CONSTRUCTION OF MULTI-LANDOWNER DRAINAGE IMPROVEMENTS IN OHIO

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ABSTRACT

Ohio law specifies procedures that allow groups of landowners to organize for the construction and maintenance of drainage improvements with the assistance of either the county engineer or the local soil and water conservation district. These multiple-landowner or group drainage improvements have been constructed since the mid-1800s and were essential for the development of much of Ohio. In the last 30 years, legislation and rule making have placed limits on the drainage of jurisdictional wetlands.

A survey of county engineers and soil and water conservation districts was conducted to determine the current demand for new group drainage improvements benefiting multiple landowners and quantify the amount of construction actually undertaken. Using a small group of individual open ditch projects, construction costs among the three legal authorities were compared.

This study found that demand for these group drainage improvements remains high. For the years 1994-96, landowners in 37 Ohio counties requested assistance for an average of 150 drainage improvements annually, using all three legal authorities available. A total of 342 group drainage improvements costing over $9.5 million were constructed during this three-year period. Nearly 310 km of open ditch improvements were constructed benefiting 58 350 ha of land.

Thirty-eight agencies each provided detailed information concerning a single ditch project constructed during the period 1988 – 1992. The three most important reasons given for constructing these open ditches were: 1) provide an adequate outlet for subsurface drains; 2) to improve crop production; and 3) to place the ditch on the county maintenance program. Construction costs ranged from $8.34/ha to $2 528.91/ha ($3.38/ac to $1 031.02/ac) and $1 888.13/km to $177 298.73/km ($3 038.85/mi to $$25 367.56/mi).

It is apparent that landowners continue to see a great need for improved drainage, and are able to accomplish these improvements in spite of legislative and regulatory limitations.

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

INTRODUCTION

Settlement lagged in much of northwest Ohio in the early part of the nineteenth century because of wetness and the presence of mosquitoes and disease. 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. Laws were enacted giving public officials or authorized public organizations (drainage districts) certain powers to overcome these difficulties. Ohio[5] passed its first drainage laws March 26, 1841 (39 Ohio Laws 122) (Frost and Nichols, 1985). Under the provisions of this law, the courts of common pleas were empowered to appoint persons for "*clearing and removing the banks and obstructions of the passages of the water in rivers, brooks, streams or ponds, which occasion the overflowing and drowning of*

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[5] Ohio is one of 10 states identified in the 1950 Census of Drainage as "county drain" states. These are states where the county serves as the predominant drainage organization.

meadows, swamps and lowlands…" (Schwartz, 1955). In 1859 the legislature gave control of the construction of drainage projects to the boards of county commissioners. Landowners that needed improved drainage were required to petition the board of county commissioners in their county to begin the process by which a group drainage project was constructed.

Today there are four legal procedures Ohio landowners may use to initiate the formal construction or reconstruction of a group drainage improvement: the Mutual Agreement, County Petition, Conservation Works of Improvement, commonly known as the Senate Bill 160 process (SB), and Ohio Conservancy District Law (Brown and Stearns, 1991).

The mutual agreement (MA) procedure is the easiest to implement. A group of landowners wishing to construct a drainage improvement files the plans for this improvement and estimated costs with the Clerk of the Board of County Commissioners. The County Engineer reviews the plans, and if approved by the Board of Commissioners, the improvement is constructed and placed on the county maintenance program (Nolte, 1985).

The County Petition (CP) procedure is one of the mechanisms used to construct a drainage improvement when all benefiting landowners do not agree on the plans or cost distribution for the proposed drainage improvement. To invoke this procedure, one or more benefiting landowners petitions the Board of County Commissioners to construct a drainage improvement. The County Engineer investigates the proposed improvement, reports to the Board of Commissioners on the feasibility, and if feasible, prepares plans and a cost distribution among the benefiting landowners. Nolte (1985) describes this procedure in detail.

The Conservation Works of Improvement, or Senate Bill 160 (SB) procedure is used in some counties in place of or in addition to the County Petition procedure. This procedure is led by the Soil and Water Conservation District Board of Supervisors, and allows the Board to cause drainage improvements to be constructed if the Board finds that the benefits exceed the costs. Nolte and Derickson (1980) describe this procedure.

