APPENDIX 3

REHABILITATION AND O&M OF IRRIGATION FACILITIES

APPENDIX 3 REHABILITATION AND O&M OF IRRIGATION FACILITIES

Contents

Table A3-1 (1/8) Implementation Program of Verification Study – Mz-11 Bethani

Items	Contents
1. General information of the scheme	1) Area Name: Bethani (Mz-11) 2) Location: Mzuzu ADD - Rumphi District - Mhuju EPA 3) Number of members of water user association: 132 (Male 66, Female 66) 4) Implementation period: October 2007 to February 2009 5) Type of irrigation facility: River diversion weir 6) Service area: Present : dry season – 22.0 ha, wet season – 22.0 ha Planning : dry season – 22.0 ha, wet season – 22.0 ha
2. Implementation schedule	1) Baseline survey: June 2007 2) Farmers workshop: June 2007 3) Rehabilitation plan/design: June - July 2007 4) Rehabilitation work/supervision: October - November 2007 5) First cropping (2007/08 wet season) / monitoring: Nov. 2007 – March 2008 6) Evaluation of the first cropping: June 2008 7) Second cropping (2008 dry season) / monitoring: May – Sept. 2008 8) Evaluation of the second cropping: Nov./Dec. 2008
3. Items to be verified through verification study	1) Contents of verification related to the Draft Package (a) Survey and design of irrigation facilities for rehabilitation (b) Rehabilitation work of irrigation facilities and & supervision of work (c) O&M of irrigation facilities including diversion weir (d) Water management of irrigation system (e) Farm management & agricultural extension (f) Management of farmers group 2) Contents of verification related to the Draft A/P (a) Implementing body for rehabilitation (b) Implementation procedure & arrangement (c) Cost sharing arrangement for rehabilitation
4. Overall goal, project purpose, expected outputs, project activities, and risks	1) Overall goal: Improvement of crop productivity & production 2) Project purpose: Improved operation of medium-scale irrigation scheme 3) Expected outputs: Improved capacity of government staff and farmers 4) Project activities: Planning workshop, design, rehabilitation, training, monitoring and evaluation 5) Risks: Cost sharing, rehabilitation work by farmers themselves, supervision by AEDOs/IOs, and self-help O&M by farmers
5. Financial efficiency (for pump site only)	N.A
6. Indicators and BM data for evaluation	1) Area planted (ha): Bench mark (BM) DS= 12.24 WS = 14.0 ha 2) Production (ton/ha): Crop: Grain maize in WS - 6.5 ha, yield - 2.6 ton/ha, production 16.9 ton Crop: Grain maize in DS - 10.5 ha, yield - 2.11 ton/ha, production 34.65 ton Crop: Beans in DS - 4.4 ha, yield - 0.6 ton/ha, production 2.64 ton Crop: Irish potato in DS - 1.21 ha, yield - 1.1 ton/ha, production 1.33 ton
7. Method and procedure of	1) Monitoring: (a) Monitoring forms will be made by the Study Team,

monitoring and evaluation	(b) Monitoring will be undertaken by the Monitoring Team of the Study Team, (c) The Monitoring Committee composed of AEDOs / IOs / farmer group / Study Team will be formed, (d) The Committee meeting will be held on bi-monthly basis at the site to discuss overall conditions and problems encountered, (e) The Study Team will facilitate the meeting and prepare the report. 2) Evaluation: (a) Evaluation workshop composed of the Committee members will be carried out after harvest of each target cropping season, (b) Workshop aims to evaluate performance of stakeholders based on utilization of irrigation facility and result of seasonal cropping, i.e. first cropping for 2007/08 wet season and second cropping for 2008 dry season, (c) Self-evaluation by farmers will be made based on farming performance through SWOT analysis, (d) Evaluation by the Study Team will also be made from the study-wide viewpoint to contribute to Draft Package and A/P, (e) Satisfaction survey will be conducted for farmer group at the time of final evaluation, (f) SWOT analysis may be organized together with more than 2 verification sites if situation is so made.
8. Feedback of monitoring / evaluation result	1) Result of self-evaluation on farming performance will be used in the planning of next cropping season. 2) Evaluation by the Study Team will be utilized for revision and improvement of Draft Package and Draft A/P.
9. Method of dissemination	1) The Study Team will prepare the technical guideline / technical manuals / posters / leaflets through the Verification Study for distribution and dissemination.

Table A3-1 (2/8) Implementation Program of Verification Study – Mz-4 Mantha

Items	Contents
1. General information of the scheme	1) Area Name: Mantha (Mz-4) 2) Location: Mzuzu ADD - Mzimba District - Luwelezi EPA 3) Number of members of water user association: 100 (Male 66, Female 34) 4) Implementation period: August 2007 to February 2009 5) Type of irrigation facility: Motorized pump 6) Service area: Present : dry season – 1.0 ha, wet season – 8.0 ha Planning : dry season – 8.0 ha, wet season – 8.0 ha
2. Implementation schedule	1) Baseline survey: June 2007 2) Farmers workshop: June 2007 3) Rehabilitation plan/design: June - July 2007 4) Rehabilitation work/supervision: August - October 2007 5) First cropping (2007/08 wet season) / monitoring: Dec. 2007 – Mar. 2008 6) Evaluation of the first cropping: June 2008 7) Second cropping (2008 dry season) / monitoring: Apr. – Oct. 2008 8) Evaluation of the second cropping: Nov./Dec. 2008
3. Items to be verified through verification study	1) Contents of verification related to the Draft Package a) Survey and design of irrigation facilities for rehabilitation b) Rehabilitation work of irrigation facilities and & supervision of work c) O&M of irrigation facilities and motorized pump d) Water management of irrigation system e) Farm management & agricultural extension f) Management of farmers group & payment of pump fuel 2) Contents of verification related to the Draft A/P a) Implementing body for rehabilitation b) Implementation procedure & arrangement c) Cost sharing arrangement for rehabilitation
4. Overall goal, project purpose, expected outputs, project activities, and risks	1) Overall goal: Improvement of crop productivity & production 2) Project purpose: Improved operation of medium-scale irrigation scheme 3) Expected outputs: Improved capacity of government staff and farmers 4) Project activities: Planning workshop, design, rehabilitation, training, monitoring and evaluation 5) Risks: Cost sharing, rehabilitation work by farmers themselves, supervision by AEDOs/IOs, and self-help O&M by farmers
5. Financial efficiency (for pump site only)	1) To analyze financial efficiency in terms of cropping pattern, crop budget and farm income for the baseline data and actual periodic data from monitoring.
6. Indicators and BM data for evaluation	1) Area planted (ha): Bench mark (BM) DS=1.0 WS = 8.3 ha 2) Production (ton/ha): Crop: Grain maize in WS - 6.6 ha, yield - 2.8 ton/ha, production 18.5ton Crop: Grain maize in DS – 0.4 ha, yield- 1.9 ton/ha, production 0.76 ton Crop: Beans in DS – 0.4 ha, yield - 0.7 ton/ha, production 0.28 ton Crop: Tomato in DS - 0.2 ha, yield - 2.8 ton/ha, production 0.56 ton

7. Method and procedure of monitoring and evaluation	1) Monitoring: a) Monitoring forms will be made by the Study Team, b) Monitoring will be undertaken by the Monitoring Team of the Study Team, c) The Monitoring Committee composed of AEDOs / IOs / farmer group / Study Team will be formed, d) The Committee meeting will be held on bi-monthly basis at the site to discuss overall conditions and problems encountered, e) The Study Team will facilitate the meeting and prepare the report. 2) Evaluation: a) Evaluation workshop composed of the Committee members will be carried out after harvest of each target cropping season, b) Workshop aims to evaluate performance of stakeholders based on utilization of irrigation facility and result of seasonal cropping, i.e. first cropping for 2007/08 wet season and second cropping for 2008 dry season, c) Self-evaluation by farmers will be made based on farming performance through SWOT analysis, d) Evaluation by the Study Team will also be made from the study-wide viewpoint to contribute to Draft Package and A/P, e) Satisfaction survey will be conducted for of farmer group at the time of final evaluation, f) SWOT analysis may be organized together with more than 2 verification sites if situation is so made.
8. Feedback of monitoring / evaluation result	1) Result of self-evaluation on farming performance will be used in the planning of next cropping season. 2) Evaluation by the Study Team will be utilized for revision and improvement of Draft Package and Draft A/P.
9. Method of dissemination	1) The Study Team will prepare the technical guideline / technical manuals / posters / leaflets through the Verification Study for distribution and dissemination.

Table A3-1 (3/8) Implementation Program of Verification Study – Kas-46 Chiwoza Dam

Items	Contents
1. General information of the scheme	1) Area Name: Chiwoza Dam (Kas-46) 2) Location: Kasungu ADD - Kasungu District - Chulu EPA 3) Number of members of water user association: 63 (Male 28, Female 35) 4) Implementation period: October 2007 to February 2009 5) Type of irrigation facility: Water Impounding Dam 6) Service area: Present : dry season – 6.1 ha, wet season – 6.7 ha Planning : dry season – 10.0 ha, wet season – 10.0 ha
2. Implementation schedule	1) Baseline survey: June 2007 2) Farmers workshop: June 2007 3) Rehabilitation plan/design: July 2007 4) Rehabilitation work/supervision: October - November 2007 5) First cropping (2007/08 wet season) / monitoring: Nov. 2007 – Feb. 2008 6) Evaluation of the first cropping: June 2008 7) Second cropping (2008 dry season) / monitoring: Mar. – Sept. 2008 8) Evaluation of the second cropping: Nov./Dec. 2008
3. Items to be verified through verification study	1) Contents of verification related to the Draft Package a) Survey and design of irrigation facilities for rehabilitation b) Rehabilitation work of irrigation facilities and & supervision of work c) O&M of irrigation facilities including water Impounding dam d) Water management of irrigation system e) Farm management & agricultural extension f) Management of farmers group 2) Contents of verification related to the Draft A/P a) Implementing body for rehabilitation b) Implementation procedure & arrangement c) Cost sharing arrangement for rehabilitation
4. Overall goal, project purpose, expected outputs, project activities, and risks	1) Overall goal: Improvement of crop productivity & production 2) Project purpose: Improved operation of medium-scale irrigation scheme 3) Expected outputs: Improved capacity of government staff and farmers 4) Project activities: Planning workshop, design, rehabilitation, training, monitoring and evaluation 5) Risks: Cost sharing, rehabilitation work by farmers themselves, supervision by AEDOs/IOs, and self-help O&M by farmers
5. Financial efficiency (for pump site only)	N.A
6. Indicators and BM data for evaluation	1) Area planted (ha): Bench mark (BM) DS=3.5 ha WS =6.7 ha 2) Production (ton/ha): Crop: Grain maize in WS - 6.7 ha, yield - 5.3 ton/ha, production 35.5 ton Crop: Grain maize in DS – 3.0 ha, yield – 1.43 ton/ha, production 4.29 ton Crop: Tomato in DS – 0.1 ha, yield – 1.5 ton/ha, production 0.15 ton Crop: Cabbage in DS - 0.4 ha, yield – 11.25 ton/ha, production 4.5 ton
7. Method and procedure of	1) Monitoring: a) Monitoring forms will be made by the Study Team,

monitoring and evaluation	b) Monitoring will be undertaken by the Monitoring Team of the Study Team, c) The Monitoring Committee composed of AEDOs / IOs / farmer group / Study Team will be formed, d) The Committee meeting will be held on bi-monthly basis at the site to discuss overall conditions and problems encountered, e) The Study Team will facilitate the meeting and prepare the report. 2) Evaluation: a) Evaluation workshop composed of the Committee members will be carried out after harvest of each target cropping season, b) Workshop aims to evaluate performance of stakeholders based on utilization of irrigation facility and result of seasonal cropping, i.e. first cropping for 2007/08 wet season and second cropping for 2008 dry season, c) Self-evaluation by farmers will be made based on farming performance through SWOT analysis, d) Evaluation by the Study Team will also be made from the study-wide viewpoint to contribute to Draft Package and A/P, e) Satisfaction survey will be conducted for farmer group at the time of final evaluation, f) SWOT analysis may be organized together with more than 2 verification sites if situation is so made.
8. Feedback of monitoring / evaluation result	1) Result of self-evaluation on farming performance will be used in the planning of next cropping season. 2) Evaluation by the Study Team will be utilized for revision and improvement of Draft Package and Draft A/P.
9. Method of dissemination	1) The Study Team will prepare the technical guideline / technical manuals / posters / leaflets through the Verification Study for distribution and dissemination.

Table A3-1 (4/8) Implementation Program of Verification Study – Kas-40 Kachere

Items	Contents
1. General information of the scheme	1) Area Name: Kachere (Kas-40) 2) Location: Kasungu ADD - Kasungu District - Chipala EPA 3) Number of members of water user association: 100 (Male 60, Female 40) 4) Implementation period: August 2007 to February 2009 5) Type of irrigation facility: Motorized pump 6) Service area: Present : dry season – 0.0 ha, wet season – 6.4 ha Planning : dry season – 6.4 ha, wet season – 6.4 ha
2. Implementation schedule	1) Baseline survey: June 2007 2) Farmers workshop: June 2007 3) Rehabilitation plan/design: June - July 2007 4) Rehabilitation work/supervision: October - November 2007 5) First cropping (2007/08 wet season) / monitoring: Nov. 2007 – Mar. 2008 6) Evaluation of the first cropping: June 2008 7) Second cropping (2008 dry season) / monitoring: Apr. – Oct. 2008 8) Evaluation of the second cropping: Nov./Dec. 2008
3. Items to be verified through verification study	1) Contents of verification related to the Draft Package a) Survey and design of irrigation facilities for rehabilitation b) Rehabilitation work of irrigation facilities and & supervision of work c) O&M of irrigation facilities and motorized pump d) Water management of irrigation system e) Farm management & agricultural extension f) Management of farmers group & payment of pump fuel 2) Contents of verification related to the Draft A/P a) Implementing body for rehabilitation b) Implementation procedure & arrangement c) Cost sharing arrangement for rehabilitation
4. Overall goal, project purpose, expected outputs, project activities, and risks	1) Overall goal: Improvement of crop productivity & production 2) Project purpose: Improved operation of medium-scale irrigation scheme 3) Expected outputs: Improved capacity of government staff and farmers 4) Project activities: Planning workshop, design, rehabilitation, training, monitoring and evaluation 5) Risks: Cost sharing, rehabilitation work by farmers themselves, supervision by AEDOs/IOs, and self-help O&M by farmers
5. Financial efficiency (for pump site only)	1) To analyze financial efficiency in terms of cropping pattern, crop budget and farm income for the baseline data and actual periodic data from monitoring.
6. Indicators and BM data for evaluation	1) Area planted (ha): Bench mark (BM) DS =0.0 ha, WS = 2.3 ha 2) Production (ton/ha): Crop: Grain maize in WS - 2.0 ha, yield - 2.8 ton/ha, production 5.6 ton
7. Method and procedure of monitoring and evaluation	1) Monitoring: a) Monitoring forms will be made by the Study Team, b) Monitoring will be undertaken by the Monitoring Team of the Study Team, c) The Monitoring Committee composed of AEDOs / IOs / farmer group /

	Study Team will be formed, d) The Committee meeting will be held on bi-monthly basis at the site to discuss overall conditions and problems encountered, e) The Study Team will facilitate the meeting and prepare the report. 2) Evaluation: a) Evaluation workshop composed of the Committee members will be carried out after harvest of each target cropping season, b) Workshop aims to evaluate performance of stakeholders based on utilization of irrigation facility and result of seasonal cropping, i.e. first cropping for 2007/08 wet season and second cropping for 2008 dry season, c) Self-evaluation by farmers will be made based on farming performance through SWOT analysis, d) Evaluation by the Study Team will also be made from the study-wide viewpoint to contribute to Draft Package and A/P, e) Satisfaction survey will be conducted for farmer group at the time of final evaluation, f) SWOT analysis may be organized together with more than 2 verification sites if situation is so made.
8. Feedback of monitoring / evaluation result	1) Result of self-evaluation on farming performance will be used in the planning of next cropping season. 2) Evaluation by the Study Team will be utilized for revision and improvement of Draft Package and Draft A/P.
9. Method of dissemination	1) The Study Team will prepare the technical guideline / technical manuals / posters / leaflets through the Verification Study for distribution and dissemination.

Table A3-1 (5/8) Implementation Program of Verification Study – Kas-47 Titukulane

Items	Contents
1. General information of the scheme	1) Area Name: Titukulane (Kas-47) 2) Location: Kasungu ADD - Dowa District - Nachisaka EPA 3) Number of members of water user association: 64 (Male 54, Female 10) 4) Implementation period: October 2007 to February 2009 5) Type of irrigation facility: River diversion weir 6) Service area: Present : dry season – 1.0 ha, wet season – 7.0 ha Planning : dry season – 7.0 ha, wet season – 7.0 ha
2. Implementation schedule	1) Baseline survey: July 2007 2) Farmers workshop: July 2007 3) Rehabilitation plan/design: October 2007 4) Rehabilitation work/supervision: October - November 2007 5) First cropping (2007/08 wet season) / monitoring: Dec. 2007 – March 2008 6) Evaluation of the first cropping: June 2008 7) Second cropping (2008 dry season) / monitoring: May – Oct. 2008 8) Evaluation of the second cropping: Nov./Dec. 2008
3. Items to be verified through verification study	1) Contents of verification related to the Draft Package a) Survey and design of irrigation facilities for rehabilitation b) Rehabilitation work of irrigation facilities and & supervision of work c) O&M of irrigation facilities including diversion weir d) Water management of irrigation system e) Farm management & agricultural extension f) Management of farmers group 2) Contents of verification related to the Draft A/P a) Implementing body for rehabilitation b) Implementation procedure & arrangement c) Cost sharing arrangement for rehabilitation
4. Overall goal, project purpose, expected outputs, project activities, and risks	1) Overall goal: Improvement of crop productivity & production 2) Project purpose: Improved operation of medium-scale irrigation scheme 3) Expected outputs: Improved capacity of government staff and farmers 4) Project activities: Planning workshop, design, rehabilitation, training, monitoring and evaluation 5) Risks: Cost sharing, rehabilitation work by farmers themselves, supervision by AEDOs/IOs, and self-help O&M by farmers
5. Financial efficiency (for pump site only)	N.A
6. Indicators and BM data for evaluation	1) Area planted (ha): Bench mark (BM) DS = 1.0 ha, WS = 4.1 ha 2) Production (ton/ha): Crop: Grain maize in WS - 3.0 ha, yield - 3.1 ton/ha, production 9.3 ton Crop: Grain maize in DS – 0.6 ha, yield - 2.4 ton/ha, production 1.44 ton Crop: Irish potatoes in DS - 0.4 ha, yield - 4.5 ton/ha, production 1.8 ton
7. Method and procedure of monitoring and	1) Monitoring: a) Monitoring forms will be made by the Study Team, b) Monitoring will be undertaken by the Monitoring Team of the Study Team,

evaluation	c) The Monitoring Committee composed of AEDOs / IOs / farmer group / Study Team will be formed, d) The Committee meeting will be held on bi-monthly basis at the site to discuss overall conditions and problems encountered, e) The Study Team will facilitate the meeting and prepare the report. 2) Evaluation: a) Evaluation workshop composed of the Committee members will be carried out after harvest of each target cropping season, b) Workshop aims to evaluate performance of stakeholders based on utilization of irrigation facility and result of seasonal cropping, i.e. first cropping for 2007/08 wet season and second cropping for 2008 dry season, c) Self-evaluation by farmers will be made based on farming performance through SWOT analysis, d) Evaluation by the Study Team will also be made from the study-wide viewpoint to contribute to Draft Package and A/P, e) Satisfaction survey will be conducted for farmer group at the time of final evaluation, f) SWOT analysis may be organized together with more than 2 verification sites if situation is so made.
8. Feedback of monitoring / evaluation result	1) Result of self-evaluation on farming performance will be used in the planning of next cropping season. 2) Evaluation by the Study Team will be utilized for revision and improvement of Draft Package and Draft A/P.
9. Method of dissemination	1) The Study Team will prepare the technical guideline / technical manuals / posters / leaflets through the Verification Study for distribution and dissemination.

Table A3-1 (6/8) Implementation Program of Verification Study – Li-2 Chaseta

Items	Contents
1. General information of the scheme	1) Area Name: Chaseta (Li-2) 2) Location: Lilongwe ADD - Lilongwe District - Mlomba EPA 3) Number of members of water user association: 150 (Male 35, Female 115) 4) Implementation period: October 2007 to February 2009 5) Type of irrigation facility: Motorized pump 6) Service area: Present : dry season – 8.0 ha, wet season – 12.0 ha Planning : dry season – 12.0 ha, wet season – 12.0 ha
2. Implementation schedule	1) Baseline survey: June 2007 2) Farmers workshop: June 2007 3) Rehabilitation plan/design: June - July 2007 4) Rehabilitation work/supervision: October - November 2007 5) First cropping (2007/08 wet season) / monitoring: Dec. 2007 – Apr. 2008 6) Evaluation of the first cropping: June 2008 7) Second cropping (2008 dry season) / monitoring: May. – Oct. 2008 8) Evaluation of the second cropping: Nov./Dec. 2008
3. Items to be verified through verification study	1) Contents of verification related to the Draft Package a) Survey and design of irrigation facilities for rehabilitation b) Rehabilitation work of irrigation facilities and & supervision of work c) O&M of irrigation facilities and motorized pump d) Water management of irrigation system e) Farm management & agricultural extension f) Management of farmers group & payment of pump fuel 2) Contents of verification related to the Draft A/P a) Implementing body for rehabilitation b) Implementation procedure & arrangement c) Cost sharing arrangement for rehabilitation
4. Overall goal, project purpose, expected outputs, project activities, and risks	1) Overall goal: Improvement of crop productivity & production 2) Project purpose: Improved operation of medium-scale irrigation scheme 3) Expected outputs: Improved capacity of government staff and farmers 4) Project activities: Planning workshop, design, rehabilitation, training, monitoring and evaluation 5) Risks: Cost sharing, rehabilitation work by farmers themselves, supervision by AEDOs/IOs, and self-help O&M by farmers
5. Financial efficiency (for pump site only)	1) To analyze financial efficiency in terms of cropping pattern, crop budget and farm income for the baseline data and actual periodic data from monitoring.
6. Indicators and BM data for evaluation	1) Area planted (ha): Bench mark (BM) DS=7.9 ha, WS = 6.7 ha 2) Production (ton/ha): Crop: Grain maize in WS - 4.7 ha, yield - 1.4 ton/ha, production 6.6 ton Crop: Grain maize in DS - 5.1 ha, yield - 1.6 ton/ha, production 8.2 ton Crop: Irish potato in DS - 2.2 ha, yield - 2.5 ton/ha, production 5.5 ton
7. Method and procedure of	1) Monitoring: a) Monitoring forms will be made by the Study Team,

monitoring and evaluation	b) Monitoring will be undertaken by the Monitoring Team of the Study Team, c) The Monitoring Committee composed of AEDOs / IOs / farmer group / Study Team will be formed, d) The Committee meeting will be held on bi-monthly basis at the site to discuss overall conditions and problems encountered, e) The Study Team will facilitate the meeting and prepare the report. 2) Evaluation: a) Evaluation workshop composed of the Committee members will be carried out after harvest of each target cropping season, b) Workshop aims to evaluate performance of stakeholders based on utilization of irrigation facility and result of seasonal cropping, i.e. first cropping for 2007/08 wet season and second cropping for 2008 dry season, c) Self-evaluation by farmers will be made based on farming performance through SWOT analysis, d) Evaluation by the Study Team will also be made from the study-wide viewpoint to contribute to Draft Package and A/P, e) Satisfaction survey will be conducted for farmer group at the time of final evaluation, f) SWOT analysis may be organized together with more than 2 verification sites if situation is so made.
8. Feedback of monitoring / evaluation result	1) Result of self-evaluation on farming performance will be used in the planning of next cropping season. 2) Evaluation by the Study Team will be utilized for revision and improvement of Draft Package and Draft A/P.
9. Method of dissemination	1) The Study Team will prepare the technical guideline / technical manuals / posters / leaflets through the Verification Study for distribution and dissemination.

Table A3-1 (7/8) Implementation Program of Verification Study – Li-21 Bawi

Items	Contents
1. General information of the scheme	1) Area Name: Bawi (Li-21) 2) Location: Lilongwe ADD - Ntcheu District - Manjawira EPA 3) Number of members of water user association: 49 (Male 28, Female 21) 4) Implementation period: August 2007 to February 2009 5) Type of irrigation facility: River diversion weir 6) Service area: Present : dry season - 6.3 ha, wet season - 6.3 ha Planning : dry season – 6.3 ha, wet season – 6.3 ha
2. Implementation schedule	1) Baseline survey: June 2007 2) Farmers workshop: June 2007 3) Rehabilitation plan/design: June 2007 4) Rehabilitation work/supervision: August – September 2007 5) First cropping (2007/08 wet season) / monitoring: Nov. 2007 – April 2008 6) Evaluation of the first cropping: June 2008 7) Second cropping (2008 dry season) / monitoring: May – Oct. 2008 8) Evaluation of the second cropping: Nov./Dec. 2008
3. Items to be verified through verification study	1) Contents of verification related to the Draft Package a) Survey and design of irrigation facilities for rehabilitation b) Rehabilitation work of irrigation facilities and & supervision of work c) O&M of irrigation facilities including diversion weir d) Water management of irrigation system e) Farm management & agricultural extension f) Management of farmers group 2) Contents of verification related to the Draft A/P a) Implementing body for rehabilitation b) Implementation procedure & arrangement c) Cost sharing arrangement for rehabilitation
4. Overall goal, project purpose, expected outputs, project activities, and risks	1) Overall goal: Improvement of crop productivity & production 2) Project purpose: Improved operation of medium-scale irrigation scheme 3) Expected outputs: Improved capacity of government staff and farmers 4) Project activities: Planning workshop, design, rehabilitation, training, monitoring and evaluation 5) Risks: Cost sharing, rehabilitation work by farmers themselves, supervision by AEDOs/IOs, and self-help O&M by farmers
5. Financial efficiency (for pump site only)	N.A
6. Indicators and BM data for evaluation	1) Area planted (ha): Bench mark (BM) DS= 6.3 ha, WS = 4.1 ha 2) Production (ton/ha): Crop: Grain maize in WS - 3.4 ha, yield - 3.2 ton/ha, production 10.9 ton Crop: Grain maize in DS – 5.1 ha, yield - 1.4 ton/ha, production 7.14ton Crop: Tomato in DS - 0.7 ha, yield - 7.2 ton/ha, production 5.0 ton Crop: Mustard in DS - 0.4 ha, yield - 2.5 ton/ha, production 1.0 ton
7. Method and procedure of	1) Monitoring: a) Monitoring forms will be made by the Study Team,

monitoring and evaluation	b) Monitoring will be undertaken by the Monitoring Team of the Study Team, c) The Monitoring Committee composed of AEDOs / IOs / farmer group / Study Team will be formed, d) The Committee meeting will be held on bi-monthly basis at the site to discuss overall conditions and problems encountered, e) The Study Team will facilitate the meeting and prepare the report. 2) Evaluation: a) Evaluation workshop composed of the Committee members will be carried out after harvest of each target cropping season, b) Workshop aims to evaluate performance of stakeholders based on utilization of irrigation facility and result of seasonal cropping, i.e. first cropping for 2007/08 wet season and second cropping for 2008 dry season, c) Self-evaluation by farmers will be made based on farming performance through SWOT analysis, d) Evaluation by the Study Team will also be made from the study-wide viewpoint to contribute to Draft Package and A/P, e) Satisfaction survey will be conducted for farmer group at the time of final evaluation, f) SWOT analysis may be organized together with more than 2 verification sites if situation is so made.
8. Feedback of monitoring / evaluation result	1) Result of self-evaluation on farming performance will be used in the planning of next cropping season. 2) Evaluation by the Study Team will be utilized for revision and improvement of Draft Package and Draft A/P.
9. Method of dissemination	1) The Study Team will prepare the technical guideline / technical manuals / posters / leaflets through the Verification Study for distribution and dissemination.

Table A3-1 (8/8) Implementation Program of Verification Study – Ma-1 Chibwana

Items	Contents
1. General information of the scheme	1) Area Name: Chibwana (Ma-1) 2) Location: Machinga ADD - Machinga District - Nsanama EPA 3) Number of members of water user association: 212 (Male 102, Female 110) 4) Implementation period: October 2007 to February 2009 5) Type of irrigation facility: River diversion weir 6) Service area: Present : dry season – 20 ha, wet season – 85.0 ha Planning : dry season – 85.0 ha, wet season – 85.0 ha
2. Implementation schedule	1) Baseline survey: June 2007 2) Farmers workshop: June 2007 3) Rehabilitation plan/design: June - July 2007 4) Rehabilitation work/supervision: October - November 2007 5) First cropping (2007/08 wet season) / monitoring: Dec. 2007 – May 2008 6) Evaluation of the first cropping: June 2008 7) Second cropping (2008 dry season) / monitoring: June – Oct. 2008 8) Evaluation of the second cropping: Nov./Dec. 2008
3. Items to be verified through verification study	1) Contents of verification related to the Draft Package a) Survey and design of irrigation facilities for rehabilitation b) Rehabilitation work of irrigation facilities and & supervision of work c) O&M of irrigation facilities including diversion weir d) Water management of irrigation system e) Farm management & agricultural extension f) Management of farmers group 2) Contents of verification related to the Draft A/P a) Implementing body for rehabilitation b) Implementation procedure & arrangement c) Cost sharing arrangement for rehabilitation
4. Overall goal, project purpose, expected outputs, project activities, and risks	1) Overall goal: Improvement of crop productivity & production 2) Project purpose: Improved operation of medium-scale irrigation scheme 3) Expected outputs: Improved capacity of government staff and farmers 4) Project activities: Planning workshop, design, rehabilitation, training, monitoring and evaluation 5) Risks: Cost sharing, rehabilitation work by farmers themselves, supervision by AEDOs/IOs, and self-help O&M by farmers
5. Financial efficiency (for pump site only)	N.A
6. Indicators and BM data for evaluation	1) Area planted (ha): Bench mark (BM), DS= 20.6 ha, WS = 73.8 ha 2) Production (ton/ha): Crop: Rice in WS - 73.8 ha, yield - 2.3 ton/ha, production 169.7 ton Crop: Grain maize in DS - 9.8 ha, yield - 2.4 ton/ha, production 23.52 ton Crop: Rice in DS - 8.3 ha, yield - 2.4 ton/ha, production 19.9 ton Crop: Pumpkin leaves in DS - 0.8 ha, yield - 0.9 ton/ha, production 0.7 ton
7. Method and procedure of	1) Monitoring: a) Monitoring forms will be made by the Study Team,

monitoring and evaluation	b) Monitoring will be undertaken by the Monitoring Team of the Study Team, c) The Monitoring Committee composed of AEDOs / IOs / farmer group / Study Team will be formed, d) The Committee meeting will be held on bi-monthly basis at the site to discuss overall conditions and problems encountered, e) The Study Team will facilitate the meeting and prepare the report. 2) Evaluation: a) Evaluation workshop composed of the Committee members will be carried out after harvest of each target cropping season, b) Workshop aims to evaluate performance of stakeholders based on utilization of irrigation facility and result of seasonal cropping, i.e. first cropping for 2007/08 wet season and second cropping for 2008 dry season, c) Self-evaluation by farmers will be made based on farming performance through SWOT analysis, d) Evaluation by the Study Team will also be made from the study-wide viewpoint to contribute to Draft Package and A/P, e) Satisfaction survey will be conducted for farmer group at the time of final evaluation, f) SWOT analysis may be organized together with more than 2 verification sites if situation is so made.
8. Feedback of monitoring / evaluation result	1) Result of self-evaluation on farming performance will be used in the planning of next cropping season. 2) Evaluation by the Study Team will be utilized for revision and improvement of Draft Package and Draft A/P.
9. Method of dissemination	1) The Study Team will prepare the technical guideline / technical manuals / posters / leaflets through the Verification Study for distribution and dissemination.

