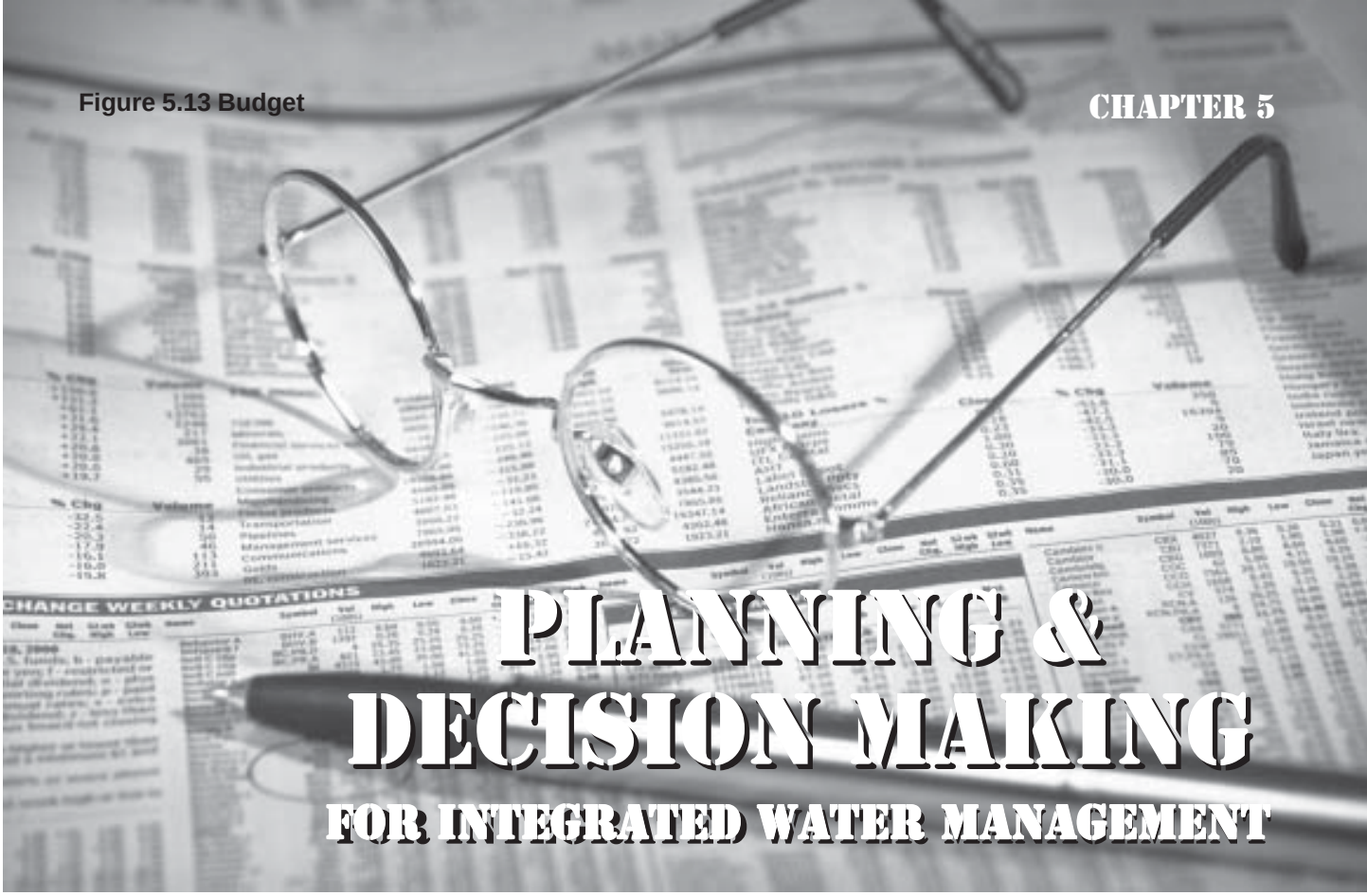


Figure 5.13 Budget

CHAPTER 5

PLANNING & DECISION MAKING

FOR INTEGRATED WATER MANAGEMENT

What are the decisions that determine key outcomes in the water industry and how do water utilities, regulators, and government officials make them? These decisions deal with the unique circumstances of the water industry, especially its regulatory and political environments. Consequently, many of the decisions are different from those made in other business organizations.

The context for decision making in a water utility includes operating and capital scenarios. Operating decisions are made for different time periods – day, week, month, year – and capital decisions are normally made for a longer time frame than operating decisions. Of course, water utility managers also make other routine decisions such as hiring and compensation, balancing the budget, and so on.

Capital decisions are based on a list of capital improvements (the capital program), the capital budget, and the master plans. The concept is that improvements are authorized through an approval process, which results in their being placed on the master plan. The list of capital improvements is prioritized through ranking, and the capital budget provides the funds to build and implement the projects.

Decisions involve management, staff, boards, and the public. An open decision process enables transparency of problem identification, determination of goals and objectives, identification of options, assessments and evaluations, selection and implementation. By including participation and reporting to all involved constituent groups and stakeholders, the water utility can increase trust in its operations.

Decision scenarios explained in this chapter include water allocation and control, use of water, development of facilities, and management of environmental systems.

As the chapter will explain, water management requires balance between interest groups and goals. The term currently in favor to describe this quest for balance is *integrated water resources management* (IWRM).

WHAT IS INTEGRATED WATER RESOURCES MANAGEMENT?

Whereas central authorities make arbitrary decisions without coordinating interdependent views, the balancing of inputs of different stakeholders is the core issue. Confusion about IWRM occurs because it involves many complex concepts. Confusion and conflicting goals lead to difficulty in implementing IWRM.

Basically, experts agree that as a process IWRM coordinates development and management of water,

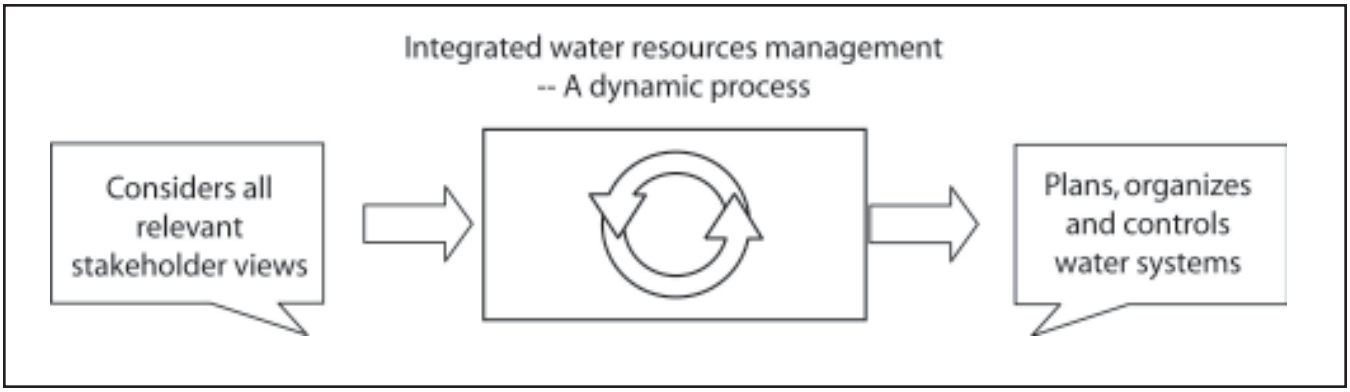


Figure 5.1 Integrated water resources management

land and other resources to improve economic and social welfare, social equity, and sustainability of the environment (Global Water Partnership, 2000). The definition recognizes interdependencies in nature and in the economic and social arenas. Interdependence is, of course, inherent in the ecological and social systems that water supports.

In an attempt to offer a short but concise definition, I offer this one: (See **Figure 5.1**)

"Integrated water resources management is a framework for planning, organizing and controlling water systems to balance all relevant views and goals of stakeholders."

IWRM can be a useful concept, or it can be a lofty, high-sounding phrase, with little meaning to most water managers. In any case, it should be translated into practical terms that have meaning and help to achieve balanced decisions about a limited resource.

How to Balance Decisions About Water Resources

In the water industry, the tasks of management (planning, organizing and controlling) refer to the planning process, implementation processes for facilities and programs, and the operational phase of water management. Each phase requires many decisions. It is important that these decisions balance many interests, or take the IWRM viewpoint.

