GPS Field Data Collection Techniques:

Geographic data represent spatial locations and non-spatial attributes measured at certain times. We defined "feature" as a set of positions that specifies the location and extent of an entity. Positions, then, are a fundamental element of geographic data. Like the letters that make up these words, positions are the building blocks from which features are constructed. A property boundary, for example, is made up of a set of positions connected by line segments.

Although differences do exist, GPS technology is considered to be the most accurate, reliable and productive means of capturing position information at present. GPS data can be stored on a field computer to capture standardised and complete attribute note (comment) information in the field. Producing accurate, reliable, and complete maps of urban streams is often possible only using GPS or other ground survey methods. With careful equipment choices, field procedures, and data analysis, accuracy of five metres or better is readily achieved, even under dense forest cover typical of coastal areas of British Columbia. Corrected GPS positions are inherently geo-referenced, that is, they have global co-ordinates such as UTM (Universal Transverse Mercator). GPS data is easily and automatically integrated with other data such as municipal cadastral mapping, provincial resource mapping, and digital orthophotos using all common GIS and mapping programs. There is no requirement for time-consuming connections to local monuments or photo-identifiable points in the field.

Errors in conventional surveying methods (such as compass and tight chain traverse) accumulate throughout the traverse as the survey progresses. Errors in GPS positions are independent and whether the survey is 10 metres or 10 kilometres, the error remains constrained to each data co-ordinate captured given the local conditions of GPS reception. As well, conventional survey methods require crews of at least two people, with much starting, stopping, and note keeping and data entry. GPS methods require only one person - if a second person is needed for safety, that person can perform other tasks such as measuring cross sections or setting reference points. Extensive experience in the forest industry suggest that one person using GPS methods can survey twice as Module 5 - 163 much in the same time as with two people using conventional methods and it is almost always more accurate.

Limitations of GPS:

The main limitation of GPS technology for field mapping is that survey productivity and accuracy can be limited by local terrain / canopy conditions. Steep terrain and heavy forest cover can make GPS data capture slow due to reception of acceptable satellite coverage. Field methods such as offsets and fill-in traverses using conventional (compass and chain) methods can help productivity in difficult terrain conditions, although this adds a level of complexity to the field and office procedures, and potential error. Position accuracy is often degraded in difficult terrain conditions, and in some cases may not meet accuracy standards and require re-surveying. Proper GPS equipment choices can help ensure sufficient accuracy, but this requires much more careful analysis and assessment of the corrected data. Another major limitation of GPS technology is the fact that, although GPS data is inherently three-dimensional, the elevation is usually much less accurate than the horizontal position. Elevations are often required for hydraulic and other engineering purposes. Usually the elevation accuracy requirement is actually greater than the horizontal requirement for these surveys.

Personnel Requirements:

For most watercourse mapping projects, the GPS survey component will be performed by existing personnel (e.g. fisheries technicians, GIS analysts, project managers). These people will usually have existing skills in watercourse assessment, although GPS surveying may be new to most people. The following skills are required of personnel undertaking a SHIM stream mapping project:

Field Operator:

A GPS field operator will perform the data capture in the field. This may involve just GPS work, or GPS work as well as stream assessment. If position and attribute information are to be captured coincidentally, then field operators must be well versed in both GPS and stream assessment. Field operators must also, of course, be capable of working safely in a difficult environment.

Data Processor:

The data processor will operate the GPS software. This includes downloading the receiver, downloading the reference station files (if required), differentially correcting the data, and exporting the data to the GIS/Mapping program being used. Processing GPS data is perhaps the least technical task of all and requires very little training. It is usually a matter of executing a few commands and choosing a few files (some software is automated to the extent that only

a single command is necessary). Many organisations have field operators or a clerk processing GPS data part-time and passing the data on to the Mapping Technician, where the important quality decisions are made.

Mapping Technician:

The mapping technician will take the GPS data created by the data processor using the GPS software and create a final product. This is perhaps the most important step in the entire process as it is where decisions are made as to the quality of the GPS data. A mapping technician must be well versed in the operation of the GIS or mapping software. Most importantly, they must have a thorough understanding of the nature of errors in GPS data and how to best deal with these errors.

Project Manager

The project manager is the person (or group of people) making decisions about personnel, equipment, methods, etc. He or she is ultimately responsible for the quality of the data (positions and attributes). The project manager will supervise all other personnel on the project and choose the scenarios, equipment, and methods to be used. Naturally, in many organisations one person may perform a number of these tasks. In some instances, tasks will be shared between people.

Field Methods or Resource Mapping:

This section is intended for field personnel and others who must understand the different methods of capturing positional data in the field using GPS receivers. It is up to field operators and their supervisors to decide which methods will work best in each circumstance. Stream mapping is usually more complex than idealised GPS mapping projects as described in manufacturer's tutorials and most literature and training available. The different mapping scenarios (described in section 5.4.4.), difficult observing conditions (e.g. forest cover and steep terrain), and variable physical conditions (e.g. high runoff, debris piles, and steep banks) mean that field operators must creatively use all methods and skills at their disposal. It is assumed that field operators have had some basic training in using the specific GPS receiver system and that they understand some basic GPS concepts such as Dilution of Precision. This basic training is available from many sources (discussed in section 5.5.2.). In this section, the different methods for capturing stream location information using GPS technology are discussed. The section is intended to supplement the training and experience that field operators

may have by describing methods and strategies to deal with some of the unique requirements of stream mapping projects. For urban stream mapping projects, a geographical feature such as a stream or a barrier usually has both positional and attribute information. Positional information describes where the feature is and its size and shape. Attribute information includes non-geographical information, which further describes the feature.

Geographical Features

There are three fundamental types of geographical feature: points, lines, and polygons (Fig. 5.6). Maps and GIS databases, which represent the ground, are composed of these three features. Using symbology (e.g. pattern, symbol, colour, line thickness), different attributes (e.g. stream classification, point type, ownership status) can be represented. The methods used during a stream survey will vary depending on many different factors.