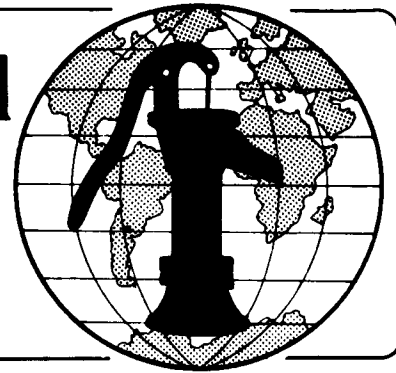


Water for the World



Planning How to Use Sources of Surface Water

Technical Note No. RSW. 1.P.1

Surface water includes water from ponds, lakes, streams, rivers and springs. Surface water sources can be important for community water supplies. Surface water is available without major digging or use of expensive machinery and sometimes can be delivered to users without pumping. The quantity of water available is easy to determine by simple measurements. The development of surface water sources is not simple and careful planning is necessary. Surface water is subject to run-off and human and animal contact and may be contaminated with feces or other wastes. Before a surface source can be used it should be well protected, and, in most cases, connected to a distribution system. Most water from surface sources should be treated.

This technical note describes the planning needed to use surface water sources in terms of eight important planning steps: (1) recognize the problem, (2) organize community support and set objectives, (3) collect data, (4) formulate alternatives, (5) choose the best method, (6) establish the system, (7) operate and maintain the system and (8) evaluate the system. Worksheet A may be adapted for use in cataloging information gathered during the planning process.

Useful Definitions

EVAPORATION - Loss of surface water to the air as the surface water is heated by the sun and rises to the atmosphere as vapor.

WATER-RELATED DISEASES - Diseases caused by a lack of safe water and poor sanitation.

Recognize the Problem

Before planning to use any source of water, the community's water supply problem must be defined. The current water source is unacceptable if (a) the water is of poor quality, (b) the water is not available in sufficient quantities to meet the needs of the users, (c) the source is not accessible to the users and (d) the source is not reliable.

Water quality is generally measured by laboratory testing. In many areas, testing will be impossible because of lack of equipment and the distances from the source to testing facilities. Water quality must then be judged through observation of local conditions and through a sanitary survey. (See "Conducting Sanitary Surveys to Determine Acceptable Surface Water Sources," RWS.1.P.2). If a water source is exposed to contamination from human and animal wastes, aquatic growths in the water, and surface run-off, it must be protected, treated or abandoned for a more suitable source. If there is a high rate of water-related disease among users of a certain water source, suspect that the source is contaminated and take measures to improve the water supply. Table 1 shows examples of diseases caused by lack of safe water. Where such diseases exist, water supply improvements will reduce the number of cases. Water improvements will not eliminate these diseases.

Water quantity is measured by the number of liters per day people use. Table 2 shows typical water consumption rates for rural areas. A water source should provide an average of 15 liters

Worksheet A. Planning the Development of a Surface Water Source

1. Name of community _____
2. Number of people to be served by water source _____
3. Type and number of water-related diseases in the community per year _____
4. Significant beliefs and taboos about water _____
5. Present source(s) of water and form of distribution _____
Determine:
water quality (see RWS.1.P.2) _____
water quantity (see RWS.1.P.3) _____
accessibility _____
reliability _____
form of and location of distribution system _____
6. Potential source(s) of water _____
Determine:
water quality (see RWS.1.P.2) _____
water quantity (see RWS.1.P.3) _____
accessibility _____
reliability _____
7. Community resources and organization
Determine:
a) sources of income _____
b) seasonal distribution of income _____
c) labor and materials available _____
d) infrastructure in existence _____
e) concerned community leaders and groups _____
8. Project costs
Estimate total costs for:
a) equipment _____
b) materials _____
c) labor _____
d) maintenance _____
e) other costs (transportation, etc.) _____
9. Sources of finance
Determine:
a) local funding capability _____
b) external funding possibilities _____

Table 1. Diseases Related to Deficiencies in Water Supply and/or Sanitation

Group	Diseases
Diseases transmitted by water (Water Borne)	Cholera Typhoid Bacillary Dysentery Infectious Hepatitis Amebic Dysentery Giardiasis Gastroenteritis
Diseases caused by lack of water and poor sanitation (Water Washed)	Scabies Skin Ulcers Lice and Typhus Trachoma Conjunctivitis Bacillary Dysentery Amoebic Dysentery Salmonellosis Diarrheas Ascariasis Whip Worm or Trichuriasis Hook Worm
Diseases caused by infecting agents spread by contact with or ingestion of water and of animals living in water (Water Based)	Schistosomiasis (Blood fluke) Guinea Worm Thread Worm Lung Worm Human Liver Fluke

per person per day for non-piped systems, 40 liters per person per day for one tap piped systems and 70-100 liters per person for multi-tap piped systems. If the water is to be brought near or into the houses, the amount used will increase greatly. A source producing insufficient quantities is unacceptable. Determine the amount of water a community will need by multiplying the population by the estimated amount of water used per person per day.

