

Part C1

Component 1: Irrigation Service Provision

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Part C1

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1. Sub-Component 1:Infrastructure Development

Sub-component 1.1 will finance the works, goods and services needed to develop irrigation and drainage infrastructure in the SVIP-I area. These include detailed design preparation, construction supervision and quality assurance, and construction of the physical bulk water conveyance and main distribution system, major drainage, flood protection works, and service and access roads. Detailed technical feasibility studies were conducted¹ and PAPs were pre-identified, leading to the layout and preliminary designs for the project. *Given resettlement needs along the canal routes, the MoLHUD will play an important role in the land-acquisition process as detailed in the PIM Part B, C2 and D.*

Provisions will also be made for the SVIP-II area in terms of canal dimensions, right of way, and preparatory studies. The component will support spatial planning in the wider project area to ensure the irrigation scheme is well-integrated with other land uses and natural resources, in parallel with establishing a professional management, operation and maintenance system for the scheme.

1.1 Intake structure

The intake structure will be located on the right side of the Kapichira Reservoir. It is designed to have an automatic control system for the gates, so the system will automatically operate the gates to release the required water. The design abstraction and maximum feeder canal conveyance capacity is 50 m³/sec, which will satisfy the peak water requirements with 80 percent probability. This capacity is for a command area of up to 43,370 ha, which includes 22,280 ha and 21,090 ha to be developed under SVIP I and SVIP II respectively.

The design water requirements are calculated for current crops (mostly sugarcane) in the areas already developed, as well as the standard cropping pattern of dry beans, pigeon peas, cotton, soya bean, and maize for the new areas. It is assumed that the irrigation methods in the already-developed areas will remain the same and that new areas will be developed for surface irrigation.

Technical Feasibility Study

Further details on the canal layout and technical design elements in general can be found in the SVTP Technical Feasibility Study¹.

Some design stats

- Max Q (flow) = 50,000 liters/sec.
- 133 km of main canals
- Total irrigation = 43,370 ha
- SVTP-I = 22,280 ha
- SVTP-II = 21,090 ha
- Concrete-lined main and secondary canals
- Surface irrigation - can be upgraded to pressurized systems

¹ Technical Feasibility Study on the Shire Valley Irrigation Project, October 2016. Korea Rural Corporation in JV with Dasan Consultants Co., Ltd., GK Works Civil and Structural Engineer. SVTP Project Technical Team, MoAIWD, Malawi.

As such, the irrigation scheme has been designed for the most conservative scenario. However, it is expected that a number of farm entities will select sprinkler irrigation, which is more efficient. Illovo is already increasing its area under drip irrigation, a practice which may be adopted more widely in other areas over time. This would provide a buffer for possible climate change when higher crop water requirements can be expected and maybe reduced water availability. The total irrigation command area can be adjusted during Phase 2 when there is more clarity on irrigation preferences.

1.2 Canal names, details and descriptions

The naming of the main canals has evolved during the project preparation process and different names are used in the engineering pre-feasibility study, and the World Bank Project Appraisal Document (PAD²) and other consultancy reports³. These can be easily cross-referenced using the information in Table C1-1.