The Ohio Conservancy Law (Chapter 6101 of the Ohio Revised Code), can be used for drainage improvements. This is often used in conjunction with the Watershed Protection and Flood Prevention Act, Public Law 83-566. These projects are usually quite large, and are not considered in this paper.

Following passage of the Clean Water Act in 1972, federal policy has increasingly limited technical assistance from NRCS and other federal government agencies to individuals and groups wishing to drain wetlands. For example, in 1977, Presidential Executive Order 11990 limited federal assistance to projects that would adversely affect wetlands. The Food Security Act of 1985, and subsequent farm bills, denied price support and other farm program benefits to producers who use wetlands converted after 1985 for crop production.

By 1884, the Ohio Society of Engineers and Surveyors reported that 32 180 km (20 000 miles) of public ditches benefiting over 4.45 million ha (11 million ac) of land had been constructed (Wooten and Jones, 1955). While this would seem to indicate that much of the large drainage work had been accomplished by the end of the 19th century, in fact, group drainage projects continue to be constructed. There are two main reasons for this. First, group drainage projects often were not effectively maintained following construction, and consequently many projects were petitioned for improvement more than one time. For example, in a study of county petition projects in Franklin County, Pierce (1996) reported finding only 439 separate drainage systems resulting from over 1000 petitions. Second, drainage needs and standards have changed over time, with the result that older projects no longer provide the drainage capacity needed for optimum agricultural production, infrastructure needs, or flood control.

In 1972, the Ohio Soil and Water Conservation Commission initiated a study of the economic effects of channel modification for drainage and flood prevention purposes. The final report indicated that about 788 km (490 mi) of stream modification work was done annually by all interests in Ohio; 59.5 km (37 mi) of open ditch mains and laterals were constructed by individuals using Soil Conservation Service (SCS) designs during fiscal year 1971; groups of landowners cooperated to construct or reconstruct 179 km (111 mi) of open ditches during FY 1971; the Ohio Department of Natural Resources (ODNR) was reviewing about 65 plans for petitioned drainage projects each year; and 11 415 km (7 093 mi) of natural and constructed streams and channels were being maintained in 53 counties (Channel Modification Task Force, 1972).

Since that study, several other drainage surveys have been done in Ohio. Nolte (1972) refers to a 1964 survey which showed an estimated 16 093 km (10,000 mi) of county tile and 32 187 km (20,000 mi) of county open ditches in 47 Ohio counties[6]. 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 196 km (122 mi) of open ditches (12 responses) and 6.4 km (4 mi) of subsurface drains (11 responses) per county were on a permanent maintenance program. Eleven respondents estimated that an average of an additional 1092 km (679 mi) of open ditches per county were in need of maintenance, construction or reconstruction, while 9 respondents estimated 159 km (99 mi) 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. Atherton (1999) found that over 3359 individual open ditches, subsurface drainage mains, and grassed waterways are maintained by county maintenance programs and estimated that over 1.25 million ha (3.1 million ac) of land is benefited by these programs.

The objective of this study is to summarize the extent of group drainage project activity in Ohio. In this chapter we will present the findings of a survey of county engineers and SWCDs conducted in 1997 covering the three year period 1994 – 1996. We will discuss the scope of their group drainage project activities during this period, including requests for assistance, group drainage project construction, 1996 ditch maintenance program activities, and details of several individual ditch projects constructed during the period 1988 – 1992.

METHODS

An extensive survey instrument was developed to obtain the data needed to meet the objectives of this paper (Atherton, 1999). The survey instrument contained four sections. Sections I and III 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 this information by project type - open ditches, subsurface mains, grassed waterways, and other project types - for each of the three legal authorities - County Petition (CP), Senate Bill 160 (SB), and Mutual Agreement (MA) - provided for by the Ohio Revised Code.

