# Joint Research on the Load of Nonpoint Source Pollution (Otsu City)

| Year of research | 2008～2010 | Establishment of sound water environment |
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**(Purpose)**

This research has been conducted on Setaura Creek (hereinafter referred to as Creek). The Creek is located in Seta, Otsu city. It is a canal developed to drain the upstream stormwater as part of the landfill project of the shores of Lake Biwako around 1970.

The runoff from rivers into Lake Biwako via the Creek affects the water quality of the southern Biwako. The 5th-term plan of the Lake Biwako water quality management plan Shiga and Kyoto prefectures mapped out in March 2007 focuses on runoff control to reduce the load of nonpoint source pollution as well as continuing to tackle point source pollution. The nonpoint pollution comes from the urban areas, roads, mountains, agricultural areas, railways and various other sources in the Creek basin. In this research, we carried out a basic survey, evaluated the capabilities and developed a framework of the improvement plan for nonpoint source pollution load control that makes the most of the Creek, focusing on the Creek's self purification capacity.

**(Results)**

(1) Field survey

We have conducted a field survey to find out effects of the control facilities for reducing the load of nonpoint source pollution (sedimentation pond and vegetation for purification).

1) We built purification facilities near Miyagawa River that flows into Setaura Creek and conducted a purification test. The facilities consisted of a sedimentation pond and vegetation. As the vegetation for purification, we selected reed, water spinach and watercress. The purification test was conducted twice on sunny days, twice in the rain and once in the rain during the season of paddy puddling. We sampled water from the sedimentation pond only when it was raining.
2) The sedimentation pond greatly contributed to removal of particulate substances. S-COD decreased by 89% (95%), S-T-P by 76% (93%) and S-T-N by 71% (83%). The figures in parentheses are the removal rates during the puddling season. The vegetation mainly removed dissolved substances. The removal rates at a surface loading of 0.6 $m^3/m^2$/day were as follows: Reed reduced D-T-N by 24% and $PO_4$-P by 56%. Water spinach and watercress decreased D-T-N by 41% and $PO_4$-P by 59%. None of the plants exhibited removal capability for D-COD.

(2) Construction and examination of water quality evaluation models

We have constructed a runoff analysis model, ecosystem model and vegetation purification model, based on the last year's water quality survey on the inflow to and outflow from the Creek and water in the Creek, property survey on the mud at the bottom of the Creek and the field survey. We evaluated the models and adjusted them to match actual measurements (Table 1). Using the constructed water quality evaluation models, we calculated the required sizes of the control facilities. We also calculated the load of runoff from Setaura Creek after the runoff control had been implemented. The result has confirmed improvement. COD decreased from 2.7 mg/L to 2.4 mg/L, T-N from 0.81 mg/L to 0.76 mg/L and T-P from 0.18 mg/L to 0.17 mg/L.

Table 1 Overview of water quality evaluation models

| Area | Model | Application in this research |
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| Inflow river | Runoff analysis model | ■Calculated runoff water and runoff load in the rain from the model.<br>■Used fixed amounts based on actual measurements for those on sunny days. |
| Setaura Creek | Runoff analysis model | ■Calculated the flow between the creek boxes on sunny days and in the rain from the model. |
| | Ecosystem model | ■Used the value calculated from the runoff analysis model for inflow load.<br>■Conducted simulations throughout the year. |
| | Vegetation purification model (native plants) | ■Difficult to identify the load reduction mechanism by vegetation only.<br>■Adsorption and sedimentation by plants are expressed together with sedimentation of free-floating COD.<br>■About nutrients plants absorbed through the roots, dissolution of I-N and I-P is expressed together. |
| Sedimentation pond + vegetation facilities | Sedimentation pond model | ■Develop a model using the removal rates in the pond in proportion to the inflow from rivers. |
| | Vegetation purification model | ■Develop a model using the removal rates by surface loading and season prior to the inflow to the Creek. |

(3) Development of a framework of the improvement plan

We have developed a framework of the improvement plan of the Creek for providing control functions of pollution loads (e.g., sedimentation pond and vegetation for purification), covering five rivers that flow into the Creek. In the framework, we have incorporated the requests made at the briefings for the residents, for example, improvement of the stagnation in the Creek and the scenery.

Figure 1 Conceptual image of improvement plan

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| Key words | Nonpoint source, Pollution load, Vegetation for purification, Water quality evaluation model, COD, T-P and T-N |
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