Total Water Management

Although they did not use the term, the American Water Works Association recognized this need for balance in IWRM and developed a concept named "Total Water Management:" (See **Figure 5.2**)

"Total Water Management is the exercise of stewardship of water resources for the greatest good of society and the environment. A basic principle of Total Water Management is that the supply is renewable, but limited, and should be managed on a sustainable use basis. Taking into consideration local and regional variations, Total Water Management:

• Encourages planning and management on a natural water systems basis through a dynamic process that adapts to changing conditions;

• Balances competing uses of water through efficient allocation that addresses social values, cost effectiveness, and environmental benefits and costs;

• Requires the participation of all units of government and stakeholders in decision-making through a process of coordination and conflict resolution;

• Promotes water conservation, reuse, source protection, and supply development to enhance water quality and quantity; and

• Fosters public health, safety, and community good will."

Source: American Water Works Association Research Foundation, 1996.

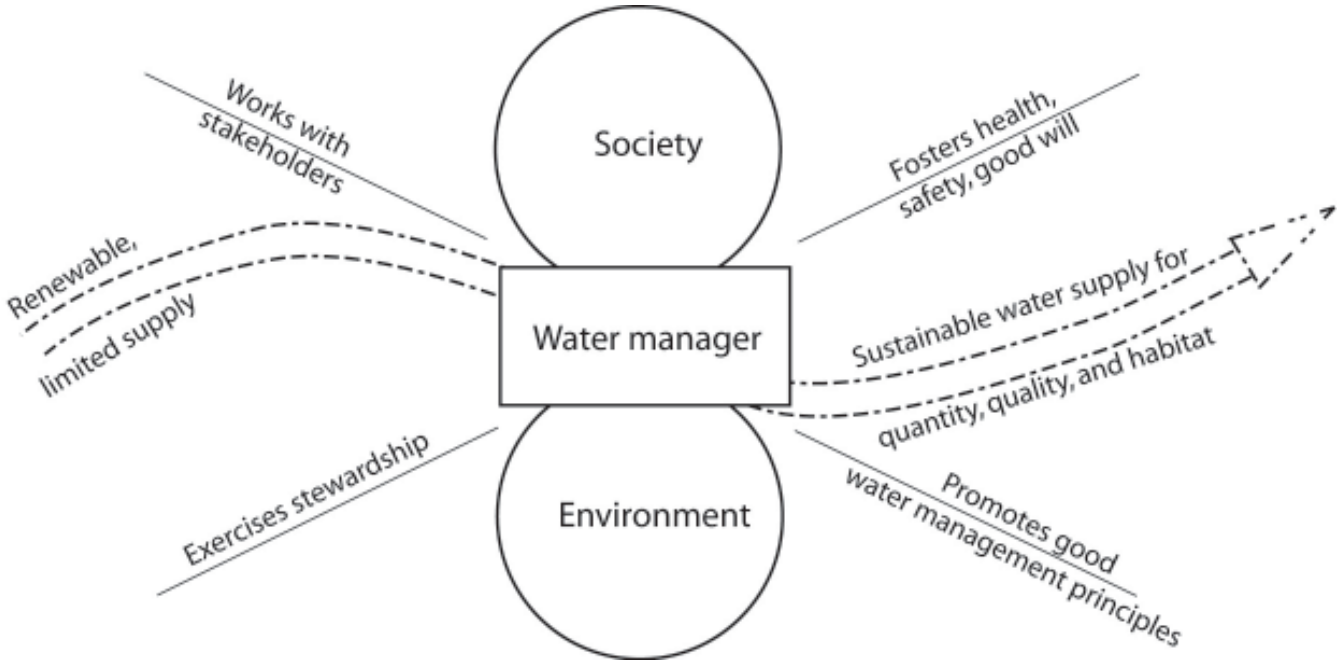


Figure 5.2 Total water management (same concept as IWRM)

To see how this concept can work in the water industry requires us to probe how the industry functions as an integrated whole. The starting point is to examine the scopes, purposes, stages and functions of water management.

SCOPES, PURPOSES, STAGES, AND FUNCTIONS OF WATER MANAGEMENT

The scopes, purposes, stages and functions of water management show how water decisions vary. Scope refers to how wide a problem is. The purpose of water management refers to its goal, as in water supply, water quality management, and so on. The stage of a problem identifies whether it is early in the game, as in conceptual planning, or later on, as in operating a project that is already built. Functions of water management are like the boxes on an organization chart and the "business processes" of an organization.

The word that captures scope is "comprehensive." Does the action include different areas, different players, and different purposes? A limited action focuses on fewer of these, whereas a broad, comprehensive action includes many of them.

The word that captures purposes is "multipurpose." If a project is multipurpose, it seeks to achieve more than one goal, as in water supply, wastewater, flood control, and others. Water management purposes involve multi-sector or single-sector approaches. They include the following to:

- Provide safe water supply services for humans, business, and agriculture
- Manage water quality to protect public health
- Provide and protect water for the natural environment and fish and wildlife.
- Provide and protect water for instream uses (energy, navigation, and recreation)
- Protect people and property from floods

Stages of issues range from early planning to later operations, and

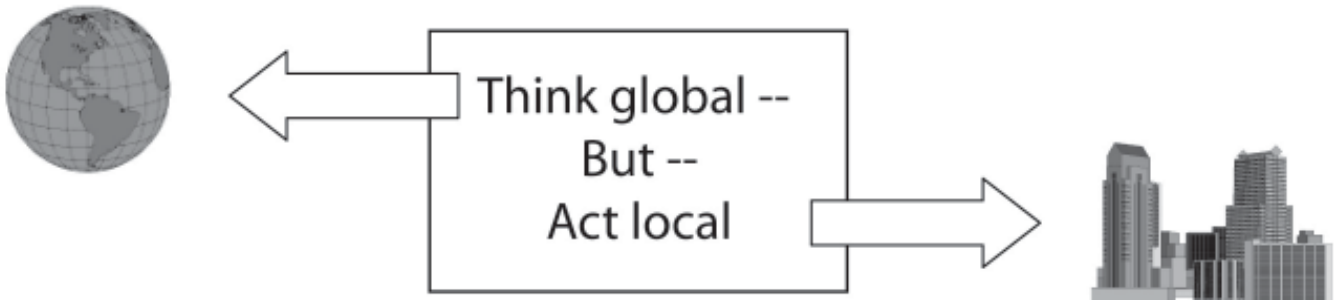
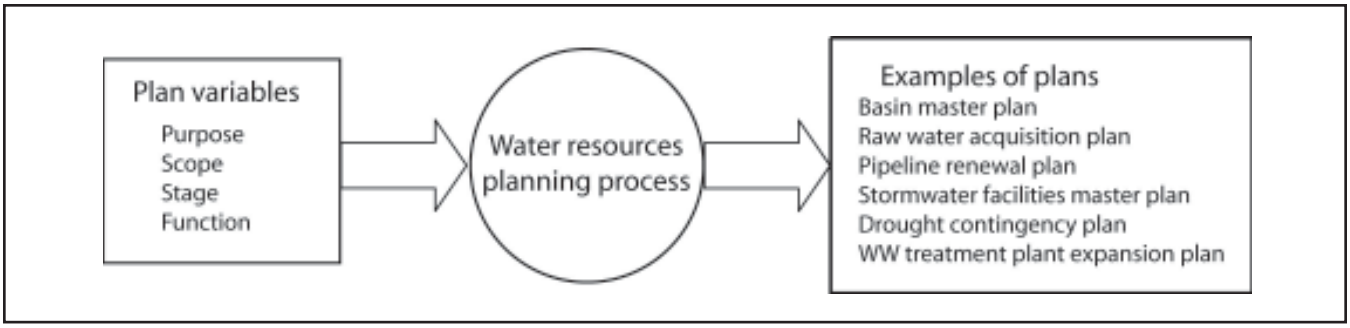


Figure 5.3 Think globally, act locally

Figure 5.4 Variables of water resources plans



several stages in between. A number of words are involved in the stages of water management. These are terms such as "conceptual," "preliminary," "design," "construction," "operations," and so on.