Section III was designed to obtain information that would allow the author to summarize how the legal authority for a drainage project was selected, why the project was necessary, sources of funding for drainage projects, the range in unit costs for these projects, and how costs were allocated among work items. Each agency was asked to provide detailed information about one ditch project constructed during the time period 1988-1992. This time frame is after the implementation of the Swampbuster provisions of the 1985 Farm Bill, and thus reflects current regulatory conditions. Presumably, few non-cropped areas have been brought back into production by improved drainage since Swampbuster implementation. The agencies were asked about ditch projects only since about 90% of the total length of projects on county maintenance programs were 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.

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, and site visits were made by the author

[6] The term “county tile” or “county ditch” in common usage refers to group drainage projects that were constructed using the county petition process, found in Chapter 6131 of the Ohio Revised Code.

to two county engineers to get further information on project construction and maintenance activities.

Certain details are missing from several counties because of incomplete data provided by the counties. These data are available in the county records, but it would take some time to collect, and agency personnel cited workload concerns as the main reason they could not provide this data. An effort should be made to collect this information in the future, for once compiled, the data could be kept current with little extra effort.

Requests for New Group Project Assistance

Fifty-two agencies representing 37 counties reported having new or active group project requests during 1994, 1995 and 1996. From 1994 to 1996, 25 agencies reported assisting with county petition (CP) projects, 14 agencies assisted with Senate Bill 160 (SB) projects and 29 reported assisting with mutual agreement (MA) projects (Table 1). In general, the county engineers assist with county petition (CP) requests, SWCDs assist with SB-160 (SB) requests, and either agency can assist with mutual agreement (MA) requests.

Table 1. Summary of the number and fate of requests for group project assistance by year and legal authority, 1994-1996.

Year	Legal Authority Used*	Number of Counties Reporting	Number Filed	Number Approved	Percent Approved†	Number Rejected or Withdrawn	Percent Rejected or Withdrawn	Number Active End of year‡
1994	CP	21	54	35	65%	14	26%	73
	MA	25	69	69	100%	6	7%	57
	SB	13	32	28	88%	2	6%	55
	Subtotal		155	132	85%	22	14%	185
1995	CP	20	35	32	91%	9	26%	72
	MA	20	78	78	100%	11	14%	78
	SB	13	31	27	87%	2	6%	70
	Subtotal		144	137	95%	22	15%	220
1996	CP	23	47	35	74%	13	28%	79
	MA	25	71	72	101%	7	10%	69
	SB	14	35	24	34%	3	9%	86
	Subtotal		153	131	86%	23	15%	234
	Three year total		452	400	88%	67	15%	

* CP denotes the county petition process
MA denotes the mutual agreement process
SB denotes the SB-160 process

† Percentages may not total 100% because of requests carried over from previous years

‡ Active petitions may include those filed but still in the approval process

The number of requests for assistance with group drainage projects remained fairly constant, averaging about 150 requests annually for the counties reporting. Nearly half (48%) of the requests were for projects to be organized under the mutual agreement (MA) process. These requests were almost always approved by the responsible administrative authority, since all or nearly all of the landowners are in agreement. Although the initial approval rate is 100%, apparently some approved requests are later rejected or withdrawn, since 24 requests were reported to suffer this fate. The total number of requests acted upon totals more than the number of requests submitted because of carry over from previous years. The number of active MA requests at the end of the calendar year increased just over 20% from 57 in 1994 to 69 in 1996. A high number (78) was reported active in 1995, so the number of active projects actually decreased from 1995 to 1996, suggesting that the agencies are able to keep current with the requests for assistance for MA projects.

County petition requests are the second most numerous, with 136 total requests made during 1994 – 1996, 30% of the total number of requests. Only 75% of the requests were approved, with 26% of the total being rejected or withdrawn. The number active at the end of the year increased slightly from 73 requests in 1994 to 79 requests in 1996. The increase in active requests is likely because of a large (34%) increase in requests for 1996 over 1995. These numbers suggest that the agencies are staying fairly current with the CP requests.

