$C_{\text{HAPTER 12}-\text{ WATERWORKS}} \text{ Development and management strategies}$

NEED FOR WATERWORKS DEVELOPMENT AND MANAGEMENT STRATEGIES

Alternative options for the future management and ownership of major water resource infrastructure currently owned and operated by DWAF, is being investigated at national level. There remains an ongoing need to economically and safely manage the existing water resource infrastructure at both national and regional level.

The Waterworks Development and Management Main Strategy is required to address:

- ⇒ Strategies for new proposed schemes;
- ⇒ Strategies for major infrastructure operational components;
- ⇒ Strategies for specific geographical areas or rivers;
- \Rightarrow Recreation relating to water resources;
- ⇒ Disaster management planning.

RELEVANT IDENTIFIED STRATEGIES

The following specific strategies have been developed further:

- 12.1 Orange-Fish-Sundays Water Supply System Management;
- 12.2 Using water resources for recreation;
- 12.3 Public health and safety.

No major new supply scheme has been identified for implementation.

12.1 ORANGE-FISH-SUNDAYS WATER SUPPLY SYSTEM MANAGEMENT

Management objective:

Ensuring effective operation and maintenance of the water supply system bulk infrastructure and components and transfer of ownership of identified infrastructure.

Situation assessment:

System overview

This system supplies Orange River water to the Great Fish River valley and thence to the Sundays River valley, to supplement local water supply for irrigation and urban use. Water is also transferred to the Nelson Mandela Metropolitan Municipality (NMMM) via this system. The system will be referred to as the Orange-Fish-Sundays Water Supply System (OFSWSS). This strategy addresses management of the integrated system and sub-systems. The various components and some operational aspects of the system were discussed under Section 2.3.1 of Chapter 2, *Overview of the ISP area*. A detailed layout of the system is shown in **Figure 12.1**. Major infrastructural work and the identification of development options have not been included under this strategy, but the identification of such requirements will flow from it.

The system is currently managed and controlled through the use of the FISUN (Fish-Sundays) model with regard to scheduled releases, water quality and control of black fly. While additional water needs to be released to improve salinity, breeding of black fly can be controlled by rapidly dropping water levels, but nothing is being done at present. The existing model has an 11-day operational cycle. A typical problem encountered is that farmers often do not inform the system operator/s when they do not use their allocated water.

The system is functional but can be much improved, particularly when given better information on quantities and patterns of use. Some problems with major infrastructure, especially the Darlington Dam gates, should be urgently addressed. An improved operational system model is required to address, *inter alia*:

- evaluation of operational scenarios and making of recommendations on improved system operation;
- water quality;
- control of black fly; and
- improved monitoring to address modelling requirements is urgently required.

Current system management

The Free State RO manages transfer infrastructure of the Orange River Project up to the tunnel outlet at Teebus, and the Eastern Cape RO the remainder. The infrastructure of the transfer scheme is ageing, which requires higher maintenance, but no major problems are experienced. Control of black fly has a high priority, as it is a major problem in the area's rivers and canals. This pest species is currently controlled through flow discharge control, but it is not very effective. The problem is very difficult to control further away from control infrastructure. Control of black fly should also be addressed as part of the *Reserve and RQOs Strategy*, Strategy 6.1.

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Water quality management is an important component of the management of the system, especially in the lower Fish River, where total dissolved solids can be in excess of 6 000 mg/l. Releases in the lower Fish River are made with the aim of achieving a water quality of less than 650 mg/l at Hermanuskraal Weir, where water for Grahamstown and the Lower Fish GWS irrigation is abstracted. This requires a large volume of water which is effectively lost to other users, inclusive of flows to the sea. The current operational objective of releases from Darlington Dam (where extensive citrus plantations are sensitive to chloride) is to try to keep the TDS of water released to below 600 mg/l.