Management functions cover the boxes on the organization chart and cross-cutting functions. They include, for example:

- Operations
- Engineering
- Maintenance
- Finance and budget
- Public education and outreach
- Staffing and training
- Property acquisition and management
- Information systems
- Legal affairs
- Research
- Emergency management

Sometimes the term "function" is used to describe a purpose, such as water supply. This is simply another way to use the term "function."

VALUES, MISSION, GOALS, AND OBJECTIVES IN PLANNING

In formulating their plans, managers recognize the planning terms "values, mission, goals, and objectives," but the words may mean different things to different people.

Values are the fundamental bedrock beliefs that provide guidance for the establishment of programs. For example, a value might be "public health is our paramount concern."

The mission is the broad statement of the reason for the organization to exist. For example, a mission statement might be: "the mission of the water department is to provide safe and adequate water supply for our customers."

Goals are the next level. For example, a water utility might have goals to meet water demands, preserve the environment, maintain high water quality, and hold costs down. Each of these four goals can be broken into a number of objectives, and each objective can be measured by one or more performance indicators. Decisions can be tested according to how well they solve problems and meet goals.

PLANNING FOR WATER DECISIONS—HARDER THAN IT LOOKS!

Planning should lead to decisions, not just produce documents or "shelf art." Given the need for balance we explained earlier, effective planning is not easy. Of course, it may not seem difficult to prepare a plan. The difficult task is to prepare one that is *implemented*.

Planning coordinates actions by providing a framework on which to hang the decisions required by different players in water resources management.

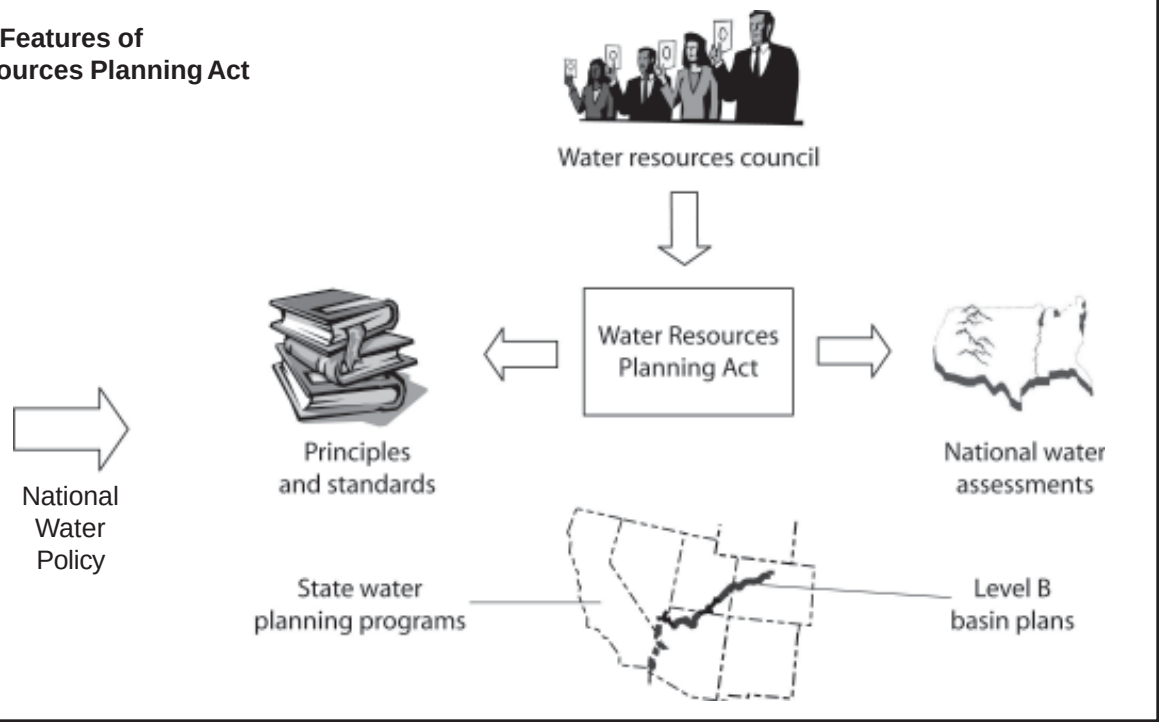
An example of a complex definition was given by the U.S. National Water Commission (1972): "*Planning is the creative and analytical process of: (1) hypothesizing sets of possible goals, (2) assembling needed information to develop and systematically analyze alternative courses of action for attainment of such goals, (3) displaying the information and consequences of alternative actions in an authoritative manner, (4) devising detailed procedures for carrying out the actions, and (5) recommending courses of action as an aid to the decision-makers in deciding a set of goals and courses of action to pursue.*"

Stated more simply, planning is *creating options and and deciding what to do.*

WATER RESOURCES PLANNING ACT

Due to its many players and dimensions, the water planning process is inevitably complex. The framers of the Water Resources Planning Act (WRPA) of 1965 attempted to provide a national framework for it. The

Figure 5.5 Features of Water Resources Planning Act



Act provided for:
- Establishment of a government Water Resources Council
- Establishment of Principles and Standards for water resources plans
- Periodic national water assessments
- Support for state planning programs
- River basin (level B) studies

The WRPA recognized three levels of plans: (1) framework studies or level A plans, (2) river basin plans or level B plans, and (3) level C plans at the implementation level. In theory, a level C plan should be consistent with level A and level B plans, providing for coordination in the planning process.

The programs of this Act did not survive, and were terminated during the Reagan Administration in 1981. Some people thought the WRPA was an example of the last gasps of the New Deal, that is, reliance on government solutions; whereas, there ought to be more political and private emphasis in water decision making. This view has mostly prevailed since 1981. (See **Figure 5.6**)

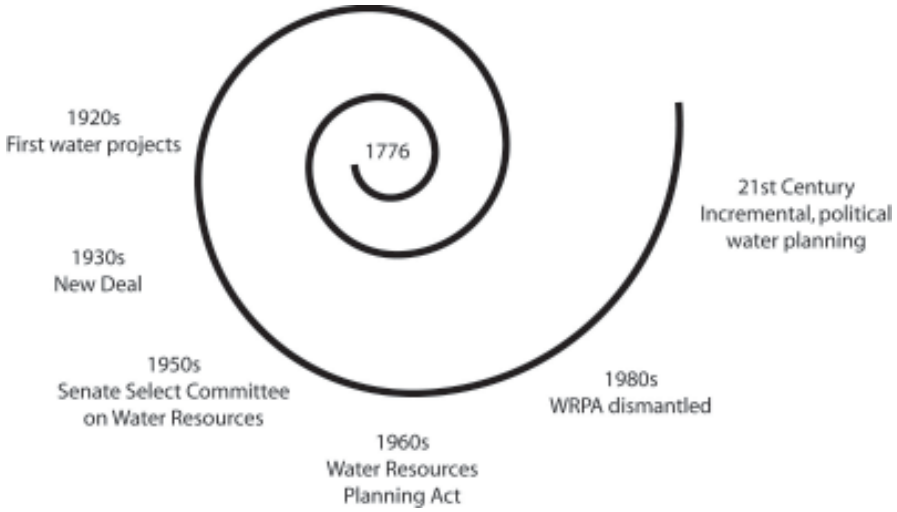


Figure 5.6 Phases of Water Resources Planning

PLANNING TODAY

Regardless of its status, planning follows a rational problem-solving sequence within a framework bounded by administrative law and the political process. Planning concepts have changed, and today the emphasis is on low cost approaches to water management and more public involvement.