Table A3-2 Work Quantity for Completion of Rehabilitation at 8 Verification Schemes

1) Bethani Irrigation Scheme (MZ-11)

a) Items and quantity of rehabilitation work

Rehabilitation items and work quantity as planed and actual are shown in the table below. One division box at Bethani B was canceled because the landowner was not able to prepare the bricks.

Table A3-2 (1/16) Bethani Scheme, Work Quantity of Rehabilitation Work

Rehabilitation Items	Planned Quantity	Completed Quantity	Remarks
1. Repair of Weir and Intake			
1-1. Repair of Intake	1 m^3	1 m^3	Stone masonry
1-2. Repair of Weir	2.9 m^3	2.9 m^3	Stone masonry
2. Bethani A Main Canal			
2-1. Main Canal	50 m	50 m	Brick masonry
2-2. Division Box	4 pc	4 pc	Brick masonry
3. Bethani B Main Canal			
3-1. Main Canal	50 m	50 m	Brick masonry
3-2. Division Box	3 pc	2 pc	Brick masonry

b) Utilization of local and foreign inputs

Following inputs were provided by the farmer group and the Study Team.

Table A3-2 (2/16) Bethani Scheme, Local and Foreign Inputs

	Local	Foreign	Remarks
1. Unskilled labors	325 man･day	-	All done by farmers
2. Skilled labors	25 man･day	-	All done by farmers
3. Local material			
3-1. Sand	6 m^3	-	Community
3-2. Stones	4 m^3	-	Community
3-3. Bricks	13,000 pc	-	Community
4. Cement	-	75 bags	15 bags from community
5. Transportation			
5-1. Vehicle	-	Pick-up	Study team
5-2. Fuel	-	42.7 lit for IO.	Study team

c) Work period

Preparation work was started on 24th October 2007 and the construction work was started on 2nd November. The work was completed on 21st November 2007.

2) Mantha Irrigation Scheme (Mz-4)

a) Items and quantity of rehabilitation work

Rehabilitation items and work quantity as planed and actual are shown in the table below. Development of secondary and tertiary canals will be continued by farmers.

Table A3-2 (3/16) Mantha Scheme, Work Quantity of Rehabilitation Work

Rehabilitation Items	Planned Quantity	Completed Quantity	Remarks
1. Main Canal	300 m	300 m	
1-1. Excavation	600 m	600 m	
1-2. Brick Work	300 m	300 m	
2. Discharge Box	1 pc	1 pc	

2-1. Excavation	1 m^3	1 m^3	
2-1. Brick work	700 pc	700 pc	
3. Pipe Installation	200 m	200 m	
3-1. Excavation	23.4 m^3	23.4 m^3	
3-2. Pipe Installation	200 m	200 m	
3-3. Back Filling	21.8 m^3	21.8 m^3	
4. Repair of Pump	1 set	1 set	

b) Utilization of local and foreign inputs

Following inputs were provided by the farmer group and the Study Team.

Table A3-2 (4/16) Mantha Scheme, Local and Foreign Inputs

	Local	Foreign	Remarks
1. Unskilled labors	626 man･day	-	All done by farmers
2. Skilled labors	13 man･day	-	All done by farmers
3. Local material			
3-1. Sand	8.5 m^3	-	Community
3-2. Bricks	17,700 pc	-	Community
4. Cement	-	85 bags	5 bags from community
5. PVC Pipe ϕ 140	-	3 pc	Study team
6. Transportation			
6-1. Vehicle	-	Pickup	Study team
6-2. Fuel	-	108.85 lit	Study team

c) Work period

Preparation work was started on 21st August 2007 and the construction work was started on 25th August. The work was completed on 15th October 2007. The pump was repaired and brought back to the site on 22nd November.

3) Chiwoza Dam Irrigation Scheme (Kas-46)

a) Items and quantity of rehabilitation work

Rehabilitation items and work quantity as planed and actual are shown in the table below. The area of stone masonry of spillway was extended because of the request by farmers.

Table A3-2 (5/16) Chiwoza Dam Scheme, Work Quantity of Rehabilitation Work

Rehabilitation Items	Planned Quantity	Completed Quantity	Remarks
1. De-Silting of Dam	530 m^3	200 m^3	
2. Repair of Spillway			
2-1. Excavation	14 m^3	20 m^3	Extension of area
2-2. Stone Masonry	21.4 m^3	33 m^3	Extension of area
3. Left Side Main Canal	50 m	50 m	
3-1. Excavation	50 m	50 m	
3-2. Brick Work	50 m	50 m	
4. Right Side Main Canal	50 m	50 m	
4-1. Excavation	50 m	50 m	
4-2. Brick Work	50 m	50 m	
5. Drop Box	2 pc	2 pc	
5-1. Excavation	0.5 m^3	0.5 m^3	
5-2. Brick Work	200 pc	200 pc	
6. Stream and Road Crossing	5Box, main canal 25m, PVC ϕ 200 x 2 pc	5Box, main canal 25m, PVC ϕ 200 x 2 pc	
6-1. Excavation / Embankment	3 m^3	3 m^3	
6-2. Brick Work	1,300 pc	1,300 pc	

b) Utilization of local and foreign inputs

Following inputs were provided by the farmer group and the Study Team.

Table A3-2 (6/16) Chiwoza Dam Scheme, Local and Foreign Inputs

	Local	Foreign	Remarks
1. Unskilled labors	1,714 man･day	-	All done by farmers
2. Skilled labors	104 man･day	-	All done by farmers
3. Local material			
3-1. Sand	21 m^3	-	Community
3-2. Stones	33 m^3	-	Community
3-3. Bricks	5,600 pc	-	Community
4. Cement	-	206 bags	Study team
5. PVC Pipe	-	2 pc	Study team
6. Transportation			
6-1. Vehicle	-	Truck 6t / Truck 4t	Kasungu DAO/Study team
6-2. Fuel	-	105.67 lit	Study team

c) Work period

Preparation work was started on 15th October 2007 and the construction work was started on 20th October. The work was completed on 24th November. De-Silting of the dam was suspended on 9th November 2007 due to hard work. The farmers intend to continue de-silting after completion of another work. Brick work 50 m for each side main canal was completed and the farmers continued extending brick lining for main canal with surplus cement.

4) Kachere Irrigation Scheme (Kas-40)

a) Items and quantity of rehabilitation work

Rehabilitation items and work quantity as planed and actual are shown in the table below. Existing pipes for discharge box No.2, 220 m were also installed. The length of No.1 pipeline was modified at the site. Development of secondary and tertiary canals will be continued by farmers.

Table A3-2 (7/16) Kachere Scheme, Work Quantity of Rehabilitation Work

Rehabilitation Items	Planned Quantity	Completed Quantity	Remarks
1. Main Canal	300 m	300 m	
1-1. Excavation	300 m	300 m	
1-2. Brick Work	300 m	300 m	
2. Discharge Box	2 pc	2 pc	
2-1. Excavation	1 m^3	1 m^3	
2-1. Brick work	1,400 pc	1,400 pc	
3. Pipe Installation	200 m	180 m	Modification
3-1. Excavation	23.4 m^3	21 m^3	
3-2. Pipe Installation	200 m	180 m	
3-3. Back Filling	21.8 m^3	20 m^3	
4. Repair of Pumps	2 sets	2 sets	

b) Utilization of local and foreign inputs

Following inputs were provided by the farmer group and the Study Team.

Table A3-2 (8/16) Kachere Scheme, Local and Foreign Inputs

	Local	Foreign	Remarks
1. Unskilled labors	1,658 man･day	-	All done by farmers
2. Skilled labors	187 man･day	-	All done by farmers
3. Local material			
3-1. Sand	10 m^3	-	Community

3-2. Bricks	18,500 pc	-	Community
4. Cement	-	100 bags	10 bags from community
5. PVC Pipe ϕ 90	-	38 pc	Study team
6. Transportation			
6-1. Vehicle	-	Pickup	Study team
6-2. Fuel	-	-	Study team

c) Work period

Preparation work was started on 18th August 2007 and the construction work was started on 23rd August. The work was completed on 11th October. No.1 pump repair was completed and returned to the scheme on 11th October 2007. No.2 pump repair is to be completed in February 2008.

5) Titukulane Irrigation Scheme (Kas-47)

a) Items and quantity of rehabilitation work

Rehabilitation items and work quantity as planed and actual are shown in the table below. The area of gabion was modified at the site. The length of intake pipe was modified at the site. 1 location of gully crossing will be constructed later on.

Table A3-2 (9/16) Titukulane Scheme, Work Quantity of Rehabilitation Work

Rehabilitation Items	Planned Quantity	Completed Quantity	Remarks
1. Weir			
1-1. Excavation	5 m^3	5 m^3	
1-2. Stone Masonry	21.3 m^3	21.3 m^3	
1-3. Gabion Work	54 m^3	40 m^3	
2. Intake			
2-1. Excavation	3.6 m^3	3.6 m^3	
2-2. Discharge Box	500 pc	500 pc	Bricks
2-3. Installation of Pipes	2 pc (12.0 m)	3 pc (15.0 m)	PVC ϕ 200
3. Gully Crossing	3 locations	2 locations	
3-1. Excavation	2.4	1.6	
3-2. Construction of Box	6	4	
3-3. Installation of Pipes	4	2	

b) Utilization of local and foreign inputs

Following inputs were provided by the farmer group and the Study Team.

Table A3-2 (10/16) Titukulane Scheme, Local and Foreign Inputs

	Local	Foreign	Remarks
1. Unskilled labors	1,538 man･day	-	All done by farmers
2. Skilled labors	26 man･day	-	All done by farmers
3. Local material			
3-1. Sand	11 m^3	-	Community
3-2. Stones	61.3 m^3	-	Community
3-3. Bricks	500 pc	-	Community
4. Cement	-	107 bags	Study team
5. PVC Pipe ϕ 200	-	6 pc	Study team
6. Gabion wire net	-	15 pc	Study team
7. Transportation			
7-1. Vehicle	-	Pickup	Dowa DAO
7-2. Fuel	-	171.31lit	Study team

c) Work period

Preparation work was started on 23rd October 2007 and the construction work was started on 30th

October. The work was completed on 25th November 2007.

6) Chaseta Irrigation Scheme (Li-2)

a) Items and quantity of rehabilitation work

Rehabilitation items and work quantity as planed and actual are shown in the table below. Development of secondary and tertiary canals will be done by farmers.

Table A3-2 (11/16) Chaseta Scheme, Work Quantity of Rehabilitation Work

Rehabilitation Items	Planned Quantity	Completed Quantity	Remarks
1. Main Canal	340 m	340 m	
1-1. Excavation	340 m	340 m	
1-2. Brick Work	200 m	150 m	
2. Discharge Box	1 pc	1 pc	
2-1. Excavation	1 m^3	1 m^3	
2-1. Brick work	700 pc	700 pc	
3. Pipe Installation	410 m	900 m	
3-1. Excavation	46.8 m^3	11.7 m^3	
3-2. Pipe Installation	410 m	90 m	
3-3. Back Filling	43.6 m^3	10.9 m^3	
4. Replace of Pump	1 set	1 set	

b) Utilization of local and foreign inputs

Following inputs were provided by the farmer group and the Study Team.

Table A3-2 (12/16) Chaseta Scheme, Local and Foreign Inputs

	Local	Foreign	Remarks
1. Unskilled labors	317 man･day	-	All done by farmers
2. Skilled labors	2 man･day	-	All done by farmers
3. Local material			
3-1. Sand	8 m^3	-	Community
3-2. Bricks	12,500 pc	-	Community
4. Cement	-	80 bags	Study team
5. PVC pipe ϕ 110	-	15	Study team
5. Pump		1 set	Study team
6. Transportation			
6-1. Vehicle	-	Pickup	Study team
6-2. Fuel	-	-	Study team

c) Work period

Preparation work was started on 25th October 2007 and the construction work was started on 30th October. Pipe installation will be completed by February 2008.

7) Bawi Irrigation Scheme (Li-21)

a) Items and quantity of rehabilitation work

Rehabilitation items and work quantity as planed and actual are shown in the table below. Gabion work of bamboo gabion and wire net gabion at No.5 weir were added to compare durability and effectiveness of bamboo gabion. A significant defect was found at main canal downstream of intake of No.5 weir and repair work of main canal was added.

Table A3-2 (13/16) Bawi Scheme, Work Quantity of Rehabilitation Work

Rehabilitation Items	Planned Quantity	Completed Quantity	Remarks
1. No.5 Weir			

1-1-1. Stone Masonry	2.2 m^3	4.0 m^3	Modification of cross section
1-1-2. Gabion Work	-	4.0 m^3	Trial of bamboo gabion and wire net gabion
1-2. Intake Stone Masonry	5.8 m^3	6.5 m^3	
1-3. Repair of Main Canal	-	30 m^3	Gabion wire net, stone pitching, stone masonry
2. No.7 Weir			
2-1-1. Stone Masonry	26.3 m^3	26.3 m^3	
2-1-2. Gabion	17.0 m^3	15.0 m^3	
2-2. Intake Stone Masonry	5.8 m^3	6.5 m^3	

b) Utilization of local and foreign inputs

Following inputs were provided by the farmer group and the Study Team.

Table A3-2 (14/16) Bawi Scheme, Local and Foreign Inputs

	Local	Foreign	Remarks
1. Unskilled labors	771 man･day	-	All done by farmers
2. Skilled labors	59 man･day	-	All done by farmers
3. Local material			
3-1. Sand	23 m^3	-	Community
3-2. Stones	62.3 m^3	-	Community
3-3. Bamboo	-	40 pc	Study team
4. Cement	-	237 bags	4 bags from community
5. Gabion wire net		23	Study team
6. PVC pipe ϕ 140		2	Study team
5. Transportation			
5-1. Vehicle	-	Tractor/Truck 4t	District Assembly/Study team
5-2. Fuel	-	329 lit for tractor	Study team

c) Work period

Preparation work was started on 20th August 2007 and the construction work was started on 21st August. The work was completed on 25th November 2007.

8) Chibwana Irrigation Scheme (Ma-1)

a) Items and quantity of rehabilitation work

Rehabilitation items and work quantity as planed and actual are shown in the table below. The area of gabion was modified at the site. Site clearing of protection bank was completed but embankment was not done. Surplus gabions were used for slope protection of main canal downstream of turnout.

Table A3-2 (15/16) Chibwana Scheme, Work Quantity of Rehabilitation Work

Rehabilitation Items	Planned Quantity	Completed Quantity	Remarks
1. Repair of Weir			
1-1. Excavation	20 m^3	10 m^3	Modified at the site
1-2. Gabion	32 m^3	20 m^3	Modified at the site
2. Repair of Protection Bank	187.5 m^3	0 m^3	Embankment
3. Repair of Turnout			
3-1. Brick work	2,240 pc	2,240 pc	
3-2. Backfill	13.6 m^3	13.6 m^3	
4. Repair of Tertiary Canal			
4.1 Embankment	58 m^3	40 m^3	
4.2 Brick Work	1,820 pc	1,820 pc	
5. Repair of Main Canal EP.			
5-1. Gabion Work	12 m^3	12 m^3	

5-2. Backfill	2 m^3	2 m^3	

b) Utilization of local and foreign inputs

Following inputs were provided by the farmer group and the Study Team.

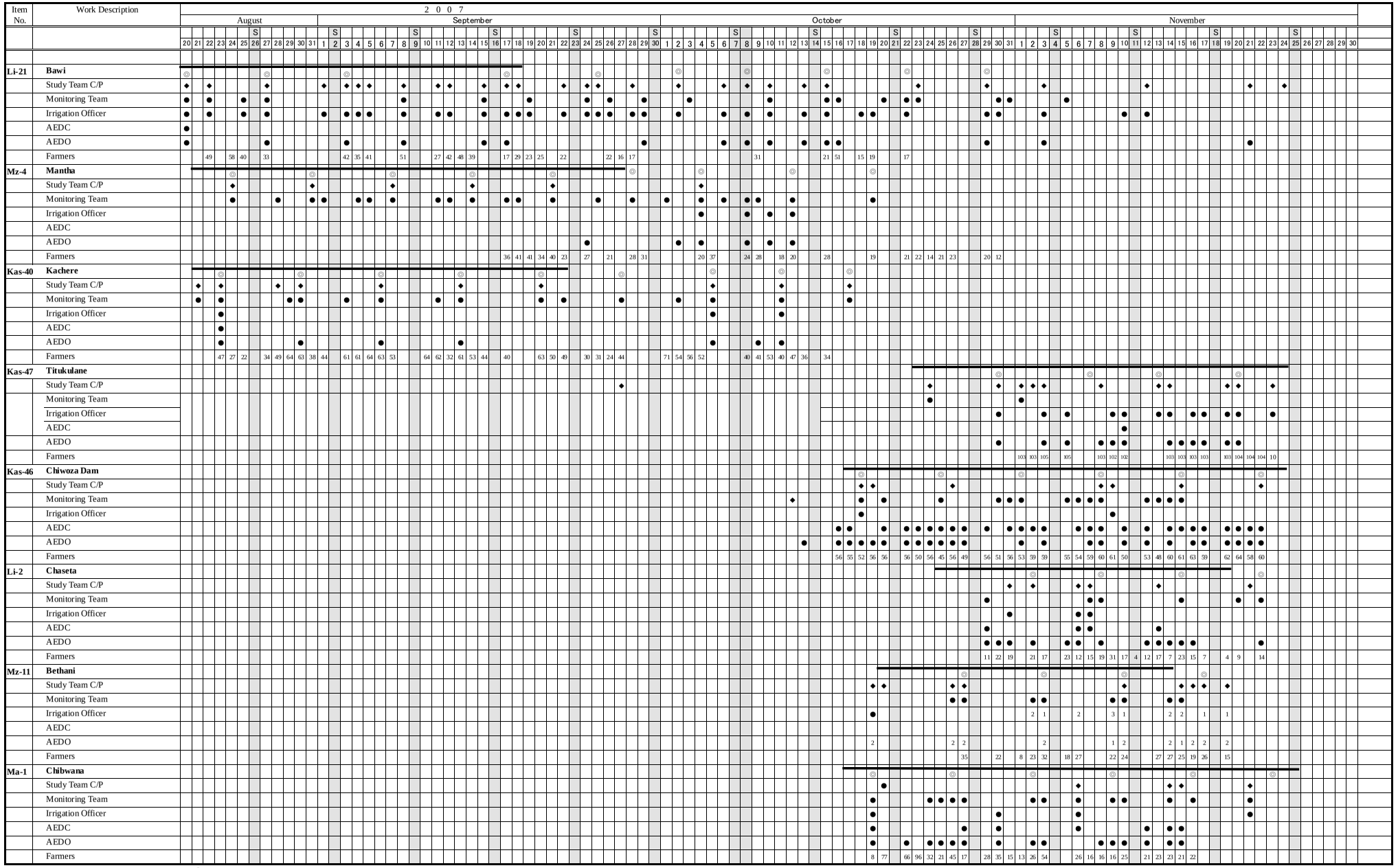
Table A3-2 (16/16) Chibwana Scheme, Local and Foreign Inputs

	Local	Foreign	Remarks
1. Unskilled labors	749 man・day	-	All done by farmers
2. Skilled labors	0 man・day	-	
3. Local material			
3-1. Sand	5 m^3	-	Community
3-2. Stones	44 m^3	-	Community
3-3. Bricks	4,060 pc	-	Community
4. Cement	-	50 bags	Study team
5. Gabion wire net		22 pc	Study team
6. Transportation			
6-1. Vehicle	-	Truck 4t	Study team
6-2. Fuel	-	-	Study team

c) Work schedule

Preparation work was started on 18th October 2007 and the construction work was started on 26th October. The work was completed on 22nd November 2008.

Table A3-3 Participation of Stakeholders to Rehabilitation Works



◎: Weekly Meeting

●:Site Visit ◆:Site Visit Team A

Table A3-4 (1/9) Training Report on O&M of Irrigation Fcailities (Bethani)

1. Name of Scheme **Bethani Irrigation Scheme (Ma-1)**
2. Date 11-Jul-08
3. Place of Worshop Bethani Irrigation Scheme Site
4. Attendants
1) JICA Study Team C/P (1)
2) DoI Staff .
3) Farmers Committee F(1) M(4)
4) AEDO/AEDC AEDO
5) IO From DAO Trainee Ios
5. Outline of Training
1) Inspection Training for inspection was carried out accoding to following check list.
a. Diversion weir system
b. Pipeline system
c. Canal system

a) Maintenance Check List for Canal System

Item	Frequency	Point to be checked	Findings
1. Brick or	Daily	Water flow conditions	Smooth
concrete	Monthly	Crack	Small scale.
lined canal	Annually	Conditions of drain ditch (along the main	Functioning. Need clearing
	Monthly	Sediment	Small scale . Need removal
	Monthly	Weeds	a few. Need clearing
2. Earth canal	Daily	Water flow condition	some area smooth some area not
	Monthly	Cross section area	some area need repair
	Monthly	Erosion	most part will erode if unattended to.
	Monthly	Weeds	some canals need clearing and cleaning
			sedimentation done in March 08
3. Road	Daily	Water flow conditions	
crossing and	Monthly	Sediment	
gully crossing	Monthly	Crack or damage	
	Daily	Trash	
4. Structures	Daily	Water flow conditions	smooth
(division box,	Monthly	Sediment	small scale, need removal
drop box	Monthly	Crack or damage	small scale,no repair required
turnout)	Monthly	Conditions of stop log	some need repair
5. Others			

b) Maintenance Check List for Pipeline System

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water flow conditions	Stable and rich
conditions	Daily	Water level	no staff gauge present
	Daily	Conditions of intake point	Enough depth.
		Others	
2. Pipes	Monthly	Crack or damage	none
	Monthly	Water leakage	none
			one area needs backfilling
3.. Discharge	Daily	Water flow conditions	smooth
box	Monthly	Sediment	Small scale. Need removal
	Monthly	Crack or damage	some portion needs repair
	Monthly	Conditions of stop log and groove	
4. Others			

c) Maintenance Check List for River Diversion Weir

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water level	Enough
conditions	Daily	Water flow conditions	Stable. and Rich
	Daily	Sediment	not much, removal done last week
			Water quality good
2. Weir	Annually	Crack or damage of stone masonry	Small scale. Need repair or not

	At after every	Erosion at abutment	none
	Annually	Water leakage	Small scale. No repair required
	Annually	Riverbed scouring at downstream	none
	Daily	Sediment	not much, removal done last week
	Annually	Damage of gabion	
	Annually	Subsidence and deformation of gabion	
3. Intake	Annually	Crack or damage of stone masonry	none
	Daily	Sediment	not much, removal done last week
	Daily	Trash	none
	Daily	Water level	Enough
	Monthly	Damage of pipes	none
	Daily	Function	Functioning.
4. Others	Monthly	Conditions of stop log	none
	Monthly	Conditions of gate	no
		Protection bund	none

2) Maintanance work Training for maintenance work was carried out on the following items.
a. River diversion weir
b. pipeline system
c. canal system

6. Outcome of the training

To obtain skills and knowledge no maintenance work for River diversion weir
To obtain skills and knowledge no maintenance work for pipeline system
To obtain skills and knowledge no maintenance work for canal system

7. Farmers group Gpinion/ Suggestion/ Questions

Will JICA Study Team provide cement for repair at the pipeline at the intake?
Counterpart told the farmers to buy cement on their own

8. Recommendation for Farmers' Group by Counterpart

Farmers should fill soil and stones on the exposed pipeline 100m from the diversion weir and also buy cement to repair the part destred to remove a stone that entered the pipe

9. Others

Table A3-4 (2/9) Training Report on O&M of Irrigation Fcailities (Mantha)

1. Name of Scheme **Mantha Irrigation Scheme (Mz-4)**
2. Date 23-Jun-08
3. Place of Worshop Matntha Irrigation Scheme Site
4. Attendants
1) JICA Study Team Engineer(1), C/P(1)
2) DoI Staff Mechanic of DOI Workshop (1)
3) Farmers Committee F(4), M(7)
4) AEDO/AEDC AEDC(1)
5) IO from DAO -
5. Outline of Training
1) Inspection Training for inspection was carried out accoding to following check list.

a) Maintenance Check List for Canal System

Item	Frequency	Point to be checked	Findings
1. Brick or	Daily	Water flow conditions	Smooth or not
concrete	Monthly	Crack or damage	Small scale or large scale. Need repair or not
lined canal	Annually	Conditions of drain ditch (along the main canal)	Functioning or not. Need excavation or not.
	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Weeds	A lot or a few. Need clearing or not.
2. Earth canal	Daily	Water flow condition	Smooth or not
	Monthly	Cross section area	Enough cross section or not
	Monthly	Erosion	Need repair or not
	Monthly	Weeds	Need clearing or not
3. Road	Daily	Water flow conditions	Smooth or not
crossing and	Monthly	Sediment	Small scale or large scale. Need removal or not
gully crossing	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Daily	Trash	If it is a lot to block pipe, it shall be removed
4. Structures	Daily	Water flow conditions	Smooth or not
(division box,	Monthly	Sediment	Small scale or large scale. Need removal or not
drop box	Monthly	Crack or damage	Small scale or large scale. Need repair or not
turnout)	Monthly	Conditions of stop log	Need repair or not
5. Others			

b) Maintenance Check List for Pipeline System

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water flow conditions	Stable or not, flood, rich or drought
conditions	Daily	Water level	Elevation
	Daily	Conditions of intake point	Enough depth or not, Any obstruction.
2. Pipes	Monthly	Crack or damage	Small scale or large scale. Need repair or replacement.
	Monthly	Water leakage	Small scale or large scale. Need repair or replacement.
3.. Discharge	Daily	Water flow conditions	Smooth or not
box	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Monthly	Conditions of stop log and groove	Need repair or not
4. Others			

c) Maintenance Check List for Pump and Engine

Item	Frequency	Point to be checked	Findings
1. Diesel	Daily	Appearance	Need re-painting or not, Neede repair or not, Cleaning
engine	Daily	Engine oil	Enough or not
	Daily	Fuel tank	Enough fuel or not
	Daily	Noise	Abnormal noise or not
	Daily	Vibration	Abnormal vibration or not
	Daily	Oil and fuel leakage	Any leakage

	Monthly	Various bolts for loosening	Tighten all bolts and nuts
	Monthly	Vent hole in the fuel tank cap	Cleaning
	Monthly	Battery	Water level
	Monthly	Fuel tank	Cleaning
	Monthly	Fuel filter	Cleaning
	Annually	Engine oil filter element	Replacement
	Annually	Fuel filter element	Cleaning or replacement
	Annually	Engine oil	Replacement
	Annually	Paint condition	Need re-painting or not
	Annually	Air cleaner	Cleaning or replacement
	Annually	Fan Velt	Adjustment tension, Worn out or not
		Cylinder head portion(nozzle,	Adjustment, cleaning
		Shaft portion	Adjustment
		Main engine portion (piston, crank, etc)	Adjustment, cleaning
		Fuel injection system	Adjustment, cleaning
		Gasket	Need replacement or not
		Alternator	Functioning or not
2. Pump	Daily	Vibration	Abnormal vibration or not
equipment	Daily	Noise	Abnormal noise or not
	Daily	Water leakage	Small scale or large scale. Need repair or not.
	Daily	Bearing	Greasing
	Monthly	Appearance	Need re-painting or not, Need repair or not
	Monthly	Loose bolts	Tighten all bolts and nuts
	Monthly	Coupling rubber wear	Need replacement or not
	Annually	Gland packing wear condition	Need replacement or not
	Annually	Shaft center misalignment	Adjustment
	Annually	Paint condition	Need re-painting or not
3.Others	Daily	Conditions of strainer.	Clogged or not. Cleaning
	Daily	Conditions of suction pipe	Damaged or not. Water leakage.

2) Maintenance Work Training for maintenance work was carried on following items.
- Maintenance work for engine and pump
- Maintenance work for canal system
- Maintenance work for pipeline system

6. Outcomes of the training
- To obtain skill and knowledge on maintenance work for engine and pump
- To obtain skill and knowledge on maintenance work for canal system
- To obtain skill and knowledge on maintenance work for pipeline system

7. Farmers' Group Opinion/Suggestion/Question
Farmers: How they repair or clean the altornator and starter motor?
Study Team: Those works should be done by a mechanic. Farmers are advised to call mechanic of ADD.
Farmers: How to deceleration and acceleration of the engine?
Study Team: Study Team demonstrated how to do that.
Farmers: Is it better to replace PVC pipe of gully crossing to aluminum pipe to avoid daage by UV and to strengthen.
Study Team: It is better to install additional aluminum pipe to increase flow capacity.
Farmers: Is it better to dig out the pipes and place them on the surface?.
Study Team: If it is fixed to the ground, it is possible. However it is not recommendable because of safety of pipes.

8. Recommendation for Farmers' Group by Study Team
- To keep operation and maintenance record.
- To protect foundation of gully crossing with clay plastering.
- To excavate drain ditch at gully crossing in order to avoid running water scour the foundation of canal..

Farmers agreed to try to do above items.

Table A3-4 (3/9) Training Report on O&M of Irrigation Fcailities (Chiwoza Dam)

1. Name of Scheme **Chiwoza Dam Irrigation Scheme (Kas-46)**
2. Date 24-Jun-08
3. Place of Worshop Chiwoza Dam Irrigation Scheme Site
4. Attendants
1) JICA Study Team Engineer (1), C/P (1)
2) DoI Staff Mechanic of DoI Workshop (1)
3) Farmers Committee F(6), M(3)
4) AEDO/AEDC AEDO
5) IO from DAO AIO. Kasungu DAO (1)
5. Outline of Training
1) Inspection Training for inspection was carried out accoding to following check list.

a) Maintenance Check List for Water Impounding Dam

Item	Frequency	Point to be checked	Findings
1. Reservoir	Daily	Water level	Elevation
	Annually	Sediment	Depth
2. Spillway	Annually	Crack or damage of stone masonry	Small scale or large scale. Need repair or not
	At after every flood	Erosion at abutment	Need repair or protection or not
	At after every flood	Erosion at downstream	Need repair or protection or not
	At flood	Flow capacity	Enough or not (at flood time)
	At flood	Flow condition at flood	Stable or not
	Annually	Conditions of channel	Damage, weeds etc.
3. Dam	Monthly	Crack at embankment	If there is, consult with irrigation engineer.
embankment	Monthly	Erosion of embankment	Small scale or large scale. need repair immediately or
	Monthly	Collapse of embankment	Small scale or large scale. need repair immediately or
	Monthly	Water leakage at down stream	Small scale or large scale. expanding or not. Need repair immediately or not.
4. Intake and	Annually	Sediment	If it is a lot to affect intake pipe, it shall be removed.
outlet	Daily	Trash	If it is a lot to affect intake pipe, it shall be removed.
	Daily	Function	Functioning or not.
5. Others	Daily	Water quality	Affect to crops or not.

b) Maintenance Check List for Canal System

Item	Frequency	Point to be checked	Findings
1. Brick or	Daily	Water flow conditions	Smooth or not
concrete	Monthly	Crack or damage	Small scale or large scale. Need repair or not
lined canal	Annually	Conditions of drain ditch (along the main canal)	Functioning or not. Need excavation or not.
	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Weeds	A lot or a few. Need clearing or not.
2. Earth canal	Daily	Water flow condition	Smooth or not
	Monthly	Cross section area	Enough cross section or not
	Monthly	Erosion	Need repair or not
	Monthly	Weeds	Need clearing or not
3. Road	Daily	Water flow conditions	Smooth or not
crossing and	Monthly	Sediment	Small scale or large scale. Need removal or not
gully crossing	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Daily	Trash	If it is a lot to block pipe, it shall be removed
4. Structures	Daily	Water flow conditions	Smooth or not
(division box,	Monthly	Sediment	Small scale or large scale. Need removal or not
drop box	Monthly	Crack or damage	Small scale or large scale. Need repair or not
turnout)	Monthly	Conditions of stop log	Need repair or not
5. Others			

c) Maintenance Check List for Pipeline System

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water flow conditions	Stable or not, flood, rich or drought
conditions	Daily	Water level	Elevation
	Daily	Conditions of intake point	Enough depth or not, Any obstruction.
2. Pipes	Monthly	Crack or damage	Small scale or large scale. Need repair or replacement.
	Monthly	Water leakage	Small scale or large scale. Need repair or replacement.
3.. Discharge	Daily	Water flow conditions	Smooth or not

box	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Monthly	Conditions of stop log and groove	Need repair or not
4. Others			

d) Maintenance Check List for Pump and Engine

Item	Frequency	Point to be checked	Findings
1. Diesel	Daily	Appearance	Need re-painting or not, Neede repair or not, Cleaning
engine	Daily	Engine oil	Enough or not
	Daily	Fuel tank	Enough fuel or not
	Daily	Noise	Abnormal noise or not
	Daily	Vibration	Abnormal vibration or not
	Daily	Oil and fuel leakage	Any leakage
	Monthly	Various bolts for loosening	Tighten all bolts and nuts
	Monthly	Vent hole in the fuel tank cap	Cleaning
	Monthly	Battery	Water level
	Monthly	Fuel tank	Cleaning
	Monthly	Fuel filter	Cleaning
	Annually	Engine oil filter element	Replacement
	Annually	Fuel filter element	Cleaning or replacement
	Annually	Engine oil	Replacement
	Annually	Paint condition	Need re-painting or not
	Annually	Air cleaner	Cleaning or replacement
	Annually	Fan Velt	Adjustment tension, Worn out or not
		Cylinder head portion(nozzle, valves	Adjustment, cleaning
		Shaft portion	Adjustment
		Main engine portion (piston, crank,	Adjustment, cleaning
		Fuel injection system	Adjustment, cleaning
		Gasket	Need replacement or not
		Alternator	Functioning or not
2. Pump	Daily	Vibration	Abnormal vibration or not
equipment	Daily	Noise	Abnormal noise or not
	Daily	Water leakage	Small scale or large scale. Need repair or not.
	Daily	Bearing	Greasing
	Monthly	Appearance	Need re-painting or not, Need repair or not
	Monthly	Loose bolts	Tighten all bolts and nuts
	Monthly	Coupling rubber wear	Need replacement or not
	Annually	Gland packing wear condition	Need replacement or not
	Annually	Shaft center misalignment	Adjustment
	Annually	Paint condition	Need re-painting or not
3.Others	Daily	Conditions of strainer.	Clogged or not. Cleaning
	Daily	Conditions of suction pipe	Damaged or not. Water leakage.