SB-160 requests make up 22% of the total. The smaller number of SB requests reflects the smaller number of counties using this process. On an annual basis, there were 2.33 SB requests per county, compared with 2.51 MA requests and 1.81 CP requests per county. This shows that in those counties where it is used, it is a popular process. Overall, the approval rate for SB requests was slightly better than for CP requests, 81% vs. 76%. However, the rejection or withdrawal rate was much less, 9% for SB requests vs. 26% for CP requests. Apparently only about 90% of the requests are being acted upon in a timely fashion (81% approved and 9% rejected or withdrawn), indicating the agencies are not keeping current with these requests. This is probably one reason why the number of active SB requests at the end of the year increased dramatically from 55 in 1994 to 86 in 1996, an increase of 56%.

This increase in active SB requests occurs in spite of the steady number of new requests, which averaged just under 33 requests annually. Thus, the increase in the number of active SB requests (31) nearly equals the average number of new requests, indicating that over the three year period, the agencies actually fell behind one year in dealing with the requests. The reasons for this are not known. It could be that the workload exceeded the capability of existing staff. A contributing factor could be that the SB-160 process is not as well laid out as the county petition (CP) process, resulting in less motivation to move requests along in a timely manner. The SB-160 process is relatively new, about 30 years old, whereas the county petition process in its current form is over 75 years old, and some form of the county petition process has been in use for nearly 150 years. The MA backlog is approximately 1 year (79 requests active vs. 72 new requests annually), and the CP backlog is less than 2 years (79 requests active vs. an average of 45 new requests annually).

Examination of the data also indicates that some agencies (e.g., S-27) may have listed projects completed during the calendar year (question Q-3 and Q-9) as still active at year end (question Q-2(d) and Q-8(d)). Thus the number of active projects at the end of a calendar year may be overstated. This problem could be remedied in future surveys by having the agencies provide milestone dates for each request. For instance, agencies could list the request date, date of approval or rejection, hearing dates, and the date a project was completed and provide this information to the researcher. The researcher could then put a consistent interpretation on the data.

Agencies were not asked for the reasons that requests were rejected or withdrawn, or even to differentiate between the two outcomes. This deficiency should be remedied in future surveys, and the agencies should be asked to specify which action occurred and why. This information would be helpful in explaining the differing rejection or withdrawal rates among the three project processes.

Group drainage project construction

Agencies in 37 counties reported the construction of 342 projects costing over $9.5 million for the three year period. Subsurface mains were most numerous with 153 reported, followed by 134 open ditch projects. Twenty-nine grassed waterways were reported. Subdivision drains, detention basins and other project categories made up the 26 remaining projects. Data for the subdivision drains and detention basins was compiled from the “other” category in the survey. Since a separate category for subdivision drains was not included in the survey, some subdivision drains may have been reported in the subsurface main category. Future surveys should include categories for subdivision drains and detention basins.

Finding that subsurface main projects outnumbered open ditches was unexpected, given the project distribution found in county ditch maintenance programs from previous surveys. For instance, a 1994 survey (Vigh, undated) showed 7988 km (4965 mi) of open ditches on maintenance programs compared with 709 km (441 mi) of subsurface mains. Perhaps not all subsurface mains in the past have been placed on the county maintenance program. Or perhaps an increasing number of aging mains are reaching replacement age, leading to more subsurface main projects. Many drainage mains date from 1890 – 1910, and were often under-designed with respect to current capacity and depth standards.

Construction activity was higher in 1995 than in either 1994 or 1996, mainly because of an increase in MA projects completed during this period, especially subsurface mains. Because of the design and goals of the survey, only total construction costs were requested. Thus, we were not able to partition costs among the various project categories.

While the number of subsurface main projects exceeded the number of open ditch projects, the open ditch projects were larger on average and the total length of ditches was over three times the total length of subsurface mains installed. About 309.6 km (192.4 mi) of open ditches were constructed over the three year period (Table 2). These open ditches reportedly benefited 58 276 ha (144 127 ac) of land. (The use of the word 'benefited' mainly indicates that the project authority has made a judgment that a parcel of land has benefited from these projects, and not necessarily that financial benefits were determined.) Twenty-eight projects totaling 98.8 km (61.4 mi) of subsurface mains were installed benefiting 10 739 ha (26 535 ac) (Table 3). Grassed waterways were a minor part of construction activity, amounting to 17.78 km (11.05 mi) benefiting 2 535 ha (6 264 ac) of land.

