

# MAINTENANCE OF MULTI-LANDOWNER DRAINAGE IMPROVEMENTS IN OHIO

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## ABSTRACT

Much of Ohio was uninhabitable by humans until it was drained during the nineteenth century. Settlement lagged in many areas because of wetness and the presence of wetness and disease. As the population increased, landowners cooperated to construct mutually beneficial drainage improvements to convert land with wetness problems to productive cropland. By 1884, it was estimated that 20,000 miles of public ditches benefiting over 4.45 million hectares of land had been constructed. However, lack of organized maintenance often resulted in cycles of declining benefits followed by reconstruction for many of these drainage improvements.

Since 1957, many Ohio counties have established organized maintenance programs for drainage improvements constructed under the relevant legal authority. As part of the creation of Ohio's Agricultural Water Management Guide, a study was undertaken to inventory the number and types of drainage improvements under maintenance, the area benefited by these projects, and the cost of maintenance for the years 1994-1996.

Forty-seven counties of 50 counties surveyed reported organized ditch maintenance programs for 1996. Over 3359 individual open ditches, subsurface drainage mains, and grassed waterways are maintained by these programs, and over 1.25 million ha of land is estimated to be benefited. Over \$2.8 million was spent on maintenance for these projects in 1996. The average annual cost for maintenance of a selected group of open ditches with detailed records was less than \$2.00 per hectare of benefited land.

**KEYWORDS.** Agricultural drainage, group drainage, drainage districts, ditch maintenance, drainage benefits.

## INTRODUCTION

Much of northwest Ohio was uninhabitable by humans until it was drained during the nineteenth century. Settlement lagged in these areas because of the wetness and the presence of mosquitoes and disease but individual landowners often had problems removing excess water because of insufficient outlets downstream (Sandretto, 1987). Thus, the expansion of agricultural drainage was often enhanced by the cooperation of groups of landowners having a common interest in the removal of excess water. However, cooperative efforts, especially in larger projects, had limitations. In addition to the inherent weaknesses of groups to achieve a common goal, they did not possess the power to compel all landowners who benefited from the endeavor to pay their fair share of the costs, nor could they compel an uncooperative landowner to allow construction across his property. A third limitation was that often a project was not maintained. By 1884, the Ohio Society of Engineers and Surveyors reported that 20,000 miles of public ditches benefiting over 11 million acres of land had been constructed (Wooten and Jones, 1955).

Prior to 1947, maintenance of drainage projects was the responsibility of benefiting landowners and the county ditch supervisor assigned sections of a ditch to benefiting landowners to maintain. However, maintenance was haphazard and projects were often re-petitioned periodically for reconstruction. For example, in a study of county petition projects in Franklin County, Pierce (1996) reported finding over 1000 petitions for improvements to only 439 separate drainage systems.

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After 1947, the boards of county commissioners were authorized by Sections 6546-6547 of the General Code to establish a maintenance fund for a county or joint county ditch when a majority of benefiting landowners petitioned for maintenance (Baldwin, 1948). This provision was changed in 1953 (6137.02 of the Revised Code) to allow a petition by three or more landowners (Page, 1953). In 1957, the wording of 6137.02 RC was changed so the board of county commissioners “shall establish and maintain a fund” for the maintenance of all projects constructed under the provisions of 6131, 6133 and 6135 of the Revised Code (Anderson Co., 1959). This fund is financed by special assessments on the benefiting land apportioned on the basis of the estimated benefits for construction (6137.03 RC). It was after this change in law that nearly all present-day formal ditch maintenance programs were begun.

Several attempts have been made in recent years to document group drainage activity in Ohio. In 1972, it was reported that 7093 miles of natural and constructed streams and channels were being maintained in 53 counties (Channel Modification Task Force, 1972). In 1971, a drainage survey was mailed to 8 contractors and 12 conservationists in 18 Ohio counties; fifteen questionnaires were returned. From this survey, Nolte (1972) reported that an average of 122 miles of open ditches (12 responses) and 4 miles of subsurface drains (11 responses) per county were on a permanent maintenance program. Eleven respondents estimated that an average of 679 additional miles of open ditches per county were in need of maintenance, construction or reconstruction, while 9 respondents estimated 99 miles of subsurface drains needed similar work. The 15 respondents also estimated the percentage of open ditches and tile that were affected by various problems. The major concerns with the open ditches were: 1) the channel was overgrown with brush (affecting 50% of cases); 2) the bottom of the channel was filled (43%); and 3) subsurface drain outlets were submerged (29%). The major problem with subsurface mains was a submerged outlet (affecting 25%) or limited capacity (13%). The respondents estimated that an average of 72% of the inadequate outlets would require group action to resolve.

