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Sustainable Management of The Navigability of Large Natural Rivers

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Many rivers in the world have been regulated or trained for protection against floods, water supply, navigation, hydropower generation, agriculture and other societal services. The world's largest rivers, however, have often remained natural or quasi-natural, with unregulated hydrology and unconstrained morphology. The river can freely respond to the environmental boundary conditions provided by the watershed. The significant depths and widths of large natural rivers offer opportunities for navigation. In such rivers, however, it is often not technically feasible nor environmentally desirable to improve navigability through river training works. The only solution is then to assist the river in maintaining a navigable channel through specific actions – for example morphological dredging or adaptive management of the navigation channel itself. It is within this context that PIANC (World Association for Waterborne Transport Infrastructure) has established Working Group 236 to develop guidelines for improving navigability conditions on natural or quasi-natural rivers, while maintaining morphological processes and natural river form and function. Its key objectives include: 1) development of guidelines to improve and maintain the navigability in natural rivers; 2) assess the sustainability of river training works designed to improve the navigability; 3) assess the sustainability of dynamic river management (monitoring and shifting of navigation aids to adapt the navigation channel to the river dynamics); 4) highlight the technical, operational, economic and environmental considerations for navigation in natural rivers compared to that in regulated rivers and canals; and 5) improve the understanding of the physical processes in natural rivers, developed with or without river training works. The guidance includes a planning framework for developing a navigability improvement masterplan for natural or quasi-natural rivers, and the integrated and adaptive management strategies that can be applied at a system scale. Specific interventions and measures have been identified to meet the dual goals of maintaining morphological river function and improving navigability conditions. They include dynamic charting; morphological dredging and disposal management; temporary, adaptable, and flexible training structures (TAFTS); riverbed armoring and sediment nourishment; rock excavation; meander cutoffs; localized traditional river training structures; and channel closure strategies. The guidance also presents the continual monitoring, management, and operational tools available for improving navigability in a morphologically active river. The more fluvially active and dynamic natural and quasi-natural rivers will require new and innovative strategies to monitor the fluvial and geomorphic changes of the system in order to inform managers and navigators. Case studies are presented that include the Madeira River (Brazil); Magdalena River (Colombia); Niger Delta (Nigeria); Yangtze River (China); the Brahmaputra-Jamuna River (India); and the Red River (Vietnam).