Table 2. Summary of open ditch projects completed by year, 1994 – 1996.

	Number Of	Total length			Total area benefited	
Year	Projects	(ft)	(mi)	(m)	(ac)	(ha)
1994	42	389 648	73.80	118 765	64 421	26 071
1995	49	315 581	59.77	96 189	41 335	16 728
1996	43	310 601	58.83	94 671	38 461	15 565
Total	134	1 015 830	192.40	309 625	144 217	58 364

Table 3. Summary of subsurface main projects completed by year, 1994 – 1996.

	Number Of	Total length			Total area benefited	
Year	Projects	(ft)	(mi)	(m)	(ac)	(ha)
1994	41	98 191	18.6	29 929	10 339	4 184
1995	65	125 292	23.7	38 189	9 824	3 976
1996	47	100 702	19.1	30 694	6 372	2 579
Total	153	324 185	61.4	98 812	26 535	10 739

The distinction between grassed waterway and subsurface main projects is not consistent among the various agencies. At least one group drainage project reported included a grassed waterway, subsurface main and open ditch in the one project, with the same amount of benefited area for each part of the project. Hence, the benefited areas reported may include some double counting, and thus be overstated. For instance, agency S-25 reported one subsurface main of 3658 m (12 000 ft) and one grassed waterway of 1 219 m (4 000 ft), but listed the benefited area of both projects as 121 ha (300 ac), so they probably were the same area. In contrast, agency S-26 only listed grassed waterway projects as being completed, but when asked for the lengths and benefited area of the projects listed values for both subsurface mains and grassed waterways. Agency S-66 also listed the same areas and lengths for grassed waterway and subsurface drain projects.

A way to obtain more consistent information is to ask the agencies to list the various components that together make up one project. It may not be practical to get the cost breakdown for each component, but this approach would make the data easier to evaluate.

Review of selected individual open ditch projects, 1988-1992

Thirty-eight agencies representing 28 counties responded to the request for detailed information about 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 most important reason given for constructing these open ditches was to provide an adequate outlet for subsurface drains. The second most important reason was to improve crop production. The third most important was to place the ditch on the county maintenance program. Reduced flooding concerns were relatively less important on average as reasons to construct these projects.

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 that this was the preferred process or it was 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 an 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. The majority chose this process 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 (MA) process is the easiest and is seen as providing the least cost to landowners, since the SWCD does not assess landowners for the engineering and administrative assistance. The SB-160 method is also thought to be less expensive than a county petition, because the SWCD usually provides technical and administrative assistance without assessing the landowners. The county engineer by law assesses the benefiting landowners to recover his costs in the county petition (CP) process.

Mutual agreement (MA) projects are typically smaller projects, measured either by length or area, than county petition (CP) or Senate Bill 160 (SB) projects. SB projects seem to be slightly shorter than CP projects, 3.49 km (2.17 mi) vs. 4.04 km (2.51 mi). However, the average benefited area for the SB projects is less than half the benefited area of the CP projects, resulting in an area/length ratio only about 50% of the CP value. The area/length ratio for MA projects is only slightly less than for the CP projects. It is not known why the area/length ratio should be so dramatically different for SB vs. CP projects. Perhaps the counties that more often use the SB process have landscapes that are considerably different than the counties typically using the CP process.

It might be expected that the cost per unit length of an open ditch project would be similar among the three methods if all costs were accounted for in similar fashion. However, the data indicate that the average cost per mile for constructing the mutual agreement projects is greater than for open ditch projects organized under the other procedures. The cost per acre is also higher ranging from just over $49.42/ha ($20.00/ac) to over $152.86/ha ($95.00/ac). By comparison, the cost of Senate Bill 160 projects ranges from $35.91/ha ($22.32/ac) to $308.33/ha ($191.63/ac), and the county petition (CP) projects range from $16.80/ha ($6.80/ac) to $925.90/ha ($374.86/ac). The latter is a large range and reflects the wide range in area/length ratios. The high cost per acre project had a very low ratio of 26 ha/km (40 ac/mi), while the low cost project had a high ratio of 849 ha/km (1 304 ac/mi). Of course, costs vary widely among the projects, depending on site specific characteristics.