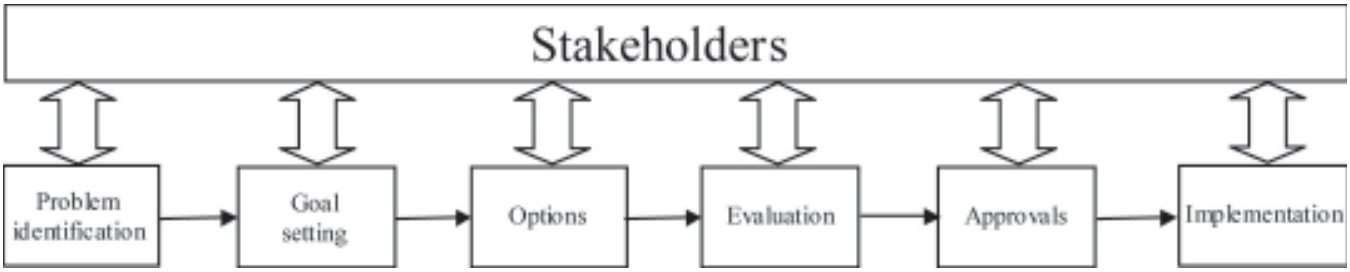


Figure 5.7 Rational problem solving process

RATIONAL MODEL OF PLANNING

The rational problem-solving sequence (See **Figure 5.7**) involves the question: for a given goal for water management, what is the best way to accomplish it? The steps are:

- Problem identification
- Goal-setting
- Assembly of information on options
- Evaluation of options
- Decision making
- Implementation
- Operations and control phase

POLITICAL MODEL OF PLANNING

The political model of planning is more realistic because of interest-group involvement in the process. See **Chapter 13** for more discussion of interest groups.

In the real world, the technical process operates inside a political environment and bridges the gap between the "rational" and "political" models of planning.

Some problems are "structured," and political conflict has been mostly settled. Other problems are "unstructured," and both technical and political measures will be needed.

The concept for the combined rational-political model is illustrated in **Figure 5.8**, which shows the rational process taking place within the political environment.

An example of a problem requiring this approach might be a regulatory decision about a water quality standard that has costs and benefits that are disputed by different scientists and that might disrupt a local economy.

An example of a more structured problem would be storage requirements for a reservoir to provide a safe yield within defined limits of drought risk tolerance.

The planning process must consider the divergent agendas of the players. The political environment involves factors such as identification of players and interest groups, identification of trade offs and negotiating strategies, public participation, establishment of incremental alternatives as well as far reaching solutions, consideration of individual and group preferences, analysis of voting behavior, and other political concepts.

Figure 5.9 shows the process. In it, a problem is initially identified, and the next step is to determine if there is a commitment by authorities to solve the problem. The manager will need to know who the stakeholders and decision-makers are, and need to involve them up front.

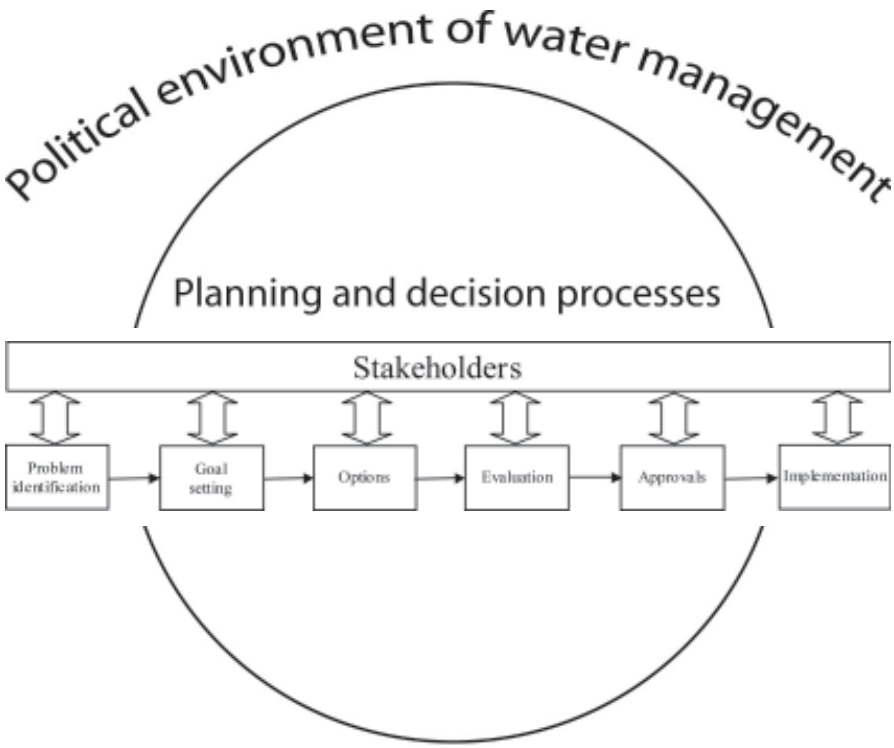


Figure 5.8 Rational process in political environment

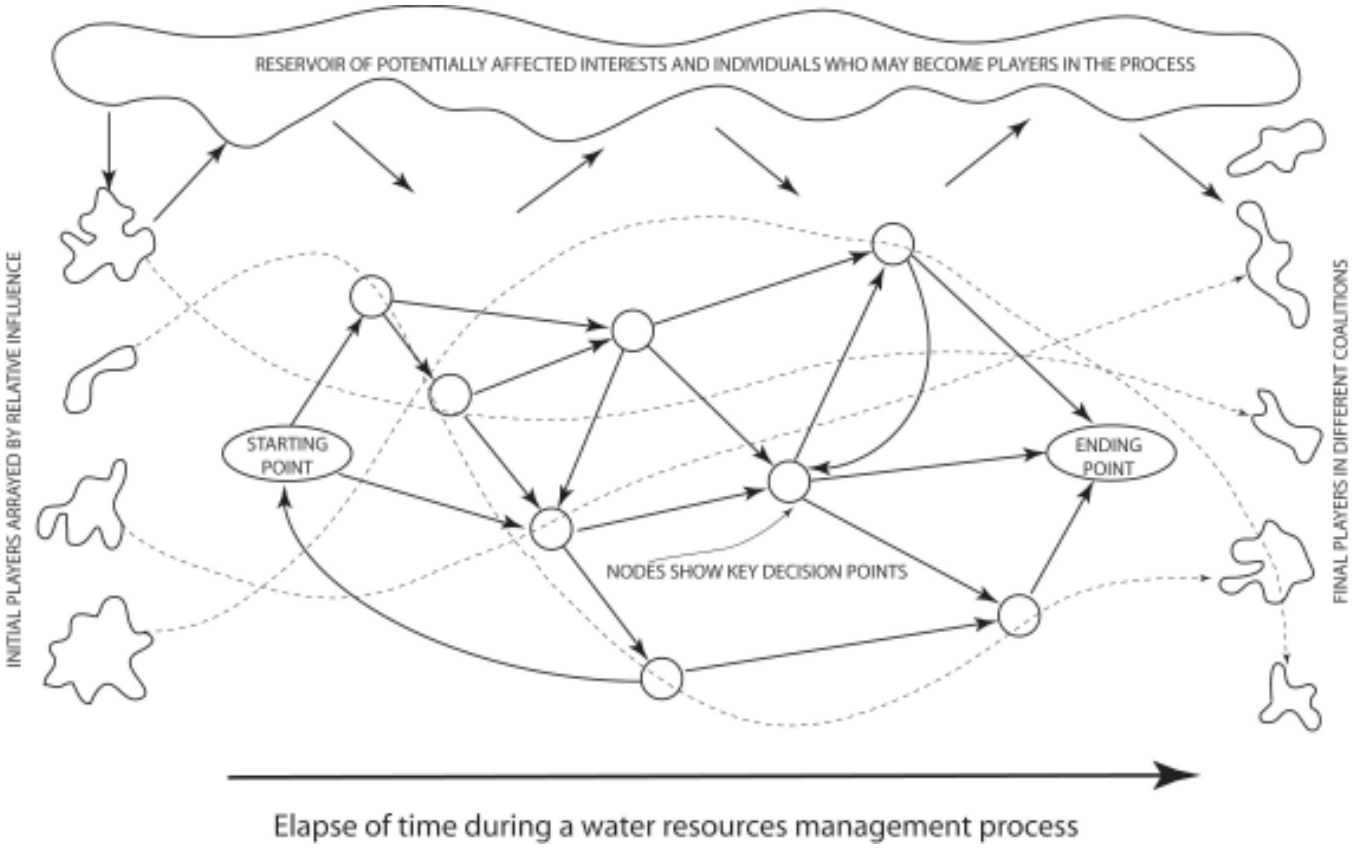


Figure 5.9 Political model of water planning

The stakeholders organize themselves by coalitions or interest groups and by levels of power or influence in the decision process. These positions vary over time, introducing more dynamism to the process.

Stakeholders enter and leave the overall process during the long time period of many water resources problems and projects.

