When we started in business in 1976, many of the tasks that are now done by computer or with electronic devices were undertaken manually. I will try to provide you with some examples.

**DRAINAGE AREA BOUNDARIES AND PLAN**

Firstly, let’s consider the establishment of the drainage area or watershed boundary and preparation of the drainage area plan. Initially, we used the 1966 aerial photography as the basis for both the boundary establishment and the plan. When working on a new drainage project, we would have to walk most of the land within the watershed to establish the external and internal boundaries, OR, if we were fortunate enough to have access to a 4-wheel drive vehicle and the crop and ground conditions were right, we could drive over the fields to make these determinations. As you can imagine, if it was a large watershed area, this would take considerable time and energy. You might ask “Why didn’t we use topographic mapping?” Well, in most cases, the only topo mapping available was the DND sheets that were published in 1941, using 1935 aerial photography, and had only 25-foot contour lines shown, so they were not much help, at all. Of course, there was always discussion with the landowners to make sure they agreed, at least in principle, with our findings of the affected areas, and that we were including the fields that they wanted to drain, where practical.

Occasionally, we used “stereo pairs” of aerial photos and a stereoscope to try to get a three-dimensional look at some portions of the drainage area to reconfirm our field investigations.

These old aerial photos, with wax pencil markings all over them, were the base mapping for our plans. We actually put tracing paper or Mylar over them and traced these boundaries, as well as the bush and wetland areas, and the watercourses, and other pertinent information to make our plan. Then the draftswomen/men used their talents and old equipment to make the plans somewhat presentable.

Of course, if we were working on the improvement or major maintenance of an existing drain, we would use the plan from the previous report as our starting point and, if the landowners had no objections or concerns with that existing plan and the affected areas on their properties, we would...
simply reuse it. Many times, however, the older plans did not include interior drainage area boundaries, which meant that we would have to make site visits to establish that important information.

SITE SURVEYING

The essential equipment for surveying the route of a proposed drain consisted of:

- Boots (leather or rubber), wooden stakes, a back pack to carry the stakes, a good quality marker, a small sledge, a 100-foot steel tape or chain and, sometimes, hip waders, chest waders, insect repellant or even head nets;
- A level and tripod, a survey rod, survey notebooks, pencils and erasers;
- A hammer and rather large nails for setting bench marks; and
- Spray paint and flagging tape were often required, as well.

Usually, the survey started with Station 0+000 at what we thought would be the extreme downstream end of the drain, where we initially determined that there was “sufficient outlet” in accordance with Section 15 of the Act. We headed upstream setting a stake at every 100-foot interval, and at other intermediate points of interest such as bends, confluences with tributaries, lane crossings, road crossings, and etcetera. Usually, benchmarks were set during this staking process, in accordance with Section 13, at critical locations such as fence lines/property lines, lane crossings and road crossings.

In most cases, we would use an assumed bench mark elevation of say 100.00 feet at the downstream end of the drain and run a fly level upstream taking elevations of the ditchbottom and top of ditch bank at every 100-foot station. This meant a lot of climbing in and out of the channel, if it was an open drain. The widths of the bottom and top of the channel, as well as sediment depths, were also recorded at every station. If the proposed work was a closed drain, we would take a ground shot in the low run and one offset at the proposed new drain location, which I expect is the same procedure followed today.

These field surveys were normally undertaken by a two-man crew, sorry ladies, a two-person crew, so you ended up walking the length of the drain 4 times, but occasionally, 4 people were used, 2 to stake and 2 to survey. The 4-person crew had the advantage of less wear and tear on the body and less time to complete the survey but also some disadvantages in that the second crew did not know.
exactly where all the stakes had been placed and where all the bench marks were set. We usually used walkie-talkies when employing the 4-person crew.

Personally, I preferred to be involved in the site survey myself so that I had first hand knowledge of the proposed route of the drain and all the details such as crossings, confluences, erosion sites, bends, etcetera. Especially after one particular meeting to consider when I was embarrassed by a landowner, I did my best to at least walk the entire length of the proposed drains and branches.