System modelling requirements

An operational model is required which:

- Is user-friendly and does not demand a high level of technical skill in its operation and interpretation;
- Is understood and can be repaired, corrected or improved by any water resource engineer/programmer with an appropriate level of skill (i.e. this should not be dependent on one service provider or person);
- Has a 2-hourly time-step (for quality and quantity control);
- Receives and works with real-time water quality and quantity data;
- Receives and reacts to monitoring feedback, e.g. the weekly releases of water for irrigators.

The water supply system must be managed to control black fly, which causes damage by attacking sheep's eyes etc. Periodical disruption or loosening of black fly larvae is required. They breed at the edge of the water and are only killed when the water level is adequately dropped.

Water quality management

a. Water Quality Management Plan

An OFSWSS Water Quality Management Plan is required that addresses:

- Operational water quality requirements, i.e., where and when a specific water quality is needed;
- Releases for ecological requirements, to counter water quality problems that occur when the river stops flowing for short periods, especially in the Fish River system;
- Appropriately timed releases from system dams to counter high salinity releases, particularly from the off-channel Glen Melville Balancing Dam;
- Evaluation of the efficiency of water use and salt management at farm level;
- Management of irrigation return flow, which should also be addressed through the *Water allocations and licensing strategy*, Strategy 7.2, as follows:
 - Long-term sustainability intervention measures must take into account surface watergroundwater interaction;
 - Manage for more efficient irrigation to limit the amounts of return flows;
 - Aim to reduce irrigation return flow in the upper Fish catchment, which could improve the river water quality situation significantly, as concluded by the ORRS study;

- Address water quality impacts of irrigation through dialogue with the WUAs and irrigation boards;
- Plan new irrigation schemes in areas where resultant return flows will not cause even bigger problems;
- Flushing of the system should be scheduled for the rainy season

b. Fish sub-area

The highly elevated nutrient levels in especially the lower Fish River (which also occur naturally) are primarily caused by agricultural production (leaching and fertilizers). These nutrients stimulate organic growth. When the river stops flowing for short periods, as it does occasionally, the water goes stagnant and problems with algae follow. Water quality management is needed.

Salinity increases over time in the off-channel Glen Melville Balancing Dam due to evaporation. Saline water is then released down the river system. This could severely impact on downstream farmers if these releases (especially if made at the wrong time of the year) have a significantly poorer quality than the quality of water already flowing in the river stretches below the dam.

c. Sundays sub-area

There is significant eutrophication in the Sundays River downstream of Darlington Dam, probably as a result of agricultural activities.

The extensive citrus plantations in the lower Sunday River are sensitive to poor water quality. The current operational objective of releases from Darlington Dam is to try and keep the TDS to below 600 mg/l. The acceptable level of chloride presents a challenge, and many complaints about the water quality are received from affected farmers. There may however also be alternative soil management measures/irrigation practices to address the issue.

The NMMM is also experiencing problems with the water drawn from the Scheepersvlakte Balancing Dam. These include corrosion, high salinity, taste and odour problems and tri-halomethane generation. The reasons for these problems are inadequately understood but DWAF believes that the situation could be improved by changing some of the treatment processes based on a recent study which addressed the concerns.

System monitoring

Improved real-time water quality and quantity data is needed as input to the operational model. The current level of available data is not acceptable. There is no reliable recording of freshening releases and actual use by irrigation farmers. Monitoring of salt loads with regard to irrigation return flows and analyses of pesticide concentrations are not routinely done. Nutrient content needs to be monitored routinely in the Fish River to be able to manage water quality adequately.



Figure 12.1: Orange-Fish-Sundays Water Supply System

<u>Agricultural Water Conservation and Demand Management</u>

Water quantity (flow) is in fact recorded at a fair number of sites, and many of these have electronic data loggers, but real time data is required. Security problems are also being experienced. Many areas have no cellphone coverage and it is recommended that satellite phones etc. be investigated as telecommunication options. Weekly requests for water by irrigators should be linked to monitoring, so as to reduce losses. Water quality data is also not provided in real-time, nor is enough sampling being done.

