—	0.9
Weighted ave.	2.2	3.0	1.1
Farm			
New	—	—	1.3
Established	—	0.5	1.7
Weighted ave.	—	0.5	1.6
Total			
New	2.2	3.0	1.3
Established	—	0.5	1.4
Weighted ave.	2.2	1.3	1.4

The ratio of school-age children per household is largest for the new rural residents who indicated that they were definitely or partially influenced by the rural water system in their location decision. These are entirely non-farm families. In fact, for non-farm residents definitely influenced by the system the number of school-age children per household is twice as high as for non-farm residents but influenced by the rural water system.

Summary of Findings

Members of rural water systems estimated that the value of their farmland affected by installation of the rural water system (44% of the respondents' farmland) had increased an average of 31% due to the rural water system.

However, when the influences of distance from Sioux Falls and the nearest town were considered, the difference between the water system and non-water system areas in increases in farmland values was not statistically significant. These conflicting results suggest that gains in farmland values associated with rural water systems perceived by members may not actually occur.

Estimates for increases induced by the water systems in the property values of homes ranged from 10.7 to 11.6%. These estimates included high probabilities of error and consequently provide only weak evidence that housing values do increase when service by a rural water system is made available.

The evidence that rural residential acreages increase in value is strong. Study respondents indicated that the value per acre of land being converted to rural residential uses had increased by $538 more in the rural water system area than in the non-water system (control) area. Water system members estimated that 37% of the change in their acreage property values was due to the water system, or $444. Regression analysis, controlling for distance from Sioux Falls and neighboring towns, found a $497 higher increase per acre within the water system area over the 1970-1975 period.

Population growth is encouraged by the water system. Over half (58%) of the new non-farm residents in the Lincoln Rural Water System area reported that the water system definitely influenced their location decision. This suggests that the rate of growth of non-farm population in the system area was somewhat higher than would have occurred without the system.

On the other hand, it also means that not all of the new non-farm growth can be attributed to the water system. in this case study 38% of the new non-farm families located in the area without reference to whether or not a system was installed.

The type of family encouraged to move to the area by the water system had more children in elementary and secondary schools than did either established residents or those new residents who said that the water system did not affect their residency decision.

Potential Impacts of Growth

The development of a rural water system has several initial and long term impacts. The net income generated from the construction of the system and new homes is an immediate increase to income in the area. Also, the conversion of farmland to residential use generates income to the original farmland owners.

Over a longer period, additional income attributable to the land and associated capital facilities will come only from maintenance of the new facilities and from property value appreciation. Meanwhile, income that would have been generated by the farmland now converted to acreages will be lost.

Both revenues and expenditures of local governmental units are likely to increase: revenues because increasing land values and building construction add to the tax base and taxable value; expenditures because of accelerated growth of the non-farm population and the numbers of school-age children.

The apparent impacts of a rural water system may overstate the real local community impacts, insofar as developments within the water system area represent transfers from adjacent cities, towns or rural areas. For example, construction of a new rural residence within a rural water system area may merely displace construction of the same house for the same people and by the same construction firm within the same or an adjacent taxing and public service district. In such a case most of the apparent impact disappears when viewed from even a slightly broadened community perspective.

Other considerations that may be more difficult to quantify are relevant to an evaluation of water system developments. Health and sanitation for people and livestock in the area served may be improved. However, if development occurs in the open country the amount of water used for lawns and gardens for a given level of population may increase; and if city residents move to the country, the amount of gasoline consumed may increase as they commute for work and household needs. The extra travel may also add to air and noise pollution, especially where travel is on gravel roads. Another potential for pollution would result from increased dependency on septic tanks for sewage disposal.

Potential conflicts in perceptions of acceptable land use may develop. Non-farm rural residents may complain about the noise, dust, or odors of normal farming operations, and seek public regulations to control the hours or types of farming operations. Increased traffic on rural roads and possible interference with pets and children of new rural residents may restrain farming operations.

If rural residential development occurs in an uncontrolled manner, wildlife habitats and life styles may be changed or eliminated. Development along roadsides may eliminate ditches as wildlife habitat areas. Strip development, especially along riverbed or other ecologically sensitive areas, may alter the life patterns of predator animals, or the movement of animals such as deer.

Among the things most difficult to estimate is whether the satisfactions some gain from living in open spaces outweigh the costs or shortcomings of providing them this opportunity. The scope for out-of-doors play for children and outside recreation and hobbies for adults in rural developments may be greater than in an urban setting. The question may be: who is paying for these opportunities, not should they be created.

Questions for Further Study

With the increased development of water systems, what will be the net fiscal impact on local units of government, especially those near urban centers? What are the effects in or on small towns that buy water from the systems?

Would the development that is occuring in the rural areas of eastern South Dakota have happened anyway? Does the development of rural water systems just speed up development, or is it a catalyst for a permanently sustained increase in population and property values?