Water supplies must be accessible. If a great distance separates the supply from the user, a decrease in the amount of water used and a reduction in standards of hygiene is likely. People who must carry water may even choose a nearby contaminated supply over a distant protected one. The water supply should not be located more than 250m from the users.

Table 2. Domestic Water Use

Type of Supply	Typical Consumption (liters per capita per day)	Range (liters per capita per day)
Communal water point (village well, standpost) located at: - distance greater than 1000m from house - distance between 500-1000m from house	7 12	5-10 10-15
Village well less than 250m from house	20	15-25
Public standposts less than 250m from house	30	20-50
Yard connection (tap in yard)	40	20-80
House connection - single tap in house - multiple taps	50 150	30-60 70-250

The reliability of a source ensures its continued use. A water supply that dries up, provides insufficient water, or is tapped by a system that breaks down often may force people to use a less desirable source. A source must provide water year-round. Local technicians must be able to operate and maintain the treatment delivery system to ensure that water is always available to the community.

Organize Community Support and Set Objectives

The main objective is to provide a community with an adequate quantity of safe water from a convenient and reliable system. A good water system will reduce the incidence of water-related diseases and improve the overall health of the community. An accessible supply will increase water use for hygiene-related purposes and reduce the time spent in carrying water. More time will be available for productive activities. An abundant source can provide water for home vegetable gardens.

A successful project must include a plan for community support. Support is gained through three methods: (1) promotion, (2) community involvement and (3) training for operation and maintenance.

Promote the project in the community to create an awareness of the water supply problem. Organize meetings and educational programs, show pictures or films, and make home visits to explain the connection between a good water supply and good health. Once the community is aware of the problem, it will be more willing to work toward a solution by contributing time, effort and resources.

Involve the community in the project. Enlist the support of local political, religious and community leaders and include them in decision-making. Ask the potential users of the water system for advice. They will be good sources of information. They will express their preferences and be good sources of information on such matters as the

resources available for the project. Discuss the cost of the project and emphasize the need to finance not only its construction but also its long-term operation and maintenance.

Training local people to operate and maintain the system is essential. Plan a training program for people active in the project so the water supply system can be developed and maintained by the community. The goal is that the community contribute to, participate in, and maintain the water supply system.

Collect Data

In order to understand the water supply problems of a community, information must be collected about local environmental, social and economic conditions. Appropriate solutions to problems will be suggested by this information. Data should be gathered on the following items: (a) local development history, (b) current community conditions, (c) environmental and geographic factors, (d) available resources and (e) local customs.

Obtain information about the community's development history. The success or failure of a past development project, especially in water supply, can guide decision-making. If a development project has failed, similar mistakes must be avoided. Information about past projects and traditional water sources should be available from village elders or local government agencies.

Study the present situation. Determine the community's current population and estimate likely growth rates and demand for water. Check the present water sources for their suitability and figure out possibilities for improvement. To plan efficiently, you need to collect information about incomes, resources and community needs.

Collect environmental and geographic data. Information should be collected on: (1) total annual precipitation, (2) seasonal distribution of precipitation,

(3) annual or monthly variations of rainfall from normal levels, (4) stream and river flow rates and (5) spring yield. Some of this data may be obtained from local or national government agencies. Airports are likely to have useful statistics on rainfall and the stream and river flow rates and spring yield can be measured in the field using simple techniques. These are discussed in "Conducting Sanitary Surveys to Determine Acceptable Surface Water Sources," RWS.1.P.2. A great deal of useful information can be collected through interviews with local people and observation of local conditions.

Data on run-off and evaporation rates would aid planning greatly. This data is very difficult to obtain, but will prove useful if available.

Know what material and human resources the community can provide to the water project. The community should make contributions of labor, materials and money for the water system. Limit the amount of outside material or assistance whenever possible. Where outside technical assistance or material is needed, try to obtain it from the national or regional government, or from private donors. Determine what percentage of the project can be financed through local funds and use a combination of the local and outside resources to complete the project.

Know the customs of the community. Village preferences and desires may be determined by religious and cultural beliefs or taboos. Certain members of the community, such as water vendors, may depend on the present water system for their economic well-being and be opposed to a change. Know the community well before proposing a water project. Never promote or insist on a method that continues to meet with local resistance after it has been fully explained to the community.

Formulate Alternatives

Once all available data are collected, formulate possible solutions to the problem. The best alternatives will provide the community with safe and abundant water from a reliable and accessible source at the lowest cost. When considering alternatives, determine which method of surface water development will best solve the water supply problem (see "Methods of Developing Sources of Surface Water," RWS.1.M). Evaluate each method by determining its acceptability and suitability to the community. Determine the type of system most appropriate to the community's needs. Decide whether people will obtain their water directly from the source, from a standpipe or from household taps.

Discuss the cost and resource requirements of each alternative with community leaders and local groups to determine community preferences. In some cases, there will be only one acceptable alternative and no choice will be necessary. In other cases, there may be several acceptable alternatives, or there may be a combination of methods that could meet the community's needs. The decision about which to use will depend on the many factors discussed in this technical note.