All data is currently processed and provided by the RO Technical Services Sub-Directorate. The level of technology used by them is quite advanced but is continually improving and thus changing. There is an identified need for technology used for operation of the system and for hydrological monitoring to match. This should be addressed through the requirements of an updated operational model.

Infrastructure maintenance

The Cookhouse Tunnel, which is unlined for most of its length (transfer from Great Fish to Little Fish River) presents a significant risk factor, as it is very difficult to undertake maintenance in the tunnel, and no transfer alternative is in place. Access is very restricted and the tunnel does not empty because of the alignment. It is a very difficult and slow process to remove rock-falls. Many smaller rock-falls occur in the tunnel, however not disastrous. Adequate maintenance equipment is not available.

Problems are being experienced with the pepper-pot valves in the Orange-Fish Tunnel outlet at Teebus, which could limit tunnel transfer capacity if failing.

Wave action has caused damage to the embankment protection at Grassridge Dam and the dam is being operated at the 30 to 40% level, partially because of this. A decision to repair the damage caused to the dam wall by wave action is required. Enlargement of Grassridge Dam is currently planned for 2014, but this depends on the growth of demand. Careful evaluation of the situation is required to decide what the best option is for fixing or refurbishing or enlarging the dam – or combinations thereof.

There is a need to establish the benefits of refurbishing the gates of Darlington Dam (which is managed by the Sundays River WUA) versus the estimated high cost. Such a decision will influence aspects such as storage and system yield, operation of the dam, irrigation opportunities, water quality, etc. These gates were not adequately maintained in the past. The dam is also heavily silted. The floodgates are permanently closed and the auxiliary gate is left open. Darlington Dam therefore does not fill to more than 46%. There is a concern with regard to safety during flooding.

Significant erosion of riverbanks in the Schoenmakers River takes place due to high flows resulting from the transfer of Orange River water. Bridges are affected on secondary roads and to farms. There has also been erosion of riverbanks along the upper Fish River because of the additional water in the system. Erosion protection works are costly and there are questions of responsibility for protection and liability for damage.

Maintenance of dams which form part of existing irrigation schemes, that have fallen into disrepair and are now being revitalized and further developed, needs to be improved. Such maintenance is currently done *ad hoc*.

Hydropower station

The only hydropower station in the ISP area is situated at the Teebus tunnel outlet of the Orange-Fish transfer tunnel. The small 600 kVA hydropower station has never been commercially used and was damaged in 1990. DWAF is at present evaluating the possibility of implementing a public/private partnership for its future operation.

Tariffing

Differentiated payment regarding the operation and maintenance tariff exists in the system, with users towards the lower end of the system paying more than users towards the upper end. A uniform system tariff is preferred but the users towards the top of the system are against it, as they perceive that it would negatively impact on them. The management ("functions and support") component of the tariff is the same throughout the system.

Transfer of ownership

Transfer of ownership of canals in smaller tributaries is envisaged at Somerset East, Sundays River, etc., once properly established WUAs are in place. Some Sundays River GWS infrastructure, e.g. below Scheepersvlakte Dam, will also be transferred.

Strategic approach:

This water supply system is the lifeblood of this ISP area and good management of it is essential. An integrated management approach to the system is immediately required, which will address overall system management, development planning, monitoring, releases and other operational aspects, freshening releases and other water quality aspects, control of black fly and routine maintenance. Improved system operation and the cutting of losses or spillages from the system will be addressed as key priorities.

In the longer term, the water supply system will be kept operational and the condition of its ageing infrastructure urgently needs to be improved, through continued revitalisation of components in disrepair, fixing of damage at dams, addressing erosion problems caused by transfers as well as some expansion of irrigation (4 000 ha). Any potential future operation of the hydro-power station must not influence the operation of the tunnel system. A *Long-Term Plan* must be put in place, with financing starting now. Areas where new development could take place (in areas which do not add to the problems) or where activities should be closed down through trading (in areas which feed the current problems) must urgently be identified and included in the Plan. Heavy investing in monitoring and modelling is required.