Also, what role does a water system play in directing development? Does a water system make it easier for a developer to open up an area for residential use? Are builders then encouraged to fill in solid units, or to scatter along the water line?

More understanding is needed of demand for housing in general and of the constraints or encouragements causing people to build on the urban-rural fringe rather than within urban centers. What factors other than those considered in this study are relevant?

What institutional arrangements might mitigate the conflicts between residents of rural water systems and adjacent urban areas? Alternatives may include not only various forms of land use planning and control but also revision of the school finance system.

The question facing local units of government now is: if a fiscal deficit is (or may be) incurred, what (if anything) should be done? The general mill levy may be raised, special assessments on new developments to pay the full cost of servicing them may be used, or zoning restrictions may be used to control or stop growth associated with rural water system development. Because the impact will be different in every location, no recommendation is made here.

While the direct benefits of a rural water system to its customers are not questioned, the secondary impacts on local units of government may be a problem.

Estimation of the impacts of rural water systems must be done on a case-by-case basis as impacts will vary with the size of the rural community and its proximity to an urban center, among other factors.

Recently the impacts of rural water systems have come under new public scrutiny in South Dakota.[1] Some of the concerns that have been expressed are: the loss of prime farmland, wastewater from subdivisions polluting underground waters, increased public sector costs due to urban sprawl, adverse fiscal impacts on rural areas and adjacent urban areas, and impairment of orderly growth of existing communities.

A city official in Sioux Falls has recommended that two proposed new rural water systems be required to prepare detailed impact statements (Jackson, p. 14). Specifically, the recommendation suggested each system should "provide detailed analytical data and actively solicit public participation in order to:

1. determine the potential magnitude of induced urban sprawl resulting from the construction and operation of each rural water system,
2. provide detailed economic, social, political, and environmental studies of the potential impacts of urban sprawl resulting from the installation of each rural water system,
3. study alternatives to the proposed water system projects, and most important,
4. provide a mechanism for the study and public discussion of the alternative design and management schemes for each rural water system so as to mitigate the negative probable impacts of each system."

Officials of rural water systems have resisted this proposal. The reasons for these two views are related to the distribution of the benefits and costs. The expected benefits of new water systems exceed the costs to water system members. Members receive an ample and dependable supply of good quality water at prices considered reasonable by many. Land values within a water system may increase considerably. Urban sprawl often improves the "retirement programs" of farmers with land to subdivide. It also sometimes increases population density enough to make rural water system service feasible for previously isolated farmsteads.

On the other hand, officials of towns and cities outside of but affected by the system (such as Sioux Falls) are concerned that the increased population and residential tax base will be at their expense. If the middle-aged voters, those with no children needing further education but wishing to build a newer, more expensive home, move to rural areas, the city loses a valuable tax base. In many respects the underlying problem is the system of financing public education. If the property tax provided a smaller proportion of the support, the city would probably be less concerned.

In addition to the city officials' concern that their tax base will be eroded by rural housing development, there is concern among property owners within the city that their property values will decrease, or at least not increase as fast as they would otherwise. The more that growth is facilitated elsewhere, the less demand pressure there is on housing and land values in the city and the less capital gain is captured over time by property owners there.

The proposal to require rural water systems to develop detailed impact statements raises two important policy questions:

1. Do the rural water systems have the technical personnel, or the financial resources, to hire consultants to conduct detailed impact studies?
2 If detailed impact studies are undertaken, who should pay the cost? Should it be the potential rural water system users, neighboring cities, the state, or the federal government?

Currently, it is doubtful that any single agency, such as the rural water systems, the Farmers Home Administration, or the South Dakota Department of Natural Resources, has the technical personnel required to estimate all of the potential economic, social, political, and environmental impacts. Also it is unlikely that they have adequate financial resources available to hire consultants for this task. Because of the widespread benefits in terms of better public sector decisions that might accrue as a result of better planning, including impact assessment, the costs and performance of such studies should probably be shared by local, state and federal interests.

[1] An example of the conflicting views over impacts is given by recent public hearings and litigation concerning expansion of rural water systems around Sioux Falls. Active parties to the conflict include the city of Sioux Falls, the Water Systems' Boards of Directors, the Sierra Club, and the South-East Council of Governments (SECOG). See "Rural Development Beckons Urban Sprawl: Analysis of Rural Water Systems in Lincoln and Minnehaha Counties, South Dakota. Re: Sierra Club versus Gordon Cavanah, et al." by Thomas E. Jackson, Urban Planner and Professional Civil Engineer, Office of Planning and Zoning Dept., City of Sioux Falls, S.D., November 20, 1977. An unpublished preliminary study was also done by SECOG prior to the initiation of this study. It was labeled "Impact Analysis of the Proposed Lincoln County Rural Water System Expansion" but was labeled preliminary and without a date or author.

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