The person who did the survey reduced these survey notes by hand, usually. Then a different person, preferably the engineer, checked them. A draft profile was then plotted on grid paper for preliminary design purposes.

**DESIGN**

I don’t think our design methods were tremendously different than what is practiced today except that it all had to be done “by hand” with the help of calculators and slide rules. We followed the ministry guidelines of the day and used nomographs and hydrologic equations to calculate design flows. Affected areas were calculated using a Planimeter, which was a slow and tedious job, which really had to be checked to insure accuracy.

REFER to Soil Conservation Service of the US Department of Agriculture design book and Ayers text book.

For soils information we referred to the Soil Survey reports of the Canada Department of Agriculture and the Ontario Agricultural College. (described the 1952 Huron County one)

**DRAWING PREPARATION**

- Plan drawings were done on Mylar (a thin plastic-like film) and profiles were plotted on grid paper. As previously mentioned, the drain plan was traced from the aerial photos, usually in the top left corner of a 2’ by 3’ sheet, and specifications were lettered into the upper right, with the lower half of drawing containing the profile.
- All lettering was done either freehand or using Leroy lettering equipment. Making corrections or changes to these drawings was difficult.
- Printing was done with an ammonia machine using treated, white print paper. Proper ventilation in the print room was essential!

Presentation to the 2018 Land Drainage Engineers Conference  
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REPORT PREPARATION
Initially, we wrote our reports by hand and asked our secretary to type them, on an electric typewriter, double-spaced so we could review and edit them; however, invariably in my case, I would miss something so, in some cases, part or all of the text would have to be typed three times. This process was also followed for the special specifications as well as the tender and contract documents. As soon as we could afford it, we purchased Dictaphone dictation equipment which was much more efficient, once we all learned how to use it properly. We certainly moved to word processors as soon as we could afford them. And, oh yes, reproduction of reports and other documents was done with a Gestetner machine, not a photocopier.

As for content, we reviewed reports from many of our predecessors and some of our competitors and incorporated much of the same information. We also tended to add more detail than some in an effort to be as transparent as possible and provide the readers (i.e. the affected landowners and Council members) with enough information to understand the Drainage Act process and our procedures.

Engineer Herb Todgham presented his assessment calculation method to this conference in 1969 and we followed that for our assessment calculations, pretty much religiously, as we thought it was readily understandable by landowners and council members and because it was easily defendable in front of Courts of Revision and the Tribunal, which was established in 1977. One aspect of our assessment reasoning that may have differed from the Todgham method was with respect to how maintenance assessments were established as, after a few years, we felt that using only outlet assessments was the fairest way to distribute maintenance costs. Our thoughts were that a property that was assessed benefit for work initially done on it should NOT have to pay on that higher basis for maintenance over and over again in the future. That reasoning seemed to be acceptable to most of our clients over the years.

- *Land Taken and ROW Allowance calculation method – Section 29 of the Act* – We relied on land values from Farm Credit Canada and provided 100% of that value as an allowance for land actually permanently taken for a drain but a significantly lesser amount was provided for the ROW given for a closed drain. Permanent buffer strips were not common in the 1970’s but, in more recent years when incorporated in a project, we provided an allowance of about 33% of the land value for that use.
• **Crop Damage Allowance calculation method – Section 30 of the Act.** We obtained various crop values from a number of reliable sources and provided 100% of that averaged value for the damage allowance in the year of construction, two thirds of that value in the year after construction and one third in the second year after construction to allow for reduced production in those two years.

• **Presentation of Reports** – Of course, the time period I am describing was before any significant municipal amalgamation had taken place; therefore, every meeting to consider a report was held in front of the township council, usually at a regular meeting where the press was present. It gave those “special” landowners, those who wanted to grandstand in front of their peers, the perfect opportunity to do that, which resulted in some real “memorable moments”.

**CONSTRUCTION SUPERVISION**

I’d say that the major difference between the 1970’s and now is that the checking of elevations and gradients is much easier with your more accurate equipment such as GPS units and total stations. We had to do it all with the old level and rod and two staff, if the contractor was not cooperative in supplying a rod person. Of course, the larger and more sophisticated construction equipment of today also allows you more options for design than were available 40+ years ago.