

water could be regulated, it could provide the dilution water needed to alleviate the acid problem farther downstream during much of the time.

4. "*Flushouts*" due to large and sudden increases in runoff caused by sudden excessive precipitation, or due to inadvertent causes such as the "dumping" of a reservoir, can drastically change the quality of the water in the receiving stream. This appears to be caused by at least two factors: (1) by flushing into the stream the acid-forming materials that have collected on the banks and on the flood plain since the last storm of consequence, and (2) by agitation of acid-forming materials that had settled out on the streambed during sustained periods of relatively constant low flow such as droughts. Thus the acidity and iron content of a stream can be increased by the introduction of non-acid and non-iron waters long before acid and iron contributions from known sources could have reached the point of sampling.

Although the aforementioned illustrations have discussed only the hydrologic facets of surface mining, they are basic to other reclamation facets; furthermore, they are examples of the need for additional research to provide new answers to old questions that have been incorrectly answered in the past, and to reinforce other answers that have been standing on rather shaky ground. This, after all, is the purpose of all research—to provide new knowledge—and in the Busseron Creek Watershed of western Indiana we have a marvelous natural laboratory for continued research and demonstration of surface-mining reclamation.

Many other universities are studying additional phases of reclamation such as the botanical effects of reforesting surface-mined areas, some are investigating other biological effects of the surface-mining process such as wildlife and bacteria—and a few are studying the physical rehabilitation of the cast-overburden areas. Other universities are conducting laboratory studies of the chemistry of acid waters. However, relatively little attention has been paid to the total hydrologic picture as related to surface mining, and Indiana University's research results have shown that this phase of the effect of surface mining on the environment is providing many new answers, some of them startling.

Results of such research have already provided significant contributions to our enjoyment of living, and we have every reason to believe that continued research will enable us to enjoy our environment even more.

Of first importance is the matter of water supply. We can cite several examples of individuals and towns in Indiana that are directly using water supplies, developed by the surface-mining process; and there are many additional towns using river water, which is supplied at low-flow times by ground water contributed naturally from surface-mined areas.

The very important matter of flood control is also involved, for it appears that under certain hydrologic conditions the ridges of cast-overburden material can act as flood-retarding features.

Recreational use of surface-mined areas is a burgeoning thing, as people seek out watery and wooded areas for fishing and deer-hunting and bird-watching. Furthermore, many such areas have already been developed privately into income-producing parks, lakes, and playgrounds that rival other types of park areas in terms of beauty and enjoyability. Moreover, for the person who wants to have a cottage retreat, or one who wants to live permanently with water at his doorstep, reclamation of surface-mined areas for housing developments is already upon us. And the hydrology of surface-mining reclamation is the basis for all of these uses.

Certainly, much additional research needs to be done in all of these areas—by universities, by industry, and by governmental agencies. With the answers thus produced we will be able to understand more fully the total effect of surface mining on the environment, and to design better ways through which the process can and should be regulated.

In the meantime, awareness of our ignorance of the answers to some of the questions, and awareness of the need for acquiring such answers, should provide the incentive for us to enact worthwhile legislation such as that embodied in Senate Bill S. 3132 which the Indiana University Water Resources Research Center recommends subject to the reservations and modifications suggested above, dealing with Federal versus State regulations, and with the need to reevaluate the regulations every two years on the basis of new knowledge that results from research.

Thank you.