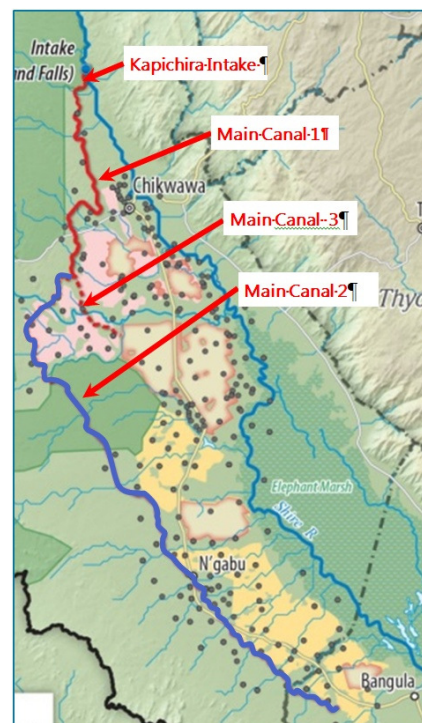


Table C1-1: Summary data of the SVTP main canals

Canal name (Feasibility Study)	Canal name (PAD ² and COWI ³)	Length	Comment
Main Canal 1 (MC 1)	Conveyance Canal (incl. 1 km Feeder Canal)	33.7 km	Bulk irrigation water transfer from Kapichira, through Majete, incl. Chikwawa water supply.
Main Canal 2 (MC 2)	Bangula 1 Canal	18.4 km	Supplies Zone A: 4,058 ha.
	Bangula 2 Canal	70 km	SVTP-II Irrigation Area
Main Canal 3 (MC 3)	Supuni Main Canal	10.6 km	Supplies 12,180 ha (incl. Illovo 9,995 ha)

The canal routes are described in outline below noting that important details regarding resettlement along the routes are described in the COWI Land Tenure Diagnostic Report². The Resettlement Policy Framework will also guide this aspect of the project implementation.

Main canals

The first 3.8 kilometer of Main Canal 1 is constructed within two segments of the Majete Wildlife Reserve. This section is a different design from the canal located outside of Majete Reserve and will mainly comprise a covered siphon-structure to minimize adverse environmental impacts and allow free

² The PAD is the World Bank Project Appraisal Document for the SVTP and is part of the Financing Agreement.

³COWI. 2016. Communication, Community Participation, Land Tenure and Resettlement Policy Framework for the Shire Valley Irrigation Project: Land Tenure Diagnostic, Allocation and Consolidation Strategy Report. 3March2016. SVTP Project Technical Team. MoAIWD, Government of Malawi.

movement of wild animals. A distinct and major hydraulic structure to be integrated into Main Canal 1 just before the exit from Majete Reserve is a fish-barrier comprising a vertical drop structure. This will prevent the movement of invasive fish species such as the tiger fish upstream of Kapichira Dam into the Lake Malawi ecosystem. In addition, several mitigation measures requested by Majete Wildlife Reserve, such as the installation of masonry walls around the open canal section, crossing roads and watering point, were also included in the canal design.

Design and construction of the intake and initial section of the feeder canal will commence at the start of construction, with enhanced contractor oversight given the environmental risks that must be addressed.

The remainder of MC 1, also called the conveyance canal section, traverses from Majete Wildlife Reserve onwards for 32.7 km to the bifurcation point with MC 2 and MC 3. This section of MC 1 will also be used to supply drinking water for an estimated 41,000 people in Chikwawa Township.

Main Canal 2 (called the Bangula 1 Canal in some reports) will have an initial length of 18.4 km to irrigate Zone A (4,058 ha). In SVTP-II, MC 2 will be extended by 70 km to irrigate the area developed during SVTP-II. This extension is also called the Bangula 2 canal. Main Canal 3 (or Supuni Canal) will be 10.6 km long, and will supply water to an area covering 12,180 ha, including 9,995 ha belonging to Illovo Estate.

Secondary Canals

There are a total of 16 secondary canals that will be constructed to convey water from the main canals to the farm zones in SVTP-I: five secondary canals on MC1; seven on MC2 and five on MC3. Measurement devices will be used to measure the volume of water delivered to each zone. Secondary canals will be directly connected to the Main Canals 1, 2 and 3 lined with reinforced concrete 10 cm thick.

Existing and new irrigated areas

It is expected that during Phase I, about 22,280 ha of on-farm area will be equipped for irrigation, comprising 12,180 ha of currently irrigated estate areas that would be connected to the gravity system and 10,100 ha of new development (Table C1-2). The actual area will depend on the readiness of the farmers following the extensive land consolidation and agricultural development activities that are undertaken in Component 2 and 3, as well as progress with the construction of the higher-order canal system, and available financing. A mixture of irrigation methods (including surface and pressurized irrigation) is expected to be developed based mostly on farmer preferences and crop choices, and considering development costs (soil and topography) and water productivity.