Select a Method

Where there are several alternatives for a surface water source, it will be necessary to choose the best, most appropriate method. In making this decision consider the following:

Community needs. Determine whether the source can meet the needs of the community adequately now and in the near future. Do not choose a sophisticated method if it is not really necessary. Avoid selecting methods for prestige rather than suitability and maintainability.

Social acceptability. Determine whether the water source is acceptable

to all the users. If the water has an odd taste or smell or is turbid, people will be against drinking it. Avoid having the supply a long way from the users since people will not walk long distances to fetch water. The greater the community acceptance of the system, the more willing people will be to pay for building and maintaining it.

Economic factors. Determine whether the community can afford the construction and maintenance of the system. Do not over-tax the resources of the community. A successful project will involve community labor and participation in fund-raising and other activities. A project partially paid for with community resources will be a source of pride. When selecting a method do not overlook the possibility of improving the current water source. It may not need much improvement and will probably meet with little local resistance. Improvement of the current source may be the best and least expensive alternative. Use "Selecting a Source of Surface Water," RWS.1.P.3, in deciding on the best water source for the community.

Establish the System

Once the best method is chosen, develop a project plan. The plan will serve as a guide throughout the project and ensure that labor and materials are available when needed. In many cases a plan must be submitted to a government agency or donor organization for approval. The plan should state a goal, provide population information, indicate the number of people affected by the project, and demonstrate how the project will aid the community. This is especially important when money is sought from international donors. Determine their requirements as early as possible. In such cases the plan should be quite detailed and include information on: (a) proposed system, (b) costs, (c) sources of finance, (d) implementation schedule, (e) plans for construction and sources of materials and (f) operation and maintenance requirements.

Proposed system. Design drawings for the project should be submitted with the plan. The drawings should include all measurements and capacities. Photographs of the work site and a topographic map showing houses, buildings, and water sources should accompany the plan.

Costs. The plan must include a list of all estimated costs, including materials, tools, equipment and labor for both construction and maintenance. If land must be purchased, that cost should be included in the total. Local materials probably will be less expensive and should be used whenever available. Labor costs will depend on the local pay rate and the time and skills required. Any labor or materials which are donated should be included in total costs.

Sources of funding. If at all possible, local funds should be used to finance some portion (at least 10-15 percent) of the project. This money can come from contributions, fund-raising activities such as dances, user fees, and various other sources. Money for the development of larger scale, or more expensive, water systems may be available from government organizations, international groups or private donors. Donor agencies generally require that the community cover a percentage of the construction costs and all of the operation and maintenance costs.

Implementation schedule. Determine the amount of time necessary to complete the project. Attempt to schedule the project at a time when volunteer labor and money are available to the community. Generally, this will be after harvest time or just before planting season. Fund-raising activities should take place during times of increased community income. In scheduling work, take into account wet and dry seasons.

Plan for construction. Develop a plan for constructing the system including both the labor and supplies needed. A complete materials list for the project will help ensure that tools, equipment and materials are at

the site when people come to work. If tools and materials are stored at the site, provide a well-protected, secure place to store them. There should be a supervisor at the site so that workers will know what to do at all times. If the system is very complex, a contractor may be hired to do the construction.

Operation and maintenance. Plan for the continued operation of the system. This may include a training program for local villagers. No matter how simple the system, there will always be a need for maintenance. People trained in basic construction, pipe-laying, pump repair and simple water treatment are needed in the community. The people in charge of maintenance must know where to obtain spare parts, extra chlorine and other resources important to the system. A local storehouse can easily be established. Permanent arrangements for operation and maintenance must be made. More systems fail because of improper operation and maintenance than for any other reason.

In a community where water is piped into households, an administrative system for collection of fees and continued operation and maintenance must be established. Community members with managerial skills and community leaders should be involved in the system administration.

Evaluate the System

After completion, evaluate the system by determining if it is achieving the goals set at the beginning of the project. To measure the system's success, use the four characteristics of a suitable water supply: quality, quantity, accessibility and reliability.

Quality. Is the water provided of acceptable quality? Have the water tested, if possible, and determine if there has been a decline in water-related illnesses since the completion or improvement of the system. Fewer cases would indicate that quality has improved. Make sure the source is protected from sources of contamination, and that treatment is adequate.

Quantity. Is the quantity of water produced adequate? Determine if the system is meeting the daily needs of the users and if it supplies adequate quantities for potential additional users.

Accessibility. Is the system accessible to all intended users? Determine if the community is satisfied with the supply's location and has any problem getting water. Also, find out if water consumption has increased since the system was developed. An increase in consumption may indicate that water is more easily available to the users. If traditional family water carriers have increased time for other activities, try to estimate the benefits gained from this extra time.

Reliability. Is the system proving reliable? There should be no design flaws or breakdowns. Water should be reaching the users without interruption. If technicians have been trained, evaluate their performance in operating and maintaining the system. Be sure that they know where parts and materials can be obtained and that they can handle specific maintenance problems. Provide for a modest store of replacements and a means to make added house connections.

The evaluation of the system will provide important information for the development of future projects. Compare the success of this project to projects in other communities to gain valuable lessons in the development of surface water supply systems.

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