Nolte (1979) conducted a ditch maintenance survey at the 1979 drainage conferences. He found that ditch maintenance work was being done in 32 counties. These 32 counties maintained an average of 114 miles of open ditches while 26 counties maintained an average of 9 miles of subsurface mains.

In an unattributed mimeo, probably by Nolte, it was reported that 3687 miles of open ditch and 323 miles of subsurface drainage mains were under ditch maintenance programs in Ohio in 1980. The average expenditure for counties with over 50 miles under maintenance was \$303 per mile, ranging from \$92 to \$662 per mile.

A 1982 survey found 3827 miles of open ditch and 358 miles of subsurface mains being maintained under the authority of Ohio drainage laws. The 13 counties that had more than 50 miles under maintenance reported an average expenditure of \$252 per mile (Nolte, 1985b). The 1985 ditch maintenance survey found a total of 4200 miles of open ditches and 415 miles of subsurface mains under county ditch maintenance programs in 47 counties. Average costs for the 28 counties that reported more than 50 miles of drainage under maintenance were \$328 per mile in 1985 (Ernst, 1985).

Vigh (undated) presented a summary of ditch maintenance programs in Ohio in 1994. The 45 county programs in this publication listed 4966 miles of open ditches, 441.56 miles of subsurface mains, 97.71 miles of grassed waterways along with a few other projects under maintenance. A total of \$2,557,750 was reportedly spent to maintain these projects.

In preparation for the publication of a new Ohio Agricultural Water Management Guide, a survey of County Engineers and Soil and Water Conservation Districts was conducted to evaluate group drainage practices in Ohio for the years 1994-1996. This paper presents a summary of maintenance activities conducted in certain Ohio counties during calendar year 1996. The objectives of this study pertaining to maintenance of group drainage practices were:

- Assess the extent of drainage maintenance programs;
- Determine the costs of this maintenance, in general, by project type;
- Determine detailed costs of maintenance for a select group of recently constructed projects.

## **METHODS**

An extensive survey instrument was developed to obtain the data needed to meet the objectives of this project (Atherton, 1999). The instrument contained four sections. Sections I and II are relevant to this study. Section I was designed to assess the level of recent project activity in Ohio. The agencies were asked to provide information regarding the number of projects and total costs associated with assistance provided for new group project activity during 1994, 1995 and 1996.

For projects constructed during this time period, respondents were asked to provide information by project type - open ditches, subsurface mains, grassed waterways, and other project types - for each of the three organizational authorities - County Petition (CP), Senate Bill 160 (SB), and Mutual Agreement (MA) - provided for by the Ohio Revised Code. The specific agency having responsibility for ditch maintenance in each of the surveyed counties was asked to provide detailed information about its county ditch maintenance program in Section II.

Section II was designed to obtain specific information on the types of projects identified in Section I. The agencies were asked to provide the number of projects, total length, total benefited acres, total maintenance fund expenditures, and the total of other maintenance expenditures. The agencies were asked about ditch projects only since about 90% of the total length of projects on county maintenance programs was found to be ditches in a previous report (Vigh, undated). Survey recipients were asked to provide costs broken down by as many as 14 categories for each of four sources of funds. Finally, the maintenance expenditures by year were requested in each of five sources of funds.

## **RESULTS AND DISCUSSION**

A mail survey of both County Engineers and Soil and Water Conservation Districts (SWCDs) in 50 Ohio counties was conducted from November 1997 through April 1998, using a modified Dillman (1978) approach. The response rate was very good with 79 surveys returned by 34 county engineers and 45 SWCDs. In addition, one county engineer and two SWCDs took the initiative to either send a letter or phone to indicate their activity, for an overall response rate of 82% (82 agencies). Phone calls were made to the agencies that did not respond to the survey, resulting in partial information obtained from 16 agencies. The author made site visits to two county engineers. Overall, information relating to Section I of the survey was obtained from 80 agencies (80%), while information relating to Section II was obtained from 77 agencies (77%).

### County Group Drainage Maintenance Programs

Section II of the survey asked for detailed information about county drainage maintenance programs<sup>5</sup>. By law, the county engineer has administrative authority over these programs, although in some cases the SWCD administers these programs through a memorandum of understanding or working agreement with the county engineer and the board of county commissioners. Of the 50 counties in the survey, 34 ditch maintenance programs were administered by the county engineer's office and 13 by SWCDs. Three counties reported no ditch maintenance program.