2) Maintenance Work Training for maintenance work was carried on following items.

- Maintenance work for engine and pump
- Maintenance work for water impounding dam
- Maintenance work for canal system
- Maintenance work for pipeline system

6. Outcomes of the training

- To obtain skill and knowledge on maintenance work for engine and pump
- To obtain skill and knowledge on maintenance work for water impounding dam
- To obtain skill and knowledge on maintenance work for canal system
- To obtain skill and knowledge on maintenance work for pipeline system

7. Farmers' Group Opinion/Suggestion/Question

Farmers: What to do with the crack on the dam embankment on the right side?
Study Team: The part is low and need embankment and compaction.
Farmers: How to minimize erosin at turnouts?
Study Team: To provide dry brick laying drop structure.

8. Recommendation for Farmers' Group by Study Team

- To keep operation and maintenance record.
- Spillway elevation shall not be raised any more.
- To excavate reservoir and use excavated material to raise embankment.

Farmers agreed to try to do above items.

9. Others

Table A3-4 (4/9) Training Report on O&M of Irrigation Fcailities (Kachere No.1)

1. Name of Scheme **Kachere Irrigation Scheme (Ma-1)**
2. Date 10-Jul-08
3. Place of Worshop Kachere Irrigation Scheme Site
4. Attendants
1) JICA Study Team C/P (1)
2) DoI Staff Mechanic (Mr, Phiri)
3) Farmers Committee F(0 M(4)
4) AEDO/AEDC AEDO
5) IO from DAO -
5. Outline of Training
1) Inspection Training for inspection was carried out accoding to following check list.
a. Pump and Engine system
b. Pipeline system
c. Canal system

a) Maintenance Check List for Canal System

Item	Frequency	Point to be checked	Findings
1. Brick or	Daily	Water flow conditions	Smooth
concrete	Monthly	Crack	Small scale. Need repair
lined canal	Annually	Conditions of drain ditch (along the main canal)	Not Functioning. Need excavation.
	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Weeds	A lot or a few. Need clearing or not.
2. Earth canal	Daily	Water flow condition	
	Monthly	Cross section area	
	Monthly	Erosion	
	Monthly	Weeds	
3. Road	Daily	Water flow conditions	
crossing and	Monthly	Sediment	
gully crossing	Monthly	Crack or damage	
	Daily	Trash	
4. Structures	Daily	Water flow conditions	Not Functioning as irrigation has not started.
(division box,	Monthly	Sediment	
drop box	Monthly	Crack or damage	
turnout)	Monthly	Conditions of stop log	
5. Others			

b) Maintenance Check List for Pipeline System

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water flow conditions	Stable and rich
conditions	Daily	Water level	staff gauge destroyed by by water, but to be replaced
	Daily	Conditions of intake point	Enough depth.
2. Pipes	Monthly	Crack or damage	none
	Monthly	Water leakage	none
3.. Discharge	Daily	Water flow conditions	no irrigation taking place
box	Monthly	Sediment	Small scale. Need removal
	Monthly	Crack or damage	none
	Monthly	Conditions of stop log and groove	need no repair
4. Others			

c) Maintenance Check List for Pump and Engine

Item	Frequency	Point to be checked	Findings
1. Diesel	Daily	Appearance	Needs Cleaning
engine	Daily	Engine oil	Enough
	Daily	Fuel tank	no fuel has been purchased yet
	Daily	Noise	none according farmers
	Daily	Vibration	none according farmers
	Daily	Oil and **fuel leakage**	diesel filter seal needs replacing
	Monthly	Various bolts for loosening	some bolts and nuts were tightened

	Monthly	Vent hole in the fuel tank cap	Clean
	Monthly	Battery	no battery required
	Monthly	Fuel tank	presently clean
	Monthly	Fuel filter	presently clean
	Annually	Engine oil filter element	not required
	Annually	Fuel filter element	Ok
	Annually	Engine oil	Ok
	Annually	Paint condition	no painting required
	Annually	Air cleaner	Cleaning
	Annually	Fan velt	Adjust tension, Worn out or not
		Cylinder head portion(nozzle, valves	Adjustment, cleaning
		Shaft portion	Adjustment
		Main engine portion (piston, crank, etc)	Adjustment, cleaning
		Fuel injection system	Adjustment, cleaning
		Gasket	Need replacement or not
		Alternator	functioning or not
		Others	
2. Pump	Daily	Vibration	None
equipment	Daily	Noise	None
	Daily	Water leakage	leaking on the gland packing. Farmer breaks the bracket holding the grand packing to the impeller
	Daily	Bearing	Needs Greasing
	Monthly	Appearance	none
	Monthly	Loose bolts	some needs tightening
	Monthly	Coupling rubber wear	No
	Annually	Gland packing wear condition	Needs checking because it is leaking
	Annually	Shaft center misalignment	No Adjustment required
	Annually	Paint condition	No
3.Others	Daily	Conditions of strainer.	Ok
	Daily	Conditions of suction pipe	Ok

2) Maintenance Work Training for maintenance work was carried on following items.
- Maintenance work for pump and engine
- Maintenance work for Pipeline system
- Maintenance work for canal system

6. Outcomes of the training
- To obtain skill and knowledge on maintenance work for pump and engine
- To obtain skill and knowledge on maintenance work for Pipeline system
- To obtain skill and knowledge on maintenance work for canal system

7. Farmers' Group Opinion/Suggestion/Question

Farmers: worry concerns on the diesel filter seal as it has been leaking for a long time and causes a lot of fuel wastage
Counterpart: Mechanic said that the only solution is to replace with a new seal.
Farmers: Is it possible to use car bostic paste on the seal?
Mechanic: Absolutly No because the paste might damage the diesel injector pump
Farmers: when to replace diesel filter
Mechanic: when the engine is jerking while running and also replace filter annually or after six months depending on irrigation h
Farmers: what causes engine revolution to maximize or minimize
Mechanic: unneccesary adjustment of of the accelerator throttle knob by either children or adults

8. Recommendation for Farmers' Group by Counterpart
- -Farmers should a protection bund on the upland of the main canal.
- -They should add more oil to the air cleaner before running the engine.
- -Use of sand bags on the division boxes to block water not canal soil to prevent erosion

9. Others

During the training session farmer breaks the **bracket** holding the grand packing while tightening it.

Table A3-4 (5/9) Training Report on O&M of Irrigation Fcailities (Kachere No.2)

1. Name of Scheme **Kachere Irrigation Scheme (Ma-1)**
2. Date 23-Aug-08
3. Place of Worshop Kachere Irrigation Scheme Site
4. Attendants
1) JICA Study Team Monitoring Engineer
2) DoI Staff Mechanic (Mr, Phiri)
3) Farmers Committee F(8 M(14)
4) Pump operators M(5)
5) AEDO/AEDC Absent
6) IO from DAO Absent
5. Outline of Training
(1)Pump operation Training for pump operation when farmer group first operated a pump for dry season maize was started.

a) Maintenance Check List for Canal System

Item	Frequency	Point to be checked	Findings
1. Brick or	Daily	Water flow conditions	Not used, farmers requested for special supervision from the Study Team Engineers for this.
concrete	Monthly	Crack	Small scale at canal base. Need repair
lined canal	Annually	Conditions of drain ditch (along the main canal)	Not Functioning. Need excavation.
	Monthly	Sediment	Small scale, Need removal
	Monthly	Weeds	A few, Need clearing.
2. Earth canal	Daily	Water flow condition	Not started using yet
	Monthly	Cross section area	
	Monthly	Erosion	
	Monthly	Weeds	
3. Road	Daily	Water flow conditions	
crossing and	Monthly	Sediment	
gully crossing	Monthly	Crack or damage	
	Daily	Trash	
4. Structures	Daily	Water flow conditions	Not used
(division box,	Monthly	Sediment	
drop box	Monthly	Crack or damage	
turnout)	Monthly	Conditions of stop log	
5. Others			

b) Maintenance Check List for Pipeline System

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water flow conditions	Stable
conditions	Daily	Water level	dropping
	Daily	Conditions of intake point	Enough depth.
2. Pipes	Monthly	Crack or damage	Small scale, need replacement
	Monthly	Water leakage	not traced yet
3.. Discharge	Daily	Water flow conditions	no irrigation taking place
box	Monthly	Sediment	Small scale. Need removal
	Monthly	Crack or damage	none
	Monthly	Conditions of stop log and groove	need no repair
4. Others			

c) Maintenance Check List for Pump and Engine

Item	Frequency	Point to be checked	Findings
1. Diesel	Daily	Appearance	Needs Cleaning
engine	Daily	Engine oil	Enough
	Daily	Fuel tank	Enough fuel
	Daily	Noise	Normal
	Daily	Vibration	Normal
	Daily	Oil and **fuel leakage**	small scale, needs sealing
	Monthly	Various bolts for loosening	some bolts and nuts were tightened
	Monthly	Vent hole in the fuel tank cap	Clean
	Monthly	Battery	no battery required
	Monthly	Fuel tank	presently clean
	Monthly	Fuel filter	presently clean

	Annually	Engine oil filter element	not required
	Annually	Fuel filter element	Ok
	Annually	Engine oil	Ok
	Annually	Paint condition	no painting required
	Annually	Air cleaner	Cleaning
	Annually	Fan velt	
		Cylinder head portion(nozzle, valves	
		Shaft portion	
		Main engine portion (piston, crank, etc)	
		Fuel injection system	
		Gasket	
		Alternator	
		Others	
2. Pump	Daily	Vibration	None
equipment	Daily	Noise	None
	Daily	Water leakage	none
	Daily	Bearing	Needs Greasing
	Monthly	Appearance	none
	Monthly	Loose bolts	none
	Monthly	Coupling rubber wear	No
	Annually	Gland packing wear condition	fine
	Annually	Shaft center misalignment	No
	Annually	Paint condition	No
3.Others	Daily	Conditions of strainer.	Ok
	Daily	Conditions of suction pipe	Ok

(2) Technical pump check up: Training for pump check up and care before and after operation was conducted.
-Water availability in the supply pipe before starting the engine.
- Oil and fuel check up need illustrated.
- Stabalising the engine position and continuous supervision at the engine site.
- Recording of all pump proceedings.

6. Outcomes of the training

-Farmers knew how to check all necessary pump parts before operation
-Farmers knew the importance of water in the supply pipe before starting the engine.
- Farmers knew how to record all pump expenditures in irrigation period
-Farmers knew how to check if diesel is being pumped or not.
- Farmers knew how to operate the engine

7. Farmers' Group Opinion/Suggestion/Question

Farmers worry about the engine breaking sound some seconds after starting was responded to by the mechanic as some signs of airlo
Farmers are not comfortable with the canal structure, looking dip as compared to Chiwozas and fear will consume a lot of fuel to use it
Farmers agreed not to use the canal structure but improvise their own earth canal to used during this dry planting.
Pipes alined from the intake direct to the lined canal will be removed and used to deliver water to earth canals.

8. Recommendations

Farmers minds are already set on using earth canal to save fuel hence advised to do so but still care for the lined canal.
Farmers should find enough fuel to test the lined canal before making conclusions that it can not work.
All pipes should be taken care of in changing to reduce damages.

9. Others

Planting starts on Monday 25th August 2008.

The Delivery pipe was changed from one pump to the other because the former pipe could not hold the leaflet well.

Table A3-4 (6/9) Training Report on O&M of Irrigation Fcailities (Titukulane)

1. Name of Scheme **Titukulane Irrigation Scheme (Kas-47)**
2. Date 2-Jul-08
3. Place of Worshop Titukulane Irrigation Scheme Site
4. Attendants
1) JICA Study Team Engineer (1), C/P (1)
2) DoI Staff -
3) Farmers Committee F(0), M(6)
4) AEDO/AEDC -
5) IO from DAO -
5. Outline of Training
1) Inspection Training for inspection was carried out accoding to following check list.

a) Maintenance Check List for River Diversion Weir

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water level	Elevation, Enough or not.
conditions	Daily	Water flow conditions	Stable or not. Flood, Rich or Drought.
	Daily	Sediment	If it is a lot to affect intake, it shall be removed.
			Water quality, flotage etc.
2. Weir	Annually	Crack or damage of stone masonry	Small scale or large scale. Need repair or not
	At after	Erosion at abutment	Need repair or protection or not
	Annually	Water leakage	Small scale or large scale. Need repair or not
	Annually	Riverbed scouring at downstream	Need protection or not
	Daily	Sediment	If it is a lot to affect intake, it shall be removed.
	Annually	Damage of gabion	Small scale or large scale. Need repair or not
	Annually	Subsidence and deformation of gabion	Stable or not. Need repair or not.
3. Intake	Annually	Crack or damage of stone masonry	Small scale or large scale. Need repair or not
	Daily	Sediment	If it is a lot to affect intake pipes, it shall be removed.
	Daily	Trash	If it is a lot to block intake pipes, it shall be removed
	Daily	Water level	Enough or not
	Monthly	Damage of pipes	Need repair or not.
	Daily	Function	Functioning or not.
4. Others	Monthly	Conditions of stop log	Need repair or not.
	Monthly	Conditions of gate	Need painting, reapir or not.
		Protection bund	Collapse or erosion. Need repair or not.

b) Maintenance Check List for Canal System

Item	Frequency	Point to be checked	Findings
1. Brick or	Daily	Water flow conditions	Smooth or not
concrete	Monthly	Crack or damage	Small scale or large scale. Need repair or not
lined canal	Annually	Conditions of drain ditch (along the main canal)	Functioning or not. Need excavation or not.
	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Weeds	A lot or a few. Need clearing or not.
2. Earth canal	Daily	Water flow condition	Smooth or not
	Monthly	Cross section area	Enough cross section or not
	Monthly	Erosion	Need repair or not
	Monthly	Weeds	Need clearing or not
3. Road	Daily	Water flow conditions	Smooth or not
crossing and	Monthly	Sediment	Small scale or large scale. Need removal or not
gully crossing	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Daily	Trash	If it is a lot to block pipe, it shall be removed
4. Structures	Daily	Water flow conditions	Smooth or not
(division box,	Monthly	Sediment	Small scale or large scale. Need removal or not
drop box	Monthly	Crack or damage	Small scale or large scale. Need repair or not
turnout)	Monthly	Conditions of stop log	Need repair or not
5. Others			

c) Maintenance Check List for Pipeline System

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water flow conditions	Stable or not, flood, rich or drought
conditions	Daily	Water level	Elevation
	Daily	Conditions of intake point	Enough depth or not, Any obstruction.
2. Pipes	Monthly	Crack or damage	Small scale or large scale. Need repair or replacement.
	Monthly	Water leakage	Small scale or large scale. Need repair or replacement.
3.. Discharge	Daily	Water flow conditions	Smooth or not
box	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Monthly	Conditions of stop log and groove	Need repair or not
4. Others			

2) Maintenance Work Training for maintenance work was carried on following items.
- Maintenance work for weir and intake
- Maintenance work for canal system
- Maintenance work for pipeline system

6. Outcomes of the training
- To obtain skill and knowledge on maintenance work for weir and intake
- To obtain skill and knowledge on maintenance work for canal system
- To obtain skill and knowledge on maintenance work for pipeline system

7. Farmers' Group Opinion/Suggestion/Question

Farmers: In rainy season, big stones hit the weir and damage it. In that case, will JICA assist us?
Study Team: Maintenance work shall be done by farmers.
Farmers: Children sometimes throw stones and damage the pipes.
Study Team: Pipes shall be covered with soil and vegetation shall be provided to protect them.
Farmers plan to replace manmade-cliff-canal to pipline or stone masonry.

8. Recommendation for Farmers' Group by Study Team
- Some parts of main canal have not enough cross section area. Those parts shall be excavated.
- From upstream of gully crossing No.2 to downstream end of the main canal, water has not been supplied. The condition and function of the canal shall be checked supplying water.
- Left side abutment of the weir is not so strong as right side. Farmers need take care of it.
- Water being conveyed at the intake into the canal is enough to irrigate whole scheme.

9. Others

Study team instructed how to flash pipes.

Table A3-4 (7/9) Training Report on O&M of Irrigation Fcailities (Chaseta)

1. Name of Scheme **Chaseta Irrigation Scheme (Li-2)**
2. Date 1-Jul-08
3. Place of Worshop Chaseta Irrigation Scheme Site
4. Attendants
1) JICA Study Team Engineer (1)
2) DoI Staff Mechanic of DoI Workshop (1)
3) Farmers Committee F(20), M(19)
4) AEDO/AEDC AEDO. (1)
5) IO from DAO AIO. Lilongwe DAO (1)
5. Outline of Training
1) Inspection Training for inspection was carried out accoding to following check list.

a) Maintenance Check List for Canal System

Item	Frequency	Point to be checked	Findings
1. Brick or	Daily	Water flow conditions	Smooth or not
concrete	Monthly	Crack or damage	Small scale or large scale. Need repair or not
lined canal	Annually	Conditions of drain ditch (along the main canal)	Functioning or not. Need excavation or not.
	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Weeds	A lot or a few. Need clearing or not.
2. Earth canal	Daily	Water flow condition	Smooth or not
	Monthly	Cross section area	Enough cross section or not
	Monthly	Erosion	Need repair or not
	Monthly	Weeds	Need clearing or not
3. Road	Daily	Water flow conditions	Smooth or not
crossing and	Monthly	Sediment	Small scale or large scale. Need removal or not
gully crossing	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Daily	Trash	If it is a lot to block pipe, it shall be removed
4. Structures	Daily	Water flow conditions	Smooth or not
(division box,	Monthly	Sediment	Small scale or large scale. Need removal or not
drop box	Monthly	Crack or damage	Small scale or large scale. Need repair or not
turnout)	Monthly	Conditions of stop log	Need repair or not
5. Others			

b) Maintenance Check List for Pipeline System

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water flow conditions	Stable or not, flood, rich or drought
conditions	Daily	Water level	Elevation
	Daily	Conditions of intake point	Enough depth or not, Any obstruction.
2. Pipes	Monthly	Crack or damage	Small scale or large scale. Need repair or replacement.
	Monthly	Water leakage	Small scale or large scale. Need repair or replacement.
3.. Discharge	Daily	Water flow conditions	Smooth or not
box	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Monthly	Conditions of stop log and groove	Need repair or not
4. Others			

c) Maintenance Check List for Pump and Engine

Item	Frequency	Point to be checked	Findings
1. Diesel	Daily	Appearance	Need re-painting or not, Neede repair or not, Cleaning
engine	Daily	Engine oil	Enough or not
	Daily	Fuel tank	Enough fuel or not
	Daily	Noise	Abnormal noise or not
	Daily	Vibration	Abnormal vibration or not
	Daily	Oil and fuel leakage	Any leakage
	Monthly	Various bolts for loosening	Tighten all bolts and nuts
	Monthly	Vent hole in the fuel tank cap	Cleaning
	Monthly	Battery	Water level

	Monthly	Fuel tank	Cleaning
	Monthly	Fuel filter	Cleaning
	Annually	Engine oil filter element	Replacement
	Annually	Fuel filter element	Cleaning or replacement
	Annually	Engine oil	Replacement
	Annually	Paint condition	Need re-painting or not
	Annually	Air cleaner	Cleaning or replacement
	Annually	Fan Velt	Adjustment tension, Worn out or not
		Cylinder head portion(nozzle, valves	Adjustment, cleaning
		Shaft portion	Adjustment
		Main engine portion (piston, crank, etc)	Adjustment, cleaning
		Fuel injection system	Adjustment, cleaning
		Gasket	Need replacement or not
		Alternator	Functioning or not
2. Pump	Daily	Vibration	Abnormal vibration or not
equipment	Daily	Noise	Abnormal noise or not
	Daily	Water leakage	Small scale or large scale. Need repair or not.
	Daily	Bearing	Greasing
	Monthly	Appearance	Need re-painting or not, Need repair or not
	Monthly	Loose bolts	Tighten all bolts and nuts
	Monthly	Coupling rubber wear	Need replacement or not
	Annually	Gland packing wear condition	Need replacement or not
	Annually	Shaft center misalignment	Adjustment
	Annually	Paint condition	Need re-painting or not
3.Others	Daily	Conditions of strainer.	Clogged or not. Cleaning
	Daily	Conditions of suction pipe	Damaged or not. Water leakage.

2) Maintenance Work Training for maintenance work was carried on following items.
- Maintenance work for engine and pump
- Maintenance work for canal system
- Maintenance work for pipeline system

6. Outcomes of the training
- To obtain skill and knowledge on maintenance work for engine and pump
- To obtain skill and knowledge on maintenance work for canal system
- To obtain skill and knowledge on maintenance work for pipeline system

7. Farmers' Group Opinion/Suggestion/Question
Farmers: How to blow the air element of the engine?
Study Team: Just blow it by using bicycle pump or by cleaning with diesel.
Farmers: How to stop water leakage?
Study Team: Use rubber gaskets or gasket maker.
Farmers: Type of engine oil to be used?
Study Team: SAE 40 for deisel engine
Study Team: Where do you buy diesel?
Farmers: Filling station to ensure quality of diesel.

8. Recommendation for Farmers' Group by Study Team
- To keep operation record so that they find service time for the engine.
- To provide vegetation on the slope surface along the canal.
- To complete excavation of earth canal.
- To keep good maintenance to keep engine in good condition long time.
- Maintenance tools shall be prepared by the farmers committee.

9. Others
Many of the farmers attended the training and they understand maitenance work
Not only operators but also some women got how to operate and maintain engine and pump.

Table A3-4 (8/9) Training Report on O&M of Irrigation Fcailities (Bawi)

1. Name of Scheme **Bawi Irrigation Scheme (Li-21)**
2. Date 28-Jun-08
3. Place of Worshop Bawi Irrigation Scheme Site
4. Attendants
1) JICA Study Team Engineer (1), C/P (1)
2) DoI Staff -
3) Farmers Committee F(1), M(9)
4) AEDO/AEDC -
5) IO from DAO -
5. Outline of Training
1) Inspection Training for inspection was carried out accoding to following check list.

a) Maintenance Check List for River Diversion Weir

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water level	Elevation, Enough or not.
conditions	Daily	Water flow conditions	Stable or not. Flood, Rich or Drought.
	Daily	Sediment	If it is a lot to affect intake, it shall be removed.
			Water quality, flotage etc.
2. Weir	Annually	Crack or damage of stone masonry	Small scale or large scale. Need repair or not
	At after	Erosion at abutment	Need repair or protection or not
	Annually	Water leakage	Small scale or large scale. Need repair or not
	Annually	Riverbed scouring at downstream	Need protection or not
	Daily	Sediment	If it is a lot to affect intake, it shall be removed.
	Annually	Damage of gabion	Small scale or large scale. Need repair or not
	Annually	Subsidence and deformation of	Stable or not. Need repair or not.
3. Intake	Annually	Crack or damage of stone masonry	Small scale or large scale. Need repair or not
	Daily	Sediment	If it is a lot to affect intake pipes, it shall be removed.
	Daily	Trash	If it is a lot to block intake pipes, it shall be removed
	Daily	Water level	Enough or not
	Monthly	Damage of pipes	Need repair or not.
	Daily	Function	Functioning or not.
4. Others	Monthly	Conditions of stop log	Need repair or not.
	Monthly	Conditions of gate	Need painting, reapir or not.
		Protection bund	Collapse or erosion. Need repair or not.

b) Maintenance Check List for Canal System

Item	Frequency	Point to be checked	Findings
1. Brick or	Daily	Water flow conditions	Smooth or not
concrete	Monthly	Crack or damage	Small scale or large scale. Need repair or not
lined canal	Annually	Conditions of drain ditch (along the main canal)	Functioning or not. Need excavation or not.
	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Weeds	A lot or a few. Need clearing or not.
2. Earth canal	Daily	Water flow condition	Smooth or not
	Monthly	Cross section area	Enough cross section or not
	Monthly	Erosion	Need repair or not
	Monthly	Weeds	Need clearing or not
3. Road	Daily	Water flow conditions	Smooth or not
crossing and	Monthly	Sediment	Small scale or large scale. Need removal or not
gully crossing	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Daily	Trash	If it is a lot to block pipe, it shall be removed
4. Structures	Daily	Water flow conditions	Smooth or not
(division box,	Monthly	Sediment	Small scale or large scale. Need removal or not
drop box	Monthly	Crack or damage	Small scale or large scale. Need repair or not
turnout)	Monthly	Conditions of stop log	Need repair or not
5. Others			

2) Maintenance Work Training for maintenance work was carried on following items.
- Maintenance work for weir and intake
- Maintenance work for canal system

6. Outcomes of the training
- To obtain skill and knowledge on maintenance work for weir and intake
- To obtain skill and knowledge on maintenance work for canal system

7. Farmers' Group Opinion/Suggestion/Question
Farmers: Some farmers are doubting if their land will take over by GOM or JICA because of surveying.
Study team: GoM and JICA will never take over their land.
Farmers: How to protect No.5 main canal beginning point?
Study Team: Final solution is stone masonry. It is recommended to maintain it every year.

8. Recommendation for Farmers' Group by Study Team
Some parts of main canal have not enough cross section area. Those parts shall be excavated.
Repair of water leaking at No.7 weir left abutment shall be done soon.

9. Others

Table A3-4 (9/9) Training Report on O&M of Irrigation Fcailities (Chibwana)

1. Name of Scheme **Chibwana Irrigation Scheme (Ma-1)**
2. Date 28-Jun-08
3. Place of Worshop Chibwana Irrigation Scheme Site
4. Attendants
1) JICA Study Team Engineer (1), C/P (1)
2) DoI Staff -
3) Farmers Committee F(11), M(6)
4) AEDO/AEDC -
5) IO from DAO -
5. Outline of Training
1) Inspection Training for inspection was carried out accoding to following check list.

a) Maintenance Check List for River Diversion Weir

Item	Frequency	Point to be checked	Findings
1. River	Daily	Water level	Elevation, Enough or not.
conditions	Daily	Water flow conditions	Stable or not. Flood, Rich or Drought.
	Daily	Sediment	If it is a lot to affect intake, it shall be removed.
			Water quality, flotage etc.
2. Weir	Annually	Crack or damage of stone masonry	Small scale or large scale. Need repair or not
	At after	Erosion at abutment	Need repair or protection or not
	Annually	Water leakage	Small scale or large scale. Need repair or not
	Annually	Riverbed scouring at downstream	Need protection or not
	Daily	Sediment	If it is a lot to affect intake, it shall be removed.
	Annually	Damage of gabion	Small scale or large scale. Need repair or not
	Annually	Subsidence and deformation of	Stable or not. Need repair or not.
3. Intake	Annually	Crack or damage of stone masonry	Small scale or large scale. Need repair or not
	Daily	Sediment	If it is a lot to affect intake pipes, it shall be removed.
	Daily	Trash	If it is a lot to block intake pipes, it shall be removed
	Daily	Water level	Enough or not
	Monthly	Damage of pipes	Need repair or not.
	Daily	Function	Functioning or not.
4. Others	Monthly	Conditions of stop log	Need repair or not.
	Monthly	Conditions of gate	Need painting, reapir or not.
		Protection bund	Collapse or erosion. Need repair or not.

b) Maintenance Check List for Canal System

Item	Frequency	Point to be checked	Findings
1. Brick or	Daily	Water flow conditions	Smooth or not
concrete	Monthly	Crack or damage	Small scale or large scale. Need repair or not
lined canal	Annually	Conditions of drain ditch (along the main canal)	Functioning or not. Need excavation or not.
	Monthly	Sediment	Small scale or large scale. Need removal or not
	Monthly	Weeds	A lot or a few. Need clearing or not.
2. Earth canal	Daily	Water flow condition	Smooth or not
	Monthly	Cross section area	Enough cross section or not
	Monthly	Erosion	Need repair or not
	Monthly	Weeds	Need clearing or not
3. Road	Daily	Water flow conditions	Smooth or not
crossing and	Monthly	Sediment	Small scale or large scale. Need removal or not
gully crossing	Monthly	Crack or damage	Small scale or large scale. Need repair or not
	Daily	Trash	If it is a lot to block pipe, it shall be removed
4. Structures	Daily	Water flow conditions	Smooth or not
(division box,	Monthly	Sediment	Small scale or large scale. Need removal or not
drop box	Monthly	Crack or damage	Small scale or large scale. Need repair or not
turnout)	Monthly	Conditions of stop log	Need repair or not
5. Others			

2) Maintenance Work Training for maintenance work was carried on following items.
- Maintenance work for weir and intake
- Maintenance work for canal system

6. Outcomes of the training
- To obtain skill and knowledge on maintenance work for weir and intake
- To obtain skill and knowledge on maintenance work for canal system

7. Farmers' Group Opinion/Suggestion/Question
Farmers: Who will be responsible for water distribution.
Study team: Water user's assosiation. Representatives of each block should discuss water schedule.

8. Recommendation for Farmers' Group by Study Team
Secondary canal shall be cleaned to be functional.
Farmers need to raise-up intake water level by placing sand bags or leaves and soil in front of gabion.

9. Others
The training was good but the level of understanding was low as farmers were reluctant to explain what they understand from what they have learned.