Table C1-2: Irrigation areas to be supplied and developed during SVTP Phases I-II

Phase	Existing equipped area (ha)	New developed area (ha)	Total (ha)
SVTP-I	12,180 (Illovo and out-growers)	10,100	22,280
SVTP-II	3,580 (Illovo and out-growers)	17,510	21,090

Total	15,760	27,610	43,370
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1.3 Hydraulic structures

The construction of numerous hydraulic structures is required for the higher-order canal system. These include:

- The fish barrier to prevent invasive species, constructed within Majete Wildlife Reserve on MC 1.
- Siphons for crossing locations where valleys, rivers, and main roads are passed.
- Control and offtake structures (mostly weirs) to distribute the water and deliver it to the head of the farm zones.
- Road and foot bridges, animal crossings, and offtakes to water points, as required.
- Sediment basins and night storage reservoirs, as required.
- Drainage channels, and access and field roads that are incorporated into the irrigation system.

Each secondary canal will serve several farm blocks, where organized groups of farmers will practice commercial agriculture. The farm block designs and irrigation methods (surface, sprinkler, drip) will be prepared in full consultation with members of the farm organizations, supported by the professional organizations responsible for managing the irrigation infrastructure and farm operations on behalf of the farm organizations.

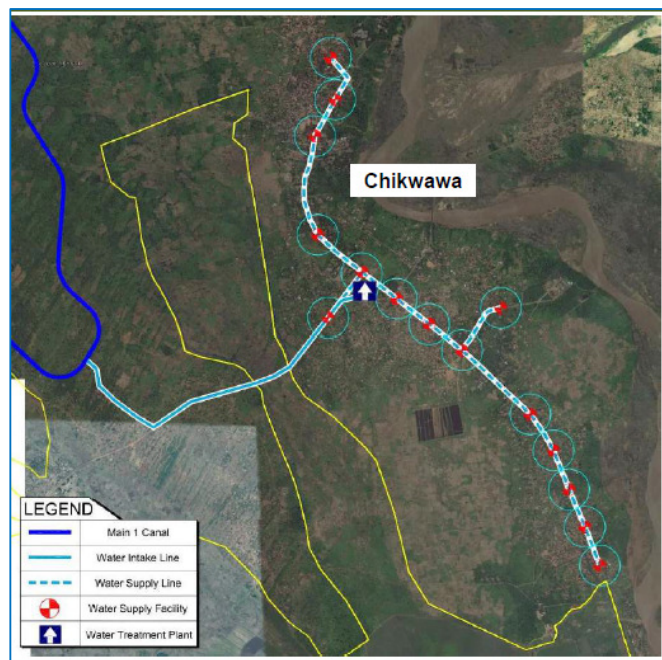
1.4 Chikwawa water supply system

A water supply system with a design capacity of 14.4 l/s will be designed in collaboration with Southern Region Water Board, and installed to benefit residents within and around the Chikwawa Boma area. The beneficiary population is projected to be 30,619 in 2016, and 41,335 by 2026.

The water source will be a **feeder canal** designed to meet this water demand over and above the irrigation water requirements.

To allow for safe multiple use of the infrastructure, the scheme provisions include a variety of safety measures, especially near populated areas; safe washing and playing access; livestock watering; and provision for safe canal

crossing for people, vehicles and animals. These aspects will be designed in detail with the neighboring communities. Further information is provided in the Environmental and Social Management Plan (ESMP) and RPF.



2. Sub-Component 1.2: Support to Effective & Sustainable Irrigation Management, Operation and Maintenance

2.1 Institutional support

Subcomponent 1.2 will help the government develop its institutional structures and strengthen its capacity to manage the project long-term. The Operation, Management and Maintenance (OMM) of the bulk water supply system will be the responsibility of a commercial operator, while the irrigation system within each 'block' will be the responsibility of the block level SOCFE, cooperative or company purchasing water from the operator.