County ditch maintenance programs are funded by special assessments on the parcels of land benefiting by the projects in the program, each project having a separate maintenance fund. Total maintenance fund expenditures reported for the 47 county programs amounted to \$2,754,064.81 (Table 2.7). These counties reported \$56,372.22 in other expenditures, for total maintenance expenditures of \$2,810,437.03. Six of these counties reported no expenditures during 1996. While we were able to obtain expenditures for all 47 maintenance programs, we were not able to obtain other summary data from all of the county ditch maintenance programs. We found that many county ditch maintenance programs do not have all of the requested information. The information exists in individual project files, but with high workloads, and other priorities, it has not been properly compiled in every county.

The total number of projects on maintenance programs reported by 43 counties was 3359. Two counties (Hardin and Wood) expected to have a large number of projects did not report. The total length of projects reported was 4,589 mi (7385 km) from 45 counties. Only 32 counties were able to provide data on the total area benefiting from the projects on maintenance. These 32 counties reported 2,384,285 acres (964,907 ha) benefiting from 2513 projects, a figure which must be considered much less than the actual area benefiting by all group drainage projects on maintenance in Ohio. We can estimate the total benefiting area in Ohio by taking the average area per project for the 32 counties, 949 acres (384 ha) and multiplying that by the 3359 projects reported, yielding a rough estimate of 3,187,691 acres (1,290,040 ha) benefited by ditch maintenance programs statewide.

Nearly all counties report open ditch projects on their maintenance programs, which represent 71% of the total number of projects reported, and 89% of the total miles of projects. Subsurface mains are the second most importance category of project on the county maintenance programs, followed by grassed waterways, which often have a subsurface main associated with them.

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<sup>5</sup> When referring to their maintenance programs for drainage projects, most agencies use the term "ditch maintenance program," which includes all classes of projects such as subsurface mains, grassed waterways, etc. in addition to open ditches.

Not all counties made complete reports in each of the categories, so definitive statistics were not developed. More than one county reported that they do not have their records summarized in the detail needed to complete the survey (personal communication, February 1 and February 19, 1998). Developing this information can be done, but someone will have to examine each case file on hundreds of projects in some of these counties. It is clear that open ditches make up the majority of the projects on maintenance and incur the majority of the maintenance expenses.

Table 1 summarizes the maintenance programs by project category for those counties that reported complete information about number, length and benefited area. The costs shown represent averages over the entire project; costs for individual parcels may be much higher or lower than the average because of the method used to allocate costs among the parcels.

**Table 1. Maintenance costs per unit length and area for selected Ohio group drainage project projects during 1996.**

Category of Project	Number of Projects	Length		Benefited Area		Expenditures			
		(mi)	(km)	(ac)	(ha)	per mi	per km	per ac	per ha
Grassed waterway	67	58.53	94.19	60,763	24,590	658.59	409.23	0.63	1.57
Open ditch	1254	1,958.44	3,151.82	1,368,823	553,955	469.26	291.59	0.67	1.66
Open ditch	410	737.00	1,186.09	503,360	203,707	367.71	228.48	0.54	1.33
Subsurface main	256	180.35	290.25	93,968	38,028	177.23	110.13	0.34	0.84

Several counties place housing subdivision drainage mains on county maintenance programs. These apparently serve as outlets to on-site sewage disposal systems, and the county agencies feel this will insure maintenance on the outlet for these systems. Other counties are putting other storm-water management projects, such as detention basins, on the county maintenance programs. In many cases the developer is asked to do this prior to development or sale of individual lots. The mutual agreement part of the drainage laws (6131.63 RC) is used to place these projects on maintenance.

Review of selected individual open ditch projects, 1988-1992.

Section III of the survey provided detailed information about individual open ditch projects. Thirty-eight agencies representing 28 counties responded to the request for detailed information concerning one ditch project constructed during the period 1988–1992. During this 5-year period, these 38 agencies reported assisting with the construction of 249 open ditch projects, an average of seven per agency and nine per county. Assistance ranged from 1 to 45 projects per agency and from 1 to 73 projects per county.

The legal authority used to organize these 37 open ditch projects was nearly equally split among the three possible choices with 15 county petition (CP) projects, 11 mutual agreement (MA) projects and 11 Senate Bill 160 (SB) projects.

Agencies have preferred methods of dealing with group requests and this includes the legal authority used. For instance, the SWCD in Montgomery County, by agreement with the county engineer and board of county commissioners, handles all group requests and uses the SB-160 process exclusively. In Huron County, the SWCD provides assistance to all group project requests and currently uses the mutual agreement process exclusively.

There are two general themes among the reasons given for choosing the county petition (CP) process for organizing a drainage project. In six instances, respondents indicated that this was the preferred process or felt that this was the only process that could solve the problem. In four cases it was noted that the landowners selected the process by petition. One could assume this was done because it was the preferred process in the county. In two cases it was felt that this was the most expeditious process. In three cases the process was used because the landowners could not agree; otherwise the mutual agreement process could have been used.