Table A3-5 (1/8) Profile of Verification Site - Mz-11 Bethani

1. Scheme Name	**Mz-11 Bethani**				**Rumphi District**		
Contact person:	AEDO- Mr. Hara (08-567 609), AEDC-Mr. Charls Msowoya (09-622 282)						
	Farmer Group- Mr.Mtete (05-929260)						
	IO- Mr. Mbale, AIO- Mr. Kalua (cell 08-370550), AIO- Mr. Yafeti 09-226939						
	ADADO- Mr. Munyenyemde (cell 08-523-543, 01-372256)						
2. Location	Mzuzu ADD - Rumphi District - Mhuju EPA - Ngonga North Section						
Distance from Lilongwe:	Lilongwe -(355km M1)- Mzuzu -(67km)- Rumphi DADO -(6km tarmac)- turn-off -(16km earth)- site						
3. Scheme Type	River diversion weir						
4. Irrigation Service Area	Current before rehab =	12.24 ha in dry s.		Potential =	22 ha (A=8ha, B=14ha)		
	Scheme area in dry s. (irrigation) =	0.20 ha/farmer					
	Upland area in wet s. (rain-fed) =	1.00 ha/farmer					
5. Year Built & History	In 2004, built under ADB support. System was made by consultants & contractor. Winter crop started only from 2005.						
6. WUA							
1) Date of registration	not yet	Being applied as a water cooperative committee to M. of Trade & Commerce					
2) No. of members	A=50, B=82	Men =	A=30, B=36	Women =	A=20, B=46	Chairman A:	Mr. Voster Nyirongo
3) No. of committee members	EC-10	Men =	7	Women =	3	Chairman B:	Mr. Bentley Gondene
4) No. of villages & Name	5	Name:	Mbayazao, Ajuwiri, Amagawiro, Achiturika, Kamvuwi				
5) Name of TA/VHM/ethnic group	Sub TA: Chisovya	GVH: Mbazayao		Ethnic: Tumbuka			
6) Irrigation service fee							
Entry fee	None			Bank account balance:	MRFC-A= MK15,000, B= MK10,000		
Membership fee	None	2 clubs (club-A for canal-A right bank, & club-B for canal-B left bank)					
Irrigation fee	MK300 /year - for winter season only, about 85% paid in 2007						
7. Farming							
1) Main crops & cropping pattern	month	main crop					
Wet (summer) crop	Nov. - Mar.	Maize, tobacco, paprika, beans					
Dry (winter) crop	Apr. - Oct.	Maize, green maize, vegetables					

2) Crop data	BM (Wet 2006/07)		BM (Dry 2006)		Wet 2007/08		Dry 2008
Area planted / harvested (ha)	14.00		12.24		22.10	22.00	16.09
Maize yield -hybrid / local (ton/ha)	Maize: 2.6		Maize: 2.11		5.30	4.70	Maize: 4.1
Other crops (ton/ha)			Green maize	1.40	Tobacco	2.41	
			Beans	0.60	Paprika	0.40	Beans: 2.50
			I. Potato	1.11			I. Potato: 4.2
3) Net Farm Income (MK/ha)			67,514				162,329

8. Irrigation System							
1) Water source	Ruviri river, tributary of South Rukuru river						
2) Water availability	Throughout of year						
3) Water delivery system	Intake weir - delivery pipeline - discharge box - main canal - turn-out - s. canal - farm inlet						
4) Water distribution system	Rotational system, Canal A (3 blocks)- 1,2,3,1,2,3,off, Canal B (4 blocks)- 1,2,3,4,1+2,3+4,off						
9. Natural Condition / Constraints							
Flood / soils / others:	Soil type - clay loam			Market day:	Saturday at Mwangonga		
10. Technical Feature							
1) Intake weir	Diversion weir (stone masonry) + intake box (stone masonry) + conveyance pipeline (L=350m, D=140 mm, PVC + steel partially) + discharge box (stone masonry)						
2) Irrigation canal							

	For canal A (right bank)	For canal B (left bank)
Main canal:	L=700m, earth canal	L=1500m, earth canal
Secondary / tertiary canal:	at 100m interval, earth	at 100m interval, earth
Number of turn-outs:	5 boxes, brick masonry	13 boxes, brick masonry

11. Rehabilitation Work						
1) Work items	1) repair of diversion weir & intake box, 2) 6 turn-out boxes, 3) main canal - brick-lined 100m					
2) Work & cost sharing	Inputs (planned)	Undertaking (agreed)	Actual			
1. Labor (unskilled)	270 man-day	community	done			
2. Labor (skilled)	150 man-day	community	done			
3. Material (local)	sand, stone, bricks-13000	community	done	Cost sharing (MK)		
4. Material (outside)	cement (110)	community-15 + JICA-95	done 15/75	1) JICA	239,000	
5. Transportation (with driver)	1 pick-up - for sand	DADO	JICA			51%
6. Fuel for transportation	diesel - 190 lit	JICA	done	2) GOM	95,000	
7. Technical supervision	3 weeks	AEDO/IO/Committee	done			20.3%
3) Other inputs				3) Farmer G.	134,000	
1. For farmers:	Working tools,	community/JICA	done			29%
2. For AEDO, AEDC & IO:	Supervision tools,	JICA - bicycles, etc.	done	Total (MK)	468,000	
					(21,273 MK/ha)	
4) Rehabilitation period	Plan:	Oct. - Nov. 2007		Total days:	3 weeks from Oct. 23	
	Actual:	Oct. 24 - Nov. 21		Total days:	4 weeks	
12. Note						

Table A3-5 (2/8) Profile of Verification Site - Mz-4 Mantha

1. Scheme Name: **Mz-4 Mantha** — **Mzimba District**

Contact person: AEDC- Mrs. J. Mwambongo (cell 08-645 778), AEDO- Mr. Mwambongo (08-562095)
Farmer Group- Mr. Chiukepo (08-141489)
DADO- Mrs. N.C. Mipand (08-850 849)
IO of Mzimba DADO- Mr. Charles Banda (08-395 681, 01-342248)

2. Location: Mzuzu ADD - Mzimba District - Luwelezi EPA - Luwelezi Section

Distance from Lilongwe: Mzimba DADO -(77km)- M1 turn-off at Kakuwale -(12km)- site at Luelezi river -(2km)- EPA Lilongwe -(133km)- Kasungu -(63km)- M1 turn-off at Kakuwale to Mantha site

3. Scheme Type: Motorized pump with surface irrigation (pipeline + canal)

4. Irrigation Service Area: Current before rehab = 1.0 ha in dry s. by watering can; Potential = 8 ha
Scheme area in dry s. (irrigation) = 0.075 ha/farmer
Upland area in wet s. (rain-fed) = 0.72 ha/farmer (1.6 - 2 acre)

5. Year Built & History: In 2000, a pump and aluminium pipes for sprinkler system were donated by NGO Telefood, then operated only for 1 dry season in 2000. It was suspended due to failure in collection of diesel cost.

6. WUA

1) Date of registration	In 2000 at agricultural office (DADO)					
2) No. of members	100	Men =	66	Women =	34	
3) No. of committee members	EC-10	Men =	7	Women =	3	Chairman: Mr. Hervert Matundu
4) No. of villages & Name	5	Name:	Nthazama, Malenga, Yaboko Moyo, Esau, Chakechake			
5) Name of TA/VHM/ethnic group	TA: Maulawo		GVH: Kanyemba		Ethnic: Tumbuka (major), Tonga, Kalanga	
6) Irrigation service fee						
Entry fee	None			Bank account balance:	Stanbic -MK10,000	
Membership fee	MK1,000 /member/season					

7. Farming

1) Main crops & cropping pattern	month	main crop
Wet (summer) crop	Dec. - Mar.	Maize-beans mixed (rain-fed), tobacco, soybeans, cassava, sugarcane
Dry (winter) crop	May - Oct.	Beans, maize (dry / green), Irish potato, onion, tomato

2) Crop data	BM (Wet 2006/07)	BM (Dry 2006)		Wet 2007/08		Dry 2008
Area planted / harvested (ha)	8.30	1.00 (watering can)		6.23	5.25	5.16 / 2.77
Maize yield -hybrid / local (ton/ha)	Maize: 2.8	Maize: 1.9		4.60	1.40	Maize: 0
Other crops (ton/ha)		Tomato	2.80	S. potato	9.50	Tomato: 3.75
		Beans	0.70	Beans	2.50	Beans: 0.40
3) Net Farm Income (MK/ha)		19,336				9,655

8. Irrigation System

1) Water source: Luwelezi river, tributary of Dwangwa river
2) Water availability: Available throughout of year
3) Water delivery system: Before rehab: stream water - M.pump - delivery pipe - sprinkler system - farmland,
After rehab: stream water - M.pump - delivery pipe - discharge box - brick-lined canal - outlets - farmland
4) Water distribution system: After rehab: to be rotational distribution through open canal.

9. Natural Condition / Constraints

Flood / soils / others: Floods near to the stream in Jan-Feb. Sandy soil, Market day: None

10. Technical Feature

1) Intake pump: 1 portable pump (D=140mm) + diesel engine (41 HP) India made - repaired, suction pipe is okay.
2) Sprinkler system (old): Delivery pipe: aluminum D=140mm, Sprinkler set - not use after rehabilitation
3) Canal system (new): Delivery pipe (alumi. D=140mm, L=200m), + discharge box + brick-lined open canal

11. Rehabilitation Work

1) Work items: 1) repair & test operation of pump & diesel engine, 2) discharge pipeline alumi. D=140mm L=200m & discharge box, 3) main canal - brick-lined L=300m

2) Work & cost sharing	Inputs (planned)	Undertaking (agreed)	Actual		
1. Labor (unskilled)	545 man-day	community	done		
2. Labor (skilled)	125 man-day	community	done		
3. Material (local)	bricks-17700, sand-5m3	community	done		
4. Material (outside)	cement (105), PVC (3)	community-10 + JICA-95	done (5/85)	Cost sharing (MK)	
5. Equipment (engine repair)	spare parts, test operation	DOI/JICA	done	1) JICA	362,000
6. Transportation (with driver)	oxcart	community/EPA	EPA+JICA		62%
7. Fuel for transportation	not needed	not needed	JICA	2) GOM	43,000
8. Technical supervision	30 days	AEDO/IO/Committee	done		7.4%
3) Other inputs				3) Farmer G.	175,000
1. For farmers:	Working tools,	community/EPA/JICA	done		30%
2. For AEDO, AEDC & IO:	Supervision tools,	JICA - bicycles, etc.	done	Total (MK)	580,000
					(72,500 MK/ha)

4) Rehabilitation period: Plan: Aug. - Sept. 2007 — Total days: 30 days from Aug 24
Actual: Aug. 21 - Oct. 15 — Total days: 8 weeks

12. Note

As of March 2009, FICA has tried to convert the pump irrigation system to a gravity fed system tapping water from 2-4 km upstream the stream. Alingnment susvey has been made.

Table A3-5 (3/8) Profile of Verification Site - Kas-46 Chiwoza Dam

1. Scheme Name	**Kas-46 Chiwoza Dam**				**Kasungu District**		
Contact person:	AEDC- Mr. Baloy (cell 09-340 611), AAEDC/AEDO- Mr. Msunje (09-496699), Assist DADO Mr. Lungl						
	Farmer Group- Mr. Byton Banda (09-490603)						
	IO DADO- Mr. BGK Banda (09-283677), AIO Mr. Mabedi (09-479909), Miss Mtoso (09-885585)						
2. Location	Kasungu ADD - Kasungu District - Chulu EPA - Chulu South Section						
Distance from Lilongwe:	Lilongwe -(133km)- Kasungu - (in summer: 25km)- M1 turn-off at Mbhomwa -(19km earth)- EPA -(9km earth)- Site						
	In winter route: Kasungu -(3km)- M1 turn-off -(26km earth)- Site -(9km earth)- EPA						
3. Scheme Type	Water impounding dam (earth dam)						
4. Irrigation Service Area	Current before rehab = 3.5 ha in dry s.				Potential =	10 ha (Right-6 ha, Left-4 ha)	
	Scheme area in dry s. (irrigation) = 0.10 ha/farmer						
	Upland area in wet s. (rain-fed) = 0.72 ha/farmer (1.6 - 2 acre)						
5. Year Built & History	In July 1962, built the dam by Colonial government						
	Started with w/can, in 2000 provided treadle pumps by DANIDA, in 2006 got 1 motorized pump from MASAF, GoM.						
6. WUA							
1) Date of registration	not yet						
2) No. of members	63	Men =	28	Women =	35		
3) No. of committee members	EC-10	Men =	5	Women =	5	Chairman: Mr. Gift Muyayi	
4) No. of villages & Name	11	Name:	Chiwoza, Chitedze, Zolomondo, Chikuni, Chafwamba, and others				
5) Name of TA/VHM/ethnic group	TA: Chulu	GVH: Chiwoza, Mr. Fecher				Ethnic: Chewa/ Tumbka (major)	
6) Irrigation service fee							
Entry fee	MK1500	Bank account balance:	OIBM- MK32,000				
Irrigation fee	MK30 /plot						
7. Farming							
1) Main crops & cropping pattern	month	main crop					
Wet (summer) crop	Nov. - Mar.	Maize, tomato, beans, tobacco					
Dry (winter) crop	April - Oct.	Green maize, cabbage, tomato, paprika, other vegetables					

2) Crop data	BM (Wet 2006/07)	BM (Dry 2006)		Wet 2007/08		Dry 2008
Area planted / harvested (ha)	6.70	3.50		5.93	5.78	5.08
Maize yield -hybrid / local (ton/ha)	Maize: 5.3	Maize: 1.43		4.05	-	Maize: 4.2
Other crops (ton/ha)		Cabbage	11.25	Beans	2.10	Cabbage: 8.50
		Tomato	1.50	Tomato	7.90	Tomato: 8.80
				Paprika	2.50	Paprika: 2.00
3) Net Farm Income (MK/ha)		7,595				188,024

8. Irrigation System							
1) Water source	Chisuwe river, tributary of Dwangwa river						
2) Water availability	Available up to Sept., in-flow water up to April						
3) Water delivery system	(1) Dam water - gate valve - delivery pipes - farmland, (2) Dam water - M.pump - main canal brick-lined (R/L banks) - outlets - farmland, (3) Dug well - T.pumps - farmland,						
4) Water distribution system	7-day interval for 5 irrigation blocks. Monday to Friday on irrigation for 1 day - 1block						
9. Natural Condition / Constraints							
Flood / soils / others:	Scarce in-flow water to dam after May. Sandy soil					Market day: Wednesday	
10. Technical Feature							
1) Earth dam	Dam length L=100m, heavily silted, 2 spillways (mechanical & emergency) repaired, outlet pipe repaired, gate valve being functioned.						
2) Motorized pump	1 pump x D=90mm x 10 HP, Q= 15 lit/sec, used since 2006 winter cropping.						
3) Treadle pump	25 T.pumps operational						
4) Intake facility	Dam - outlet pipe (D=100mm, L=27m) - gate valve - PVC/flat pipes for delivery						
5) Irrigation canal							
Main canal:	Right bank (L=250m earth include L=71m brick-lined), left bank (250m earth) being improved by farmers sometimes, Several outlets exist and improved.						
11. Rehabilitation Work							
1) Work items	1) de-silting from dam (200 m3), 2) repair of spillway (33 m3), 3) repair of main canal with brick-lined (100m), 2 drops & outlets.						

2) Work & cost sharing	Inputs (planned)	Undertaking (agreed)	Actual		
1. Labor (unskilled)	960 man-day	farmer group	done		
2. Labor (skilled)	108 man-day	farmer group	done		
3. Material (local)	sand, bricks, stones	farmer group	done	Cost sharing (MK)	
4. Material (outside)	cement (165), PVC pipes (2)	farmer group + JICA	done (206)	1) JICA	729,000
5. Transportation (with driver)	1 lorry -3 days	DADO	done+JICA		56%
6. Fuel for transportation	diesel - 190 lit	JICA	done	2) GOM	126,000
7. Technical supervision	5 weeks	AEDO/IO/Committee	done		9.6%
3) Other inputs				3) Farmer G.	455,000
1. For farmers (tools):	Working tools,	community/JICA	done		35%
2. For AEDO, AEDC & IO:	Supervision tools,	JICA - bicycles, etc.	done	Total (MK)	1,310,000
					(131,000 MK/ha)

4) Rehabilitation period				
Plan:	Oct. - Nov. 2007	Total days:	5 weeks from Oct. 12	
Actual:	Oct. 15 - Nov. 24	Total days:	6 weeks	

12. Note
Main problem is heavy siltation of dam thus continuous de-silting is needed in future.

Table A3-5 (4/8) Profile of Verification Site - Kas-40 Kachere

1. Scheme Name	**Kas-40 Kachere**	**Kasungu District**
Contact person:	AEDO- Mr. P.D. Matatiyo (cell 09-318 057), AEDC- Mr. N.A. Mbale (cell 09-448308)	
	Farmer Group- TA Chambwe (04-030057), Mr. Duncan (05-382390)	
	IO DADO- Mr. BGK Banda (09-283677), AIO Mr. Mabedi (09-479909), Miss Mtoso (09-885585)	
2. Location	Kasungu ADD - Kasungu District - Chipala EPA - Kadifula Section	
Distance from Lilongwe:	Lilongwe -(133km M1)- Kasungu DADO -(2km M18)- M18 turn-off -(7km)- end tarmac -(19km earth thru Kadifula)- Chambwe -(3km)- site	
	Alternative: M1 Madisi turn-off -(32km earth thru Bowe & BUA bridge) - Chambwe - (3km) - site	
3. Scheme Type	Motorized pump with pipeline / surface irrigation	
4. Irrigation Service Area	Current before rehab = 0.0 ha in dry s.	Potential = 6.4 ha
	Scheme area in dry s. (irrigation) = 0.10 ha/farmer	
	Upland area in wet s. (rain-fed) = 2.80 ha/farmer (3-4 acre) + 0.10 ha in Dambo area	
5. Year Built & History	In 2006, supported by MASAF through District Assembly for 2 pumps together with starter packs for diesel, seeds & fertilizer. Only after one dry season operation in 2006, two pumps were broken down.	

6. WUA

1) Date of registration	not yet		Only registered to DADO office as Irrigation Club			
2) No. of members	100	Men =	60	Women =	40	
3) No. of committee members	12	Men =	8	Women =	4	Chairman: Mr. Fordson Phiri
4) No. of villages & Name	11	Name:	Nkokotere, Esav, Udungama, Mthupi, etc.			
5) Name of TA/VHM/ethnic group	TA: Chambwe (Sub TA)	GVH: Nkokotere			Ethnic: Chewa	
6) Irrigation service fee						
Entry fee	MK100		Bank account balance:		OIPM - MK2,320	
Membership fee	MK500 /year					

7. Farming

1) Main crops & cropping pattern	month	main crop
Wet (summer) crop	Nov - Mar	Maize (rain-fed), planted area is minimal due to water-logging
Dry (winter) crop	May - Nov.	Maize 75%, others 25% - Irish potato, tomato, onion, cabbage

2) Crop data	BM (Wet 2006/07)	BM (Dry 2007)	Wet 2007/08		Dry 2008
Area planted / harvested (ha)	2.30	0.00	1.26	1.26	3.17
Maize yield -hybrid / local (ton/ha)	Maize: 2.8	0.00	5.20	2.40	Maize: 4.0
Other crops (ton/ha)			(None)		Tomato: 7.70
3) Net Farm Income (MK/ha)		0			105,980

8. Irrigation System

1) Water source	Direct from Bua river
2) Water availability	Throughout of year
3) Water delivery system	Bua river - 2 M.pumps - 2 pipelines - 2 discharge boxes - main canal (brick-lined) - turn-outs - farm diches (earth) - farmland
4) Water distribution system	After rehab: to be rotational distribution through open canal.

9. Natural Condition / Constraints

Flood / soils / others: Floods & swamped near to Bua river in wet season. Market day: at Chambwe

10. Technical Feature

1) Intake pump: 2 portable pumps (D=90mm) + diesel engine (10HP, 1500rpm), Q= 15 lit/sec, Fuel consumption= 2.5 lit/hr, Valliant-India made. Both of them were repaired.

2) Irrigation canal

Delivery pipeline: PVC pipes (D=90mm, L=138m - 23 pc x 6m)

Main canal: Brick-lined open canal

11. Rehabilitation Work

1) Work items: 1) repair 2 engines, 2) discharge pipeline L=180m, 3) 2 discharge boxes with brick masonry, 4) repair of main canal with brick-lined L=300m

2) Work & cost sharing	Inputs (planned)	Undertaking (agreed)	Actual		
1. Labor (unskilled)	750 man-day	community	done		
2. Labor (skilled)	65 man-day	community	done		
3. Material (local)	bricks-18500, sand-4.2 m3	community	done		
4. Material (outside)	cement (55), PVC pipe (38)	community-10 + JICA-45	done(10/100)	Cost sharing (MK)	
5. Equipment (repair)	parts, test operation	DOI/JICA	done	1) JICA	432,000
6. Transportation (with driver)	lorry - 6 days	ADD	JICA		46%
7. Fuel for transportation	diesel - 100 lit	JICA	done	2) GOM	56,000
8. Technical supervision	30 days	AEDO/IO/Committee	done		5.9%
3) Other inputs				3) Farmer G.	460,000
1. For farmers:	Working tools,	community/JICA	done		49%
2. For AEDO, AEDC & IO:	Supervision tools,	JICA - bicycles, etc.	done	Total (MK)	948,000
					(148,125 MK/ha)

4) Rehabilitation period				
Plan:	Aug. - Sept. 2007	Total days:	30 days from Aug. 22	
Actual:	Aug. 18 - Oct. 11	Total days:	4 weeks	

12. Note

Only one winter cropping in 2006 was practiced with 2 pumps, thus farmers are not familiarized yet in irrigated agriculture particularly in pump operation and water distribution.

Table A3-5 (5/8) Profile of Verification Site - Kas-47 Titukulane

1. Scheme Name	**Kas-47 Titukulane**				**Dowa District**		
Contact person:	AEDO-Miss Joyce Phiri (09-639887), AEDC- Mr. M. Ndalama Phiri (09-645996)						
	Farmer Group- Mr. Njobvu (05793692)						
	AIO of Dowa DADO (Mponela)- Mr. Banis (09-330753), ADADO- Mr. Mphanda (09-218315)						
2. Location	Kasungu ADD - Dowa District - Natchisaka EPA - Topaidzi Section						
Distance from Lilongwe:	Lilongwe -(30km M1)- M1 Dowa turn-off -(21km earth)- Dowa -(10km earth)- site,						
	Alternative: Mphonela on M1 -(33km earth thru passing by EPA office)- site						
3. Scheme Type	River diversion weir						
4. Irrigation Service Area	Current before rehab = 1.0 ha in dry s. Potential = 7 ha						
	Scheme area in dry s. (irrigation) = 0.10 ha/farmer						
	Upland area in wet s. (rain-fed) = 1.00 ha/farmer						
5. Year Built & History	Initially initiated by farmers, then in 2002 stone masonry weir was built under MASAF. After 5-year operation, in 2007 right-abutment of weir & intake was scored & collapsed by floods.						
6. WUA							
1) Date of registration	not yet						
2) No. of members	64	Men =	54	Women =	10		
3) No. of committee members	EC-10	Men =	6	Women =	4	Chairman: Mr. Goriati Nyoawe	
4) No. of villages & Name		Name:	Kalikwembe, Topaizi, Zolire				
5) Name of TA/VHM/ethnic group	TA: Maskambewa	GVH: Kalikwembe				Ethnic: Chewa	
6) Irrigation service fee							
Entry fee	MK300			Bank account balance:	MK1,005		
Membership fee	MK100/year				Saving Bank Dowa		
7. Farming							
1) Main crops & cropping pattern	month	main crop					
Wet (summer) crop	Dec. - Mar.	Maize, tomato, tobacco					
Dry (winter) crop	May - Nov.	Maize, tomato, cabbage, onion, Irish potato					

2) Crop data	BM (Wet 2006/07)	BM (Dry 2007)		Wet 2007/08		Dry 2008
Area planted / harvested (ha)	4.10	1.00		5.90	5.90	8.01
Maize yield -hybrid / local (ton/ha)	Maize: 3.1	Maize: 2.4		2.50	1.30	Maize: 4.0
Other crops (ton/ha)		I.potato	4.50	Tobacco	1.23	Tomato: 7.35
				S. potato	4.80	I. Potato: 2.70
				Ground nuts	0.95	Mustard: 3.50
3) Net Farm Income (MK/ha)		47,296				185,910

8. Irrigation System	
1) Water source	Topaizi stream - Mzami River, tributary of Lingadzi River
2) Water availability	Available throughout of year
3) Water delivery system	Stream water - weir (stone masonry) - main canal (earth) - outlets - farmland
4) Water distribution system	Before rehab: simple rotation system by cropping block
	After rehab: to be rotational distribution through open canal by cropping block.
9. Natural Condition / Constraints	
Flood / soils / others:	Floods in Mzami river in Jan - Feb
Market day:	None
10. Technical Feature	
1) Intake weir	Stone masonry weir partially broken and eroded at right bank by flood in 2007, needs repair of weir and canal intake.
2) Irrigation canal	
Main canal:	Earth canal L=4 km
Secondary / tertiary canal:	None
Number of turn-outs:	Many

11. Rehabilitation Work

1) Work items: 1) Repair of diversion weir & intake (21 m3), 2) repair of gully crossings (2)

2) Work & cost sharing	Inputs (planned)	Undertaking (agreed)	Actual		
1. Labor (unskilled)	250 man-day	farmer group	done		
2. Labor (skilled)	60 man-day	farmer group	done		
3. Material (local)	stones, sand, bamboo	farmer group	done	Cost sharing (MK)	
4. Material (outside)	cement (100), pipe, gabion	JICA /farmer group	JICA (107)	1) JICA	706,000
5. Transportation (with driver)	lorry 7ton	Dowa DADO	done		60%
6. Fuel for transportation	60 lit	JICA	done	2) GOM	92,000
7. Technical supervision	20 days	AEDO/IO/Committee	done		7.8%
3) Other inputs				3) Farmer G.	377,000
1. For farmers:	working tools,	community /JICA	done		32%
2. For AEDO, AEDC & IO:	supervision tools,	JICA - bicycles, etc.	done	Total (MK)	1,175,000
					(167,857 MK/ha)

4) Rehabilitation period				
Plan:	Oct. - Nov. 2007	Total days:	3 weeks from Oct. 22	
Actual:	Oct. 23 - Nov. 25	Total days:	4 weeks	

12. Note

Table A3-5 (6/8) Profile of Verification Site - Li-2 Chaseta

1. Scheme Name	**Li-2 Chaseta**				**Lilongwe District**		
Contact person:	AEDO- Mr. B.S. Kaunda (cell 09-104 888), AEDC- Mr. H.J. Msiska (cell 08-528 953)						
	Farmer Group- ?? (09-624077)						
	AIO DADO- Mr. Kumasala (08-304319), AIO- Mr. Mkaka (09-329524), Mr. Ligowe (09-673029)						
2. Location	Lilongwe ADD - Lilongwe District - Mlomba EPA - Diamphwi Section						
Distance from Lilongwe:	Lilongwe ADD -(9km M1)- M1 Bunda turn-off -(14km tarmac + 12km earth)- EPA at Mitundu -(6km earth)- site						
3. Scheme Type	Motorized pump with surface irrigation (pipeline + canal)						
4. Irrigation Service Area	Current before rehab =	7.9 ha in dry s. by watering can			Potential =	12 ha	
	Scheme area in dry s. (irrigation) =	0.04 ha/farmer					
	Upland area in wet s. (rain-fed) =	1.00 ha/farmer + 0.30 ha in Dambo area					
5. Year Built & History	In 1997, provided a pump set by GOM, then just operated for 1 year only. Not used since 1999 when pump was burned and suction pipe was broken down.						
6. WUA							
1) Date of registration	not yet	presently called as irrigation club					
2) No. of members	150	Men =	35	Women =	115		
3) No. of committee members	EC-10	Men =	6	Women =	4	Chairman: Mr. Chalos Mbewe	
4) No. of villages & Name	1	Name:	Chaseta, with 11 sub-villages				
5) Name of TA/VHM/ethnic group	TA: Chiseka	GVH:Mgombe			Ethnic: Chewa		
6) Irrigation service fee							
Entry fee	None	Bank account balance:					
Membership fee	MK130 /plot/year						
Irrigation fee	MK250 /member/season						
7. Farming							
1) Main crops & cropping pattern	month	main crop					
Wet (summer) crop	Dec. - Apr.	Maize, tomato, rice					
Dry (winter) crop	May - Nov.	Maize, vegetables, Irish potato, tomato					

2) Crop data	BM (Wet 2006/07)	BM (Dry 2006)		Wet 2007/08		Dry 2008
Area planted / harvested (ha)	6.70	7.90		6.60	6.04	9.88
Maize yield -hybrid / local (ton/ha)	Maize: 1.4	Maize: 1.6		3.60	-	Maize: 3.4
Other crops (ton/ha)		I. potato	2.50	Rice	0.81	I. Potato: 5.00
				Cabbage	7.40	Tomato: 5.2
				Pigeon peas	1.20	Peas: 2.20
3) Net Farm Income (MK/ha)		24,572				127,556

8. Irrigation System							
1) Water source	Diamphwe river, tributary of Lilongwe river						
2) Water availability	Available throughout of year						
3) Water delivery system	Previous: stream water - M.pump - delivery pipeline - sprinkler system - farmland,						
	Future: stream water - M.pump - delivery pipeline - discharge box - open canal - outlets - farmland						
4) Water distribution system	After rehab: to be rotational distribution through open canal.						
9. Natural Condition / Constraints							
Flood / soils / others:	High groundwater levels & swamped - water-logging			Market day:	Wed. & Sat at Mitundu		
10. Technical Feature							
1) Intake pump	1 new pump (D=100mm) & diesel engine (20HP) from Italy, suction pipe, discharge pipe provided.						
2) Irrigation canal							
Delivery pipes:	PVC pipes (D=140mm - 100mm - 70mm, L=6mx25pie, 6mx33pie, 6mx15pie)						
Distribution canal:	Earth canal						
11. Rehabilitation Work							
1) Work items	1) replace of a pump & engine with suction pipe, 2) delivery pipeline (410m), 3) discharge box, 4) canal - brick-lined (150m)						

2) Work & cost sharing	Inputs (planned)	Undertaking (agreed)	Actual		
1. Labor (unskilled)	320 man-day	members	done		
2. Labor (skilled)	58 man-day	members	done		
3. Material (local)	sand, bricks-12500 pc	members	done		
4. Material (outside)	cement (35), PVC pipe (15)	JICA	done (80)	Cost sharing (MK)	
5. Equipment (new)	1 pump, engine, foot valve	JICA/DOI	done	1) JICA	976,000
6. Transportation (with driver)	None	-	JICA		85%
7. Fuel for transportation	None	-	JICA	2) GOM	55,000
8. Technical supervision	3 weeks	AEDO/IO/Committee	done		4.8%
3) Other inputs				3) Farmer G.	112,000
1. For farmers:	Working tools,	community/JICA	done+EPA		10%
2. For AEDO, AEDC & IO:	Supervision tools,	JICA - bicycles, etc.	done	Total (MK)	1,143,000
					(95,250 MK/ha)

4) Rehabilitation period				
	Plan:	Oct. - Nov. 2007	Total days:	3 weeks, Oct. 25 - Nov. 16
	Actual:	Oct. 25 - Nov. 30	Total days:	5 weeks

12. Note

Currently rain-fed cropping in summer and watering can in winter since 1999 when pump/engine were burned. Only experienced for 1 year, then no practice pump operation for 7 years, thus restoration to irrigated agriculture with pump in dry season will be big challenge.

