Application of Geosynthetics in Irrigation and Drainage Projects

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INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE

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Prologue

Today the use of geosynthetics (geotextiles, polymeric and bituminous geomembranes, geonets, geogrids, geomats, drainage geocomposites, bentonite geocomposites, geocells, geomattresses, geofoam structures, etc.) is an integral part of design and construction of irrigation schemes. These materials have pervaded civil engineering – in particular geotechnical, geoenvironmental and hydraulic engineering – like no other class of materials before. Geosynthetics are now indispensable in applications such as roads, railroad tracks, landfills, reinforced retaining structures and embankments on soft soil, and are used successfully in applications ranging from drainage trenches to large dams.

Geosynthetics are particularly suited for irrigation and drainage projects. Geomembranes are superior to traditional materials (such as clay and concrete) for seepage control; geotextile filters are replacing sand filters in many applications; and geosynthetics specifically developed to convey liquids are increasingly used in drainage applications. Other uses of geosynthetics in hydraulic applications include, for example: bank and slope protection using erosion control systems incorporating geosynthetics; and the use of geosynthetically reinforced soil for the steepening of embankment slopes. Furthermore, there are applications that would be impossible without geosynthetics. Two examples of such applications are: the use of geomembranes to line canals on high gypsum content soils; and the rehabilitation of the face of concrete dams using geotextile-geomembrane composites. In the latter case, it is interesting to note that the durability of the geosynthetic is less questionable than the durability of concrete that undergoes degradation due to aggregate-alkali reaction in the presence of water.

First attempts of using materials that are known today as geosynthetics date back to the 1950s, and widespread use started in the 1970s. In the past three decades, a considerable body of knowledge on geosynthetics has been developed. Standard test methods accepted internationally are available. Design methods have been developed for all applications of geosynthetics, including methods for predicting the long-term behavior of geosynthetics (e.g. accelerated testing techniques for creep evaluation). Construction methods have improved over the years and quality assurance procedures are now part of the state of practice. As a result, geosynthetics engineering is now a full-fledged discipline. In fact, there are areas where it is recognized that progress in traditional geotechnical engineering has been made due to technology transfer from geosynthetics engineering, such as soil reinforcement and filter design. The durability of geosynthetics is now well understood and, in virtually all situations, it is now possible to find a geosynthetic that meets the project specifications and has durability consistent with the project design life, even under the extreme climatic conditions that prevail in many areas where irrigation and drainage projects are built. While certification systems have been

established in many countries for existing geosynthetics, new products continue to appear, which indicates the vitality of the geosynthetics industry.

In spite of their many successful – even spectacular – applications, geosynthetics are not magic products. They must be treated like any other construction materials. In particular, applications must be carefully designed and constructed. This is especially true in the case of irrigation and drainage applications, where failures may have serious consequences. Thus, there are aspects of irrigation and drainage projects that require considerable expertise during design and installation of geosynthetics: connections between liner systems and rigid structures, filter design and installation, stability along soil-geosynthetic or geosynthetic-geosynthetic interfaces, stresses during installation, stresses in service caused by differential settlements, thermal expansion-contraction, etc. Also, strict quality assurance procedures must be implemented during construction by qualified teams. While it is important for engineers designing hydraulic projects to be aware of the many possibilities offered by geosynthetics, it is equally important for them to be aware of the need for careful design when geosynthetics are used. Clearly, information on geosynthetics is essential to ensure the safe design and construction of structures incorporating geosynthetics.

The dissemination of information has been one of the primary goals of the International Geosynthetics Society. This goal is achieved, in particular, through the two official journals of the IGS, Geosynthetics International and Geotextiles and Geomembranes, and a newsletter, IGS News. The IGS is currently taking steps to develop cooperation with other international professional societies. The International Commission on Irrigation and Drainage (ICID) is certainly one of the global organizations that could develop a mutually beneficial cooperation with the IGS.

The IGS encourages the preparation of documents that promote the safe use of geosynthetics and, therefore, welcomes the publication of this document by the ICID, as it welcomed the publication in 1990 of Use of flexible geomembranes for irrigation canal and reservoir lining, an ICID document that was reviewed in IGS News (Volume 11, No. 1). While geosynthetics are extensively used in the transportation and environment sectors, their use could be expanded in water storage and conveyance projects. Also, even though geosynthetics have been used successfully in numerous hydraulic projects, there are many cases where geosynthetic applications should have been better designed or better constructed. Clearly, there is a need for disseminating information on geosynthetics. This document will certainly be an important contribution: more potential users will become aware of the applications of geosynthetics in irrigation and drainage projects, and will understand that these applications can be designed with methods that are as sophisticated as the methods used in other branches of civil engineering.

Hervé Plusquellec should be commended for the preparation of this document. He is eminently qualified because of his extensive field experience and because he is well informed about geosynthetic products, design methods and specifications. I know that personally, having spent time with him inspecting canals in the Middle East and discussing the design of applications of geosynthetics at the World Bank, in Washington. Through this document, Hervé Plusquellec uses the most important development in the field of civil engineering of the past decades, geosynthetics, to serve the most important cause of the century, water.

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