The mutual agreement (MA) process is often used when all or nearly all landowners agree on the necessity of a project, and also agree on the allocation of costs among the benefiting landowners. Three agencies felt it was the most economical and a quicker process than the other two processes. Some agencies are using this method to place subdivision drains and storm water control structures such as detention/retention basins on the county maintenance program.

Ten projects were organized under the SB-160 (SB) process (eleven agencies provided responses, but two agencies submitted the same project). The SB process was chosen most often because of

the presence of objecting landowners. Two selected this process because it would save on engineering costs. One selected the SB process because of a backlog of county petition projects in the county. One county has a memorandum of understanding among the board of county commissioners, the county engineer, and the soil and water conservation district to use the SB process exclusively in the county.

The mutual agreement process is the easiest and provides the least cost to landowners, since the SWCD does not assess landowners for the engineering and administrative assistance. The SB-160 method is thought to be less expensive than a county petition, also because the SWCD usually provides technical and administrative assistance without assessing the landowners. The county engineer by law assesses the benefiting landowners to recover costs in the county petition process.

The most important reason given for constructing these open ditches was to provide an adequate outlet for subsurface drains. The second most important was to improve crop production. Most open ditch projects predominantly benefit agricultural uses such as cropland. Farm owners often have a large investment in subsurface drainage systems, which depend on an outlet in the form of an open ditch to operate properly. Protecting this investment is obviously of great importance, reflected in the high score given to these two factors.

The third most important was to place the ditch on the county maintenance program. As noted earlier, maintenance of drainage projects was haphazard prior to the change in the ditch maintenance laws in 1957. Lack of maintenance reduces the efficiency of many open ditches (Overmier, 1972). The high score on this item indicates recognition that a maintenance program can reduce the risk of poor drainage. Reduced flooding concerns were relatively less important on average as reasons to construct these projects.

Respondents listed maintenance expenditures by year for each of these projects. Only 33 of the 38 projects submitted are used in this analysis because of incomplete information or duplication. Using the year of construction as year one, these expenditures were converted to a present value at year one, and then an annual payment was calculated that would equal the present value. The interest rate assumed was 7.5%.

Overall, unit costs range from \$0.00 to \$2,996.63 per mile and from \$0.00 to \$20.08 per acre. The high values are caused by the very small project size, rather than by large total costs. If we ignore the projects for which no expenses were reported and the small projects, we find the average ditch maintenance cost for individual projects ranges from \$0.01 to 7.93 per acre and from \$5.95 to \$1,030.29 per mile. Average cost by legal authority for projects with non-zero expenditures is \$0.52 per acre and \$484.10 per mile for MA projects, \$0.58 per acre and \$228.04 per mile for SB projects, and \$1.11 per acre and \$327.39 per mile for CP projects. Nearly all projects have an annual maintenance cost of less than \$1.00 per acre. Of course, individual parcel costs may be many times more or less than the average, depending on the way the costs are allocated among the benefiting parcels.

This large variation in maintenance costs for these ditch projects is intriguing, and would make an interesting study. Possible explanatory variables include the soils, weather conditions at and soon after the time of construction, inclusion of erosion control measures, the cost categories that are included as maintenance costs (for example, how are administrative fees handled), adequacy of design, attitude of administering authority towards maintenance, size of project, area/length ratio, and others.

## CONCLUSION

A survey of county engineer offices and SWCDs in 50 counties was conducted in 1997 to measure the extent of new group drainage project activity and obtain information about the size of ditch maintenance programs to compare with previous survey data. The participation rate was high, although some information was not provided by several agencies because of high workloads preventing the research necessary for local agency personnel to summarize the data. In particular, the information obtained for total benefited area and the breakdown of projects by legal authority is not complete.

Of the 50 counties in the survey, 34 ditch maintenance programs are administered by the county engineer's office, and 13 by the SWCDs. Three counties reported no ditch maintenance program. Maintenance fund expenditures reported for the 47 county programs in 1996 amounted to \$2,754,064.81. These counties reported \$56,372.22 in other expenditures, for total maintenance expenditures of \$2,810,437.03. Six counties reported no expenditures for the ditch maintenance program during 1996. Thirty-two counties reported 2,384,285 acres (964,907 ha) benefiting from projects on their ditch maintenance programs. Projecting from these numbers, the author estimates that about 3.1 million acres (1.25 million ha) of land is benefited by ditch maintenance programs

statewide.

The main problem with this study was the lack of detailed information from a few agencies. This was because of a high workload and the lack of a current summary of projects that are currently on the maintenance program. It will take some effort on the part of these agencies to compile the needed information, but once compiled, it will be relatively easy to keep up to date on a computerized database.

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