II. BASIC INFORMATION REQUIRED FOR DIVERSION DESIGN

Many case histories of poorly designed surface mine channels reveal the need for more thorough planning and design methodologies. The first step in accomplishing this is to consider diversions in the early stage of mine plan formulation and then effectively integrate them into the plan. Slight alterations in mine plans before implementation can often greatly enhance the usefulness of diversions and simplify their design; however, if diversions are viewed as devices which can be added when the need appears, their effectiveness and efficiency are jeopardized. Even when diversions are properly located from the point of view of effectiveness, many fail or perform poorly because a thorough understanding of all factors related to their design is absent. The following discussion provides insight to the initial data required for efficient diversion design. Application of this information to the design of diversion structures is illustrated in the following chapters.

Proper design of water diversion structures relies on a well-developed data base. The data can result from actual measurements or they can be synthesized by various computational techniques. Information required for diversion design can be classified into the categories of topographic, hydrologic, hydraulic, geotechnical and ecological.

Topographic data on slopes, contours, distances, areas, etc. are considered as preliminary data and are essential to any diversion design. Topographic data are used throughout the entire design process and must be accurate and readily available. The U.S. Geological Survey has mapped nearly the entire United States, and topographic maps of a given region are usually available. County maps and aerial photographs can also be of value.

Hydrologic data are required for the analysis and estimation of the design discharge. For minor structures, such as diversion channels, an estimate of the peak discharge for a given frequency is sufficient for design.

Hydraulic data are used to size the structure required to carry the design discharge. The basic principles of open-channel flow are used to determine specific hydraulic data such as flow depth, velocity, energy dissipation requirements, etc.

Geotechnical considerations govern the design of rock and soil sideslopes. Of particular importance is the stability of the soils where the diversion will be located. In steep slope areas, coordination between geotechnical and hydraulic engineers is essential to produce a stable channel

that minimizes the long-term land disturbance and the potential for landslides. Ultimately, geotechnical considerations may govern the channel slope, shape and lining.

Ecological data are necessary to assess any potential adverse environmental impacts resulting from a given design. Whenever the waters of any stream are proposed to be impounded, diverted, channelized or otherwise controlled, consideration must be given to applicable state and federal laws regarding fish and wildlife habitats. Most state game and fish agencies have guidelines concerning stream improvement or restoration related to minimum flow standards, stream bottom materials and stream type (riffles and pools, etc.).

Table 2.1 provides general guidelines concerning the information required for design. Much of the data base for design is often available as a result of filing for mining permits and meeting other regulations.

Table 2.1. Possible Data Required for Channel Design.

Topographic Data

Drainage area
Stream slope
Watershed slope
Watershed shape
Longitude
Latitude
Topographic maps
Aerial photographs
Land characteristics

Hydrologic Data

Precipitation:

2-year, 24-hour rainfall amount
10-year, 24-hour rainfall amount
100-year, 24-hour rainfall amount

Hydraulic

Average velocity
Boundary roughness
Flow depth
Top width
Hydraulic radius
Wetted perimeter
Backwater profile
Bedform configuration

Geotechnical

Soils:

Type
Structure
Particle size
Permeability
Infiltration
Percent organic matter
Chemical composition
Aggregate index
Soil maps

Table 2.1 (continued)

Geology:

- Geographical region
- Rock formations

Ecological

- Fish and wildlife species present
- Water quality
- Water temperature
- Minimum flow requirements
- Siltation
- Streambed composition
- Vegetation
- Feeding areas
- Limitation of mobility
- General habitat requirements