Table A3-5 (7/8) Profile of Verification Site - Li-21 Bawi

1 Scheme Name	**Li-21 Bawi**	**Ntcheu District**
Contact person:	AEDO- Mr. Harrison Munthali (cell 08-738029), AEDC- Mr. Khaonga (cell 09 227 825)	
	Farmer Group- Mr. Mangulenje (09-917123), Mr. Alex Juwawo (05-604963) Chairman	
	IO of DADO- Mr. Cheyo (08-133524), SAIO- Mr. Chawinga (08-144215)	
2 Location	Lilongwe ADD - Ntcheu District - Manjawira EPA - Bawi Section	
Distance from Lilongwe:	Lilongwe -(161km M1)- Ntcheu DADO -(4km)- Ntcheu -(29km)- M1 turn-off -(1km) - site	
3 Scheme Type	River diversion weir	
4 Irrigation Service Area	Current before rehab = 6.3 ha in dry s. (No.5-3.5, No.7-2.8)	Potential = 6.3 ha
	Scheme area in dry s. (irrigation) = 0.10 ha/farmer	
	Upland area in wet s. (rain-fed) = 0.60 ha/farmer	
5 Year Built & History	1949, started with temporary weirs by farmers themselves. 12 weirs there for Bawi Club. In 2003, 2 stone masonry weirs (No.5 & No.7) were built under Public Work Program (EU), then in 2005 they were collapsed (No.5) & damaged (No.7) by floods.	
6 WUA		
1) Date of registration	not yet	
2) No. of members	49	No.5= 23 = M (13) +F (10) No.7= 26 = M(15) +F(11)
3) No. of committee members	No.5 General Committee: 3 = M (2) +F (1)	Chairman: Mr. Mangulenje
	No.7 General Committee: 5 = M (4) +F (1)	Chairman: Mr. Alex Juwawo
4) No. of villages & Name	3	Name: No.5 - Adam, No.7 - Sontchaya, Tokonasu
5) Name of TA/VHM/ethnic group	TA: Makwangwala	GVH: Gwaza / Kuthakwangi Ethnic: Ngoni
6) Irrigation service fee		
Entry fee	None	Bank account balance: MK77,000
Membership fee	MK500 /dry season	

7 Farming

1) Main crops & cropping pattern	month	main crop
Wet (summer) crop	Dec. - Apr.	Maize, tobacco, cabbage, beans
Dry (winter) crop	May - Nov.	Green maize , sweet potato, beans, sugarcane, citrus,

2) Crop data	BM (Wet 2006/07)		BM (Dry 2006)		Wet 2007/08		Dry 2008
Area planted / harvested (ha)	4.10		6.30		6.90	6.75	6.74
Maize yield -hybrid / local (ton/ha)	Maize: 3.2		Maize: 1.4		1.95	-	Maize: 3.4
Other crops (ton/ha)			Tomato	7.20	Tobacco	1.19	Tomato: 9.00
			Mustard	2.50	S. potato	3.60	S.Potato: 13.89
					Ground nuts	0.80	Cabbage: 8.7
3) Net Farm Income (MK/ha)			52,642				127,027

8 Irrigation System

1) Water source	Bawi river, tributary of Riviridze river down to Shire river
2) Water availability	Available throughout of year
3) Water delivery system	Stream water - weir (stone masonry) - canal (earth) - outlets - farmland
4) Water distribution system	None

9 Natural Condition / Constraints

Flood / soils / others: Floods in Bawi river in Jan. - Feb. Market day: None

10 Technical Feature

1) Intake weir: 2 stone masonry weirs named Mangulenje (No.5) and Adam (No.7) with the length of 5 m and 7 m. Weir No. 5 was repaired and No.7 was re-built attaching pipe intake structure to the both.

2) Irrigation canal

Main canal: All earth canal, No.5 main canal L=1.5 km, No.7 L= 1.8 km

Secondary / tertiary canal: None

Number of outlets: Many direct outlets from main canal to farmland

11 Rehabilitation Work

1) Work items: 1) construction of No.7 masonry weir with intake, 2) repair of No.5 masonry weir with intake,

2) Work & cost sharing

	Inputs (planned)	Undertaking (agreed)	Actual		
1. Labor (unskilled)	335 man-day	community	done		
2. Labor (skilled)	104 man-day	community	done		
3. Material (local)	stones, sand, bamboo	community	done	Cost sharing (MK)	
4. Material (outside)	cement (160), gabion, PVC	community + JICA	done (4/237)	1) JICA	886,000
5. Transportation (with driver)	1 pick-up-20 days	District Assembly	DA+JICA		68%
6. Fuel for transportation	diesel -130 lit	JICA	done	2) GOM	164,000
7. Technical supervision	30 days	AEDO/IO/Committee	done		12.6%
3) Other inputs				3) Farmer G.	252,000
1. For farmers:	Working tools,	community/JICA	done+EPA		19%
2. For AEDO, AEDC & IO:	Supervision tools,	JICA - bicycles, etc.	done	Total (MK)	1,302,000
					(206,667 MK/ha)

4) Rehabilitation period

Plan:	Aug. - Sept. 2007	Total days:	30 days from Aug. 13
Actual:	Aug. 20 - Nov. 25	Total days:	9 weeks

12 Note

No.4 weir, used to be a brush dam located upstream of No.5 weir, was built by farmers themselves with stone masonry using 2 bags of cement in November 2007 and it was collapsed on 20 January 2008 by floods due to absence of engineering.

Table A3-5 (8/8) Profile of Verification Site - Ma-1 Chibwana

1. Scheme Name	**Ma-1 Chibwana**				**Machinga District**		
Contact person:	AEDO- Mr. Chodzadza, AEDC- Mr. Alabi (cell 08-569 308)						
	DADO- Mr. Gondwe (01-544-017), ADADO- Mr. M.D. Cheyo, IO- Mr. Chiwayula (09-313 748)						
2. Location	Machinga ADD - Machinga District - Nsanama EPA - Chibwana Section						
Distance from Lilongwe:	Lilongwe -(237km M1 & M8)- Liwonde -(27km S131 tarmac)- S131 turn-off -(8km earth)- site, Ntaja (Machinga DADO) -(17km S131 tarmac)- Nsanama EPA -(6km S131)- S131 turn-off						
3. Scheme Type	River diversion weir						
4. Irrigation Service Area	Current before rehab = 20.6 ha in dry s.				Potential =	85 ha in wet s, 34 ha in dry s.	
	Scheme area in dry s. (irrigation) = 0.50 ha/farmer						
	Upland area in wet s. (rain-fed) = 0.60 ha/farmer						
5. Year Built & History	Initially scheme started in 1979 umder support of GOM. In 2005 December, irrigation system was improved under IFAD assistance.						
6. WUA							
1) Date of registration	not yet						
2) No. of members	212	Men =	102	Women =	110		
3) No. of committee members	EC-10	Men =	6	Women =	4	Chairman: Mr. Nicks Tapwata	
4) No. of villages & Name	13	Name:	Chibwana, Katema, Solokoto, Mbwana, Right Nsinjri, etc.				
5) Name of TA/VHM/ethnic group	TA: Mlomba	GVH: Chibwana			Ethnic: Yao (Muslim)		
6) Irrigation service fee							
Entry fee	MK500			Bank account balance:	No account		
Membership fee	Plot fee: MK1,000 /0.1 ha						
7. Farming							
1) Main crops & cropping pattern	month	main crop					
Wet (summer) crop	Dec. - April	Rice - Most areas under rain-fed, only areas along canal under irrigation					
Dry (winter) crop	June - Nov.	Maize					

2) Crop data	BM (Wet 2006/07)		BM (Dry 2006)		Wet 2007/08		Dry 2008
Area planted / harvested (ha)	73.80		20.60		63.00	61.00	34.85
Yield of main crops (ton/ha)	Rice	2.30	Maize	2.40	Rice	2.50	Maize: 3.20
Other crops (ton/ha)			Rice	2.40	(None)		Rice: 5.00
			Pumpkin lea.	0.90			Pumpkin lea.: 2.00
							Tomato: 6.00
3) Net Farm Income (MK/ha)			26,277				118,594

8. Irrigation System							
1) Water source	Sumulu River flowing down to Lake Chilwa						
2) Water availability	Throughout of year						
	Water right arrangement with other scheme: Previously water allocation with Sumulu (3days) - Chibwana (3days)						
3) Water delivery system	Weir (gabion) - intake gate (steel) - main canal - turn-out - secondary canal - farm inlet						
4) Water distribution system	After rehab: to be rotational distribution through main canal by secondary canal.						
9. Natural Condition / Constraints					Market day:	None	
Flood / soils / others:	Lowland (egdge of swamp - Lake Chilwa), Flooded sometimes in Jan.-Feb. from Sumulu River						
10. Technical Feature							
1) Diversion weir	Diversion gabion - repaired, intake gate (steel sluice gate 1.0m x 1.0m - broken in Jan 2008) - replaced						
2) Irrigation canal							
Main canal:	800 m with lined, 1.35 km with earth canal						
Secondary / tertiary canal:	6 secondary canals						
Number of turn-outs:	6 turn-out structures with stoplog at main canal						
11. Rehabilitation Work							
1) Work items	1) intake weir rehab -Gabion 20 m3, 2) repair of turn-outs of main canal & parts of secondary canals, 3) repair of flood protection bund (50m)						

2) Work & cost sharing	Inputs (planned)	Undertaking (agreed)	Actual		
1. Labor (unskilled)	462 man-day	community	done		
2. Labor (skilled)	36 man-day	community	done		
3. Material (local)	stones, sand, bricks	community	done	Cost sharing (MK)	
4. Material (outside)	gabion wire, cement (40)	JICA	done (50)	1) JICA	542,000
5. Transportation (with driver)	Lorry	ADD/DADO	JICA		67%
6. Fuel for transportation	400 lit	JICA	done	2) GOM	61,000
7. Technical supervision	5 weeks	AEDO//IO/Committee	done		7.6%
3) Other inputs				3) Farmer G.	203,000
1. For farmers:	Working tools,	community/JICA	done		25%
2. For AEDO, AEDC & IO:	Supervision tools,	JICA - bicycles, etc.	done	Total (MK)	806,000
					(9,482 MK/ha)

4) Rehabilitation period				
	Plan:	Sept. - Oct. 2007	Total days:	5 weeks from Oct 16
	Actual:	Oct. 18, 2007 - Jan. 2008	Total days:	2 months (actual period)

12. Note

Table A3-6 Existing Medium-Scale Irrigation Schemes as surveyed under Donors' Activty Survey

	ID No	Name of Scheme	District	EPA	Technology	GoM/ Donors/ NGOs	Current Area (ha)	Potential Area (ha)	Beneficiary	Condition of the Scheme
	LILONGWE ADD									
1	Li-1	Mchenga	Lilongwe	Mpenu	Motorised pump	Israel/USA	0	8	63	Need rehabilitation
2	Li-3	Balang'ombe / Kasandulika	Lilongwe	Chiwamba	Impounding dam	GoM/MASAF (WB)	3	10	200	Need rehabilitation
	KARONGA ADD									
3	Ka-2	Chonanga	Karonga	Vinthukutu	River diversion	GoM / IFAD (WB)	35	50	79	Good condition growing rice
4	Ka-6	Miyombo	Karonga	South Kaporo	Motorised pump	IFAD	10	10	28	Just constructed as of Feb 2007, not yet operational
5	Ka-33	Mpale	Chitipa	Chisenga	Earth dam	Gom/HIPIC (ADB)	24	25	869	Not functioning
	KASUNGU ADD									
6	Kas-4	Kaombe	Ntchisi	Chikwatula	River diversion	FAO	10	10	45	Operational
7	Kas-37	Kasinjeni	Kasungu	Kuchipala	Motorised pump	GoM / MASAF	7.5	18	32	Operational
	SALIMA ADD									
8	Sa-2	Kaombe	Nkhota kota	Linga	Motorised pump	GoM / IFAD (WB)	0	80	282	Not Operational
9	Sa-3	Kasitu	Nkhota kota	Nkhunga	River diversion	GoM / IFAD (WB)	35	55	136	Operational
10	Sa-8	Ngolowindo	Salima		Motorised pump	GoM / EU-COSPE	17	17	169	Operational
11	Sa-11	Gola	Salima	Chipoka	Inland canal with treadle pump	ADB/HIPC	0	10	120	Not Operational
	MACHINGA ADD									
12	Ma-1	Zumulu	Machinga	Nsanama	River diversion	GoM / IFAD (WB)	85	85	212	It is in good condition
13	Ma-20	Khwisa	Balaka		River diversion with polders	GoM / IFAD (WB)	78	113	367	The weir was washed away

Table A3-7 Outlines of Identified Issues on Donors' Activity Survey

Irrigation Scheme	Lessons Learnt through Donors' Support	Major Problems Encountered	Countermeasures to be solved
Mchenga (Li-1) (Motorized pump)	**From AEDC/AEDO:**		
	- Declination of established farmer organization when Donors' supports are terminated - Poor leadership of group	- Lack of marketing knowledge and systems - High running and maintenance costs of pumps - Mismanagement of funds	- More support of input materials by GOM - No continuous support by Donors
	From Farmers :		
	- Learning of agronomic skills was lacking - Educational support for adult learning and malnutrition program - Spirit of hard working, but they have no time to waste	- Engine failure - No effective utilization of sprinkler during windy seasons - Water leakage from gadgets and pipes - Poor management skill of extension workers	- Change of irrigation schemes from sprinkler systems to furrow systems with provision of water tanks at the top of hill
Balang'ombe(Li-3) (Water impounding dam)	**From AEDC/AEDO :**		
	- Need coordination of program with participation of relevant stakeholders	- Lack of communication - Lack of local government staff	- Orientation of programs to staff and technical peoples - Implementation of program on time - Need of good planning
	From Farmers :		
	- Government considerations to uplift living standards of local people - Findings of farmers potential to implement project with donors support are important.	- Washed away of dams - No payment for works as agreed - Taking away of construction materials by GOM - No dam construction expert - Insufficient equipment and labors	- Needs of a new committee - Needs of technical expert and support - Needs of construction materials, e.g. cement - Needs of finance for construction
Chonanga (Ka-2) (River diversion weir)	**From Irrigation Officers, AEDC/AEDO :**		
	- Farmers attitude towards changed farming - Improved farmers organization - Insufficient honor of Donors - Trainings provided by Donors	- Slow adoption of technology - Not enough participation in work activities - No financial contribution by farmers - Limited market points	- Starting of training for local leaders - Intensification of capacity building - Training on O&M of the scheme - Preparation of maintenance funds
	From Farmers :		
	Solidarity of improved yields - Realization of benefits of crops and animal diversification - Integration of irrigated agriculture - Realization of importance for farming calendar - Realization of group procurements of production materials - Changing and shifting from barter trade system	- Low price of rice - Failed agreement for participatory agreement - Participatory completion of facilities - Lack of backing shade (warehouse) - Suspended pipes across the river and no properly implementation of drainage systems	- Improved drainage systems - Adequate protection of pipes crossing the river - Construction of protection bands, access roads, bridges to the schemes - Needs of training and learning of contract management and cooperatives - Improved cooperation among members
Miyombo (Ka-6)	**From Irrigation Officers, AEDC/AEDO :**		

Irrigation Scheme	Lessons Learnt through Donors' Support	Major Problems Encountered	Countermeasures to be solved
(Motorized pump)	- Planning and implementation of organization set-up are important - Strengthening the relationship with farmers - Generation of a sense of ownership for the farmers is essential - Staff capability build-up through training - Farmers participation to meeting	- Work management during wet season, when farmers are busy with outside the schemes - No planning of crop diversification though farmer were trained - No timely Donors funds, as a result construction works were delayed - Delay of designing and implementation of scheme	- Needs of training on construction, record keeping, water management, O&M, etc. - Adequate construction of tail end structures and farm roads
	From Farmers :		
	- Formulation of association principles for sustainability - Financial management - Obtained knowledge on farming technique from Donors and fellow farmers - Strengthening of solidarity among scheme members	- High electricity bills - Health and sanitation problems - No adequate warehouse/shade for product storage, though Donors provided materials for construction - No completion of road construction - Less profits make it difficult to maintain the structure	- Introduction of solar panel to replace electricity - Additional support by other Donors to build warehouse - Exposure to other sites though visits - Adequate training - Looking for private traders to sell product at a higher price
Mpale (Ka-33) (Water impounding dam)	**From Irrigation Officers, AEDC/AEDO :**		
	- Farmers appreciation for dam construction - Importance of participatory agreement - Possible land reclamation	- Lack of follow-up and feedback from Donors - No return-back of construction materials from farmers - No benefits from dam for direct beneficiaries - No technical support to farmers by extension workers - Poor utilization of dam	- Effective coordination with RDP and EPA by MOAFS and MOIWD - Introduction of field day to demonstrate the usage of dam - Training of dam maintenance works
	From Farmers :		
	- Availability of all year round irrigation water by the project - Serving drinking water for livestock.	- Water shortage during wet season due to large number of cattle to the dam - Infection with pests for tomato production due to lack of proper pesticides - Damages of dam and siltation in dam, due to lack of organizational functionality - Lack of proper input materials such as seed	- Provision of fence around dam - Needs to set-up committee and involve the chief to solve problems for farming near dam - Introduction of treadle pump for irrigation - Construction of another dam - Provision of drinking troughs for cattle
Kaombe (Kas-4)	**From AEDC/AEDO :**		

Irrigation Scheme	Lessons Learnt through Donors' Support	Major Problems Encountered	Countermeasures to be solved
(River diversion weir)	- Community dependency on Donor support - Empowerment of community capability	- No involvement of government staff - No support by government staff, because Donors directly link with the farmers - No involvement of EPA staff for training - No canal supervisor - No idea for budgets	- Involvement of EPA staff from the onset - Farmers training and empowerment
	From Farmers :		
	- Technical knowledge about irrigation and farming - Timing of different type of crops - Marketing of crops to outside area	- Water shortage in 2003 - Inadequate support from the Donors for construction equipment - Long transportation distance to collect sand and bricks - One tractor not sufficient for construction works - Short period of construction to finish 5 km long canal for local builders	- Needs to increase the number of builders - Provision of another tractor - Payment a little amount of money after doing the works
Kasinjeni (Kas-37) (Motorized pump)	**From Irrigation Officers:**		
	- Insufficient financial budgets and late of release from Donors - Different plans between Donors (MASAF) and GOM - Offering of training to government staff and farmers	- Too lengthy procedures from MASAF, resulting in project activities are not finish in time - Transportation problems for supervision, e.g. lack of cars and fuel - Low illiteracy level of farmers to manage funds	- Need fuel consideration - Donors representation in the fields
	From AEDC/AEDO :		
	- Learnt of irrigated agriculture by farmers - Farmers findings their capability to produce crops if supported.	- Inadequate findings - Shortage of water - Water seepage from pipeline, resulting in relay of growth of the scheme - Inadequate pump parts - No durable pumps	- Need farmers capacity building - Increasing in funds - Need the identification of marketing of crops for scheme sustainability - Leveling of land in the scheme
	From Farmers :		
	- Self sustainability - Self reliability - Technical support by GOM with respects of irrigation, agronomy and extension services	- Insufficient pipe materials for irrigation - Water shortage - Undulating topography	- Construction of water harvesting structures - Land leveling and development and construction of canals - Introduction of sprinkler irrigation because of terrain problems
Kaombe (Sa-2)	**From Irrigation Officers, AEDC/AEDO :**		

Irrigation Scheme	Lessons Learnt through Donors' Support	Major Problems Encountered	Countermeasures to be solved
(Motorized pump)	- Sticking of Donors budgets, releasing them in time and right amount - Disappointment of staff due to no fulfillment of Donor promises in time - Disagreements among farmers in selecting leader - Lack of farmers training through field visit	- Farmer misunderstandings on misusing of funds by EPA and RDP staff due to untimely fundings - ADD bypassed when Donors use the Consultants - Unfinished works in the schemes - Misallocation of funds, e.g. used for 3 schemes	- Re-planning of implementation plan - Involvement of farmers and extension workers in decision making
	From Farmers :		
	- Constructed pump house at a wrong place - Trainings on budget use, crop production, field visits - No direct working with Donors	- Lack of transparency of scheme money - Lack of coordination and cooperation between GOM staff and farmers - Unfulfilled works - Taken away the construction material by GOM - High electricity bills and lack of security for pumps	- Direct involvement of farmers by Donors, not through PRD and ADD - Protection of water harvesting reservoir - Needs to finish the scheme construction rather than building a shade and irrelevant training - Need of land leveling - Canalizing the whole scheme instead of using motorizing pump
Kasitu (Da-3) (River diversion weir)	**From Irrigation Officers :**		
	- Donors should be flexible, could accept and take into account farmers opinions - Decentralization of funds & hand-over process - Farmers are not ignorant on issues of the scheme - Low level of illiteracy	- Delays in financing the project - Insufficient site engineers - Lack of group procurement and selling on inputs	- Donor should be flexible - Donors should be time conscious - Needs farmers opinions for sustainability of the schemes
	From AEDC/AEDO :		
	- Involvement of farmers in planning and monetary issues - Establishment of farmers organization, if there was money - Direct impact to outside people of the schemes - Donor approach with paying money to farmers was wrong, and farmers are no longer works without giving something	- Misunderstanding among committee members - Lack of transparency and sustainability - Dependability of Donor support, due to poor leadership - No attendance to meeting by farmers because of no incentives - Poor coordination by the farmers with other farm organization - Lack of crop diversification	- Involvement of farmers on monetary issues, e.g. budgeting and implementation issues - Enhancement and promotion of farmers independence in running the scheme - Constitution review and its awareness the WUA members - Frequent and refresh training
	From Farmers :		

Irrigation Scheme	Lessons Learnt through Donors' Support	Major Problems Encountered	Countermeasures to be solved
	- Operation, maintenance and construction experience given by Donors - Increased areas for cultivation - Training offered by Donors during the supporting period	- Washed protection bunds and 50 % of schemes was washed as well - No farmer involvement in planning and decision making - Unfinished works (no provision o chickens and no build of toilet) - No lining of main canal, resulting in water seepage - Lack of demonstration and training - Two small shade/warehouse for their produce - Lack of reliable markets for the produce - Difficult to purchase expensive fertilizers, because no provision of loans - Needs of scheme manager	- Needs of expertise and good materials to reconstruct bunds - Needs of identification of good market by Donors and GOM - Canal lining with farmers' contribution - Intervention of Donors for construction of warehouse and rice mill
Ngolowindo (Sa-8) (Motorized pump)	**From Farmers :**		
	- Capacity building through Donors - Great impact by financial assistance - Clear Donors objectives for the scheme	- High bills of electricity - Unreliable market - Affected pest and diseases - High cost of farm inputs	- Identification of reliable market for their perishable commodity (tomato) - Application of fertilizer
Gola (Sa-11) (Inland canal)	**From Irrigation Officers :**		
	- No involvement of GOM staff for decision-making - No preparation of planning and design of the schemes, because of political issues	- No chance of participation for GOM staff and farmers - No realization of scheme benefits - No adequate timing of scheme construction (construction was done during rainy season) - No effective utilization of treadle pump, due to sedimentation of canal - No timing of funds - No training to farmers	- Provision of engine pump
	From Farmers :		

Irrigation Scheme	Lessons Learnt through Donors' Support	Major Problems Encountered	Countermeasures to be solved
	- Formulation of action plan before scheme construction is needed. - Awareness of solidarity to achieve and accomplish the scheme - Goodness of Sasakawa project	- Damaged scheme and crops by Hippos - Poor design of facilities (scheme facilities were destroyed within one year) - Lack of involvement of farmers opinion - Unsuitable canal alignment and in adequate canal structures - No acquiring and realization of scheme benefits from first year - Insufficient irrigation materials, and treadle pumps - Lack of training - Lack of funds to procure farm inputs	- Rehabilitation of Scheme - Alternation of irrigation systems from surface irrigation to pump irrigation systems - Fencing the scheme to solve the hippo problems - Training on agronomic issues and marketing - Upgrading product quality by milling and packaging
Zumulu (Ma-1) (River diversion weir)	**From Irrigation Officer, AEDC/AEDO :**		
	- Training on O&M and conflict management - Association unity among members - By-passes of GOM staff during implementation periods - No honor of Donars - Finding the effectiveness of fertilizer use by farmers	- Leadership problems - Minimum financial support for demonstration plots - Lack of proper and adequate trainings - High level of illiteracy among farmers - No involvement of farmers and staff on PRA and related programs - Lack of farmer vision - Erratic funding	- Farmer involvement in plan formulation - Lining of main canals - Farmers' leader training on agronomic issues - Rehabilitation of protection bunds - Timely funding
	From Farmers :		
	- Agronomic training offered by Donors - Independence after Donors left - Strong construction of intake facilities - No involvement of farmers in most of the meeting	- Damaged infrastructures of canals - Washed four protection bands - No definition of marketing of products - Unplanted rice-mill and no land leveling - Poor road conditions	- Maintenance and rehabilitation of the schemes and construction of the bunds - Lining of main canals - Searching of reliable markets - Upgrading of roads and leveling in the schemes
Khwisa (Ma-20) (River diversion weir)	**From Irrigation Officers, AEDC/AEDO :**		
	- Solidarity between villages by project - Hard working and participation of farmers - No involvement of Donors technical members - No proper site investigation in the plan	- Lack of transparency - No timely funding provided - Low level of farmers education - Poor road accessibility - Poor market for the produce - Washed away weir	- Reconstruction of weir - Revision of dam design - Rehabilitation of canals - Training of farmers and extension staff - Construction of roads, bridges and warehouse
	From Farmers :		

Irrigation Scheme	Lessons Learnt through Donors' Support	Major Problems Encountered	Countermeasures to be solved
	- Establishment of cooperative - Training s on cropping calendar, crop production and conflict resolution - No fulfillment of Donor promises	- Washed away weir (three times) - Lack of transparency of funds - Unfinished works of road and shade constructions - Damaged canals (no lining and poor designing) - Poor design of dam (a lot of seepage) - Seasonability of stream water - Untimely funding	- Adequate assistance by Donors for construction of weir - Redesigning /Reconstruction of dam / canals - Diversion of regulated river flow - Timely funding for construction - Needs of consultation and involvement of farmers in every stage of scheme construction

APPENDIX 4

WATER MANAGEMENT

APPENDIX 4 WATER MANAGEMENT

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2. Estimation of Irrigation Water Requirements

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1. Climate and Hydrology

2. Estimation of Irrigation Water Requirements

Table A1-1(1) **Monthly Rainfall Data (Station : Karonga in North Region)**

(Unit : mm/month)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1970/71	1.8	0.0	0.0	3.8	52.1	255.3	137.2	170.4	143.5	175.5	0.8	0.0	940.4
1971/72	0.0	0.0	0.0	0.0	52.6	137.7	186.9	134.9	251.2	172.2	10.9	4.1	950.5
1972/73	0.0	0.0	0.0	0.0	79.2	221.0	127.8	199.6	169.4	145.0	8.6	0.0	950.6
1973/74	0.5	0.0	0.0	0.0	1.0	134.1	407.2	141.7	503.2	451.9	269.0	2.8	1911.4
1974/75	11.7	0.0	0.0	6.4	4.8	236.0	219.2	130.8	211.3	218.2	3.0	1.8	1043.2
1975/76	0.0	7.1	0.0	0.0	13.2	124.5	220.0	154.9	439.7	206.8	12.4	5.6	1184.2
1976/77	0.0	0.5	0.0	6.4	0.0	99.3	184.9	117.1	261.6	156.5	71.4	0.0	897.7
1977/78	0.0	0.0	0.0	0.0	59.9	167.4	179.8	192.5	540.8	161.3	0.0	0.8	1302.5
1978/79	0.0	0.0	0.0	0.0	52.3	236.7	235.5	324.1	450.9	342.6	16.3	0.5	1658.9
1979/80	0.0	0.0	0.0	0.0	159.5	345.7	157.2	110.5	477.8	236.0	0.8	0.0	1487.5
1980/81	0.0	0.0	0.0	0.0	30.1	115.2	83.0	270.1	224.6	89.9	74.0	0.0	886.9
1981/82	0.0	0.3	0.0	0.0	155.8	73.4	68.7	140.8	144.1	125.9	27.9	0.2	737.1
1982/83	0.0	0.0	0.0	16.1	88.0	54.1	230.3	46.9	171.5	297.4	15.5	0.0	919.8
1983/84	0.0	0.0	0.0	0.0	27.9	367.7	255.7	202.5	295.0	44.0	2.6	0.0	1195.4
1984/85	0.0	0.0	0.0	0.0	91.5	429.3	159.9	90.6	229.5	80.1	1.2	0.0	1082.1
1985/86	0.7	0.0	0.0	0.0	118.1	100.7	307.5	126.7	274.9	68.7	22.8	6.0	1026.1
1986/87	0.0	0.0	0.0	4.5	9.3	385.9	74.4	260.1	159.3	146.9	0.1	0.0	1040.5
1987/88	0.0	0.0	0.0	0.0	14.4	98.1	213.9	155.5	248.9	33.6	7.3	0.0	771.7
1988/89	0.0	0.0	0.0	1.2	67.7	141.0	133.8	93.5	269.6	194.4	6.0	1.3	908.5
1989/90	2.5	0.0	0.0	0.0	75.7	106.7	109.0	162.8	149.3	119.9	10.6	0.0	736.5
1990/91	0.0	0.0	0.0	0.0	10.7	43.0	198.3	118.8	218.0	221.8	14.2	0.0	824.8
1991/92	1.1	0.0	0.0	0.0	0.5	201.0	214.9	100.8	139.8	193.3	45.1	0.6	897.1
1992/93	0.0	0.0	0.0	0.0	118.4	117.5	137.5	130.2	159.7	217.3	1.4	0.2	882.2
1993/94	0.0	0.0	0.0	0.0	0.0	8.9	119.9	135.5	135.6	67.5	0.0	0.0	467.4
1994/95	0.0	0.3	0.0	0.0	7.7	52.8	115.1	265.3	222.2	56.9	1.2	0.0	721.5
1995/96	0.0	0.0	0.0	0.0	0.0	102.4	148.9	145.8	410.4	177.6	65.7	0.3	1051.1
1996/97	0.3	0.0	0.0	0.0	0.1	83.7	91.5	127.3	57.7	81.3	0.0	0.0	441.9
1997/98	25.1	0.0	0.0	0.2	31.9	479.5	248.3	152.9	117.1	258.6	15.5	0.0	1329.1
1998/99	0.0	0.0	0.1	0.0	0.2	132.6	115.4	62.8	323.7	235.1	23.6	0.3	893.8
1999/00	0.0	0.0	0.0	0.0	21.9	48.6	95.1	86.4	263.9	240.5	0.0	0.0	756.4
2000/01	0.0	0.0	0.0	20.2	130.0	241.6	187.9	90.9	343.6	110.1	65.9	0.0	1190.2
2001/02	0.0	0.0	0.3	0.0	0.0	187.0	228.1	243.4	544.9	108.7	0.0	0.0	1312.4
2002/03	0.0	0.0	0.0	0.0	53.9	191.3	254.9	133	113.9	167.4	2.1	0.0	916.5
2003/04	0	0	0	0	0	126.1	185.7	212.1	193.3	497.8	2	0.0	1217.0
2004/05	2.0	0.0	0.0	0.0	222.5	199.0	226.1	200.7	175.8	53.4	1.4	0.3	1081.2
2005/06	0.2	0.0	0.0	0.0	5.0	167.4	242.6	59.1	289.9	298	33.4	0.5	1096.1
Average	1.3	0.2	0.0	1.6	48.8	172.6	180.6	152.5	259.0	179.2	23.1	0.7	1019.7