The need for a more user-friendly and understandable planning and operational model will be addressed. The model will *inter alia* be used to operate the system more efficiently to limit operational losses. A Water Quality Operational Plan component, which will form part of the overall OFSWSS Management Plan, will be drafted. The focus of the model will be to show what transfers are necessary, when and of what quality, and distinction will be made between releases for use and

freshening releases. In addition, control of black fly will be addressed in co-operation with catchment forums.

Management actions:

System management

- 1. Document the longer-term strategy of the water supply system (Long-Term Plan);
- 2. The existing operation and maintenance procedures for the OFSWSS should be documented, reviewed and amended;
- 3. Ensure that management plans are implemented for all major dams and promote adequate maintenance on non-DWAF operated dams;
- 4. Determine why farmers in the Lower Sundays use less than their allocation, and make recommendations;
- 5. Investigate the phasing in of regional systems tariffs and how users will be affected;

Monitoring

- 6. Undertake early planning of monitoring needs for an improved operational model;
- Investigate the requirements for routine monitoring of salt loads and nutrient content, with regard to irrigation return flow, to adequately manage water quality in the Fish River and the Sundays River downstream of Darlington Dam, to support the requirements of a short time-step operational model;
- 8. Ensure proper record keeping of all freshening releases and releases for irrigation use made in the system;

System model

- 9. Initiate a study into the revised requirements for an *improved planning and operational model*, and develop the model;
- 10. Once an improved model is available, develop a better understanding of the system and calibrate the model;
- 11. Undertake planning and operational scenario evaluation, such as e.g.:
 - a. Evaluating options to limit operational losses and to manage salinity;
 - b. Limiting the large loss of water due to the need for freshening releases in the lower Fish River;
 - c. Evaluate the sensitivity of citrus farmers in the lower Sundays River Valley to chloride content and the water quality requirements of the NMMM;
 - d. Evaluate the fixing of Darlington Dam's gates and transferring water to it in winter, when there are no return flows, to make full use of dam storage and improve water quality;
 - e. Filling up of dams by transferred additional volumes when there are surplus flows in the Orange River System;
 - f. Transferring maximum amounts of water for flushing salts when large floods occur in the Orange River catchment;
- 12. Evaluate and review system operation, make recommendations, and implement;

Infrastructure maintenance

- 13. Review the requirements for repairs due the wave action damage at Grassridge Dam, along with the operational and management requirements of the system;
- 14. Annually inspect the Cookhouse Tunnel and problematic canal sections. Proper investigation and overall review of the integrity of the tunnel is required;
- 15. Clarify the responsibility of DWAF regarding the erosion of riverbanks in the Schoenmakers River due to the transfer of Orange River water. Initiate a study, along with the Department of Agriculture, to evaluate and make recommendations to address the problem;
- 16. Review the options to utilise the hydropower plant;
- 17. Continue the transfer of the ownership of components of the system to the Lower Sundays and Great Fish River WUAs.

Responsibility:

The D: NWRP is responsible for general planning. The D: WRPS is responsible for modelling, in conjunction with NWRP and the RO. The responsibility lies with the RO for operation and maintenance and upgrading of existing infrastructure and with D: Options Analysis for new infrastructure. The RO is responsible for developing this strategy (especially in the long-term) in consultation with the WUAs and irrigation boards.

Priority:

1- Very high.

12.2 USING WATER RESOURCES FOR RECREATION

Management objective:

Ensuring the sustainable and equitable management and regulation of the use of water resources, especially state-owned dams, for recreation.

Situation assessment:

Many dams, rivers and estuaries in the ISP area are extensively used for recreational purposes, such as boating, swimming, sailing, angling etc. and recreational use linked to tourism is growing. The annual Fish River canoe marathon, for which releases from dams are especially made, is a high-profile event. The extremely high levels of E-coli in the Bloukrans tributary of the Kowie River is a health hazard for recreational users and should receive urgent attention.

DWAF's *Policy for Using Water for Recreational Purposes* defines government's responsibility towards this water use, and the principles, aims and policy for regulating this water use. In an effort to meet the objectives of the NWA and this Policy relating to the creation of economic opportunities for historically disadvantaged people and improving quality of life, DWAF has initiated an Implementation Programme.

