

GUIDELINE FOR ENVIRONMENTAL MANAGEMENT PLANNING IN WATERSHED OF TRIBUTARIES FLOWING INTO SETO INLAND SEA IN HYOGO PREFECTURE

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Background

Harima-Nada and Osaka Bay, a part of Seto Inland Sea, have been suffering from water pollution problems caused by eutrophication and COD. Special Law For Environmental Protection Of Seto Inland Sea was established in 1973 (temporary law) and in 1978 (permanent law), and several standards and guidelines for reduction of total loadings of COD, phosphorus and nitrogen based on the law have been carried out. Water quality has been improved gradually, however not dramatically. Comprehensive and integrated environmental management including whole watershed and involving citizens is necessary for noticeable reduction of pollutants' loading, because large part of these pollutants are loaded through tributaries and originated from living houses and dispersed (non-point) sources. It is also expected to make citizens, who live far from shoreline, having attention to environment through preserving and creating aerial environment in healthy for human and ecosystem. That contributes to reduction of pollutant loading to Seto Inland Sea.

On the other hand, all activities of people has affected and will affect water systems and water cycles, that causes increase of flow rate in flood, decrease (sometimes depletion) of flow rate under normal weather condition, deterioration of water quality, deterioration of aquatic biota and ecosystem, disappearance of amenity space, and so on in rivers. To solve these kinds of problems, global circulation, aerial-wide circulation and small-aerial circulation of water should be preserved and created in healthy and sound .

Based on these background, Hyogo Prefecture established Guideline For Environmental Management Planning in Watershed Of Tributaries (GEMP) in June, 1996, with receiving a proposal from a committee consisted of researchers.

Objectives

The main purpose of GEMP is "preservation of water environment in healthy and creation of comfortable space with water for human and ecosystem" in each area of watershed. "Water environment" in GEMP includes viewpoints of biota and ecosystem, accessibility and aesthetic aspect, culture, and nature as well as water

quality and water flow rate, and GEMP covers forest and mountain area, country area, and city area as well as water and river basin. The objectives of each environmental items included in GEMP are as follows: (1)water quality--accomplishment of environmental standard of water quality associated with human health and living conditions; (2)flow rate--flow rate for satisfying sound water circulation and aquatic ecosystem; (3)biota--preservation of diversity and ecosystem, and preservation and creation of space for them; (4)amenity--preservation and creation of comfortable environment and environmental education; and (5)culture--preservation of historical culture and creation of new culture associated with water and water area.

Strategies

For accomplishment of these objectives, following strategies are considered. These strategies are to be planned and integrated beyond sections of domestic government.

(1)Consideration of water environment in planning of land use -- Contribution and effects on accomplishment of the objectives are required to be discussed and considered in all planning about land use; that is urban, agricultural, forest, natural park, artificial park and water area plans. Circulation and stock-flow systems of water are especially important in this discussion. Preservation of forest and improvement of stock ability as water source in mountain area are also noticed.

(2)Reduction of pollution loading to water bodies -- Loadings of COD, phosphorus and nitrogen to river are intended to be decreased by advanced treatment of domestic wastewater and industrial wastewater, change in life style, application of closed system of water and best available technology in factory, appropriate usage of fertilizer and pesticides and circulation of water in agriculture, and improvement urban storm drainage system. Strategies to maintain appropriate flow rate and in-situ treatment of pollutant in river are also recommended to be adopted. Establishment of appropriate systems of water circulation in area, and preservation of wetland and ponds are included in these strategies. Reuse of advanced treated sewage is noticed as a source of water to maintain sound water circulation in small area. Combined secondary treatment, coagulation and sedimentation, ozonation, biological activated carbon and chlorination process is discussed for reusing sewage to creating amenity and keeping suitable flow rate in river and pond. Water quality expected for this purpose is as follows; coliform group is not detected, BOD is less than 5 mg/L, COD is less than 10 mg/L, SS is less than 5 mg/L, total nitrogen and phosphorus is less than 10 and 1 mg/L, respectively, and color is less than 30 degrees of color.

(3)Preservation and creation of space in and adjacent to water body -- Preservation and creation of living environment with viewpoints of good water quality, safety and culture are considered as an important factor. Protection and creation of space for water, biota, aesthetic aspect and recreation are also important strategies to achieve the

objectives.

(4) Establishment of network of environmental information and education -- This contributes greatly to a good and effective environmental planning and to involvement of citizens.

Example of GEMP Application

Mukogawa River is studied based on the concept and framework of GEMP. Mukogawa River has 65.4 km in length and 481 km² in watershed area. About 380,000 people live and 552 factories are located in the watershed. 5,600 caws and 320 pigs are also cultured. Watershed is discussed by being divided into 7 districts from the upper to the lower stream. Total COD and phosphorus loadings to the river are calculated to be 13,476 and 485 kg/day, respectively, about 50% of which is originated from domestic wastewater. And about 45 % of the total loading is originated in the upper stream districts. From this results, importance of GEMP is proved well.