Table A1-1 (2) **Monthly Rainfall Data (Station : Mzuzu in North Region)**

(Unit : mm/month)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1970/71	13.8	1.7	4.8	3.7	42.3	221.3	287.2	157.8	283.9	178.9	11.5	10.8	1217.7
1971/72	15.6	0.5	1.7	16.0	39.5	124.0	152.2	110.4	168.3	160.2	72.7	43.3	904.4
1972/73	14.8	7.0	24.3	25.0	149.6	112.8	107.8	96.9	189.6	270.7	0.6	51.0	1050.1
1973/74	20.0	15.3	0.3	10.8	21.7	176.3	287.3	147.3	171.0	298.9	106.5	5.1	1260.5
1974/75	45.0	7.1	0.0	3.2	4.1	215.7	210.8	190.3	317.4	285.6	40.0	26.6	1345.8
1975/76	9.6	7.3	0.0	23.9	15.9	179.6	298.3	172.9	287.1	229.1	171.2	81.0	1475.9
1976/77	7.3	3.9	0.0	77.0	55.3	78.5	174.1	107.6	181.2	136.4	41.2	25.4	887.9
1977/78	31.0	14.1	0.8	37.0	47.2	234.1	155.3	103.9	294.3	297.9	3.1	82.0	1300.7
1978/79	15.2	0.0	9.6	71.7	114.6	205.9	222.9	228.2	344.9	158.4	21.5	14.8	1407.7
1979/80	57.9	0.0	4.6	15.4	101.7	166.8	296.1	51.7	256.1	301.0	50.5	3.3	1305.1
1980/81	14.0	13.8	10.4	32.4	21.1	191.9	138.9	223.3	131.3	76.5	31.5	9.2	894.3
1981/82	5.1	2.0	17.1	106.1	7.9	231.8	267.9	150.2	225.1	130.3	111.2	11.0	1265.7
1982/83	57.1	17.1	6.5	25.0	220.2	151.0	240.7	137.4	126.3	97.1	55.8	35.6	1169.8
1983/84	86.1	6.2	0.0	17.6	22.2	224.0	154.8	153.5	313.6	231.0	110.6	64.1	1383.7
1984/85	35.5	1.4	0.0	149.8	57.2	343.2	106.2	142.7	195.6	396.9	76.9	13.0	1518.4
1985/86	18.8	5.0	12.7	56.4	374.8	210.0	185.8	117.2	285.6	233.6	23.8	44.5	1568.2
1986/87	1.3	0.0	5.2	9.6	218.8	199.1	160.1	178.2	97.8	130.7	34.7	5.5	1041.0
1987/88	9.5	11.7	4.0	69.4	8.8	153.4	160.5	104.8	268.0	217.3	142.3	36.2	1185.9
1988/89	6.7	26.1	0.0	104.3	294.2	219.6	167.1	326.4	179.4	224.4	77.4	29.1	1654.7
1989/90	69.1	0.5	20.2	6.5	129.1	154.9	160.3	205.4	62.8	71.8	155.3	12.7	1048.6
1990/91	37.7	17.6	5.3	32.4	150.4	99.6	230.9	108.4	596.5	219.4	6.5	0.9	1505.6
1991/92	42.5	13.7	0.2	22.7	94.8	132.6	122.5	35.9	140.8	55.9	40.6	38.1	740.3
1992/93	9.1	12.0	0.0	4.6	53.0	130.5	148.4	149.1	226.7	11.1	14.8	25.2	784.5
1993/94	33.7	5.0	0.0	0.2	39.0	41.8	269.3	263.2	148.8	123.1	5.3	3.5	932.9
1994/95	8.3	19.0	2.1	18.4	62.6	54.9	190.8	147.5	95.9	139.3	90.6	5.5	834.9
1995/96	1.0	36.9	12.4	27.7	62.3	152.3	205.4	365.9	270.4	169.6	58.7	17.8	1380.4
1996/97	27.9	0.0	15.4	12.3	0.0	161.3	195.6	188.9	194.7	89.3	21.7	6.8	913.9
1997/98	144.9	0.5	0.0	27.5	44.4	290.7	259.5	174.1	149.0	110.1	0.8	6.2	1207.7
1998/99	29.5	13.9	13.2	15.8	31.0	43.9	209.5	116.8	538.3	585.3	21.7	14.9	1633.8
1999/00	49.5	39.4	28.4	48.0	43.9	140.3	159.7	145.2	291.6	166	22.3	19.2	1153.5
2000/01	21.4	7.2	0.0	18.2	101.9	128.1	291.9	59.5	319.3	111.2	52.7	4.4	1115.8
2001/02	32.8	20.9	8.0	3.9	2.3	78.6	215.5	260.9	350.6	172.6	4.2	94.6	1244.9
2002/03	9	43.5	58	11.1	309.2	217.9	194.7	180.5	186.5	97.2	38.9	12.7	1359.2
2003/04	76.6	3	152.1	1.8	42.1	296.9	194.4	81.3	149.2	337.7	53.5	22.3	1410.9
2004/05	4.5	4.1	18	124.9	11.6	261.5	157.4	215.1	151.3	28.8	10.2	16.2	1003.6
2005/06	41.9	0	9.9	0	6.7	142.8	85.2	122.5	230	368	28.2	12.3	1047.5
Average	30.7	10.5	12.4	34.2	83.4	171.3	196.3	158.9	233.9	192.0	50.3	25.1	1198.8

Table A1-1 (3) **Monthly Rainfall Data (Station : Kasungu in Central Region)**

(Unit : mm/month)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1970/71	0.0	0.0	0.0	6.1	50.6	166.0	302.4	373.8	52.1	3.5	4.6	0.0	959.1
1971/72	0.0	0.0	0.0	1.0	42.7	62.1	147.4	74.5	87.5	15.1	1.8	0.0	432.1
1972/73	0.0	0.0	0.0	0.0	38.0	101.2	161.6	148.1	95.5	38.9	1.0	0.0	584.3
1973/74	0.0	0.0	0.0	5.1	0.0	194.6	293.0	183.7	137.5	42.5	80.2	0.0	936.6
1974/75	13.5	0.0	0.0	0.0	62.3	106.1	131.8	181.6	155.9	35.3	0.0	0.0	686.5
1975/76	0.0	0.0	0.0	0.0	12.2	68.1	298.0	0.0	0.0	0.0	1.3	0.0	379.6
1976/77	0.0	0.0	0.0	3.8	7.6	111.8	231.3	99.8	68.9	10.9	0.0	0.0	534.1
1977/78	0.0	0.0	0.0	0.0	17.5	165.9	183.2	165.8	334.6	13.5	0.0	0.0	880.5
1978/79	0.0	0.0	0.0	0.0	54.3	299.4	17.3	200.2	178.0	22.9	0.0	0.0	772.1
1979/80	0.0	0.0	0.0	11.7	98.9	157.8	187.1	104.4	411.0	92.9	0.0	0.0	1063.8
1980/81	0.0	0.0	4.6	0.0	62.8	389.1	149.3	307.4	109.3	8.9	0.0	0.0	1031.4
1981/82	0.0	0.0	0.0	3.0	26.7	199.1	72.5	119.0	271.4	25.7	1.5	0.0	718.9
1982/83	0.0	0.0	0.0	25.0	44.4	176.2	257.1	198.2	20.3	35.2	1.1	0.0	757.5
1983/84	0.0	0.0	0.0	0.0	5.0	211.8	148.8	161.1	96.7	12.0	0.5	0.0	635.9
1984/85	0.3	0.0	0.0	0.0	64.8	138.6	124.3	258.3	115.7	9.4	1.6	0.0	713.0
1985/86	0.0	0.0	0.0	1.0	189.1	207.6	259.5	269.6	109.9	49.2	0.6	0.0	1086.5
1986/87	0.0	0.0	0.0	53.5	30.1	205.2	232.0	180.6	74.5	17.2	0.0	0.0	793.1
1987/88	0.0	0.0	2.3	0.4	0.2	177.4	223.5	248.0	168.6	10.3	0.0	0.0	830.7
1988/89	0.1	0.0	0.0	10.6	62.2	42.3	378.5	230.8	179.0	11.3	1.8	0.0	916.6
1989/90	0.0	0.0	0.0	1.0	128.3	399.7	120.6	163.3	25.1	0.1	49.4	0.0	887.5
1990/91	0.0	0.0	0.0	0.0	93.2	97.6	228.4	175.8	144.6	31.5	0.0	0.0	771.1
1991/92	1.7	0.0	0.0	1.5	30.8	187.4	74.1	100.2	109.3	1.8	9.6	0.0	516.4
1992/93	0.0	0.2	0.0	0.0	19.1	141.7	124.7	250.5	253.6	5.5	0.0	0.0	795.3
1993/94	0.2	2.9	0.0	0.0	58.0	118.7	373.6	187.3	47.7	48.6	0.0	0.0	837.0
1994/95	0.0	0.0	0.0	0.3	13.3	46.7	264.8	139.3	14.0	20.8	0.0	0.0	499.2
1995/96	0.0	0.0	0.0	0.0	7.7	153.6	309.4	274.9	164.8	0.5	0.0	0.0	910.9
1996/97	0.0	0.0	0.0	0.6	0.0	256.4	119.6	340.5	52.7	86.6	0.0	0.0	856.4
1997/98	0.0	0.0	0.8	14.9	164.0	143.1	339.2	66.9	108.4	31.5	0.0	0.0	868.8
1998/99	0.0	0.0	0.0	46.8	56.4	150.6	162.2	217.5	178.2	26.2	0.0	0.0	837.9
1999/00	0.0	0.0	0.0	0.0	0.8	64.5	141.7	162.3	169.6	6.6	0.0	0.8	546.3
2000/01	0.0	0.0	0.0	7.8	105.8	137.8	356.2	173.6	114.9	1	0.0	0.0	897.1
2001/02	0.0	0.0	0.0	0.0	3.6	105.5	185.1	207.8	65.6	29.2	0.0	0.0	596.8
2002/03	0.1	0.0	1.8	0.0	10.6	231.0	179.7	268.4	323.9	32.6	0.0	0.0	1048.1
2003/04	0	0	0.2	0	2.2	257.2	120.4	307.6	75.2	53	0	0.0	815.8
2004/05	0.0	0.0	0.0	2.9	60.0	451.0	150.3	151.7	61.2	5.1	15.1	0.0	897.3
2005/06	0.0	0.0	0.0	0.0	86.4	91.4	137.2	55.1	150.6	30	2.4	0	553.1
Average	0.4	0.1	0.3	5.5	47.5	172.6	199.6	187.4	131.3	24.0	4.8	0.0	773.5

Table A1-1 (4) **Monthly Rainfall Data (Station : Salima in Central Region)**

(Unit : mm/month)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1970/71	0.0	0.0	0.0	0.3	97.3	511.6	370.3	296.7	154.7	148.3	90.2	0.0	1669.4
1971/72	0.0	0.0	0.8	9.1	56.1	250.4	280.7	260.9	276.4	89.7	18.3	0.8	1243.2
1972/73	0.0	0.0	0.0	5.6	12.4	150.6	273.6	136.1	237.2	92.5	0.0	0.0	908.0
1973/74	0.0	0.0	0.0	1.3	4.3	162.8	506.0	377.4	443.2	108.5	75.7	1.8	1681.0
1974/75	4.3	0.0	0.3	0.5	3.0	198.4	155.2	258.1	258.1	30.0	0.3	0.0	908.2
1975/76	0.0	0.0	0.0	0.0	9.9	154.7	716.8	361.2	336.1	310.1	5.3	0.0	1894.1
1976/77	0.0	0.0	6.6	4.8	0.3	94.2	385.6	241.3	234.4	25.4	0.3	0.0	992.9
1977/78	0.0	0.0	0.0	13.7	110.7	426.5	468.1	499.4	717.0	126.5	0.0	0.0	2361.9
1978/79	0.8	0.0	0.0	0.0	51.6	339.9	275.1	362.0	225.8	34.8	0.0	0.5	1290.5
1979/80	0.8	0.0	0.0	0.0	142.2	154.2	183.9	295.7	267.5	305.6	0.0	0.0	1349.9
1980/81	0.0	0.0	0.0	3.9	0.0	403.6	193.6	488.7	145.4	14.1	2.9	0.0	1252.2
1981/82	0.0	0.0	0.0	2.7	59.9	107.2	112.0	308.7	60.9	169.7	6.1	0.0	827.2
1982/83	0.0	0.5	0.0	12.8	49.3	177.6	312.5	323.2	207.9	35.2	1.2	1.2	1121.4
1983/84	0.6	0.0	0.0	0.0	2.2	196.4	170.2	273.4	125.2	2.2	19.0	0.0	789.2
1984/85	0.0	0.0	0.0	0.0	17.5	316.5	171.4	147.8	355.4	59.3	0.0	0.0	1067.9
1985/86	0.0	0.0	0.0	7.2	51.4	380.6	580.6	187.8	233.7	38.3	0.0	0.0	1479.6
1986/87	0.0	0.0	0.0	13.3	29.3	190.0	340.8	298.2	124.4	41.1	0.0	0.0	1037.1
1987/88	0.0	0.0	1.2	2.9	15.8	139.3	590.7	375.0	440.0	152.4	0.2	0.0	1717.5
1988/89	1.2	0.0	0.0	91.9	29.1	338.9	433.4	298.0	490.9	3.1	5.0	0.3	1691.8
1989/90	0.0	1.0	0.1	0.0	49.6	272.9	416.8	116.6	155.1	43.8	4.0	0.0	1059.9
1990/91	0.0	0.3	1.4	0.1	0.0	185.4	524.3	155.2	174.8	30.4	0.7	0.0	1072.6
1991/92	0.0	0.0	5.2	4.6	62.5	198.5	256.2	110.9	337.8	43.2	16.7	4.2	1039.8
1992/93	0.0	0.0	0.0	0.0	3.4	109.6	267.1	499.4	253.5	195.2	0.5	5.2	1333.9
1993/94	0.0	0.1	0.0	0.1	42.8	53.2	551.3	140.5	57.0	2.5	0.7	0.0	848.2
1994/95	4.7	0.0	0.0	12.1	0.0	108.3	149.6	102.7	76.3	4.8	0.0	0.0	458.5
1995/96	0.0	0.0	0.0	0.0	0.7	76.1	143.9	481.8	302.2	23.2	129.2	0.0	1157.1
1996/97	0.0	0.0	0.0	1.5	0.0	182.1	285.2	333.9	199.2	231.7	0.0	0.0	1233.6
1997/98	0.4	0.0	0.0	6.5	41.5	718.8	399.7	183.0	269.2	67.0	11.0	0.0	1697.1
1998/99	0.0	0.0	0.0	2.8	36.2	118.4	177.6	416.4	470.9	16.0	2.3	0.0	1240.6
1999/00	0.0	0.0	0.0	0.0	3.2	52.1	159.2	308.6	137	100.9	0.0	0.9	761.9
2000/01	0.0	0.0	0.0	26.4	82.0	279.9	347.6	429.2	231.4	10.9	0.0	0.0	1407.4
2001/02	0.0	0.0	0.0	0.6	12.2	527.5	452.4	223.4	211.4	132.4	0.0	0.0	1559.9
2002/03	0	8.3	0.8	0	25.3	341.4	469.5	208.1	488	86.5	0.0	0.0	1627.9
2003/04	0.1	6.4	0.5	0	0	151	337.1	312.9	92.2	214.3	0.0	0.0	1114.5
2004/05	0	0	0	6.2	73.5	417.5	185.9	175.8	0	38.4	8.6	0	905.9
2005/06	0	0	0.4	0.2	19.3	165.5	341.1	344.1	760.7	40.1	0	0	1671.4
Average	0.4	0.5	0.5	6.4	33.2	240.3	332.9	287.0	265.3	85.2	11.1	0.4	1263.1

Table A1-1 (5) **Monthly Rainfall Data (Station : Chitedze in Central Region)**

(Unit : mm/month)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1970/71	0	0	0	2	76.2	363	215.1	292.9	100.6	44.5	23.4	0.5	1,118.2
1971/72	0	0	0	5.1	211.1	83.8	234.4	146.3	99.1	129	17.3	0	926.1
1972/73	0.8	0	0	16	81.3	162.6	206	79	105.2	74.7	1.5	0	727.1
1973/74	6.1	0	0	0	42.2	229.9	101.3	250.2	296.9	67.6	0	0	994.2
1974/75	6.1	0	0	0	42.2	229.9	101.3	250.2	296.9	67.6	0	0	994.2
1975/76	0	0	0	0	120.7	146.1	270	305.8	86.9	84.6	0	0.3	1,014.4
1976/77	0.8	0	7.4	10.9	19.8	211.1	315	163.6	207.3	52.1	0	0	988.0
1977/78	0	0	1.3	16.8	57.7	314.7	339.9	79.5	234.7	58.4	0	3.8	1,106.8
1978/79	0	0	0	0	74.7	194.8	107.7	238.5	124.5	18.3	5.3	0	763.8
1979/80	4.3	0	0	37.3	122.7	126.2	151.6	166.9	64.8	28.7	5.1	0	707.6
1980/81	0	0	8.8	5.7	56.7	214.5	119.5	317.3	152.7	30.2	0.1	0	905.5
1981/82	0	0	0	31.2	105	112	253.3	293.3	66.4	60.7	32.8	0	954.7
1982/83	0	1.5	0	38.4	82	156.1	145.3	185.4	67.2	42.5	2.5	6.3	727.2
1983/84	11.8	0	0	5.3	14.2	185	205.8	165.2	109.8	13.1	4.4	0	714.6
1984/85	5.5	0	0.1	0	115.7	253	192	208.1	245.3	54.4	0	0	1,074.1
1985/86	2.6	0	0	15.1	143.5	177.3	188.1	200.4	192.2	36.3	0.6	0	956.1
1986/87	0	0	0	18.9	28.3	349.4	288.6	179.3	224.3	50.4	0	0	1,139.2
1987/88	0	0	1.2	22.1	43.8	139.5	203.3	171.7	272.3	53	1.8	0	908.7
1988/89	0	0	0	43.1	7	102.2	358.6	270.7	267.8	12.3	11.3	3.7	1,076.7
1989/90	0	0	0	2.4	209.9	217.2	326.7	149.1	88.1	51.9	79.8	0	1,125.1
1990/91	0	1.1	0	0.5	81.5	58.5	228.6	169.7	80.4	29.7	5	0.7	655.7
1991/92	1.1	0	23	1.1	108.9	176.9	131.5	20.7	147.3	11.1	0.6	0.3	622.5
1992/93	0	0	0	0	44.7	184.5	207.5	266.8	187.4	5.2	0	0	896.1
1993/94	0	0	5	1.2	60	42.1	380.8	66.2	39.6	3.7	0	0	598.6
1994/95	0	0	0	36.4	18	142	151.6	118	10.4	2.1	0	0	478.5
1995/96	0	0	0	0	0	289.9	123.6	349.6	228.5	47.4	9.7	0	1,048.7
1996/97	0	0	0	3.2	10.3	184.7	257.1	139.5	60.2	131.5	9.7	0	796.2
1997/98	0.3	0	0.2	43.7	180.4	281.3	330.5	215.6	101	2.6	1.1	0	1,156.7
1998/99	0	0.2	0	11.9	29.4	245.7	336.1	216.1	392.5	46.4	0	6.8	1,285.1
1999/00	0.3	1	0.1	0	99.2	53.7	195.8	131	141.6	46	0	0	668.7
2000/01	0	0	0	17.3	148.4	79.8	316.8	234.5	174.4	16.5	0	0	987.7
2001/02	0.8	0	0	2	60.9	194.3	229.5	217.2	80.6	0.6	0	1.2	787.1
2002/03	0	0	8.4	0.1	53.3	206.5	324.7	209.2	230.8	5	0	0	1038.0
2003/04	0	1.7	0.9	0	5.4	113.6	222.9	258.3	89.1	83.8	0	0	775.7
2004/05	0	0	0.9	32.5	115.2	245.1	188.6	184.4	26.3	3.7	0	0	796.7
2005/06	0.0	0.0	1.4	0.9	61.9	139.6	144.9	134	183.6	43.2	0.6	0	710.1
Average	1.1	0.2	1.6	11.7	75.9	183.5	224.8	195.7	152.1	41.9	5.9	0.7	895.1

Table A1-1 (6) **Monthly Rainfall Data (Station : Mangochi in South Region)**

(Unit : mm/month)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1970/71	0.0	0.0	0.0	23.9	132.8	134.9	198.9	177.8	128.8	14.0	0.3	0.8	812.2
1971/72	0.0	0.0	1.8	0.0	40.1	117.1	132.8	122.9	112.5	27.7	0.0	3.6	558.5
1972/73	0.0	3.3	0.0	21.8	44.7	133.9	198.6	65.8	82.3	42.2	0.0	2.3	594.9
1973/74	0.0	0.0	0.0	0.8	49.0	181.1	166.9	205.5	180.3	112.0	46.2	4.1	945.9
1974/75	33.3	1.0	0.5	0.0	75.9	102.6	161.5	203.2	178.8	75.7	1.5	1.0	835.0
1975/76	1.0	0.0	0.5	39.1	77.0	167.6	213.9	378.2	296.4	115.6	8.6	1.3	1299.2
1976/77	5.3	0.0	0.0	31.5	5.8	110.5	215.6	90.4	198.9	3.0	0.3	0.0	661.3
1977/78	0.3	0.0	7.6	14.2	30.0	173.7	345.7	256.8	280.9	19.6	3.6	6.1	1138.5
1978/79	18.5	0.0	0.0	9.1	34.8	317.5	173.0	252.7	233.4	40.6	0.0	1.5	1081.1
1979/80	1.8	0.0	0.5	20.6	90.4	146.3	125.0	191.5	167.9	53.8	0.0	1.3	799.1
1980/81	0.5	4.0	0.0	29.7	73.7	459.2	75.7	252.3	141.6	5.7	15.1	0.0	1057.5
1981/82	0.0	0.0	0.0	41.0	37.5	93.3	158.9	356.7	26.8	16.7	23.1	0.0	754.0
1982/83	6.2	12.5	0.6	31.6	25.7	117.3	44.8	127.3	43.7	2.0	1.2	0.0	412.9
1983/84	16.1	0.1	0.0	21.8	37.9	183.9	108.7	453.8	174.3	5.6	0.9	2.3	1005.4
1984/85	2.4	0.1	12.7	1.7	115.7	303.6	212.8	177.2	88.3	42.3	0.2	0.6	957.6
1985/86	0.0	4.4	5.4	26.2	121.0	283.5	172.0	215.8	145.9	10.9	0.0	1.9	987.0
1985/87	1.5	0.0	0.0	6.8	64.8	205.9	245.6	119.9	71.3	40.3	2.4	3.5	762.0
1987/88	0.0	0.0	0.0	57.2	14.6	150.9	175.6	170.7	133.0	22.5	14.2	0.0	738.7
1988/89	0.0	0.0	0.0	36.9	25.9	71.6	271.4	295.7	241.5	9.0	0.0	0.0	952.0
1989/90	0.0	0.0	3.6	1.0	48.3	114.9	268.3	143.8	79.7	8.7	27.1	0.0	695.4
1990/91	0.0	2.6	0.0	0.0	6.2	73.4	351.2	276.1	170.8	11.1	3.7	0.0	895.1
1991/92	10.5	0.0	0.0	19.6	24.6	172.2	54.6	2.4	167.4	0.0	2.6	0.0	453.9
1992/93	0.3	1.8	0.6	2.2	34.1	146.8	240.8	222.7	58.0	146.8	0.0	0.0	854.1
1993/94	0.0	27.0	0.0	8.9	65.2	40.5	131.7	12.9	54.1	1.2	0.0	0.5	342.0
1994/95	0.0	6.0	0.0	4.1	0.5	55.2	165.0	99.6	10.2	0.7	1.4	0.1	342.8
1995/96	0.2	0.0	0.0	0.0	30.4	165.0	255.0	150.0	161.0	20.7	21.0	4.3	807.6
1996/97	0.0	0.1	0.0	6.8	5.7	224.3	272.0	343.1	457.6	140.6	0.0	0.0	1450.2
1997/98	6.0	0.0	16.5	19.0	29.9	254.1	198.7	64.3	85.7	3.3	0.0	0.0	677.5
1998/99	0.0	0.0	0.0	16.9	24.8	80.1	177.9	95.4	150.2	59.5	0.0	0.0	604.8
1999/00	4.4	0.2	0.0	0.1	33.6	93.2	114.4	178	187.1	47.4	0.0	5.2	663.6
2000/01	0.1	0.6	0.0	29.6	105.1	307.2	342.5	236.7	184.9	23.8	5.6	0.0	1236.1
2001/02	0.0	2.1	3.8	3.6	41.0	163.5	338.9	183.5	29.9	16.6	0.0	5.0	787.9
2002/03	0.0	0.0	1.0	12.9	34.3	185.7	201	155.6	392	45.6	3.8	0.0	1031.9
2003/04	12	9.7	3.2	0.8	32.9	74.8	198.7	119.1	18.6	42.2	2.4	0.0	514.4
2004/05	4.6	0.0	0.0	53.5	122.9	220.4	170.5	87.3	5.3	26.5	0.0	0.0	691.0
2005/06	4.9	0.0	0.2	0.0	23.3	144.5	202.8	101.8	349.9	53.5	0	3	883.9
Average	3.6	2.1	1.6	16.5	48.9	165.8	196.7	183.0	152.5	36.3	5.1	1.3	813.5

Table A1-1 (7) **Monthly Rainfall Data (Station : Chileka in South Region)**

(Unit : mm/month)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1970/71	0.0	0.0	0.0	5.8	170.2	276.6	249.7	90.4	58.4	57.2	9.4	4.3	922.0
1971/72	0.3	0.0	2.0	13.5	175.8	144.5	366.8	172.5	82.3	54.4	42.4	0.0	1054.5
1972/73	0.8	0.0	0.0	13.5	75.9	85.9	198.1	60.7	86.6	35.1	0.0	2.5	559.1
1973/74	2.3	0.0	0.0	58.4	78.5	231.9	182.1	258.1	309.9	43.9	81.8	11.9	1258.8
1974/75	5.1	2.3	0.0	0.0	142.2	266.7	107.4	140.7	23.1	38.1	1.3	2.0	728.9
1975/76	0.0	0.8	0.0	11.4	90.4	67.8	181.4	229.9	192.8	80.8	0.8	0.0	856.1
1976/77	0.0	0.0	0.0	35.6	65.0	363.7	184.7	217.7	209.6	6.4	0.0	0.0	1082.7
1977/78	0.3	0.0	6.9	6.9	104.6	132.3	168.4	297.9	355.9	63.0	14.7	2.5	1153.4
1978/79	0.5	0.0	0.0	45.0	72.6	231.9	76.5	102.1	168.9	50.0	0.0	2.8	750.3
1979/80	6.9	8.4	0.0	36.6	199.9	64.5	59.9	259.1	174.2	39.9	0.8	2.5	852.7
1980/81	0.0	0.0	10.0	26.7	18.3	256.3	146.1	245.0	173.8	12.8	4.0	0.0	893.0
1981/82	1.3	0.0	0.0	53.9	27.1	81.0	143.0	418.9	34.4	57.1	11.9	0.0	828.6
1982/83	12.0	1.3	0.0	46.7	87.9	104.5	198.3	91.7	86.3	57.0	2.1	7.9	695.7
1983/84	12.0	0.0	0.0	130.4	27.2	83.6	59.3	233.4	326.2	69.0	14.4	0.6	956.1
1984/85	0.6	0.0	21.7	10.0	166.0	199.2	218.9	230.9	345.1	77.5	11.7	0.5	1282.1
1985/86	2.2	1.1	22.6	45.1	99.3	264.3	302.4	164.0	67.0	60.4	0.0	0.0	1028.4
1985/87	0.3	0.0	0.0	113.0	211.3	145.0	265.7	68.0	47.1	2.3	0.4	1.6	854.7
1987/88	0.5	0.0	1.1	36.7	139.6	181.8	243.2	268.3	72.7	170.0	15.4	0.8	1130.1
1988/89	0.0	0.0	0.0	58.0	75.3	102.7	330.1	322.9	246.6	3.5	3.6	0.7	1143.4
1989/90	0.0	6.1	5.6	17.3	127.6	216.2	228.4	58.2	26.8	51.5	38.4	2.0	778.1
1990/91	0.0	1.1	13.6	3.6	57.1	110.4	188.4	198.2	190.9	61.8	8.4	0.0	833.5
1991/92	0.0	0.0	0.0	65.3	121.2	48.8	198.1	20.5	161.5	27.7	0.0	9.4	652.5
1992/93	0.7	0.7	0.0	29.3	87.1	83.1	285.1	137.3	30.8	72.5	8.6	8.3	743.5
1993/94	0.1	0.1	14.3	38.4	67.9	131.8	192.6	94.4	51.5	103.6	0.0	0.8	695.5
1994/95	0.0	0.0	0.0	18.5	6.7	116.4	214.8	116.4	65.0	5.4	2.3	0.5	546.0
1995/96	0.0	0.7	0.0	0.0	119.2	281.6	175.2	229.1	151.8	7.3	4.3	0.0	969.2
1996/97	0.0	0.7	0.0	6.4	93.8	293.3	357.2	592.6	59.6	27.6	0.0	0.0	1431.2
1997/98	0.8	0.0	7.9	63.9	77.7	195.7	285.2	235.6	117.8	1.1	0.6	0.0	986.3
1998/99	0.3	0.0	0.0	1.7	66.7	123.6	333.2	234.1	109.1	86.1	0.0	0.0	954.8
1999/00	8.1	0.0	0.0	0.0	98.5	78.4	268.6	205.7	90.3	16.4	0.1	0.0	766.1
2000/01	0.7	0.0	0.0	18.7	200.2	227.0	41.5	358.8	214.8	19.3	25.7	0.0	1106.7
2001/02	0.0	1.1	3.1	12.2	78.3	205.0	219.0	103.5	134.0	100.2	0.0	0.5	856.9
2002/03	0	39.2	8.2	37.1	19.2	110.9	183.8	149	214.5	1.2	30.7	0.7	794.5
2003/04	0.7	0	0	4.2	22.4	46	299.8	46.5	106.8	73	0.0	7.0	606.4
2004/05	0	7.5	0	23.6	105.4	180.1	173	12.4	5.4	0.9	13	0	521.3
2005/06	0	0	40.6	0	162.5	145	263	257.7	192.2	20.6	0	0.4	1082.0
Average	1.6	2.0	4.4	30.2	98.3	163.3	210.8	192.3	138.4	46.0	9.6	2.0	898.8

Table A1-1 (8) **Monthly Rainfall Data (Station : Chikwawa Boma in South Region)**

(Unit : mm/month)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1970/71	7.4	0	0	9.2	79.8	194.1	346.7	26.2	45.5	0	46.5	3.8	759.2
1971/72	4.3	0	0	0.8	162.8	126.2	182.1	122.7	88.6	10.2	4.8	23.9	726.4
1972/73	8.4	8.4	0	0	141.2	50.5	423.4	42.7	70.4	71.4	7.9	16.8	841.1
1973/74	24.1	8.1	0	3.8	85.6	135.6	150.6	137.9	129.3	46.2	15	28.7	764.9
1974/75	29.7	7.4	9.4	0	98.8	110.5	154.9	101.6	44.7	13	14.2	20.1	604.3
1975/76	1.3	3.8	0	116.1	114.3	196.1	30.2	174.2	206.7	42.2	50.3	38.7	973.9
1976/77	14	0.3	0	20.1	9.1	349.5	103.4	74.4	153.2	8.9	0.3	7.4	740.6
1977/78	2	3.6	11.4	0	37.3	193	201.9	74.7	220.7	51.6	5.3	17.5	819.0
1978/79	21.1	0	0	32.3	73.9	273.8	189.5	130.3	229.4	5.8	8.4	41.1	1,005.6
1979/80	38.9	0.3	3.6	22.4	80.5	187.7	92.5	65	251	13.6	23.1	21.8	800.4
1980/81	0	8.8	12.1	3.2	17.5	209.5	212.1	205.8	49.4	33.7	12.4	6.2	770.7
1981/82	15.7	0	8.3	8.9	14.3	113.4	187.4	201.4	19.5	67.1	27.6	6.8	670.4
1982/83	54.2	52.1	8.6	89.4	18	93	83.9	134.2	72	0	12	0	617.4
1983/84	18.8	8.8	0	18.1	49.3	221.3	59	132.9	61.6	34.6	7.2	6.5	618.1
1984/85	0	5.6	0	21	54.5	128.5	156.4	142.5	199.7	132.1	9	9.2	858.5
1985/86	7.7	13.9	0.8	38.8	85.7	166.1	354.1	132.3	56.3	103.8	1.8	31.7	993.0
1986/87	39	0	5.8	92.8	72.8	154.3	195.5	11.1	49.1	28.5	10.3	23	682.2
1987/88	0	0	0	34.6	129.4	137.2	168.4	138.4	124.2	8.1	32.2	0	772.5
1988/89	26.6	3.1	0	36.3	27.5	90.6	227.9	205.7	427.7	39.6	0	38.5	1,123.5
1989/90	3.3	8	7.1	9.6	62.4	98.2	202.4	94.7	63.5	19.6	31.2	38.5	638.5
1990/91	0	0	0	0	50.2	58.3	240.7	58.7	156.3	27	0	0	591.2
1991/92	0	0	0	0	62	20.1	124.3	7.4	206.3	0	10.3	0	430.4
1992/93	0	0	0	29.5	141.8	150.9	417.4	149.2	16.7	0	0	0	905.5
1993/94	4.6	16	0	12.5	97.4	49.1	172	91.2	63.6	0	0	0	506.4
1994/95	5	5	0	16.9	23.8	70	232.7	38.8	0	26.8	0	0	419.0
1995/96	0	0	0	0	65	346.1	224	274.8	167.1	66.1	17.2	45.2	1,205.5
1996/97	0	0	0	16	93.8	293.3	357.2	592.6	59.6	27.6	0	0	1,440.1
1997/98	0	0	0	17	54.2	97.4	279.6	144.7	69.8	13.6	1.8	0	678.1
1998/99	0	12.6	0	0	72.2	220	336.5	199.3	107.6	84.3	3.4	8.9	1,044.8
1999/00	18.5	0.3	61.1	8.4	89.2		246	166.8	70.8	27.1	16	6.9	711.1
2000/01	23.4	4.3	0	5.5	165.4	70.5	279	270.3	164.1	52.4	0	0	1,034.9
2001/02	0	0	0	2.3	8.9	227.1	204.9	189.6	100.8	2.6	0	0	736.2
2002/03	13.9	23	0	0	13.4	28.9	507.5	83.5	135.8	25.6	19.2	5.4	856.2
2003/04	34.5	0	18.1	0	58.3	57.9	212.5	108.5	92	32.5	18.5	27.2	660.0
2004/05	27.2	19	0	26	69.7	173.5	64.5	51.7	18.4	27.2	0	0	477.2
2005/06	0.0	0.0	0.0	0.0	61.1	179.9	135.4	112.4	233.1	23.9	0	0	745.8
Average	12.3	5.9	4.1	19.2	70.6	150.6	215.5	135.8	117.3	32.4	11.3	13.2	784.0