The *Sustainable Utilisation Planning Procedure* (SUPP) unlocks the socio-economic potential of water resources through the compilation of plans for sustainable access, utilisation and development. *Sustainable Utilisation Plans* (SUPs) are based on environmental constraints, community and water user needs and requirements, and sound business principles. All Government dams in the ISP area have O&M manuals in place, but no SUPs have been done, since it is still in its initial development stages.

The DWAF-owned dams in the ISP area are:

Fish sub-area:	Grassridge Balancing Dam (wall and appurtenant structures), Commando
	Drift Dam, Kat River Dam, Elandsdrift Weir, De Mistkraal Weir,
	Hermanuskraal Weir, Glen Melville Balancing Dam, Glen Boyd Balancing
	Dam;
Sundays sub-area:	Darlington Dam, Korhaansdrift Weir, Scheepersvlakte Balancing Dam;
Albany Coast sub-area:	None.

Grassridge Dam's surface area and surrounding land has not been zoned, as the water surface and surrounding property belongs to the GFRWUA. Commando Drift Dam falls within a Nature Reserve. Control has been delegated to Nature Conservation and it is therefore zoned as a "conservation area". The Nature Conservation Officer provides permission for the use of the surface water area and surrounds. Recreation is not allowed at De Mistkraal Weir. Darlington Dam and reservoir is located within the Addo Elephant National Park.

Strategic approach:

To effectively manage the use of water resources for recreation, management plans are required, combined with representative institutional structures, to take charge of the implementation thereof in an equitable manner. Although it is envisaged that management and control of this use will largely be based on self-regulation and compliance, the various role-players must understand their respective roles and functions regarding the regulation of this use. Such role-players are the Directorate Water Abstraction and Instream Use, Regional Offices, Delegated Authorities, and Water Management Institutions, i.e. CMAs and WUAs. The Department of Land Affairs will be responsible if a dam is in a former homeland area, else the Department of Public Works is responsible.

The approach to clarify DWAF's area-specific position and strategy will be:

- Establishing the necessary linkages with D: WA&IU for policy and protocol implementation;
- Compiling resource and asset inventories;
- Developing resource utilisation profiles;
- Evaluating existing institutionalisation and management delegations;
- Recording industry and private sector interest;
- Evaluating efficiency and representivity of community involvement and beneficiation mechanisms;
- Compiling an inventory of existing management and zoning plans;
- Prioritising the compilation, institutionalisation and empowerment of SUPs for water resources taking into consideration the area specific information; and
- Promoting implementation and regulation of SUPs.

Management actions:

In addition to the approach listed above, undertake the following:

- 1. Clarify the policy environment in which this use takes place, and implement the Departmental guidelines;
- 2. Review SUPs drafted by developers and regulate accordingly.

Responsibility:

The RO is responsible for implementing this strategy and D: WA&IU, Sub-Directorate: Environment and Recreation, Directorate Water Utilisation for the development and updating of policy and protocol based on results of performance and compliance reports.

Priority:

3 – Medium.

12.3 PUBLIC HEALTH AND SAFETY

Management objective:

To ensure effective disaster management planning and implementation relating to management of floods, operation during droughts, dam safety and emergency spills.

Situation assessment:

Disaster management

An Eastern Cape Disaster Management Forum has been established and there is a need for each District Municipality to have a disaster management forum. Operation and maintenance manuals, inclusive of emergency preparedness plans (EPPs), have been compiled for all Government dams in the ISP area.

Failure of the system due to a tunnel blockage

Failure of the Orange-Fish Tunnel or the Cookhouse Tunnel (see the discussion under the *OFSWSS Management Strategy*, Strategy 12.1) presents a significant risk factor, as no transfer alternative for Orange River water is in place. A blockage that takes a long time to clear is likely to be disastrous.