At the end of the process is a set of possible outcomes. The possible outcomes have variable characteristics, including technical alternatives, institutional alternatives, alternative goal achievement, alternative management arrangements, alternative timing and alternative location dimensions.

Along the route to the decision lie crucial decision sub-points that involve some or all of the stakeholders. These can be meetings, reviews, completion of studies, new developments, surprises and changed attitudes. In between these nodal decision process sub-points lie decision sub-processes. The decision sub-points may be the steps of the planning process, such as identifying alternatives, but these steps are really complex exercises in themselves.

During the process, influence and power are shifting, and knowledge is building.

There may be a lack of organized information and intelligence about what is going on with allies, neutral parties and opponents in water resources problem solving.

It would be helpful if all decisions involved perfect consensus among stakeholders, but experience shows that balance often requires decisions about which not everyone agrees. Toward that end, shades of meaning have developed for the term “consensus.”

- There is a high level of disagreement.
- There is enough disagreement to indicate the decision will not work.
- The disagreement and agreement are about the same.
- While all stakeholders do not agree, to move ahead they can accept the decision.
- All stakeholders agree with all aspects of a decision.

A pragmatic approach might have the stakeholders agreeing from the onset that if level four is reached, the decision can proceed.

REGULATION OF PLANNING

The administrative law that binds the planning process prescribes its required steps and inputs. This requires hearings, permits, approvals, findings, and other decisions required by laws such as NEPA, the Clean Water Act, and other laws. Within this framework, planning involves variables of authority, scope of plans, stage of planning, and purpose sought by plans.

For example, a plan could be a federally-supported, policy-level river basin plan for multi-purpose water management. Or at a smaller scale, it could be a locally-supported master plan for building facilities for a single service such as storm drainage.

ART OF PLANNING

Water managers have learned a few things about the "art of planning." The following points made by an EPA official capture some of the lessons that frame this art (Schmit, 2004):

- Planning has a number of disincentives: it takes time, seems boring, may introduce contention into community discussions, and is expensive.
- Planning also has benefits: it brings people together, funders expect a plan, it provides a comprehensive view, it anticipates regulatory challenges, and it compares local experience with national environmental planning.
- So to do planning well: take time to do it right, encompass all values of the watershed, learn from someone else, recognize there is no cookbook solution, create your own plan, don't forget prevention and protection, and balance planning and doing.

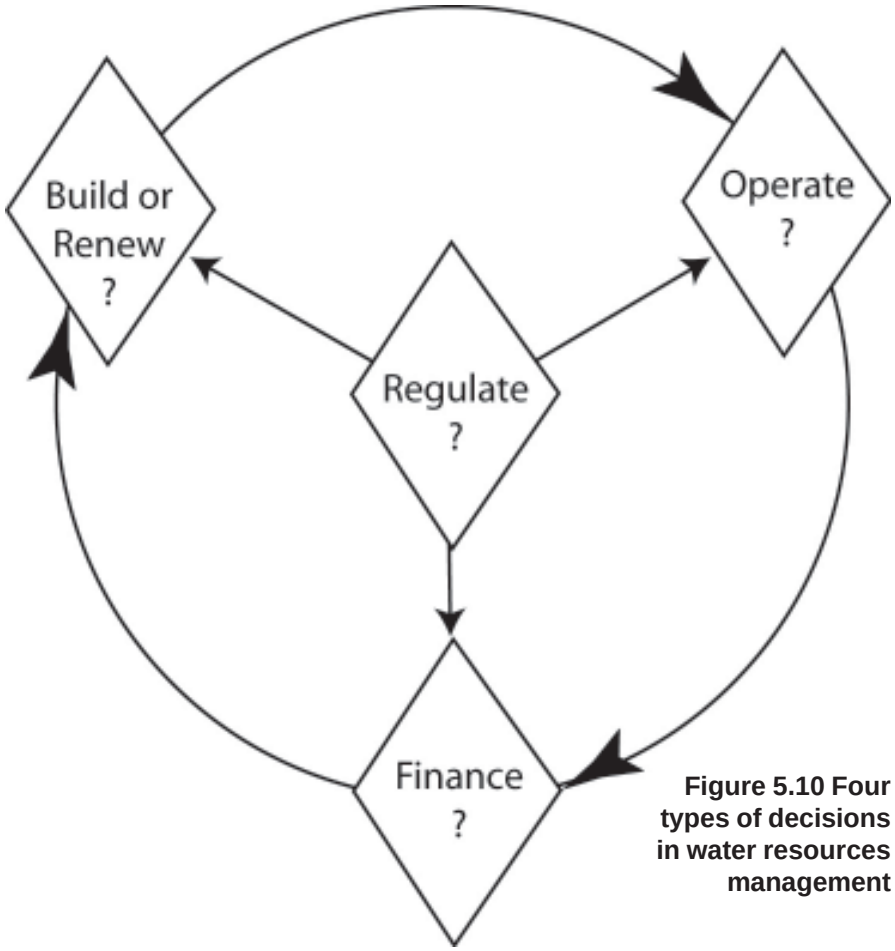


Figure 5.10 Four types of decisions in water resources management

FOUR TYPES OF DECISIONS IN WATER RESOURCES MANAGEMENT

Capital decisions	Examples of capital decisions include to build or renew a facility or obtain water supplies, and to develop or renew the organization's capacity to obtain, process, and deliver water resources.
Operating decisions	Operating decisions ensure the best use of an organization's capacity to manage water. Examples are to operate a reservoir, a treatment plant, a distribution system, an irrigation system, a monitoring system, or a program for risk management.
Regulatory decisions	Regulatory decisions ensure compliance with the law and rules established by government. Examples include setting a rule, issuing a permit, allocating or rationing uses, taking an enforcement action, operating a regulatory monitoring program, or regulating a flood plain.
Financial decisions	Financial decisions ensure that the organization has the money to build and operate its facilities and programs include capital programming and budgeting and obtaining funds for capital or operating programs.

FOUR TYPES OF DECISIONS

Water managers typically make four types of decisions (not including administrative decisions that are not unique to the water industry):

- Capital decisions
- Operating decisions
- Financial decisions
- Regulatory decisions

These four types of decisions occur in some 20 situations described in the following sections.

These types of decisions can be viewed in the context of organizational management, where capital and operating comprise the two main types of controls. Financial decisions are those that are made to provide budget inputs and controls, and regulatory decisions are those that implement rules.

Capital decisions in organizations are linked to the capital planning and programming system. Capital budgeting provides a framework whereby organizations can buy, construct, renovate, maintain, control, and dispose of their capital assets. It involves the time value of money, the cost of capital, the capital budgeting decision, and risk in capital budgeting. Capital expenses are to build new systems or renew old ones. New systems may be required for growth, improvement, or regulatory requirements. Old systems might require major repairs, rehabilitation, refurbishment, or replacement. For example, a sewer collection system might be 50 years old and contain pipes that are too small and/or worn out. The decision might be to replace part of the system with newer, larger sewers and to rehabilitate other parts. Funds for this would come from the capital budget. Another case might involve a water supply transmission main that is vulnerable to failure due to a flood. The utility might decide to install a parallel main over another route to increase reliability and reduce risk.

In operating decisions, the manager uses the operating budget as a day–to–day tool. In it details of expenses and revenues are projected, approved and reported. The resolution to approve the operating budget empowers the organization to spend its operating funds. The operating budget is used to control costs, to provide interdepartmental information, to require the organization to estimate expenditures to check adequacy of revenues, to evaluate internal competition for resources, to provide information for work planning and evaluation, to provide a communication tool for the oversight body, and to adjust annual plans to appropriations. It will include funds for operations and maintenance to include labor, materials, energy, contracted services, maintenance and repairs, and other ongoing needs. Funds are managed in operating accounts so that managers, operators, administrators, and maintenance personnel can run and care for systems. In a stormwater system, for example, a section manager may supervise engineering and maintenance branches. Employees might include an engineer, a floodplain specialist, a data manager, and maintenance workers. Salaries and benefits would be paid by the operating budget. Also, the group may have office and maintenance equipment, including vehicles, and all of their ongoing expenses would be paid by the operating budget.