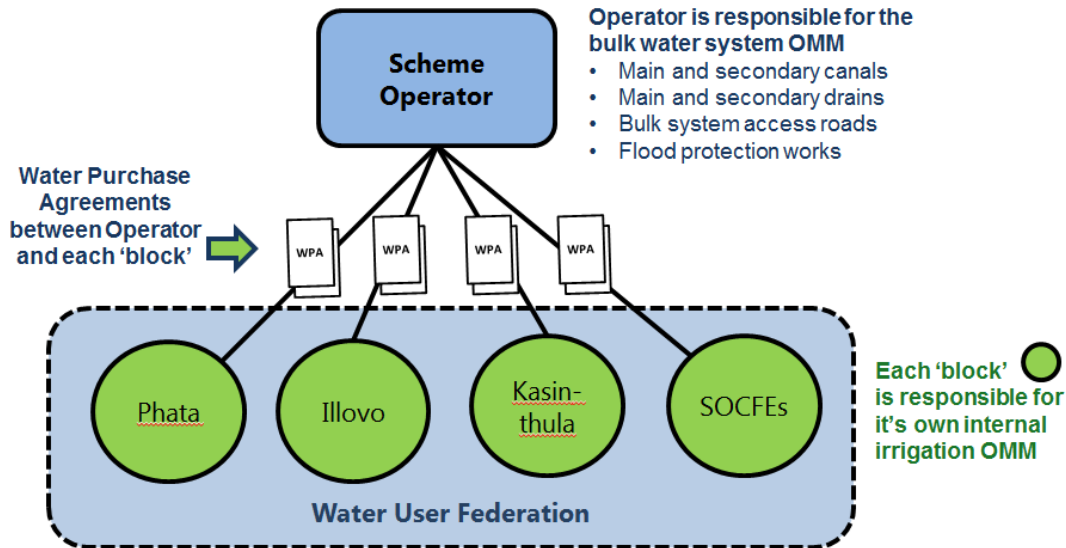


Figure C1-3: Irrigation Services Operation, Management and Maintenance

The GoM will undertake the design and construction of the project through traditional public procurement, while a management contract will be developed to engage the private sector in the long-term Operations Management and Maintenance (OMM) of the irrigation scheme. In addition to water-service provision management and operations, the operator will be responsible for the

maintenance of all common infrastructure. This would include the main and secondary canals and drains, flood protection works and irrigation-infrastructure access roads.

The operational agreement will be structured to incentivize efficient O&M and commercial management of the bulk water infrastructure assets.

At the level of the whole Shire Valley scheme, all water users (including existing estates, cooperatives and new SOCFEs) will be organized into a Water User Federation (WUF). This will be an apex organization for liaison and negotiation with the bulk water operator.

2.2 Block-level water management

The on-field water distribution within each new irrigation block or each existing cooperative or estate (such as Phata, Kasinthula, Illovo etc.), will be arranged within the boundary of the separate estate or block enterprises.

Water management within the block would vary depending on the block irrigation pathway that is selected (discussed further in Part C3 of the PIM). Depending on the irrigation pathway chosen, internal management may be fully integrated into farm management or, in looser forms of cooperation, will require internal operations and maintenance to be managed by a water user organization. Water-users will then have to be organized and have representation in the overall governance structure of their schemes.

... **find more on this in Part C3**

- Water organizations and irrigation pathways
- Technology choices – center pivots and surface irrigation

In the absence of specific legal provisions in Malawi that enable water user organization functioning, alternative and generally less-suitable legal mechanisms will have to be considered such as Trusts, cooperatives and companies.

2.3 Water Purchase Agreements

The principle of a contractual approach between off-taker at block level and operator at main level is upheld in all cases (Figure C1-3).

A Water Purchase Agreement (WPA) between Illovo and all other existing off-takers needs to be agreed upon to ensure their commitment to the project. Ongoing discussions have confirmed Illovo's interest in negotiating a long-term WPA.

A positive feature of the scheme's financial viability is that about half the area in SVTP-I will be ready to connect as soon as service is established. This should provide a steady base revenue while others may lag in farm development.