Table A1-2 (1)　　Daily Rainfall Records

Station　Ngonga North (Bethani Irrigation Scheme)

Year　: 2007/2008

Date	Month								Remarks
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1					4				
2					2.3				
3			8						
4			8	38	7				
5				30	5				
6					9				
7					14				
8				8					
9					28				
10			16						
11			14	2.2					
12			4	3.7	2				
13			15						
14									
15				14					
16									
17									
18									
19									
20				3					
21				2					
22									
23									
24				5					
25				8					
26				22					
27			18						
28			15	10					
29			19	5					
30				6					
31				11					
Total	0	0	117	167.9	71.3	0	0	0	

Data Source : Mhuju EPA

Table A1-2 (2)　　Daily Rainfall Records

Station　Luwerezi (Mantha Irrigation Scheme)

Year　: 2007/2008

Date	Month								Remarks
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1									
2					3				
3				19.3	18				
4									
5					23				
6				35					
7			16.3	19.9					
8									
9				46.2					
10			3.4	1.4					
11			1.2						
12			0.6						
13			3.1						
14			1.4						
15			11.8						
16			22.7						
17			9.2						
18									
19			2.1						
20			3.7						
21									
22									
23				14					
24			20						
25			19.6						
26	53		2.9						
27			6.3						
28				5					
29									
30			30.2						
31			17.1						
Total	53	0	171.6	140.8	44	0	0	0	

Data Source :　Luwelezi EPA

Table A1-2 (3-1) Daily Rainfall Records

Station Chulu Station (Chiwoza Dam Irrigation Scheme)

Year : 2006/2007

Date	Month								Remarks
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1				13.8					
2				22.2		41.4			
3			4.3	3.2					
4				2.1	4.8				
5					2	4.3			
6				12.4					
7			7.3			11.3			
8			5	62					
9			3.2	22.4		13.5			
10				12.7					
11									
12				6.2					
13				65		41.5			
14		40.0		14	9				
15		0.9		7.5					
16		5.0				0.5			
17			8.9				1.5		
18			7.5						
19		5.0							
20			5.5	4.7					
21			8.2		6.9				
22			12.8	25	12.9				
23			3.0		11.7				
24		28.0		2.4	32.5	3.1			
25		4.6		24.2	24.3				
26		6.5			64.5				
27			4.0	12.3					
28		2.3	58.1	46.9	5		9.1		
29				6.7					
30			2.5	22.8					
31			10.0	16.3					
Total	0	92.3	140.3	404.8	173.6	115.6	10.6	0	

Data Source : Chulu EPA

Table A1-2 (3-2) Daily Rainfall Records

Station Chulu Station (Chiwoza Dam Irrigation Scheme)

Year : 2007/2008

Date	Month								Remarks
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1									
2				25.5					
3				9	15.3				
4									
5									
6		20		22.7	38.6				
7			15	16.9	30.3				
8			1.6		24.9				
9					53.4				
10				14.1	8.5				
11									
12									
13									
14									
15									
16			18.3						
17									
18			17.9	33.1					
19			16.9						
20			45.2	20.5					
21				13.9					
22									
23				7.6					
24									
25	4.3								
26	3.1			30					
27				5.9					
28									
29				8.2					
30			65.6	7.5					
31									
Total	7.4	20	180.5	214.9	171	0	0	0	

Data Source : Chulu EPA

Table A1-2 (4)　　Daily Rainfall Records

Station　Chipala (Kachere Irrigation Scheme)

Year　: 2007/2008

Date	Month								Remarks
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1					7.3				
2					15.5				
3				7.4					
4				4.5	17.8				
5									
6				8.8					
7		21.1	53.1	2.2	8.0				
8					5.2				
9					20.5				
10			16.2		14.6				
11				9.5					
12									
13			27.5						
14				25.2					
15				2.3					
16				15.3					
17				5.0					
18				0.6					
19			14.0						
20			29.1	3.2					
21			6.4	16.2					
22			6.3						
23			5.3	3.5					
24			8.2	3.3					
25				3.6					
26			8.0	29.2					
27				9.0					
28			3.4	16.4					
29			15.1	0.7					
30			16.2	0.8					
31			16.3	1.5					
Total	0	21.1	225.1	168.2	88.9	0	0	0	

Data Source :　Chipala EPA

Table A1-2 (5) Daily Rainfall Records

Station Natchisaka Station (Titukulane Irrigation Scheme)

Year : 2007/2008

Date	Month								Remarks
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1				6.4	16.5				
2			0.9	26.7	14.9				
3				45.6	52.3				
4				41.5					
5									
6		6.2		4.6					
7			15.0	49.8					
8			5.0						
9			7.1	2.8					
10			2.1						
11		24.6		16					
12				10.7					
13		6.1	29.0						
14			5.6	29.6					
15			5.7						
16									
17									
18		5.9	26.0	12.4					
19			33.7	11.2					
20			3.6						
21			19.4	23.3					
22			1.4	8.6					
23				6.2					
24			6.4	3.4					
25		0.1	13.6	10					
26	0.6		17.9	15.8					
27				44.3					
28		2.7	9.0	29.1					
29	3.1		29.8						
30			9.9	6.6					
31			26.4	21.2					
Total	3.7	45.6	267.5	425.8	83.7	0	0	0	

Data Source : Natchisaka EPA

Table A1-2 (6) Daily Rainfall Records

Station Mlomba Station (Chaseta Irrigation Scheme)

Year : 2007/2008

Date	Month								Remarks
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1				7.6					
2				37.4					
3									
4				117.0	6.2				
5					23.0				
6		16.0	1.6						
7			6.1	2.8					
8			0.2						
9									
10		6.0	12.5						
11		31.3		70.3					
12		2.2		8.0					
13			7.6						
14									
15									
16									
17	3.0								
18	3.4	33.0	17.2	7.0					
19			19.7						
20			2.8						
21			9.8	6.9					
22	8.3		6.2	8.0					
23			0.8	35.0					
24			44.8	17.3					
25		0.5	1.0	3.0					
26			39.4	36.2					
27		7.0		18.0					
28			1.2	44.5					
29									
30	7.0		8.5	44.2					
31									
Total	21.7	96.0	179.4	463.2	29.2	0	0	0	

Data Source : Mlomba EPA

Table A1-2 (7) Daily Rainfall Records

Station Manjawira Station (Bawi Irrigation Scheme)

Year : 2006/2007

Date	Month								Remarks
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1				16	1.3				
2				42	15.5	3.2			
3				20.5	0.8				
4				25		2.1			
5				18.5					
6						19.5			
7				5		31.4			
8				6			5.3		
9									
10									
11				2	3.8				
12					8.1				
13					52				
14									
15				14.5					
16					3.8				
17						34.5			
18						3.2			
19				18.2	8.5				
20			60	59.8					
21				5.3					
22					13.9				
23				1.5		2.5			
24				5.9					
25				1.8	8.6				
26				8					
27			30.5	15.5					
28			15	1.5					
29				32			23		
30				8					
31									
Total	0	0	105.5	307	116.3	96.4	28.3	0	

Data Source : Manjawira EPA

Table A1-2 (8) Daily Rainfall Records

Station : Nsanama Station (Chibwana Irrigation Scheme)

Year : 2007/2008

Date	Month								Remarks
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1		5							
2				6					
3				30.2					
4			40						
5				9.1					
6									
7			6	23	6				
8		26			28				
9				15	40				
10		6							
11			7	13					
12			23						
13		5		24					
14			5	17					
15				13					
16				8					
17		24	23	6					
18			4	75					
19			42	15					
20			10	20					
21				28					
22			12	17.5					
23				12					
24			16	19					
25				24					
26			15	28					
27		2	27	20					
28									
29	4		24						
30			17						
31									
Total	4	68	271	422.8	74	0	0	0	

Data Source : Nsanama EPA

Table A2-1 (1) Climatological Data and Analysis for Evapo-Transpiration

Station : Chitipa Lat :09 º 42 ' S Long : 33 º 16 ' E Elevation : 1,285 (m)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	211.7	221.9	192	58.7	6.7	0.6	0.6	0.0	0.5	6.1	68.8	218.3	985.9	31	1956 - 86
Temp. Mean Max. (°C)	26.3	26.4	26	25.6	24.9	23.6	23.3	24.8	27.7	29.7	29.6	27	26.2	30	1958 - 87
Temp. Mean Min. (°C)	12.1	17.1	17.1	16.9	15	12.9	12.3	13.6	15.9	18.1	18.4	17.6	15.6	32	1956 - 87
Temp Average (°C)	21.7	21.8	21.6	21.3	20	18.3	17.8	19.2	21.8	23.9	24	22.3	21.1		
Wind Speed (m/sec)	1.6	1.5	2	2.7	3.2	3.4	3.9	4.4	4.8	4.8	3.5	1.9	3.1	25	1963 - 87
Actual Sunshine (hr)	4.7	4.8	5.4	7	8.6	9.4	9.7	10.1	9.9	9.4	7.8	5.4	7.7	29	1959 - 87
Pos. Sunshine (hr)	12.6	12.4	12.2	11.9	11.7	11.6	11.6	11.8	12.1	12.3	12.6	12.7	12.1		
Humidity (%)	83	83	84	82	77	73	69	63	55	51	60	78	71.5	32	1956 - 88
Ext. ter. Radiation (cal/cm²/day)	965	960	915	840	755	710	730	795	875	935	955	960	866.3		
ET- Penman (mm)	126.2	114.2	125.9	124.5	123.7	112.5	126.8	158.1	193.8	225.7	185.1	137.6	1754.1		
EO- Penman (mm)	162.4	147.3	162.4	161.7	162.1	148.2	165.2	201.5	240.6	277.1	230.4	175.8	2234.7		

Data Source : Meteorological Department, Ministry of Transport and Communication, Blantyre

Table A2-1 (2) Climatological Data and Analysis for Evapo-Transpiration

Station : Karonga Lat : 09 º 53 ' S Long : 33 º 57 ' E Elevation : 529(m)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	184.7	167.7	286.7	186.1	27.8	0.8	0.6	0.2	0.0	1.0	46.3	208.6	1110.5	19	1969 - 87
Temp. Mean Max. (°C)	29.6	29.6	29.1	28.9	28.5	27.3	27.1	28.2	30.5	32.4	32.5	30.4	29.5	19	1969 - 87
Temp. Mean Min. (°C)	21.8	21.7	21.5	21.3	19.9	17.9	17.2	17.7	19.6	22.1	23.1	22.4	20.5	19	1969 - 87
Temp Average (°C)	25.7	25.7	25.3	25.1	24.2	22.6	22.2	23	25.1	27.3	27.8	26.4	25		
Wind Speed (m/sec)	1.7	1.7	1.7	2.1	2.4	2.4	2.5	2.4	2.5	2.8	2.5	1.9	2.2	19	1969 - 87
Actual Sunshine (hr)	5.8	6.2	6.7	7.3	8.2	8.8	9.2	10	10.2	10.2	9.1	6.9	8.2	19	1969 - 87
Pos. Sunshine (hr)	12.6	12.4	12.2	11.9	11.7	11.6	11.6	11.8	12.1	12.3	12.6	12.7	12.1		
Humidity (%)	79	80	82	80	73	66	65	64	59	56	62	74	70	19	1969 - 87
Ext. ter. Radiation (cal/cm²/day)	965	960	915	840	755	710	730	795	875	935	955	960	866.3		
ET- Penman (mm)	151.6	139.2	148.2	138.9	137.3	125.4	134.9	154.1	180	216.7	199.5	167.4	1893.2		
EO- Penman (mm)	192.5	177.5	190.0	178.5	176.1	161.4	173.9	198.7	228.9	271.9	250.2	212.0	2411.6		

Table A2-1 (3) Climatological Data and Analysis for Evapo-Transpiration

Station : Bolero Lat : 11º 01' S Lobg 33º 47' E Elevation : 1,100 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	164.7	165.2	121.2	34.4	3.5	0.5	0.2	0	0.7	6.2	34.5	163.3	694.4	26	1962-87
Temp. Mean Max. (°C)	27.9	27.8	28.2	27.7	26.7	25.6	25.6	26.5	29.4	30.9	30.5	28.9	28	6	1982-87
Temp. Mean Min. (°C)	17.6	17.3	17	15.7	12.8	9.4	8.3	11.1	15.3	19.2	19.6	18.3	15.1	6	1982-87
Temp Average (°C)	22.8	22.6	22.6	21.7	19.8	17.5	17	18.8	22.7	25.1	25.1	23.6	21.6		
Wind Speed (m/sec)	0.9	0.8	1.3	1.3	1.4	1.1	1.6	2.1	2.4	2.9	2.2	1.3	1.6	6	1982-87
Actual Sunshine (hr)	5	5	6.2	7.4	8.2	8	9.4	9.7	10	9.4	5	5.6	7.4	6	1982-87
Pos. Sunshine (hr)	12.7	12.5	12.2	11.9	11.6	11.5	11.6	11.8	12.1	12.5	12.4	12.8	12.1		
Humidity (%)	81	83	80	78	72	70	64	59	44	45	81	74	69.3	4	1984-87
Ext. ter. Radiation (cal/cm²/day)	971	961	912	832	745	697	719	786	870	935	960	966	862.8		
ET- Penman (mm)	129.3	114	132.4	120.6	109.7	88.2	103.2	130.8	169.2	205.9	162.6	142	1607.9		
EO- Penman (mm)	166.8	147.6	171.7	158.4	146	119.4	139.5	172.4	216.3	257.5	209.1	181.4	2086.1		

Table A2-1 (4) Climatological Data and Analysis for Evapo-Transpiration

Station : Mzuzu Lat : 11º 26' S Long : 33º 01' E Eleva tion : 1,254 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	209.8	177.9	227.1	220.6	53.2	31.3	30.1	10.8	10.2	26.3	85.1	195.5	1,277.9	28	1960-87
Temp. Mean Max. (°C)	25.4	25.5	24.4	23.2	21.9	20.3	20	21.8	24.8	27.1	27.2	25.9	24	28	1960-87
Temp. Mean Min. (°C)	16	16.1	16	15.3	11.4	7.8	6.5	6.4	8.5	11.6	14.2	15.9	12.1	28	1960-87
Temp Average (°C)	20.7	20.8	20.2	19.3	16.7	14.1	13.3	14.1	16.7	19.4	20.7	20.9	18.1	28	1960-87
Wind Speed (m/sec)	1.6	1.6	1.8	2.1	1.9	1.9	1.9	1.9	2.2	2.4	2.2	1.7	1.9	26	1962-87
Actual Sunshine (hr)	4.7	4.9	5.3	5.7	7	7.3	7.7	8.9	9.6	9.7	8.4	5.6	7.1	23	1965-87
Pos. Sunshine (hr)	12.7	12.5	12.2	11.9	11.6	11.5	11.6	11.8	12.1	12.4	12.6	12.8	12.1		
Humidity (%)	85	85	89	89	89	88	87	80	69	66	72	83	81.8	25	1963-87
Ext. ter. Radiation (cal/cm²/day)	971	962	912	832	745	697	719	786	870	935	960	966	862.9		
EO- Penman (mm)	121.5	110.6	114.7	100.8	88	72.3	77.2	98	128.4	160	151.5	129.3	1352.3		
EO- PENMAN	157.2	143.4	150	132.9	120	100.5	107.6	134.2	170.4	208.3	196.5	167.1	1788.1		

Table A2-1 (5) Climatological Data and Analysis for Evapo-Transpiration

Station : Nkhata-Bay Lat : 11º 36' 3 Long : 34º 10' E Elevation : 500 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	228.8	198	177	48.1	7.1	5.8	4.9	2.2	3.5	21.9	73.4	232	1,002.7	87	1901-87
Temp. Mean Max. (°C)	28.7	28.8	28.7	28.3	27.2	25.7	25.4	26.7	28.6	30.2	30.5	28.9	28.1	32	1956-87
Temp. Mean Min. (°C)	21.2	21.2	20.8	20.2	17.9	15.7	15.2	15.6	17.4	19.7	21.2	21.3	19	32	1956-87
Temp Average (°C)	25	25	24.7	24.3	22.6	20.7	20.3	21.2	23	25	25.9	25.1	23.6		
Wind Speed (m/sec)	1.8	1.8	2	2.3	2.7	2.9	3.1	2.9	2.9	3.1	2.7	2.2	2.5	21	1967-87
Actual Sunshine (hr)	5.5	5.7	6.1	6.6	7.8	8	8.2	9.4	10	10.1	8.9	6.4	7.7	21	1967-87
Pos. Sunshine (hr)	12.7	12.5	12.2	11.8	11.6	11.5	11.5	11.7	12	12.4	12.6	12.8	12.1		
Humidity (%)	84	84	85	84	81	78	75	72	60	78	71	80	77.7	32	1956-87
Ext. ter. Radiation (cal/cm²/day)	974	962	910	828	740	691	713	782	867	934	962	970	861.1		
ET- Penman (mm)	143.8	130.2	139.2	127.2	121.2	106.2	117.2	139.5	164.4	196.5	184.5	156.2	1726.1		
EO- Penman (mm)	183.2	178.2	178.6	163.5	157.2	138.3	151.9	180.7	210.9	249.2	233.7	198.4	2223.8		

Table A2-1 (6) Climatological Data and Analysis for Evapo-Transpiration

Station : Mzimba Lat : 11º 54' S Long : 33º 36' E Elevation : 1,349 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	219.1	191.9	163.2	40.2	4.8	0.8	0.6	0.6	0.6	5.1	55.8	181.4	864.1	59	1921-24
Temp. Mean Max. (°C)	25.3	25.4	25.5	25.1	24.3	22.7	22	23.4	26	28	28.1	26.2	25.2	32	1933-87
Temp. Mean Min. (°C)	16.3	16.2	16	15.4	13	10.8	10.3	11.5	14.2	16.9	17.3	16.7	14.6	32	1956-87
Temp Average (°C)	20.8	20.8	20.8	20.3	18.7	16.8	16.1	17.5	20.1	22.5	22.7	21.5	19.9		
Wind Speed (m/sec)	1.5	1.6	2.3	2.9	3.3	3.2	3.4	3.8	4.1	4.3	3.3	2.1	3	26	1962-87
Actual Sunshine (hr)	4.6	4.9	5.3	7	8.6	8.8	8.7	9.6	10.1	10.1	8.1	5.2	7.6	32	1956-87
Pos. Sunshine (hr)	12.7	12.5	12.2	11.8	11.6	11.4	11.5	11.7	12	12.3	12.7	12.8	12.1		
Humidity (%)	83	84	83	80	74	71	69	63	56	54	62	78	71.4	32	1956-87
Ext. ter. Radiation (cal/cm²/day)	976	963	909	825	735	686	707	777	864	934	965	973	859.5		
ET- Penman (mm)	122.8	114.4	124.6	120.9	118.1	101.4	109.1	138.9	173.4	209.9	177.3	135.8	1646.6		
EO- Penman (mm)	158.4	144.2	160.9	156.9	154.7	134.1	142.9	178.9	219.3	262.3	222.9	173.3	2108.8		

Table A2-1 (7) Climatological Data and Analysis for Evapo-Transpiration

Station : Nkhotakota Lat : 12 º 55 ' S Long : 34 º17 ' E Elevation : 500 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	320	266.3	407.6	227.8	33.5	11.5	7.9	2.1	0.7	10.2	79.8	281.6	1,649	68	1920-87
Temp. Mean Max. (°C)	28.5	28.6	28.5	28.0	26.9	25.7	25.4	26.9	29.5	31.8	31.5	29.4	28.4	32	1956-87
Temp. Mean Min. (°C)	21.1	21.4	20.9	20.7	17.9	15.7	15.3	15.9	18.0	20.8	22.0	21.3	19.3	32	1956-87
Temp Average (°C)	24.6	24.7	24.7	23.8	22.2	20.0	19.9	21.1	23.6	25.8	26.3	25.2	23.5		
Wind Speed (m/sec)	1.6	1.9	1.9	2.2	2.9	3.1	2.8	2.6	2.7	2.8	2.6	2.1	2.4	21	1967-87
Actual Sunshine (hr)	5.4	5.7	6.9	8.0	8.7	9.2	9.0	9.5	9.9	9.9	9.0	6.6	8.2	20	1968-87
Pos. Sunshine (hr)	12.7	12.4	12.1	11.7	11.4	11.2	11.3	11.5	11.9	12.3	12.7	12.8	12		
Humidity (%)	83	81	81	77	72	66	65	62	59	58	63	77	70.3	26	1962-87
Ext. ter. Radiation (cal/cm²/day)	982	965	906	817	724	673	696	768	859	933	969	976	855.7		
ET- Penman (mm)	145.7	131.6	147.3	135.6	130.5	115.5	124.9	146.3	173.7	212.4	196.8	159.3	1819.6		
EO- Penman (mm)	186	167.7	188.5	174.3	169.3	149.7	160.6	187.6	220.2	266	246.3	201.8	2318		

Table A2-1 (8) Climatological Data and Analysis for Evapo-Transpitation

Station : Salima Lat : 13º 45' S Long : 34º 35' E Elevation : 512 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	234.8	226.5	176.4	36.1	6.3	1.4	2.9	1.9	1.6	25.4	68.7	187.4	969.4	34	1954-87
Temp. Mean Max. (°C)	29.3	29.1	29.3	28.9	27.8	26.2	26	27.8	30.5	32.6	32.7	30.2	29.2	30	1956-85
Temp. Mean Min. (°C)	21.4	21.2	21.3	20.6	17.7	15.7	15.7	16.5	18.5	21	22.4	21.9	19.5	30	1956-85
Temp Average (°C)	25.4	25.2	25.3	24.8	22.8	21	20.9	22.2	24.5	26.8	27.6	26.1	24.4		
Wind Speed (m/sec)	1.7	1.7	2.1	2.4	2.4	2.6	2.7	2.4	2.3	2.6	2.4	2	2.3	24	1962-85
Actual Sunshine (hr)	6.1	6.1	7.5	8.7	9.5	9.2	8.9	9.8	9.9	10.1	8.9	6.6	8.4	28	1958-85
Pos. Sunshine (hr)	12.9	12.6	12.2	11.8	11.5	11.3	11.4	11.7	12	12.4	12.8	12.9	12.1		
Humidity (%)	80	81	76	72	67	62	60	57	54	53	60	74	66.3	24	1962-85
Ext. ter. Radiation (cal/cm²/day)	788	766	903	810	713	661	684	759	854	933	974	980	818.8		
ET- Penman (mm)	153.5	135	158.1	148.2	132.1	115.5	125.2	145.7	170.4	209.6	198.6	166.2	1858.1		
EO- Penman (mm)	195.3	172.2	201.5	189.6	171.4	149.4	160.6	157.2	216.9	263.5	248.7	209.6	2335.9		

Table A2-1 (9) Climatological Data and Analysis for Evapo-Transpiration

Station : Kasungu Lat : 13º 01 ' S Long : 33º 28 ' E Elevation : 1,058 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	208.1	232.9	124.1	18.2	7.8	0.0	0.1	0.1	0.3	9.5	67.9	189.3	858.3	55	1933-87
Temp. Mean Max. (°C)	27.0	27.3	27.4	27.5	26.3	24.6	24.5	23.4	26.1	27.5	27.4	28.2	26.4	6	1983-88
Temp. Mean Min. (°C)	18.1	18.0	17.8	15.6	12.5	9.7	9.7	11.9	15.3	17.7	18.7	18.6	15.3	6	1983-88
Temp Average (°C)	21.8	21.7	22.0	21.1	19.2	17.2	17.2	18.7	21.8	23.8	24.0	22.8	20.9	4	1984-87
Wind Speed (m/sec)	2.0	2.4	2.8	3.0	2.7	2.1	1.9	1.8	2.1	2.2	2.5	2.1	2.3		
Actual Sunshine (hr)	5.0	5.4	6.8	8.4	8.7	8.7	9.0	9.2	9.8	9.7	8.5	5.8	7.9	4	1984-87
Pos. Sunshine (hr)	12.7	12.4	12.1	11,7	11.4	11.2	11.3	11.5	11.9	12.3	12.7	12.8	12		
Humidity (%)	84	85	84	80	76	71	61	60	51	52	63	79	70.5	4	1984-87
Ext. ter. Radiation (cal/cm²/day)	982	964	906	817	724	673	696	768	859	933	969	976	855.6		
ET- Penman (mm)	140.1	121.8	133.4	123.9	110.4	90.3	103.2	133	171.9	202.1	105.4	140.1	1575.6		
EO- Penman (mm)	180.7	157.4	172.1	163.2	147.9	121.5	137.6	172.7	217.5	252.7	231.9	178.9	2134.1		

Table A2-1 (10) Climatological Data and Analysis for Evapo-Transpitation

Station : Chileka Lat : 15º 40' S Long : 34º 58' E Elevation : 767 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	197.8	178.3	139.4	40.9	9	2.8	2.5	1	4.2	26.1	87.8	172.7	862.5	49	1939-87
Temp. Mean Max. (°C)	28.3	28.1	27.7	27.1	25.9	23.8	23.8	26.1	29.2	31.1	30.5	29	27.6	32	1956-87
Temp. Mean Min. (°C)	19.9	19.8	19.2	17.9	15.6	13.6	13.3	14.5	17.2	19.5	20.4	20.2	17.6	32	1956-87
Temp Average (°C)	24.1	24	23.5	22.5	20.8	18.7	18.6	20.3	23.2	25.3	25.6	24.6	22.6		
Wind Speed (m/sec)	1.7	1.6	2.1	2.1	2	2.1	2.4	2.4	2.7	2.8	2.5	2	2.2	29	1959-87
Actual Sunshine (hr)	6.3	6.6	7	7.8	8.6	7.7	7.5	8.4	8.8	8.8	7.6	6.2	7.6	32	1956-87
Pos. Sunshine (hr)	13	12.6	12.2	11.7	11.4	11.2	11.7	11.6	12	12.5	12.9	12.1	12.1		
Humidity (%)	79	79	78	75	69	66	64	57	52	52	61	75	67.3	32	1956-87
Ext. ter. Radiation (cal/cm²/day)	999	969	897	795	692	637	661	741	843	932	982	993	845.1		
ET- Penman (mm)	151.3	134.7	143.5	125.7	110.7	91.5	102.3	129.3	163.5	196.2	180.6	156.6	1685.9		
EO- Penman (mm)	193.4	173	184.5	163.2	145.4	120	132.4	165.5	205.8	244.6	225.6	198.4	2151.8		

Table A2-1 (11) Climatological Data and Analysis for Evapo-Transpiration

Station : Lilongwe Lat : 13º 57' S Long : 33º 55' E Elevation : 1,135 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	215.3	202.9	133.8	41.9	8.8	1	1	1	3.3	6	66.2	166.3	847.5	30	1949-78
Temp. Mean Max. (°C)	26.7	26.6	26.7	26.3	25.4	23.7	23.4	25.1	27.8	29.8	29.7	27.4	26.6	29	1956-84
Temp. Mean Min. (°C)	17.5	17.5	16.6	14.8	11.2	8.7	8.3	9.7	12.3	15.3	17.2	17.7	13.9	29	1956-84
Temp Average (°C)	22.1	22.1	21.7	20.6	18.3	16.2	15.9	17.4	20.1	22.6	23.5	22.6	20.3		
Wind Speed (m/sec)	1.8	1.8	2	2.2	2.3	2.6	2.8	3	3.2	3.3	2.9	2.1	2.5	29	1956-84
Actual Sunshine (hr)	5.1	5.2	6.4	7.5	8.4	8	7.8	8.8	9.3	9.5	7.7	5.3	7.4	29	1956-84
Pos. Sunshine (hr)	12.9	12.6	12.2	11.8	11.5	11.3	11.4	11.7	12	12.4	12.8	12.9	12.1		
Humidity (%)	83	85	82	79	73	68	65	59	54	53	62	79	70.2	29	1956-84
Ext. ter. Radiation (cal/cm²/day)	985	966	903	810	713	661	684	759	854	935	974	980	852		
ET- Penman (mm)	132.4	116.8	130.8	117.9	105.1	91.2	100.8	127.7	159	193.4	174.9	139.5	1589.5		
EO- Penman (mm)	169.9	150.6	169.6	154.5	139.5	120.3	131.1	164.6	201.6	243.4	219.6	177.6	2042.3		

Table A2-1 (12) Climatological Data and Analysis for Evapo-Transpiration

Station :Dedza Lat : 14º 17' S Long : 34º 15' E Elevation : 1,632 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	230.5	210.2	134.5	51.4	10.1	4.2	3.2	1.2	2.9	10.3	58.2	211.5	928.2	30	1958-87
Temp. Mean Max. (°C)	23	23	22.9	22.4	21.3	19.3	18.8	20.4	23.2	24.9	25.1	23.4	22.3	31	1957-87
Temp. Mean Min. (°C)	15.5	15.4	14.9	13.8	11.7	9.5	9	10.5	13	15	16	15.7	13.3	31	1957-87
Temp Average (°C)	19.3	19.2	18.9	18.1	16.5	14.4	13.9	15.5	18.1	20	20.6	19.6	17.8		
Wind Speed (m/sec)	2	1.9	2	2	1.9	2	2.1	2.5	3	3.2	2.8	2.2	2.3	32	1956-87
Actual Sunshine (hr)	5	5	6	7.1	8.1	8	7.7	8.7	9.5	9.4	7.6	5.2	7.3	31	1957-87
Pos. Sunshine (hr)	12.9	12.6	12.2	11.8	11.5	11.3	11.4	11.7	12	12.4	12.8	12.9	12.1		
Humidity (%)	83	85	82	80	72	68	66	61	56	56	64	79	71	31	1957-87
Ext. ter. Radiation (cal/cm²/day)	988	966	903	810	713	661	684	759	854	933	974	980	852.1		
ET- Penman (mm)	124	107.8	119	105.3	95.8	80.7	87.1	113.2	146.1	175.5	158.7	129.3	1442.5		
EO- Penman (mm)	160.3	140	155.6	140.7	129	109.5	116.9	149.1	188.7	223.8	201.6	166.2	1881.4		