Most financial decisions for water systems take place in a government environment where rules of governmental accounting apply. An adequate funding base for operations, maintenance, and renewal of systems is probably the single most important management issue faced by the manager, and as managers advance in responsibility, the more they must know about finance. The days when the financial section mainly "kept the books" but otherwise kept out of the way are over. Today, competitive pressures require line managers and financial managers to work together to use information to improve management in all areas. Operations and maintenance mainly involve recurring expenses, and capital investment requires long term funding. Managers budget for and manage finances separately in each area. The link between management and finance is in these two areas. For O&M the issue is keeping costs under control, and in capital management the issue is raising and managing funds for new or renewed systems.

In regulatory decisions, we recognize that water is a highly-regulated industry. Regulatory law aims at controlling activities to protect the public interest where private markets do not. Regulation in the water industry deals with health and safety, water quality, fish and wildlife, quantity allocation, finance, and service quality. The search for better regulatory models continues, but it seems certain that regulations will get tighter. Regulation means to control behavior with rules or laws, mainly to protect the public interest where private markets do not. Mainly, the rules come from federal law that authorizes agencies to issue regulations through "rule making." Thus, the legal system reaches further than just the laws and includes the regulations, which are usually not passed or reviewed by either the legislative or judicial branches. Regulation in the water industry

deals with health and safety, water quality, environment, quantity allocation, finance, and service quality. The regulatory dilemma faced by water agency and industrial dischargers is shown by public interest in water quality. The results eventually come to bear in the form of permits, monitoring, and enforcement of regulations. Regulation is necessary because of the inter-related and shared nature of water resources. One person's waste affects the other person's drinking water.

FOUR SCENARIOS OF CAPITAL DEVELOPMENT

An easily-identifiable capital project is to build a dam. The photo on the right shows Dnieperstoy Dam in Russia, which was destroyed in 1942 during World War II by retreating Russian forces to deny space to the advancing German army.

Capital decisions involve capital planning, programming, and budgeting. Large projected expenses or budgets for these projects require the water organization to borrow from the bond market.

Water organizations are large players in the tax-exempt bond market. Debt financing through bonding is known as "pay-as-you-use" financing because funds are borrowed to construct facilities to be used in the future, while and after the debt is repaid. If the repayment period is the same as the life of the facility, then the facility is paid for just as it needs replacing. Of course, we do not know the lifetimes of facilities in general, and repair and rehabilitation may extend the originally–planned life. Revenue bonds are used when the revenues of a self–supporting project can be used to pay the bonds off. Revenue bonds can be issued by more entities than general obligation bonds, and are usually viewed as riskier with higher interest rates. Since revenue bonds are paid by dedicated revenues, user charges are required. The repayment of the debt will require funds to be allocated from revenues, usually from the operating budget, to retire the bonds.

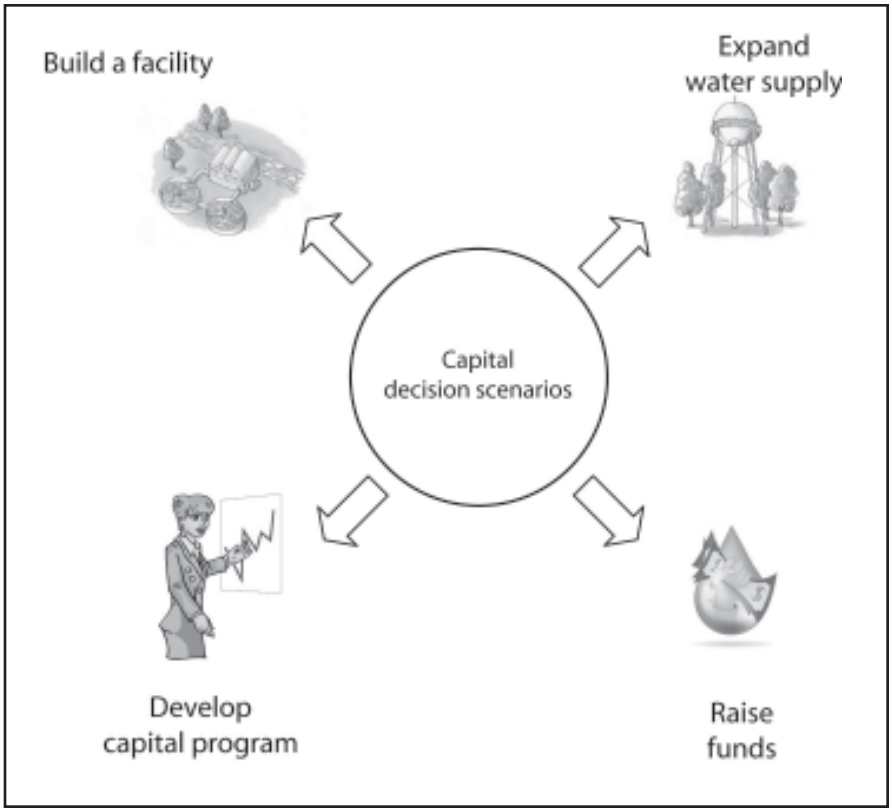


Figure 5.11 Scenarios for capital management

FOUR SCENARIOS OF CAPITAL DEVELOPMENT

Build or renew a capital facility	Build or renew dams, water or wastewater treatment plants, pipelines, or other facilities
Obtain water supplies	Gain access to new or increased sources of water supply
Capital programming and budgeting	Develop a capital improvement program and budget for facilities and systems
Obtain funds for capital or operating programs	Increase rates or fees or arrange capital financing