Drought management

The Directorate Strategic Planning has prioritised dams/areas for drought management nationally. Local plans, many undocumented, will be amended in the light of this. Drought management will be implemented for the Algoa Water Supply System. In this ISP area, a drought management plan is only in place for the Kat River Dam, although the requirements for these plans are currently not regarded as a high priority. Zones have been classified in the Kat River Dam, according to which releases are being made. Drought plans should include management of aquifer systems, to be addressed in the WSDPs. Simple methodologies are required for use by municipal staff.

Dam safety

The Darlington Dam floodgates were not adequately maintained in the past and now need to be refurbished at a high cost. There is a concern with regard to safety during flooding, although the gates can be manually operated. Darlington Dam does not fill to more than 46% because of the problem with the gates. The dam is already silted up to the bottom of the gates. The floodgates are permanently closed and the auxiliary gate is left open. The gates should be removed and the secondary overflow should be permanent left open. This would however likely be untenable from an operational viewpoint. A proposal has been made to replace the gates with stop-logs made of steel pipes to maintain a limited storage capacity.

Some damage caused by wave action at Grassridge Dam may have to be repaired in the longer term, but has a low priority. The dam is being operated at 30 to 40% level because of this. Enlargement of the dam is currently planned for 2014, but this will depend on the rate of growth of demand and what measures are adapted at Darlington Dam.

A Dam Safety Plan is needed for Nqweba Dam as there are some safety concerns regarding the dam. A Disaster Management Plan has been drafted.

Strategic approach:

Until such time as the Public Safety Unit has been established, an interim regional strategy will be implemented that will provide planning to avert or manage disaster situations by complying with required measures of disaster management and dam safety legislation and by co-operative governance initiatives. These planning measures will cater for the management of floods and droughts, dam safety measures and toxic or other spills that could potentially have hazardous impacts. Develop procedures for the implementation of restrictions in the agricultural sector. Address both surface and groundwater resources.

Address the risk of system failure that could spell disaster, by building awareness, both amongst water managers and users. The users would have to carry the losses, as DWAF cannot be held liable for failure to deliver. Users should carry this into their own management plans.

Address cholera outbreaks through co-operative governance with the Department of Health.

Management actions:

a. Disaster Management planning

- 1. Procedures on how to supply water during times of emergency need to be documented;
- 2. Reconcile any disaster management plans with the Disaster Management Act;
- 3. Develop emergency supply arrangements for various durations of possible non-supply from the system or components for the various user groups;
- 4. Encourage the establishment of disaster management forums in all District Municipalities, through the Water Management Institutional Framework Strategy;
- 5. Implement EPPs for all government dams in the ISP area, and ensure that owners of Category 2 private dams prepare EPPs for their dams.

b. Operation during floods

6. No identified action.

c. Operation during drought

- 7. Draw up a drought management plan and operating rules to operate government infrastructure during droughts, to be integrated with normal system management. Through co-operative governance draw up a drought management plan to deal with supply to local authorities during times of drought;
 - Review and document procedures adopted during previous droughts;
 - Identify shortcomings in terms of operation during previous droughts.

d. Dam safety

- 8. Undertake dam safety inspections and reporting;
- 9. Implement the requirements of the NWA regarding dam safety;
- 10. Process dam safety applications and issue authorisations as required;
- 11. Keep a regularly updated register of all dams with a safety risk;
- 12. Take actions against illegal or unsafe dams;
- 13. A decision is urgently required regarding the Darlington Dam floodgates, once it has been decided on how to best operate the system, which will be addressed through the *Orange-Fish-Sundays WSS Management Strategy*, Strategy 12.1;
- 14. A decision on the wave action damage to the Grassridge Dam wall is required. Review along with management of the system.

e. Emergency spills

- 15. Instruct the polluter to remedy its effects;
- 16. Contact relevant emergency services and disaster management centres.

Responsibility:

The RO is responsible for further developing this strategy, for upgrading existing government infrastructure as required in terms of this strategy, and for operation of government infrastructure during droughts. D: Civil Design is responsible for government water infrastructure.

Priority:

2 – High.