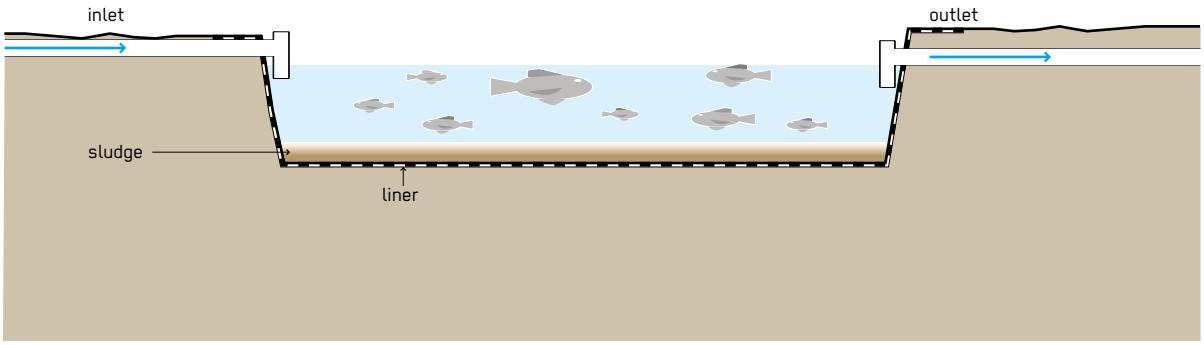
Fish Ponds

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
Acute Response * Stabilisation ** Recovery	Household * Neighbourhood ** City	Household * Shared ** Public	Productive use of nutrients for fish production
Space Required	**Technical Complexity**	**Inputs**	**Outputs**
*** High	** Medium	Effluent, Sludge	Biomass



Fish can be raised in ponds (aquaculture) receiving effluent or sludge. The fish feed on algae and other organisms that grow in the nutrient-rich water and are eventually harvested for consumption.

There are three kinds of aquaculture designs for raising fish: (1) fertilisation of Fish Ponds with effluent; (2) fertilisation of Fish Ponds with excreta/sludge; and (3) fish grown directly in aerobic ponds **(T.5)**. Fish introduced into aerobic ponds can effectively reduce algae and help control the mosquito population. It is also possible to combine fish and floating plants in a single pond. The fish themselves do not dramatically improve the water quality, but due to their economic value they can offset the costs of operating a treatment facility. Under ideal operating conditions, up to 10,000 kg/ha/month of fish can be harvested in larger-scale aquaculture. If the fish are not acceptable for human consumption, they can be a valuable source of protein for other high-value carnivores (like shrimp) or converted into fish meal for pigs and chickens.

Design Considerations: The design should be based on the quantity of nutrients to be removed, the type of fish, nutrients required by the fish and the water requirements needed to ensure healthy living conditions (e.g. low ammonium levels, required water temperature, oxygen levels, etc.). When introducing nutrients as effluent or sludge, it is important not to overload the system. Oxygen levels will show huge diurnal fluctuations due to photosynthesis and respiration. The critical period is early morning before sunrise when aeration may be required to maintain aerobic conditions. The biochemical oxygen demand should not exceed 1 g/m^2/day. Only fish tolerant of low dissolved oxygen levels should be chosen such as tilapia, catfish and carp. These species are also tolerant to disease exposure and adverse environmental conditions. The specific choice will depend on local preferences, availability and ambient temperatures.

Materials: The materials required are those necessary to build a pond **(T.5)**. The ponds can be lined or left unlined if the soil has a high clay content. An initial fish population must be brought, and sometimes additional fish feed, depending on the conditions.

Applicability: A Fish Pond is only appropriate where there is enough land (or a pre-existing pond), a source of fresh water and a suitable climate. The water used to dilute the waste should not be too warm, and the ammonium level should be kept low or negligible due its toxicity to fish. Fish Ponds can be considered from the stabilisation phase, when the construction or use of bigger sanitation infrastructure is possible. This technology is appropriate for warm or tropical climates with high levels of sunlight (ponds should not be shaded by trees or buildings) with no freezing temperatures, and preferably with high rainfall and minimal evaporation.

Operation and Maintenance: The fish should be stocked in the pond and harvested when they reach an appropriate age/size. Partial harvesting can maintain a suitable biomass while maintaining the availability of fish for consumption over time. Knowledge of fish health and care is important for the staff to understand what conditions are needed and which measures to take if the fish population faces a problem (disease, death in numbers). The pond should be drained periodically so that; (1) it can be desludged and; (2) it can be left to dry in the sun for 1 to 2 weeks to destroy any pathogens living on the bottom or sides of the pond. Workers should wear appropriate personal protective equipment.

Health and Safety: Various health hazards are associated with waste-fed aquaculture, especially hazards associated with excreta-related pathogens. The World Health Organization Guidelines for the Safe Use of Wastewater, Excreta and Greywater should be consulted for detailed information and specific guidance. The timing of the application of wastewater and excreta is an important risk management tool. It is recommended to stop the application of wastewater and excreta two or three weeks before harvest or alternatively to transfer the fish for depuration in ponds which are not fed with wastewater or sludge. Before consumption fish should be stored in clean water for at least three days. Fish should always be cooked before consumption. If a fish is healthy, cleaned after harvest and cooked well, it is considered safe for consumption.

Costs: Raising fish is an income-generating activity, which can help finance the operation and maintenance of existing ponds. Capital costs are low if this activity is done in existing ponds and medium if the ponds first need to be built. The main operational costs are for pond and fish management and the required human resources. Funds must be allocated for sludge removal every few years.

Social Considerations: This technology may be of interest in contexts where there are little or no sources of dietary protein. The quality and condition of the fish will influence local acceptance. There may be concerns about contamination of the fish; in some cultures, fish grown in this way may be completely unacceptable. It is however a common practice in many countries and the fish usually find a ready market as they cost less to grow than fish grown on expensive feeds. The introduction of Fish Ponds may require additional information or hygiene promotion activities.

Strengths and Weaknesses:

⊕ Can provide a cheap, locally available protein source
⊕ Potential for local job creation and income generation
⊕ Relatively low capital costs; operating costs should be offset by production revenue
⊕ Can be built and maintained with locally available materials

⊖ Requires a large land (pond) area, usually on flat land
⊖ May require expert design and installation
⊖ Fish may pose a health risk if improperly prepared or cooked
⊖ Social acceptance may be low in some areas

→ **References and further reading material for this technology can be found on page 196**