Management Considerations

Built Assets – bridges and crossings

Description

An efficient road transport system is critical to the economic and social fabric of the South Eastern region of South Australia.

Road transport costs are an important economic consideration and impact on the ability of the region to compete in international and national markets. It is therefore important that the efficiency of the road transport network is maintained at an appropriate level.

Bridges are critical links in the road transport system, providing access for residents, businesses and primary producers in an area criss-crossed with drainage channels and watercourses.

A failure to maintain these structures can prove to be the weakest link in the chain with road closure or restriction to load carrying capacity impacting on social and economic efficacy of the region.

Many of the bridges built under the Comprehensive Drainage Scheme are critical to the flow of traffic across the region particularly when associated with the region's primary industries sector, which is the economic powerhouse of the South East.

The majority of the South East Drainage Network Road Bridges and Crossings were constructed under the Comprehensive Drainage Scheme between 1948 and 1970. The infrastructure for which the SEWCDB manages and is responsible for is 2,589 kms of drains which is comprised of:

- 1,875 kilometres of drains in the Lower South East and
- 714 kilometres of drains in the Upper South East
- Approximately 2028 structures, including approximately 307 bridges. Other structures include box culvert crossings, pipe culvert crossings regulators and drop weirs

SEWCDB has classified structures into the following categories:

Number of Structures

Asset Type	Number of Structures
Bridge	307
Precast box culvert or pipe culvert crossing	1,480
Regulator	160
Drop Weir	81
Total	**2,028**

The SEWCD Board is not responsible for road bridges that are on main roads under the control of the Commissioner of Highways as defined in the *Highways Act, 1926*.

The SEWCD Board is responsible for road bridges on Local Government roads, excluding those that are within townships.

The responsibility of the SEWCD Board includes the bridge structure, bridge approach, bridge safety barriers, and hazard signage. The relevant Council has responsibility for the road surface over the bridge.

The responsibility of the SEWCD Board extends to:

- bridges and culvert crossings that were constructed on surveyed roads (surveyed road crossing)
- bridges and culvert crossings that were constructed on drainage reserve.

A **surveyed road** is defined as a Council road reserve that has been surveyed but not constructed as a district road. Surveyed roads do not form part of the public road system and as a consequence the resources required to maintain the bridges and crossings are less onerous.

Occupation crossings are defined as crossings over Government constructed drains that sever private property. The crossings provide a means for moving machinery and stock so that the private property can continue to be farmed and managed without undue inconvenience caused by the drains. Occupation crossings are not generally available to the public and do not form part of the public road system.

The maintenance of bridges carries with it a responsibility to ensure:

- The safety of road users,
- The structural integrity of the bridges
- The efficiency of the road system that services the South East.

Over its 140 years of operation, the SEWCD Board has maintained a steady commitment to road bridge infrastructure maintenance, refurbishment and replacement (as necessary) within the limitations of budget. The large number of such assets which are now reaching a critical service-life point (specifically those built during the 1940's and 50's under the Comprehensive Drainage Schemes) is now beyond the standing budget means of the SEWCD Board. Many of these bridges are approaching or have reached their normal service life (50 years) and will from this time be progressively load-limited and where necessary closed

to heavy traffic. The nominal service life of this type of infrastructure can under many circumstances be extended through normal life-cycle maintenance and/or service-life extension refurbishment.

Drainage works commenced in the upper South East in 1996 and were completed in 2011. As this section of the South East Drainage Network is relatively new, the initial demand for maintenance of these should be relatively low compared to the maintenance of structures in the lower South East. The upper South East area does pose some maintenance issues as parts were constructed through sandy soils. The erosion of drain banks is a primary concern, especially in large cuttings through sand hills, erosion around structures and also silting of drains. The majority of structures in the upper South East have been designed to provide an adequate level functional service in terms of width and in terms of load carrying capacity.

Current Status

The SEWCD Board is dealing with infrastructure that is nearing the end of its useful life and in many cases does not meet current design specifications for road safety. The SE WCD Board has never been well funded to meet this responsibility and asset maintenance liability.

