In recent years, with the increased national awareness of the need to preserve the natural environment and the critical attitude toward public works, land improvement facilities have been asked to serve many public as well as private functions. In response to these demands of the time, on the Wadashima head works conservancy project we have given deep consideration to three points: living creatures, water amenities, and river control for the purpose of riparian improvement and utilization.

Wadashima head works is located about 12 km up the class B river Okitsu's river mouth; it was established in the middle of the Edo era (17th century), and a concrete fixed weir was built at the conservancy in 1957. Forty years later, in 1996, the facility had become old and so decrepit, and the dam itself was found to be damaged. The reservoir rehabilitation project (river emergency) was adopted as a prefecture-operated project on in March 1998. The improvement works were completed at a cost of ¥151,000,000.

Further, the Okitsu river was designated as a model river for fish easily swimming up stream for the first time in Shizuoka Prefecture in 1994 by the Ministry of Construction. The river has become popular especially with fishermen as the earliest opening river for ayu fishing (May 20 every year) in east Japan.

In the planning of Wadashima head works, the following three points were taken into consideration in its design.

1. From the standpoint of living creatures in the river
   For the ayu swimming upstream, structural consideration was given to enabling fish to go up not only through the fishway but also from everywhere in the weir. The water level of the existing head works rises 2.4 m in three stages of 0.8 m each, which keeps the height increase within the ayu’s jumping strength (1 m vertically), based on investigation and the literature about them. After each stage the ayu are offered a resting pool, which is kept in keeping subcritical flow condition when containing an ordinary amount of water. Furthermore, fish reef blocks were adopted in the riprap of the downstream in consideration of the living creatures dwelling in the river.

2. From the standpoint of living closely by the river
   Each stage is shallow enough, at 50 cm depth, that children can enjoy water play there under their parents, supervision, and deep enough to protect the ayu from birds like the snowy heron. Artificial waterfalls between the three stages offer a scenic spectacle.

3. From the river control standpoint
   The structure was made so as to remove the earth and sand heaped on the water cushion at each stage to the lower reaches of the stream by the force of running water. Concerning this point, the land improvement project planning design (mountain stream diversion

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works) and the shape of the trap dam system used a bar screen backstream intake combined with mountain stream diversion works, which is one of the new techniques of irrigation, drainage, and reclamation engineering. This is the first attempt in Japan to apply the shape of the mountain stream diversion works to head works, and concrete material with compression strength 360 N/mm² was adopted because of its anti-weardown property.

Moreover, minute concern was paid to the following 2 points.

1) To avoid dryness and dead water at each stage during drought season, a fishway, which has less risk of being dried up, was connected to each stage with VP pipe (200 mm). Therefore, fish become able to travel between fish routes and the stages. Thus we can keep the water environment clean and can expect to enjoy the spectacle of the Cascade throughout the year.

2) Observation windows were installed on the fishway of the lowest stage to facilitate the observation of fish going upstream and the investigation of fisheries resources in the future.

The project was conducted in consultation and agreement between the fisheries co-operation society, the irrigation association, the self-governing society, and nature conservation groups. We have also succeeded in reducing costs by 5.6% in the following two areas:

As for river management, no pile of earth or soil on the stages could be found after more than one year, and the principle of the bottom of the waterfalls is fulfilling its function admirably. The ayu going upstream have been confirmed in a local report last summer, but no investigation has yet been conducted. As for the water amenity facilities, the data show that many children have enjoyed playing there under the observation of their parents last summer already, and more people are expected to utilize them this summer according to reports in the mass media.

The Cascade system is expected to be fully applicable not only to head works but also drop and grand still consolidation works; further study can be expected hereafter.

The publication of the planning indications for the Cascade system and its results will make it easier to adopt it on a nationwide scale.

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<th>Place</th>
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<td>Riprap on the stream</td>
<td>Review of planning</td>
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<td>Irrigation canal on the right bank</td>
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Dr. UENO Awards

The Construction of Rural Area Society with Vitality through Habitation Environment Improvement in Fukui Prefecture

Department of Agriculture, Forestry and Fisheries of Fukui Prefecture

In Fukui Prefecture, we are attempting to construct rural area societies with vitality through habitation environment improvement projects, which consist of rich rural space creation and large-