Respondents were asked to provide all costs of these projects by work item and source of funds. The source of funds reflects cost-share or grant funds available to groups for constructing projects. Nearly 88% of the costs of these projects was borne by the landowners. The agency costs amounted to 8% of the total reported costs, while state and federal funds used for these projects amounted to 2.6% and 1.7% respectively. The federal share of expenses may be low, since many agencies did not report design costs for SB and MA projects. It is to be expected that there are some federal expenses in the design stage, because of Natural Resources Conservation Service soil

scientist and engineer involvement, although these expenses are probably quite low in comparison to the total expenses incurred.

The earthwork costs were remarkably consistent across the three legal authorities, amounting to about 30% of total expenses. Surface inlets and rock chute expenses were a much higher proportion of the expenses for SB and MA projects, 15 – 18% of the total, compared to 1% for CP projects. This may reflect the design practices of the agencies involved. The MA and SB projects are more likely to be designed by SWCD and NRCS personnel, who may be more likely to address erosion concerns than county engineer personnel. By combining all erosion control related expenses, rock chutes, surface inlets, seeding and outlet pipes, we find that these expenses average 39% of the total for MA projects, 46% for SB projects, and only 19% for CP projects. These expenses are about twice as great for MA and SB as for CP projects, which may explain why we don't see a large cost difference because of the differences in the way engineering costs are charged. Survey and design costs are about 9% of the total costs for CP projects. These costs were not well reported for SB projects. For MA projects, survey, design and layout costs averaged about 7.5% of the total, and were better reported than for SB projects.

While these figures don't give an entirely accurate picture of the cost breakdown by work item for the various types of projects, the authors believe they are a fair approximation, since survey, design and engineering costs are typically a small fraction of the total cost. And while individual projects will vary in their needs and item costs, we can estimate that survey, design and layout costs for the average open ditch project will be bout 10% of the cost, earthwork will amount to about 30%, brush 10 – 15%, and erosion control practices about 40% of the total costs.

CONCLUSION

A survey of county engineer offices and SWCDs in 50 counties was conducted in 1997 to assess 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 high workloads prevent 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.

Demand for group drainage projects remains high in many counties in Ohio. The number of requests for assistance with group drainage projects during 1994-1996 remained fairly steady, averaging about 150 requests annually for the 37 counties reporting. Nearly half (48%) of the requests were for projects to be organized under the mutual agreement (MA) process. These requests were almost always approved by the responsible administrative authority.

County petition requests are the second most numerous, with 136 total requests made during 1994 – 1996, 30% of the total requests for all legal authorities. Only 75% of these requests were approved, with 26% of the total being rejected or withdrawn. These total more than 100% presumably because of requests carried over from the previous year.

SB-160 requests make up 22% of the total. The smaller number of SB requests reflects the smaller number of counties using this process. The number of active SB requests at the end of the year increased dramatically from 55 in 1994 to 86 in 1996, an increase of 56%. At the end of 1996, there was a backlog equivalent to over three years worth of SB requests. By contrast, the MA backlog is approximately 1 year (79 requests active vs. 72 new requests annually), and the CP backlog is less than 2 years (79 requests active vs. an average of 45 new requests annually).

Agencies in 37 counties reported the construction of 342 projects costing over $9.5 million for the three year period. Subsurface mains were most numerous with 153 reported, followed by 134 open ditch projects. About 309.6 km (192.4 mi) of open ditches were constructed over the three year period. These open ditches benefited 58,276 ha (144 127 ac) of land.

Thirty-eight agencies provided detailed information about open ditch projects constructed during the period 1988-1992. The most important reason given for constructing these open ditches was to provide an adequate outlet for subsurface drains, the second most important reason was to improve crop production, and the third most important was to place the ditch on the county maintenance program.

Mutual agreement projects are typically smaller projects, measured either by length or area, than are county petition (CP) or Senate Bill 160 (SB) projects. SB projects seem to be slightly shorter than CP projects, 3.49 km (2.17 mi) vs. 4.04 km (2.51 mi), although not greatly so. However, the average benefited area for the SB projects is less than half the benefited area of the CP projects for these projects.