The built assets in the lower South East in many cases do not meet current demands for functional level of service as farm machinery becomes wider i.e. increased load capacity, alignment width and adequacy of bridge barriers.

Many of the span-bridges built under the Comprehensive Drainage Scheme over a relatively short timeframe are reaching or have passed their nominal service-life term (50 years) and require either service-life extension refurbishment or replacement.
The steel girders are the main structural component of a steel girder bridge. The 114 bridges to undergo works require urgent intervention to prevent the introduction of reduced load limits or being removed from service. Corrosion and metal loss will continue at a steady rate if no maintenance is undertaken and service restrictions are likely to be implemented within five to ten years if no action is taken.

Plant and Equipment

Description

The SEWCD Board has acquired a number of specialised Plant and Equipment to support the complex operation and maintenance requirements of the South East Drainage Network. The SEWCD Board has purchased this equipment including trucks, hydraulic excavators, flood pumps and plant trailers to ensure availability for operations. The SEWCD Board approved the purchase of these items on the basis that owning them enabled the most efficient management of the network.

Current Status

As at 30/6/14 the SEWCD Board's plant and equipment has a replacement value of approx $2 million on its accounts.
Major equipment the SEWCD Board owns includes:
• Three Excavators and attachments for a variety of maintenance programs including – silt removal, lifting culverts and other heavy building materials into place, tree removal, earthworks and track maintenance. The three excavators are individually valued on the Boards Asset Register as follows:

Excavator Type	**Value**
23T Kobelco	$220,000
33T Kobelco	$298,000
33T Hitachi long-arm	$347,000
Attachments/buckets	$47,223
Total	**$912,223**

• Telehandler to lift heavy objects including placing small pipes into place, removal of fallen trees from drains, minor earthworks
• Tractor/Slasher to clear tall grass to reduce bushfire risk and clear tracks for vehicle access to spray weeds and other operation and maintenance duties on drains
• 4WD Truck to allow materials to be transported to various materials for construction and maintenance, to off road areas only accessible by 4WD vehicles.
• Vehicle and tipping trailers to cart plant and equipment to various sites as this alleviates hiring contractors to shift plant & equipment.
• Monitoring equipment to measure water flows and water quality.

The SEWCD Board currently funds the replacement of plant and equipment from within its budget when replacement becomes a priority, or has recently undertaken replacement of plant and equipment in the 2011-12 and 2012-13 financial years. As an example of replacement costs an excavator would be between $220,000 – 350,000 or to replace the 4 wheel drive tip truck the cost would be $170,000.

Drain Maintenance

Description

The SEWCD Board are responsible for the maintenance of drainage channels, the surrounding land within its jurisdiction and infrastructure associated with the drains. The intention is to fulfil the SEWCD Board's obligations under the *South Eastern Water Conservation and Drainage Act 1992*; to comply with the requirements of other legislation as all landholders are required to do; and prevent disruption to normal day-to-day activities of the community.

A critical function of the SEWCD Board's activities is maintenance of the drainage channels to maintain the flow efficiency and capacity of the South East Drainage Network. The aim in the lower South East is to maintain the design capacity to accommodate a 1 in 10 rainfall event. The design of the drains in the upper South East varies: some have been designed for groundwater interception; others for both groundwater and surface water and REFLOWS has been designed for above ground diversion surface water flow only.

Maintenance of these drains is intended to restore their design capacity predominantly through silt removal programs. In the past this has been undertaken on a 10-20 year rotation for the major trunk drains such as Drain M and Drain L. Hydraulic excavators are used to remove silt, clear sand from sea outlets, reshape the formation of the drain and stabilise banks. Excavators and other machinery are used to remove obstructions like fallen trees in the drainage channels, silt and obstructions in culverts. The SEWCD Board's two chemical spray units and the contract helicopter application of spray is used to control vegetative growth in the channel, which can impede flows and block culverts.

Maintenance of the land around the drains on drain reserves, drainage easements or Crown Lands vested to the SEWCD Board is also undertaken. Activities include mandated noxious weed control as a priority, slashing of tall grass for bushfire hazard reduction and safe vehicle access, and maintenance of tracks and spoil banks with the SEWCD Board's dozer and excavator.