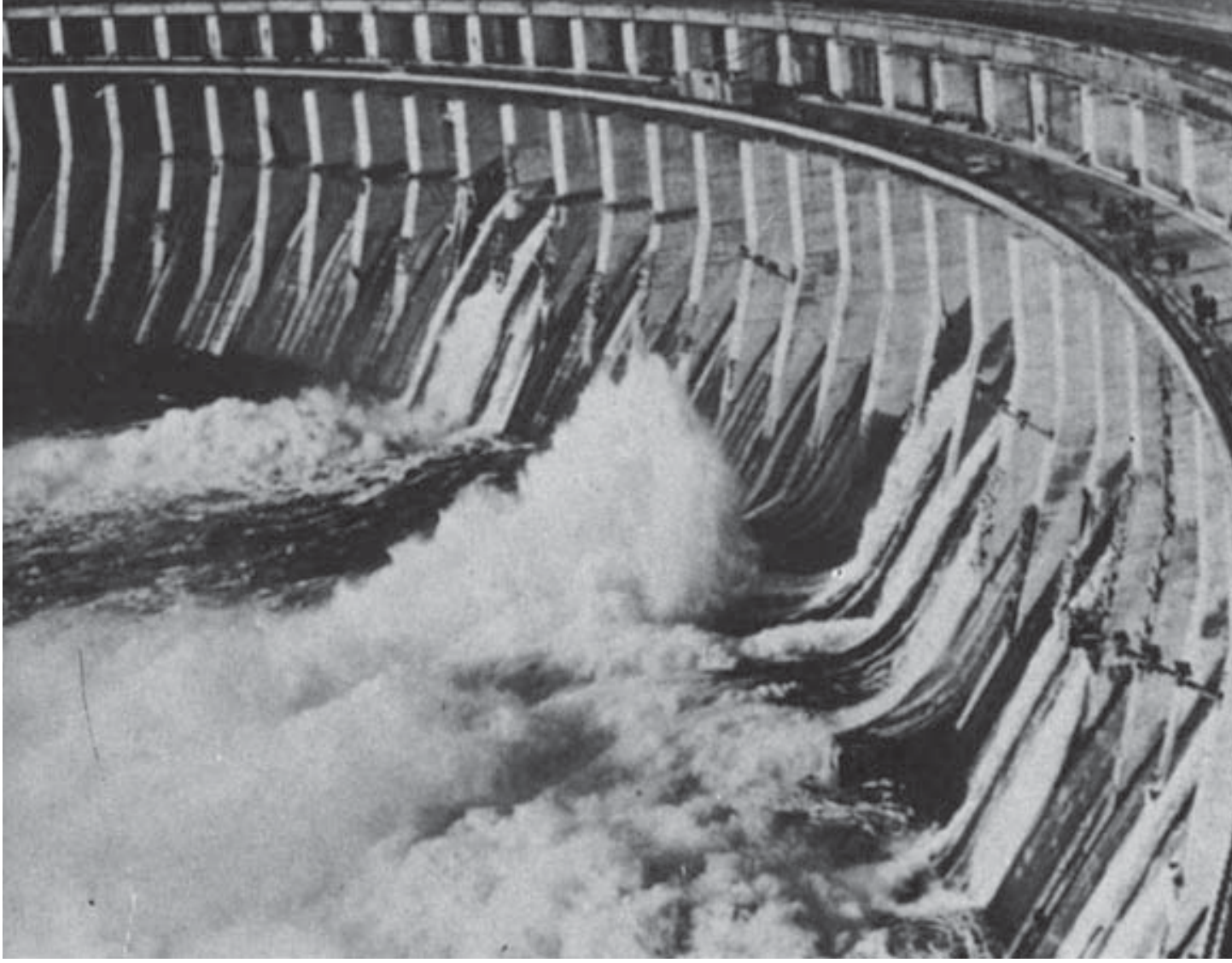


Figure 5.12 Dnieperstroy Dam in Russia, destroyed in 1942 during World War II

Actually, capital financing is one of the most important decisions ever made by water managers. The heart of the decision process is the capital improvement program. Once a project is listed in it, it implies that a commitment has been made to move ahead with it, including financing. Thus, the capital improvement program is normally only published once definite decisions have been made to undertake projects in future years. These decisions may include a vote by a governing board. Still, an organization's capital improvement program may not actually reach the implementation stage because unexpected events can occur. Economic shifts, new laws, voter swings, and financial problems can intervene in the best–laid plans and programs. Budgeting for the project is the crucial test.

Getting a planned facility onto a capital improvement program is actually only one step in the bureaucratic struggle over budget politics. In the budget process, if you get your project on an official or approved list, you may stand a better chance of being funded than if you are not on the list. How serious a capital improvement program is depends on the organization. They can range from being serious, business–like programs to being simply "wish lists." In any case, the important determinant of whether a project is built or not is whether it gets funding.

So, capital improvement program is, in the final analysis, a list of projects that an entity intends to implement under favorable circumstances. The uncertainty is about the intent and ultimate capability to follow though with the intent.

As example of capital programs, water system plans include facilities for growth, obsolescence, condition, regulatory controls, and increases in reliability or service, such as spending to increase security. As a basic input

to growth, water supply receives high priority in capital planning and budgeting. In an ideal case, new systems can be completely financed by growth fees and developer contributions as "growth pays its own way." However, on a practical basis, the picture is more complex because the utility must share and participate in projects to ensure safety, coordination, and orderly growth.

Wastewater system planning for collection, treatment, and disposal starts where water supply leaves off and is driven by service demands and regulatory controls. Basically, collection systems are planned to handle inputs to the system, treatment is planned to meet regulations, and disposal systems are planned to discharge liquid effluents and dispose of sludge residuals. Whereas water supply can deal with positive aesthetics, wastewater planning deals with external effects that include negatives such as odor and image problems. Also, wastewater treatment and disposal systems are downstream of cities rather than upstream.

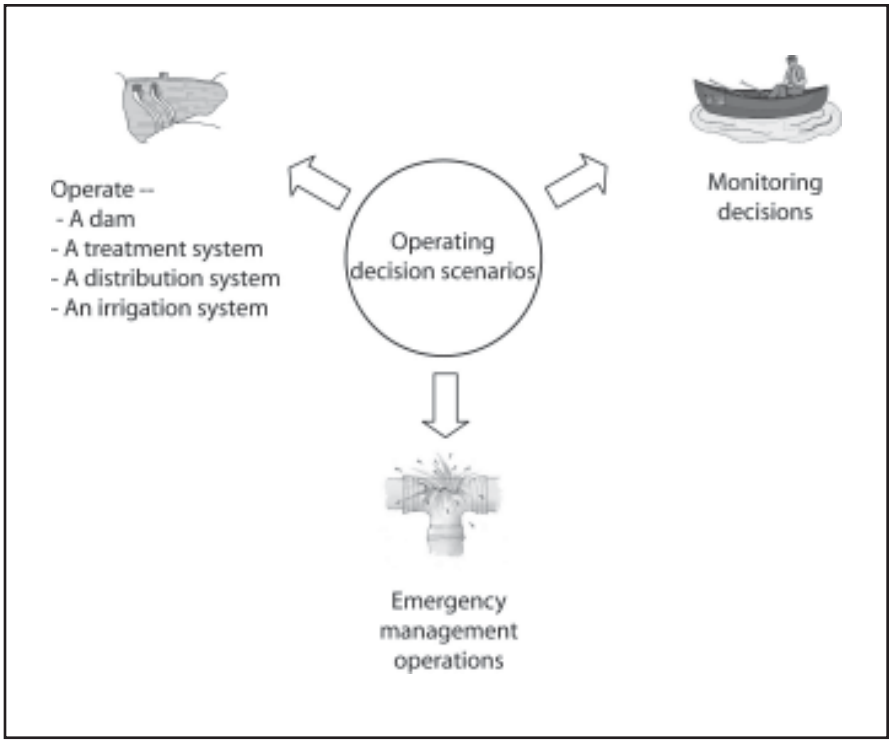


Figure 5.15 Operating scenarios

SIX OPERATING SCENARIOS

Operating scenarios focus on the decisions required to operate and monitor a system or component. Operating scenarios can also deal with program operation, as in an emergency response program.

Reservoir operation	Operate a reservoir for multiple water management purposes, including environmental goals such as habitat enhancement
Treatment plant operation	Operate and maintain a water or wastewater treatment plant to achieve goals for levels of treatment
Water distribution system operation	Operate and maintain a water distribution system to deliver water and conserve energy
Irrigation system operation	Plan and decide on an irrigation schedule
Emergency planning and security	Develop a multi-pronged plan to respond to flood, drought, or other threats, including mitigation, response, and recovery
Monitoring water source systems for operations	Implement system monitoring program to measure results and change control systems

The goal of operations management is productivity in use of resources, such as physical infrastructure. Productivity is producing something of value, such as clean water or wastewater service. Measuring productivity compares output to input, which involves effectiveness and efficiency. Effectiveness is doing the right thing or producing something of value efficiently. You can be efficient but not do the right thing, or be "counter–productive" and produce nothing of value. In water, sewer, and stormwater services, for example, value is providing customers with services they need, keeping costs low, and avoiding regulatory problems. At a higher economic level, productivity measures performance of the whole economy, including labor. Productivity can have positive and negative connotations. To be productive sounds positive, but unless handled right, workers may suspect that productivity is a guise of managers to make them work harder for less pay, or even to eliminate jobs.

SIX REGULATORY SCENARIOS

Regulatory scenarios are different in that they impose rules on operations or capital expenditures. As the water industry has evolved, a set of management principles has emerged. These can be called a paradigm for water management, or simply a list of management practices. The list that follows is a composite of principles that have been presented in many venues.