Landowners bore 88.7% of the costs of the individual ditch projects reported in this survey. The agency costs amounted to 7.8% of the total reported costs, while state and federal funds used for these projects amounted to 2.8% and 1.7% respectively. By combining all erosion control related expenses, rock chutes, surface inlets, seeding and outlet pipes, we find that these expenses average 39% of the total for MA projects, 46% for SB projects, and only 19% for CP projects. The earthwork costs were remarkably consistent across the three legal authorities, amounting to about 30% of total expenses. Survey and design costs are about 9% of the total costs for CP projects and about 7.5% for MA projects. These costs were not well reported for SB projects. We can estimate that for new open ditch improvements that survey, design and layout costs for the average open ditch project will be bout 10% of the cost, earthwork will amount to about 30%, brush 10 – 15%, and erosion control practices about 40% of the total costs.

Acknowledgements

Contributions from the Ohio Agricultural Research and Development Center (OARDC), the Ohio Statue University Extension, Department of Food, Agricultural, and Biological Engineering (FABE), The Ohio State University in cooperation with USDA-ARS Soil Drainage Research Unit are gratefully acknowledged. Funding for this study was provided, in part, by USDA-ARS Soil Drainage Research Unit, OARDC and OSU Extension, and the Overholt Drainage Education and Research Program, Department of Food, Agricultural, and Biological Engineering (FABE), The Ohio State University.

REFERENCES

1. Atherton, 1999. Drainage improvement benefit assessment methods and subsurface drainage practices in Ohio. MS thesis. Columbus, Ohio: The Ohio State University, Department of Food, Agricultural, and Biological Engineering.
2. Brown, L.C. and J.L. Stearns. 1991. Ohio's Drainage Laws - An Overview. Bulletin 822, Ohio Cooperative Extension Service, Ohio State Univ., Columbus OH.
3. Channel Modification Task Force. 1972. Some economic impacts of channel modification for drainage and flood prevention in Ohio. Report. Ohio Cooperative Extension Service. Columbus, Ohio: The Ohio State University.
4. Dillman, D.A. 1978. *Mail and Telephone Surveys*. New York: John Wiley & Sons.
5. Frost, S.L. and W.S. Nichols. 1985. *Ohio Water Firsts, Vol. I*. Columbus, Ohio: Water Resources Foundation of Ohio, Inc.
6. Nolte, B.H. 1972. Summary of survey: Drainage, 1971. Report, 3 pp. Ohio Cooperative Extension Service. Columbus, Ohio: The Ohio State University.
7. Nolte, B. H. and E. H. Derickson. 1980. *Conservation Improvement Projects Through Soil and Water Conservation Districts.* Bulletin 606, Ohio Cooperative Extension Service, Ohio State Univ., Columbus OH.
8. Nolte, B. H. 1985. *The Ohio Drainage Laws Petition Procedure.* Bulletin 482, Ohio Cooperative Extension Service, The Ohio State Univ., Columbus OH.
9. Pierce, J. 1997. GIS database of historical drainage systems for Franklin County. Presented at the 1997 Annual Meeting of the Ohio Federation of Soil and Water Conservation Districts, Worthington, Ohio. Columbus, Ohio: Franklin SWCD.
10. Sandretto, Carmen. 1987. Drainage Institutions. In *Farm Drainage in the United States: History, Status, and Prospects.* Misc. Publication No. 1455. Washington, D.C.: U.S. Government Printing Office.
11. Schwartz, A.A. 1955. A history of the ditch and drainage laws of Ohio, with special emphasis on the levying of assessments according to the benefits derived. Columbus, Ohio: Legislative Reference Bureau.
12. Vigh, D. Undated. Directory of Ohio ditch and drainage maintenance programs - 1994. Lima, Ohio.: Allen Soil and Water Conservation District.

13. Wooten, H.H. and Jones, LA. 1955. The history of our drainage enterprises. In *Water: The Yearbook of Agriculture, 1955*. Washington, D.C.: U.S. Government Printing Office.