Weirs and regulators are repaired and upgraded when possible; monitoring stations and crump weirs are maintained; bridge approaches are sprayed to maintain visibility and fence replacement is funded jointly with neighbouring landholders.

Current Status

The current level of funding requires the SEWCD Board's to prioritise its work functions in an effort to achieve its objectives.

The SEWCD Board have concentrated on drain spraying for noxious weeds and drain channel vegetation over a silt removal program and track maintenance since the 2012-13 year.

In the lower South East in 2013/2014 crews carried out 538 km of drain spraying using vehicle mounted units and hand spraying for regrowth and noxious weed control to a cost of $82,000.

Contract helicopter spraying is employed when funds are available to access difficult to reach areas and to spray major drains and flows and flow paths out of reach of vehicle spraying rigs, such as the Reedy Creek Mt Hope Drain from the Princes Highway to Mt Hope Rd.

In 2013/2014 silt removal was undertaken at nine sites totalling 24 km of channel and sea outlet. The silt removal included construction of a rock wall in a sand cutting to stabilise the banks of a section of the Bakers Range Catch Drain, adding to the $102,748 cost of this activity. Identification of silt build-up is undertaken by staff or by landholders, who recognise areas at risk of flooding. The SEWCD Board does not currently undertake a progressive assessment of silt build-up in its drains. The main and larger drainage channels in the lower South East (those 2.0 m and deeper and 10.0 m or wider) have had some silt removal undertaken in the last 20 years. Smaller channels and all subsidiary drains have not had silt removal undertaken. This is consistent with the SEWCD Board approach of keeping sea outlets and major channels operating as a priority.

The SEWCD Board receives requests from stakeholders and landholders for maintenance activities to be carried out on fences.

These are responded to on a 'first in first serve' basis. The SEWCD Board replaces the fences as half share ownership with the adjoining landholder. Currently the SEWCD Board's allocation of $20,000 per annum for fencing is spent in the first 2 months of the financial year, and goes to material purchase with the erection cost being met by the landholder. In the 2013-14 year this allowed the renewal of approximately 7km of boundary fences.

Additional maintenance activities on gauging stations have not been undertaken, resulting in closure of gauging sites. Repair of bridge approaches, cleaning of bridge scuppers (drain holes) and repair of guard rails have been prioritised lower than installing load limiting signs on bridges.

Flows Maintenance

Description

The SEWCD Board's flows management function was developed as part of the Upper South East Dryland Salinity and Flood Management Program between 2004 and 2011, for the active management of the drainage network and surface waters in the upper South East.

The concept was simple, to maintain and/or restore surface water flow to wetlands, and use drainage infrastructure for water delivery where this assists in achieving environmental objectives (Dejong and Harding 2007). The core functions of the drainage network were not neglected either, with the operating rules providing guidance on managing drain infrastructure for optimal performance for flood mitigation and saline groundwater management (DFW 2007).

In practice the realities of the complexity of the tasks at hand were realised and the flow management system was developed in recognition of:

- A large jurisdiction over several watercourse areas and source water catchments
- A vastly changed hydrological landscape
- A requirement to help redress the effects of drainage and restore or maintain flows to estimated 200 Wetlands over >40,000ha (in addition to the estimated 23,000ha of wetland connected to the drainage network in the Lower South East
- The need to accommodate differing expectations for surface water and drain management amongst landholders
- a complex network of 714 km of drain and floodway infrastructure in the Upper South East (to add to the 1,875km in the Lower South East)
- The need for the timely and efficient operation of around 140 regulators to manage flows and groundwater (to add to around 30 other regulators in the Lower South East)
- Heavily managed complex system – with varying water quality and unpredictable availability of suitable water for environmental flows

An adaptive management approach, supported by the various monitoring regimes and digital support systems is considered necessary to assist managers when faced with the following challenges:

- Current seasonal flows are infrequent and of inadequate volumes to fulfil all environmental flow requirements of all wetlands
- Future climate change effects will exacerbate the unpredictability of available environmental flows.
- Managers have some capability to prioritise flows to wetlands, and are required to make objective choices based on wetland priorities rather than succumb to subjective pressure from landholders
- May have to deviate from ideal hydrology (such as using sub-optimal salinity water) while lacking knowledge of the effects and consequences on the wetland
- Decisions need to be scientifically defensible

Given the complexities of the support systems, the spatial extent of wetlands and characteristics of the South East landscape, it has been necessary to adopt an organisation framework for implementation. This is a systematic process, which coarsely follows a 4-stage approach of planning, implementation, monitoring and review, for continually improving management policies and practices by learning of the outcomes of operational programs. An adaptive management approach has provided a structure that allows the complexities of ecology, hydrology and operating requirements to be integrated and organised in a functional manner.

To ensure that new and existing drainage infrastructure will function to achieve environmental outcomes the SEWCD Board has been provided with a sophisticated integrated system of:

- surface water monitoring
- groundwater monitoring
- catchment water quality monitoring
- ecological monitoring and
- computer based decision support systems.

The monitoring components of the program have been designed to support each stage of the adaptive management process and are critical to the efficient functioning of the system.

The hydrological monitoring network of >80 telemetric stations are used in situations where high quality, accurate and long-term data is required and provides managers with the following key capabilities (Kawalec 2008):

- early warning of rainfall events in catchment areas
- near real-time availability of flow and salinity data at key drain and watercourse points to make operational decisions
- water level, salinity and water quality data (pH and Dissolved Oxygen) in key wetlands to record and analyse the results of environmental flow diversions
- archiving of the information for future analysis and modelling and review of flow management activities

The manual collection of hydrological monitoring data (flows, water level, salinity) at 100 locations in the catchment area by managers provides:
• Validation and verification of telemetric data
• Immediate observations of catchment conditions and drain performance
• Supplementary operational decision-making information
• Ability to respond to conditions in a timely manner

The collection of groundwater data in 71 Piezometers (groundwater bores) in the upper South East provides managers with an understanding of groundwater response to seasonal conditions, drainage and management of drain flows. Five of the bores were telemetered, 61 of these are manually gauged, and 5 are logged but not telemetered.

The collection of water quality monitoring data of drain and water course flows assists in analysing the catchment water quality risks to receiving environments, and the ecological monitoring program assesses the success of environmental flow diversions.

The Decision Support System is an integral part of the flows management system in use by the SEWCD Board and was designed to perform the following (Willis 2011):
• Allow for planning of the allocation of water resources to wetland assets
• Document the current water management plan for the upper South East region
• Present information relevant to making planning and operational decisions
• Document the operational decisions made
• Document the outcomes of the operational decisions to facilitate learning for future planning
• Provide a consolidated and secure reference data repository
• Monitor current conditions and alert decision makers when conditions are such that action is required

It links the monitoring data with operating guidelines for regulators, interrogates telemetric data and provides email alerts to managers when pre-loaded catchment conditions are triggered by the hydrological monitoring sites. This system was developed to ensure managers were alerted to conditions to allow timely and appropriate operating decisions, and it recognises the complexity of the landscape, water flows and infrastructure available for management.

The Decision Support System provides modules for annual review of flow management operations (to identify successes and challenges, and operational changes) and operational planning (to improve on performance in the next year). Together with the hydrological monitoring network the Decision Support System are the most critical to the functioning of the Flow Management responsibilities of the SEWCD Board.

Current Status

The prioritised investment in drain maintenance and bridge renewal activities has resulted in a rationalised flows management system:
• The network of hydrological monitoring stations are being reduced from over 80 sites to fewer than 20
• Data from these sites is continues to be made available on the Department's WaterConnect web page but not through the Decision Support System
• manual monitoring sites that were visited on a monthly basis are being monitored quarterly, others have been removed from the monitoring program
• the Decision Support System requires specialist upgrade and maintenance to repair non-functioning change modules, especially the alert function
• Flows management decisions for example weir and regulator operation are more frequently being made in the field without appropriate data
• The annual review and associated development of the next season's operational plan are being prepared with reduced detail and content