WPAs for new irrigation block organizations (SOCFEs however legally instituted) would be developed and formalized as part of the agricultural business planning process that would take place sequentially over the project.

Various financial structuring issues need to be resolved which include:

- the financing and payment for the Illovo-specific aspects of the scheme; the structure of the various water purchase agreements;
- the extent, if any, of the differential water pricing arrangement between Illovo and new cooperatives; and
- the management of any refurbishment funds.

The detailed scheme consultations will include setting irrigation service fees and drafting the various WPAs, both being important for long-term financial livelihoods and sustainability.

The financial implications of phased entry will be part of fee structuring on fixed and variable costs recovery. Financial modeling and willingness to pay surveys that were conducted (on financial modeling and “willingness to pay”) show that full management, operation and maintenance (MOM) recovery is well within the reach of all future clients.

In addition to the cost of water provision to the user, the irrigation service fee for existing private sector commercial growers should also finance the repayment of incremental infrastructure costs. It has been preliminarily assessed that the fee to be negotiated will likely represent the value that existing users place on switching to a gravity system. The credit will not finance the private sector’s infrastructure cost.

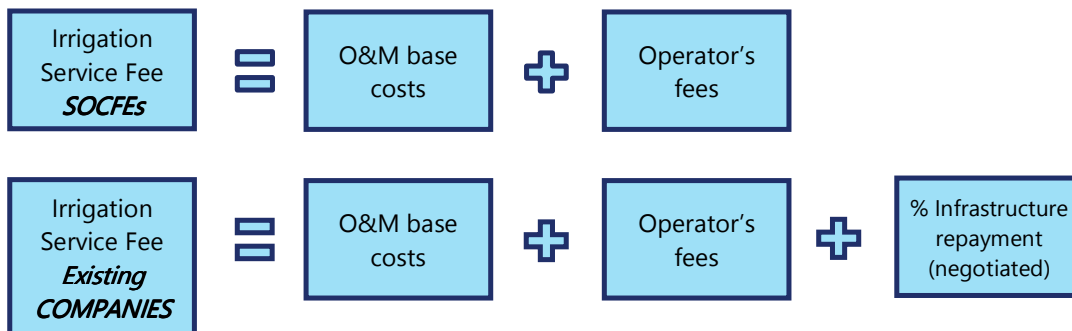


Figure C1-4: SVTP Water pricing principles for SOCFEs and private sector companies

Advisory services will support the Ministry and the Public-Private Partnership Commission (PPPC) in negotiating the various WPAs, as well as decision-making around other commercial aspects of the scheme. This may be implemented in partnership with IFC, if the Government so requests. An advisor would be required to assist the Ministry and PPPC in procuring the incentive-based management contract, although this work might only commence a year into the project. Ideally, the operator should be selected prior to the commencement of works, so that s/he can review and positively influence design and construction with the long-term vision of operability.

2.4 Financial support

This subcomponent will finance the following:

Capacity building and training of government staff and communities for the long-term management of the infrastructure assets.

Technical assistance in establishing the optimal commercial structure for the project. This will encompass:

- Advice on the financing and ownership of the Illovo specific assets, most likely in a separate Special Purpose Vehicle.
- Assisting GOM in negotiating the WPA, particularly with Illovo and other existing users.
- Refining the financial modeling undertaken under the PPP feasibility study to assist with the negotiations of the WPA with Illovo and subsequent procurement of the Management, Operations and Maintenance Agreement;
- Establishment of an asset holding company or similar vehicle to own and manage the main infrastructure asset on behalf of government and act as government counterpart in any future financing and PPP arrangement;
- Transaction advice for the procurement of an incentive-based MOM Agreement;

Installation of information systems(technical and management) necessary for long-term system management. These include SCADA (Supervisory Control and Data Acquisition), asset and financial management systems.

Community training on the proposed institutional structure for effective water management at all scheme levels. There is overlap with Component 3 on the establishment of water-management organisations and rules within the irrigation blocks (SOCFES) which will be required for Pathways 2 and 3. Issues of organizational alignment, including with the apex Water User Federation will have to be addressed coherently.