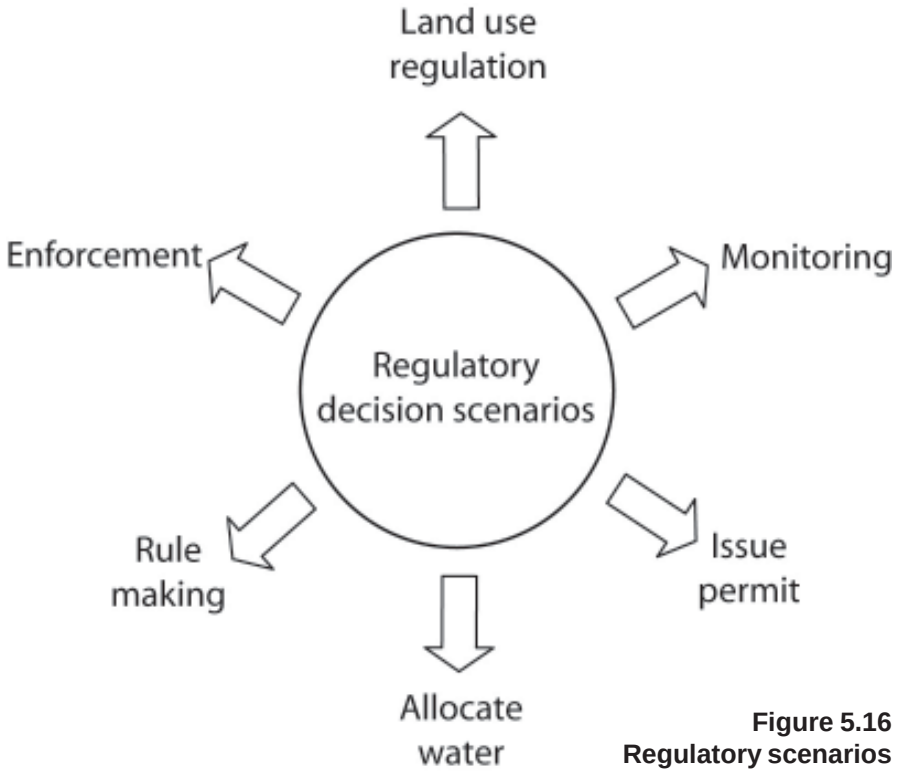


Figure 5.16
Regulatory scenarios

REGULATORY SCENARIOS

Set a rule	Develop a rule under administrative law to implement a statute or regulatory program
Issue a permit	Consider all requirements and conditions, and prepare permit action (for any regulatory program requiring a permit)
Allocate supply or ration uses	Make decisions about allocation of water among different users or customers, including during times of shortage
Enforcement action	Determine appropriate enforcement action to implement regulatory sanctions (drinking water quality, wastewater quality, water use, dam safety, or other regulatory program)
Operate a regulatory monitoring program	Implement a regulatory monitoring system to assure compliance with rules
Regulate land use in flood plain	Implement a program to obtain compliance with land use rules in flood plain

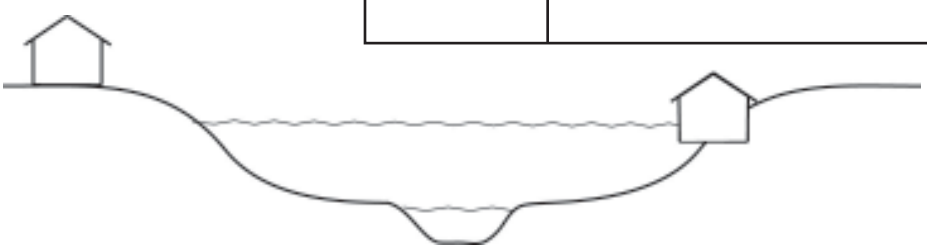


Figure 5.17
Floodplain regulation illustrates regulatory decisions

These regulatory scenarios may seem very different, but in reality, they have common elements. For example, to set a rule requires that the agency envision the full range of future regulatory scenarios, and you would definitely not want to set a rule that could not be implemented. Rule-making carries with it a great deal of responsibility. By the same token, to issue a permit carries long-term implications and requires care. Allocation of supply is another area with long term implications.

The rationing of uses may be a shorter term action, because the emergency that requires the regulatory control could be short term, or it could be long-term. In a similar way, enforcement actions are short term actions, but they link to the long term decisions.

Operating a regulatory monitoring program is an ongoing program, but it also links directly to the rest of the regulatory system.

Regulating land use in flood plain is, in many ways, a different kind of regulatory program that fits in the interface between water management and land use management.

Money in water management

FOUR FINANCIAL SCENARIOS

Financial scenarios support the other types of decisions. They include:

Planning and budgeting	The budget process is the centerpiece of financial planning.
Setting rates and charges	Setting rates and charges involves decisions about amount of funds and equity of charges.
Raising funds for capital or operating programs	Raising funds requires the manager to assess the best sources and means of fund-raising.
Controlling expenditures	Controlling expenditures is necessary to balance the budget and for responsible control of the organization.

These management scenarios are related directly to the decisions and need for data as stated in **Chapter 6**.

PRINCIPLES TO GUIDE DECISION-MAKING

As the water industry has evolved, a set of management principles has emerged. These can be called a paradigm for water management, or simply a list of management practices. The list that follows is a composite of principles that have been presented in many venues.

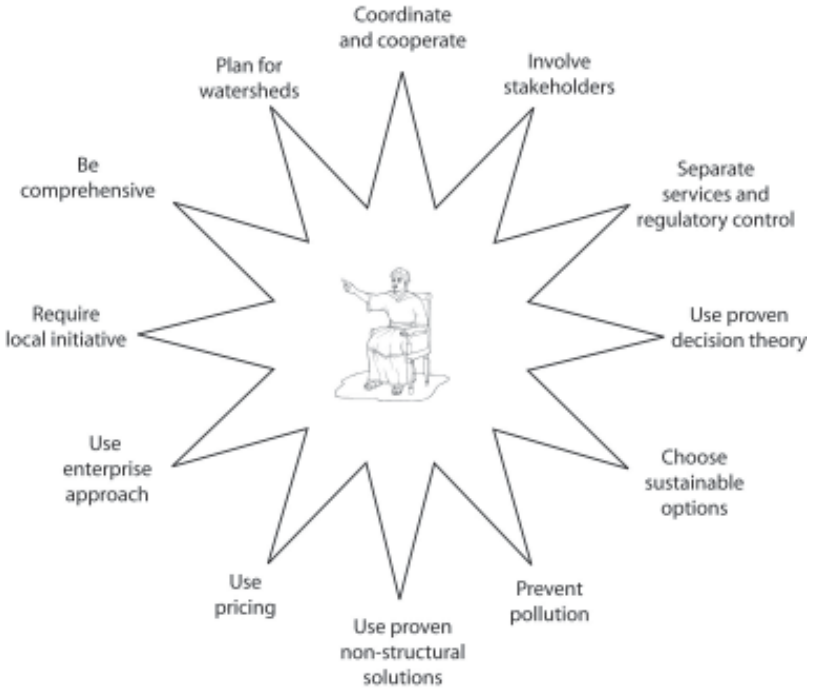


Figure 5.18 Principles for water resources management

PRINCIPLES TO GUIDE DECISION-MAKING

Use decision theory	The field of decision theory offers many useful guidelines. For example, identifying problems correctly, laying out alternatives, using fishbowl planning, involving stakeholders, weighing choices, and doing sensitivity analyses are part of the theory.
Use comprehensive framework for integration	Strive for integration through all means. Provide a comprehensive framework for problems with multiple participants at all levels fulfilling roles of problem solving, regulation, support, and coordination. Include provisions for coordination, sustainability, and accountability. Integrate water management through regional cooperation and functional coordination of programs and other means.
Coordinate, cooperate, and promote partnerships	Emphasize that water citizenship requires coordinated roles (team structure) through partnerships, a coordination mechanism, adequate support mechanisms, and a regulatory structure to handle irregularities. Use voluntary and cooperative model of problem-solving to the extent possible. Provide for vertical coordination by levels of government and horizontal coordination of partners in local areas and agencies with different missions. Manage conflicts with negotiation and alternative dispute resolution.
Manage on sustainable basis	Insist on environmental sustainability (ecosystem focus); financial sustainability (ability to pay); legal sustainability (free from legal challenges); political sustainability (coalitions that work); social sustainability (meets people's perceived needs).
Use watershed and river basin focus	Use coordination in watershed and river basin forums to prepare plans and solve problems to the extent possible.
Use water pricing	Use market mechanisms and pricing to allocate water to the extent possible, but ensure that water for natural systems and safe water for citizens are provided regardless of ability to pay.
Use enterprise approach to financing	Utilize user fees and charges to finance systems and services to the extent possible; avoid subsidies.
Separate service delivery and regulation	Separate the service delivery/development function and the regulation function.
Require local accountability, responsibility and capacity	Place responsibility and accountability for problem-solving and service delivery at local levels, and provide for self-help, enterprise financing, and avoidance of subsidies. Utilize decentralization and grass-roots participation to gain support for programs. Emphasize capacity-building.
Use non-structural approaches	When management actions and programs can solve problems, minimize the construction of infrastructure and structural solutions. Follow the non-structural approach to flood plain management to the extent possible.
Minimize diversions	Minimize diversion of water from natural systems, and insist on maximum conservation and successive use of water, particularly for agricultural and industrial uses.
Prevent pollution	Follow the pollution prevention approach, including using pure sources for water supply if possible.
Manage risk	Submit services and plans to risk assessment, and remember that risk management, as in droughts, is an on-going process.
Involve and inform leaders and the public	Provide information on transparent basis for water leaders and citizens to promote water citizenship, responsible behavior and stewardship of the environment.

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