Table A2-1 (13) Climatological Data and Analysis for Evapo-Transpiration

Station : Monky Bay Lat : 14º 05' S Long : 34º 55' E Elevation : 482 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	190.3	234	93.9	18.7	4.7	0	0.4	1.2	0.7	9.4	37.8	296.6	887.7	9	1979-87
Temp. Mean Max. (°C)	29.7	29.5	30.3	29.7	28.5	26.4	26.3	28.1	31	32.3	32.6	30.1	29.5	9	1979-87
Temp. Mean Min. (°C)	22.2	21.8	21.9	20.6	18.3	16	16	17.4	19.6	22.4	23.6	22.7	20.2	9	1979-87
Temp Average (°C)	26	25.7	26.1	25.2	23.4	21.2	21.2	22.8	25.3	27.4	28.1	26.4	24.9		
Wind Speed (m/sec)	1.9	1.8	2	2.2	2.2	2.4	2.5	2.5	2.6	3	2.8	2.4	2.4	9	1979-87
Actual Sunshine (hr)	6.6	6.8	8.1	8.6	9.4	8.9	8.8	9.6	9.8	9.8	9	6.9	8.5	9	1979-87
Pos. Sunshine (hr)	12.9	12.6	12.2	11.8	11.5	11.3	11.4	11.7	12	12.4	12.8	12.9	12.1		
Humidity (%)	79	80	75	70	64	61	58	55	53	53	79	74	66.8	9	1979-87
Ext. ter. Radiation (cal/cm²/day)	988	966	903	810	713	661	684	759	854	933	974	980	852.1		
ET- Penman (mm)	162.1	143.1	165.9	148.8	133.9	113.7	124.9	149.7	178.8	217.9	191.7	173.3	1903.8		
EO- Penman (mm)	205.8	182.8	211.7	190.2	173.3	147	160.3	191.3	225.6	271.3	242.4	217.9	2419.6		

Table A2-1 (14) Climatological Data and Analysis for Evapo-Transpiration

Station : Mangochi Lat : 14º 28' S Long : 35º 15' E Elevation : 482 m

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	191.3	188.7	136.5	36.2	4.5	2.7	2.5	1.8	2.8	13.1	54	156.8	790.9	68	1920-87
Temp. Mean Max. (°C)	30.2	30	30.1	29.5	28.3	26.5	26.2	28.4	31.4	33.6	33.3	31	29.9	32	1956-87
Temp. Mean Min. (°C)	21.5	21.4	21	19.6	16.4	14.2	14.1	15.2	17.9	20.8	22	21.8	18.8	32	1956-87
Temp Average (°C)	25.9	25.7	25.6	24.6	22.4	20.4	20.2	21.8	24.7	27.2	27.7	26.4	24.4		
Wind Speed (m/sec)	1.5	1.5	1.6	1.8	1.9	1.9	2.2	2.1	2.3	2.5	2.2	1.8	1.9	28	1960-87
Actual Sunshine (hr)	6.8	6.8	7.7	8.3	9.1	8.4	8.2	9.1	9.6	9.7	8.6	6.7	8.3	21	1967-87
Pos. Sunshine (hr)	12	12.6	12.2	11.8	11.5	11.3	11.4	11.7	12	12.4	12.8	15	12.2		
Humidity (%)	78	79	76	73	68	66	62	57	51	50	58	72	65.8	20	1956-85
Ext. ter. Radiation (cal/cm²/day)	991	966	902	807	708	655	678	755	851	933	974	983	850.3		
ET- Penman (mm)	161.5	141.7	156.2	138	121.8	99.9	112.2	136.7	170.7	209.3	195.6	167.7	1811.3		
EO- Penman (mm)	205.8	181.2	200.6	178.2	159.7	131.4	145.1	176.1	216.3	262	244.8	211.7	2312.9		

Table A2-1 (15) Climatological Data and Analysis for Evapo-Transpitation

Station : Thyolo Lat :16 º 08 ' S Long : 35 º 08 ' E Elevation : 820 (m)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	222.8	201.7	212.1	97.6	26	28.3	32.5	13.2	9.3	39.0	103.0	253.3	1238.8	26	1962 - 87
Temp. Mean Max. (°C)	27.7	27.5	27	25.7	24.4	22.4	22.2	24.8	27.9	30.0	29.8	28.2	26.5	26	1962 - 87
Temp. Mean Min. (°C)	18.7	18.6	18.2	16.6	13.5	11.4	11.1	12	14.1	16.8	18.1	18.7	15.7	26	1962 - 87
Temp Average (°C)	23.2	23.1	22.6	21.2	19	16.9	16.7	18.4	21.0	23.4	24.0	23.5	21.1		
Wind Speed (m/sec)	1.5	1.4	1.3	1.2	1.2	1.2	1.2	1.5	1.9	2.2	1.9	1.7	1.5	26	1962 - 87
Actual Sunshine (hr)	6.1	6.2	6.3	7.0	7.5	6.9	7	8.4	8.8	8.6	7.7	5.7	7.2	25	1963 - 87
Pos. Sunshine (hr)	13	12.6	12.2	11.7	11.4	11.2	11.3	11.6	12.0	12.5	12.9	13.1	12.1		
Humidity (%)	83	84	85	83	79	79	77	69	60	60.0	68.0	80.0	75.6	26	1962 - 87
Ext. ter. Radiation (cal/cm²/day)	999	969	897	795	692	637	661	741	843	932.0	982.0	993.0	845.1		
ET- Penman (mm)	142.0	124.6	125.9	106.5	89.6	70.5	77.2	105.4	138.3	171.4	162.0	142.3	1455.7		
EO- Penman (mm)	183.2	161.3	164	141.0	121.2	96.6	105.1	140.4	179.4	218.2	206.7	182.0	1899.1		

Table A2-1 (16) Climatological Data and Analysis for Evapo-Transpitation

Station : Mulanje Lat : 16 º 01' S Long : 35 º 30 ' E Elevation : 612 (m)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	318.0	316.0	340.0	172.0	71.0	60.0	34.0	36.0	18.0	67.0	188.0	288.0	1,908.0		
Temp. Mean Max. (°C)	29.1	29.0	28.0	27.5	25.2	23.0	23.6	25.5	28.8	32.1	31.1	29.7	27.7		
Temp. Mean Min. (°C)	18.7	18.6	18.2	16.3	13.2	11.1	10.3	10.6	12.8	16.3	18.1	18.6	15.2		
Temp Average (°C)	23.9	23.8	23.1	21.9	19.2	17.1	17.0	18.1	20.8	24.2	24.6	24.2	21.5		
Wind Speed (m/sec)	1.2	1.2	1.1	1.0	1.1	1.2	1.2	1.2	1.4	1.3	1.2	1.2	1.2		
Actual Sunshine (hr)	5.6	6.0	4.7	6.2	6.2	5.0	5.6	7.6	7.3	9.0	6.8	5.8	6.3		
Pos. Sunshine (hr)															
Humidity (%)	82.0	87.0	84.0	84	85	85	78	76	70.0	64	73	83.0	79.3		
Ext. ter. Radiation (cal/cm²/day)															
ET- Penman (mm)	127.1	112.0	105.4	96.0	80.6	66.0	77.5	102.3	126.0	161.2	141.0	130.2	1,325.3		
EO- Penman (mm)															

Table A2-1 (17) Climatological Data and Analysis for Evapo-Transpitation

Station : Bvumbwe Lat :15 º 55 ' S Long : 35 º 04' E Elevation : 1,146 (m)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	255.8	217.2	193.1	80.0	19.7	21.7	18.4	10.3	6.8	30.2	104.2	225.5	1182.9	43	1945-87
Temp. Mean Max. (°C)	25.1	24.9	24.5	23.4	22.1	20	19.6	22.1	25.4	27.3	27	25.5	23.9	32	1956-87
Temp. Mean Min. (°C)	17.3	17.2	16.8	15.5	13.2	11.3	10.9	11.9	14.0	15.9	17.1	17.3	14.9	32	1956-87
Temp Average (°C)	21.2	21.1	20.7	19.5	17.7	15.7	15.3	17	19.7	21.6	22.1	21.4	19.4		
Wind Speed (m/sec)	1.7	1.6	2.1	2.1	2.0	2.1	2.4	2.4	2.7	2.8	2.5	2	2.2	30	1958-87
Actual Sunshine (hr)	5.7	5.6	5.9	6.7	7.4	6.8	6.8	8.1	8.6	8.5	7.2	5.5	6.9	32	1956-87
Pos. Sunshine (hr)	13	12.6	12.2	11.7	11.4	11.2	11.3	11.6	12	12.5	12.9	13.1	12.1		
Humidity (%)	85	87	88	85	80	78	76	67	61	61	70	83	77	21	1962-82
Ext. ter. Radiation (cal/cm²/day)	999	969	897	795	692	637	661	741	843	932	982	993	845		
ET- Penman (mm)	132.1	114	118.1	102.6	89.6	72.9	81.2	108.8	140.7	169	155.4	133.3	1417.7		
EO- Penman (mm)	171.1	148.1	154.4	135.9	120.6	98.7	108.2	142.9	180.6	214.8	197.7	171.4	1844.4		

Table A2-1 (18) Climatological Data and Analysis for Evapo-Transpitation

Station : Ngabu Lat :16 º 27 ' S Long : 35 º 53' E Elevation : 104 (m)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Year	Period
Precipitation (mm)	141.7	161.1	122.9	43.6	15.7	15.7	17.1	4.7	4.2	23.7	64.4	187.7	802.5	16	1972-87
Temp. Mean Max. (°C)	34.1	33.3	32.5	31.5	30.2	28.2	27.8	30.7	33.8	36.0	37.0	34.4	32.5	17	1971-87
Temp. Mean Min. (°C)	23.4	23.2	22.7	20.8	17.8	15.3	15.3	16.8	19.9	22.2	23.6	23.4	20.4	17	1971-87
Temp Average (°C)	28.8	28.3	27.6	26.2	24	21.8	21.9	23.7	26.9	29.1	30.3	28.9	26.5		
Wind Speed (m/sec)	1.6	1.4	1.4	1.3	1.2	1.4	1.7	2.5	3.2	3.6	3.2	2.2	2.1	16	1971-87
Actual Sunshine (hr)	8.1	7.6	7.6	7.9	8.3	7.7	7.4	8.9	9.3	9.1	8.9	7.3	8.2	16	1971-87
Pos. Sunshine (hr)	13.0	12.6	12.2	11.7	11.3	11.2	11.3	11.6	12.0	12.5	12.9	13.1	12.1		
Humidity (%)	76	76	78	76	71	71	66	59	54	52	56	71	67.2	16	1972-87
Ext. ter. Radiation (cal/cm²/day)	999	969	896	792	687	631	670	736	840	931	985	997	844.4		
ET- Penman (mm)	188.5	170.4	160.3	134.1	113.2	91.5	107	145.4	191.4	234.7	230.7	190.7	1957.9		
EO- Penman (mm)	238.4	216.3	204.3	172.8	148.5	120.6	138	183.8	236.4	285.8	282.0	237.8	2464.7		

Table A2-2 Major Dimensions and Types of Proposed Cropping Pattern by Each Agricultural Development Division (ADD)

ADD	Neighboring Meteorological Station	Cropping Pattern	Crops		Rate of Cropping Area (%)	Date of Planting Period				Soil Texture	Rooting Depth 2/ (m)	Readily Available Soil Moisture (mm)	Type of Cropping Pattern	
			Summer (Wet) Season	Winter (Dry) Season		Sowing	Transplanting	Harvesting	Growing Period (day)				Summer (Wet) Season	Winter (Dry) Season
1. Karonga	Chitipa Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 1,285 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
	Karonga Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		70 (70 x 100)	Nov. 21		Mar. 20	120	Loan	1.35	80	S-Ma	
	(EL. 529 m)			Grain Maize (W1)	70 (70x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	30 (30 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
		Rice (S) + Maize (W2)	Rice (S)		30 (30 x 100)	Dec. 21	Jan.11	May 10	140 (120)				S-Ri	
				Grain Maize (W3)	70 (70 x 100)	Jul. 21		Nov. 20	120					W3-Ma
2. Mzuzu ADD	Bolero Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 1,100 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
	Mzuzu Statiion	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL.1,250 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
	Nkhata Bay Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 500 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
	Mzimba Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 1,349 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
3. Kasungu ADD	Kasungu Station (1,058 m)	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
				Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
4. Salima ADD	Nkhotakota Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		70 (70 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 500 m)			Grain Maize (W1)	70 (70x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	30 (30 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
		Rice (S) + Maize (W2)	Rice (S)		30 (30 x 100)	Dec. 21	Jan.11	May 10	140 (120)				S-Ri	
				Grain Maize (W3)	70 (70 x 100)	Jul.21		Nov. 20	120					W3-Ma
	Salima Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 512 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
5. Lilongwe ADD	Chileka Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL.767 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
	Lilongwe Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL.1,135 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
	Dedza Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 1,632 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma

ADD	Neighboring Meteorological Station	Cropping Pattern	Crops		Rate of Cropping Area (%)	Date of Planting Period				Soil Texture	Rooting Depth 2/ (m)	Readily Available Soil Moisture (mm)	Type of Cropping Pattern	
			Summer (Wet) Season	Winter (Dry) Season		Sowing	Transplanting	Harvesting	Growing Period (day)				Summer (Wet) Season	Winter (Dry) Season
6. Machinga ADD	Monkey Bay	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 482 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
	Mangochi Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		70 (70 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 482 m)			Grain Maize (W1)	70 (70x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	30 (30 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
		Rice (S) + Maize (W2)	Rice (S)		30 (30 x 100)	Dec. 21	Jan.11	May 10	140 (120)				S-Ri	
				Grain Maize (W3)	70 (70 x 100)	Jul. 21		Nov. 20	120					W3-Ma
7. Blantyre ADD	Thyolo Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 820 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
	Mulanje Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		70 (70 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(El. 612 m)			Grain Maize (W1)	70 (70x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	30 (30 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
		Rice (S) + Maize (W2)	Rice (S)		30 (30 x 100)	Dec. 21	Jan.11	May 10	140 (120)				S-Ri	
				Grain Maize (W3)	70 (70 x 100)	Jul. 21		Nov. 20	120					W3-Ma
8. Shire Valley ADD	Bvumbwe Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		70 (70 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(El. 1,146 m)			Grain Maize (W1)	70 (70x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	30 (30 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma
		Rice (S) + Maize (W2)	Rice (S)		30 (30 x 100)	Dec. 21	Jan. 11	May 10	140 (120)				S-Ri	
				Grain Maize (W3)	70 (70 x 100)	Jul. 21		Nov. 20	120					W3-Ma
	Ngabu Station	Maize (S) + Maize (W1) + Maize (W2)	Grain Maize (S)		100 (100 x 100)	Nov. 21		Mar. 20	120	Loam	1.35	80	S-Ma	
	(EL. 104 m)			Grain Maize (W1)	100 (100 x 100)	Mar. 21		Jul. 20	120		1.35	80		W1-Ma
				Green Maize (W2)	100 (100 x 100)	Jul. 21		Nov. 20	120		1.35	80		W2-Ma

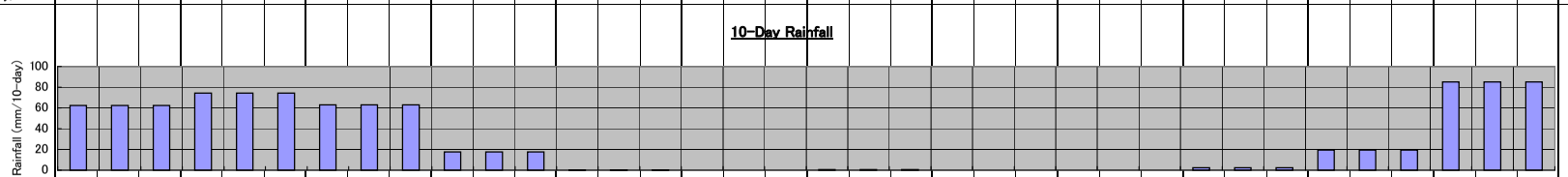
1/ : Growing period in parenthes shows the rice growing periods from transplanting date to harvesting date.

2/ : Rooting depth and readily available soil moisture are derived from FAO Irrigation and Drainage Paper No. 24

Table A2-3 (1) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Karonga ADD

Meteorological Station : Chitipa Station

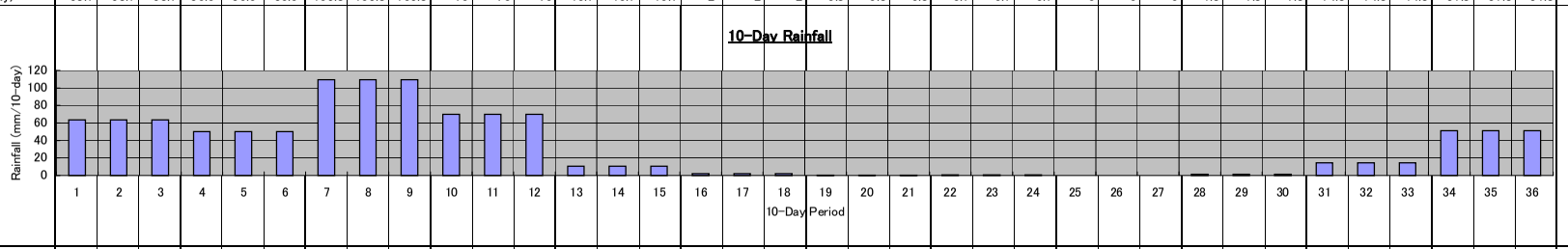
Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall 1/																																					Total Rainfall =
Monthly Rainfall (mm/month)	187.0			223.0			189.0			53.0			1.0			0.0			2.0			0.0			0.0			7.0			58.0			255.0			975.0
10-day Rainfall (mm/10-day)	62.3	62.3	62.3	74.3	74.3	74.3	63	63	63	17.6	17.6	17.6	0.3	0.3	0.3	0	0	0	0.7	0.7	0.7	0	0	0	0	0	0	2.3	2.3	2.3	19.3	19.3	19.3	85	85	85	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Grain) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Unit GWR (lit/sec/ha)																																					
Maize (Grain) (S) 100 %	0	0	0	0	0	0	0	0																									0	0	0	0	S-Ma
Maize (Grain) (W1) 100 %									0	0	0	0.38	0.61	0.81	0.99	1.05	1.09	1.14	1.17	1.01																	W1-Ma
Maize (Green) (W2) 100 %																					0.34	0.34	0.41	0.69	1.02	1.36	1.66	1.71	1.72	1.7	1.63	1.02					W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0	0	0	0	0	0																									0	0	0	0	
Winter Crop (W1)									0	0	0	0.38	0.61	0.81	0.99	1.05	1.09	1.14	1.17	1.01																	
Winter Crop (W2)																					0.34	0.34	0.41	0.69	1.02	1.36	1.66	1.71	1.72	1.7	1.63	1.02					
Total	0	0	0	0	0	0	0	0	0	0	0	0.38	0.61	0.81	0.99	1.05	1.09	1.14	1.17	1.01	0.34	0.34	0.41	0.69	1.02	1.36	1.66	1.71	1.72	1.7	1.63	1.02	0	0	0	0	



Note : 1/ : Refer to Table A.2-4(1)

Table A2-3 (2) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Karonga ADD

Meteorological Station : Karonga Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	191.0			150.0			328.0			210.0			32.0			6.0			1.0			2.0			0.0			4.0			43.0			154.0			1,121.0
10-day Rainfall (mm/10-day)	63.7	63.7	63.7	50.0	50.0	50.0	109.3	109.3	109.3	70	70	70	10.7	10.7	10.7	2	2	2	0.3	0.3	0.3	0.7	0.7	0.7	0	0	0	1.3	1.3	1.3	14.3	14.3	14.3	51.3	51.3	51.3	
																																					
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 70 %	———																																———				S-Ma
Rice (S) 15 %	·····												———																							Nursery 1/ ·····	S-Ri
Rice (S) 15 %		Nursery ·····		———											———																						S-Ri
Maize (Grain) (W1) 70 %									———							———			———																			W1-Ma
Maize (Green) (W2) 30 %																					———																W2-Ma
Maize (Grain) (W3) 70 %																					———																W3-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 2/																																					
Maize (Grain) (S) 70 %	0	0.09	0.27	0.25	0.18	0.09	0	0																									0	0	0	0	S-Ma
Rice (S) 15 %	0.63	0.29	0.29	0.2	0.22	0.28	0.67	0.69	0.69	1.41	1.37	1.33	1.46																					0	0.85	S-Ri
Rice (S) 15 %	0	0.59	0.59	0.45	0.45	0.24	0.51	0.54	0.56	0.24	0.26	0.38	1.59	1.55	1.51																						S-Ri
Maize (Grain) (W1) 70 %									0	0	0	0	0.09	0.64	1.01	1.03	1.05	1.07	1.07	0.9																W1-Ma
Maize (Green) (W2) 30 %																					0.29	0.3	0.35	0.58	0.85	1.13	1.39	1.44	1.46	1.46	1.38	0.91					W2-Ma
Maize (Grain) (W3) 70 %																					0.29	0.3	0.35	0.58	0.85	1.13	1.39	1.44	1.46	1.46	1.36	0.91					W3-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0.09	0.2	0.32	0.27	0.23	0.14	0.18	0.18																									0	0	0	0	
Winter Crop (W1)									0	0	0	0	0.06	0.45	0.71	0.72	0.74	0.75	0.75	0.63																	
Winter Crop (W2) +(W3)																					0.29	0.3	0.35	0.58	0.85	1.13	1.39	1.44	1.46	1.46	1.37	0.91					
Total	0.09	0.2	0.32	0.27	0.23	0.14	0.18	0.18	0	0	0	0	0.06	0.45	0.71	0.72	0.74	0.75	0.75	0.63	0.29	0.3	0.35	0.58	0.85	1.13	1.39	1.44	1.46	1.46	1.37	0.91	0	0	0	0	

1/ : Refer to Table A.2-5 (1)

2/ : Refer to Table A.2-4 (2) .

Table A2-3(3) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Mzuzu ADD

Meteorological Station : Bolero Station

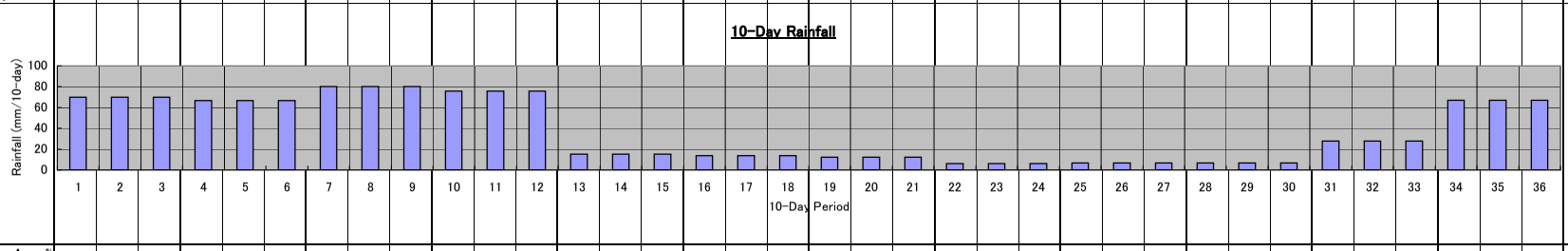
Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	164.7			165.2			121.2			34.4			3.5			0.5			0.2			0.0			0.7			6.2			34.5			163.3			694.4
10-day Rainfall (mm/10-day)	54.9	54.9	54.9	55.1	55.1	55.1	40.4	40.4	40.4	11.5	11.5	11.5	1.2	1.2	1.2	0.2	0.2	0.2	0.1	0.1	0.1	0	0	0	0.2	0.2	0.2	2.1	2.1	2.1	11.5	11.5	11.5	54.4	54.4	54.4	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
																		10-Day Period																			
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Maize (Grain) (S) 100 %	0	0	0	0	0	0.02	0.08	0.04																									0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0.04	0.39	0.69	0.95	1.16	1.22	1.26	1.3	1.3	1.1																	W1-Ma
Maize (Green) (W2) 100 %																					0.36	0.36	0.41	0.67	0.95	1.24	1.47	1.48	1.45	1.4	1.32	0.86					W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
(lit/sec)																																					
Summer Crop (S)	0	0	0	0	0	0.02	0.08	0.04																									0	0	0	0	
Winter Crop (W1)									0	0	0.04	0.39	0.69	0.95	1.16	1.22	1.26	1.3	1.3	1.1																	
Winter Crop (W2)																					0.36	0.36	0.41	0.67	0.95	1.24	1.47	1.48	1.45	1.4	1.32	0.86					
Total	0	0	0	0	0	0.02	0.08	0.04	0	0	0.04	0.39	0.69	0.95	1.16	1.22	1.26	1.3	1.3	1.1	0.36	0.36	0.41	0.67	0.95	1.24	1.47	1.48	1.45	1.4	1.32	0.86	0	0	0	0	

Note : 1/ : Refer to Table A.2-4(3)

Table A2-3 (4) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Mzuzu ADD

Meteorological Station : Mzuzu Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	210.0			200.0			241.0			227.0			46.0			41.0			37.0			18.0			20.0			20.0			83.0			201.0			1,344.0
10-day Rainfall (mm/10-day)	70	70	70	66.7	66.7	66.7	80.2	80.2	80.2	75.7	75.7	75.7	15.3	15.2	15.3	13.7	13.7	13.7	12.3	12.3	12.3	6	6	6	6.7	6.7	6.7	6.7	6.7	6.7	27.7	27.7	27.7	67	67	67	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Maize (Grain) (S) 100 %	0	0	0	0	0	0	0	0																										0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0	0	0	0	0.14	0.23	0.32	0.41	0.48	0.46																	W1-Ma
Maize (Green) (W2) 100 %																					0.14	0.2	0.25	0.43	0.62	0.8	0.95	0.94	0.9	0.85	0.75	0.45					W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0	0	0	0	0	0																										0	0	0	0	
Winter Crop (W1)									0	0	0	0	0	0	0.14	0.23	0.32	0.41	0.48	0.46																	
Winter Crop (W2)																					0.14	0.2	0.25	0.43	0.62	0.8	0.95	0.94	0.9	0.85	0.75	0.45					
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14	0.23	0.32	0.41	0.48	0.46	0.14	0.2	0.25	0.43	0.62	0.8	0.95	0.94	0.9	0.85	0.75	0.45	0	0	0	0	



Note : 1/ : Refer to Table A.2-4 (4)

Table A2-3 (5) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Mzuzu ADD

Meteorological Station : Nkhata Bay Station

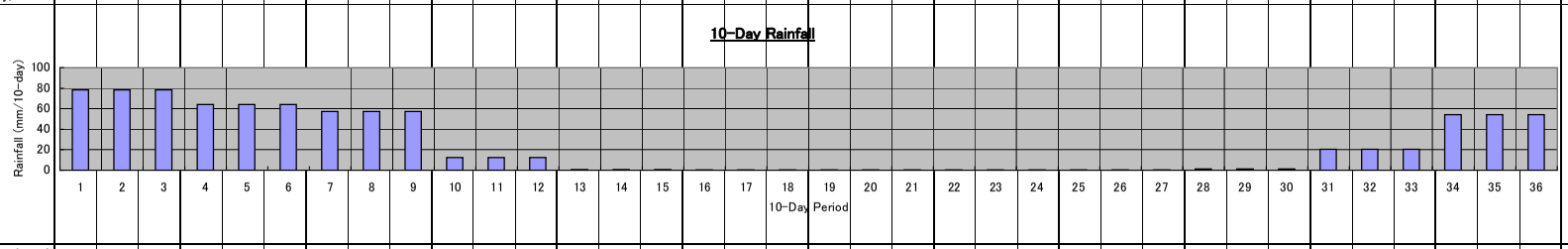
Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	273.0			214.0			376.0			273.0			65.0			40.0			23.0			6.0			4.0			18.0			88.0			217.0			1,597.0
10-day Rainfall (mm/10-day)	91	91	91	71.3	71.3	71.3	125.3	125.3	125.3	91	91	91	21.7	21.7	21.7	13.3	13.3	13.3	7.7	7.7	7.7	2	2	2	1.3	1.3	1.3	6	6	6	29.3	29.3	29.3	72.3	72.3	72.3	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
																		10-Day Period																			
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Maize (Grain) (S) 100 %	0	0	0	0	0	0	0	0																									0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0	0	0	0.17	0.44	0.59	0.76	0.85	0.85	0.67																	W1-Ma
Maize (Green) (W2) 100 %																					0.15	0.23	0.32	0.54	0.8	1.07	1.3	1.3	1.28	1.21	1.02	0.57						W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0	0	0	0	0	0																									0	0	0	0	
Winter Crop (W1)									0	0	0	0	0	0.17	0.44	0.59	0.76	0.85	0.85	0.67																	
Winter Crop (W2)																					0.15	0.23	0.32	0.54	0.8	1.07	1.3	1.3	1.28	1.21	1.02	0.57					
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0.17	0.44	0.59	0.76	0.85	0.85	0.67	0.15	0.23	0.32	0.54	0.8	1.07	1.3	1.3	1.28	1.21	1.02	0.57	0	0	0	0	

Note : 1/ : Refer to Table A.2-4 (5)

Table A2-3 (6) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Mzuzu ADD

Meteorological Station : Mzimba Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	235.0			192.0			172.0			37.0			2.0			1.0			1.0			1.0			1.0			4.0			61.0			163.0			870.0
10-day Rainfall (mm/10-day)	78.3	78.3	78.3	64.0	64.0	64.0	57.3	57.3	57.3	12.3	12.3	12.3	0.7	0.7	0.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	1.3	1.3	1.3	20.3	20.3	20.3	54.3	54.3	54.3	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
																		10-Day	Period																		
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Maize (Grain) (S) 100 %	0	0	0	0	0	0	0	0																									0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0	0.32	0.6	0.8	0.97	1.02	1.06	1.1	1.12	0.96																	W1-Ma
Maize (Green) (W2) 100 %																					0.32	0.34	0.39	0.65	0.96	1.29	1.57	1.63	1.64	1.62	1.39	0.88					W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0	0	0	0	0	0																									0	0	0	0	
Winter Crop (W1)									0	0	0	0.32	0.6	0.8	0.97	1.02	1.06	1.1	1.12	0.96																	
Winter Crop (W2)																					0.32	0.34	0.39	0.65	0.96	1.29	1.57	1.63	1.64	1.62	1.39	0.88					
Total	0	0	0	0	0	0	0	0	0	0	0	0.32	0.6	0.8	0.97	1.02	1.06	1.1	1.12	0.96	0.32	0.34	0.39	0.65	0.96	1.29	1.57	1.63	1.64	1.62	1.39	0.88	0	0	0	0	

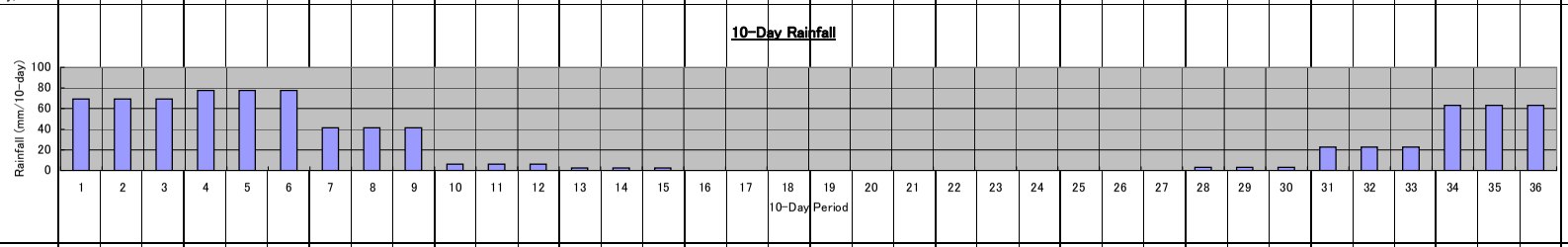


Note : 1/ : Refer to Table A.2-4 (6)

Table A2-3 (7) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Kasungu ADD

Meteorological Station : Kasungu Station

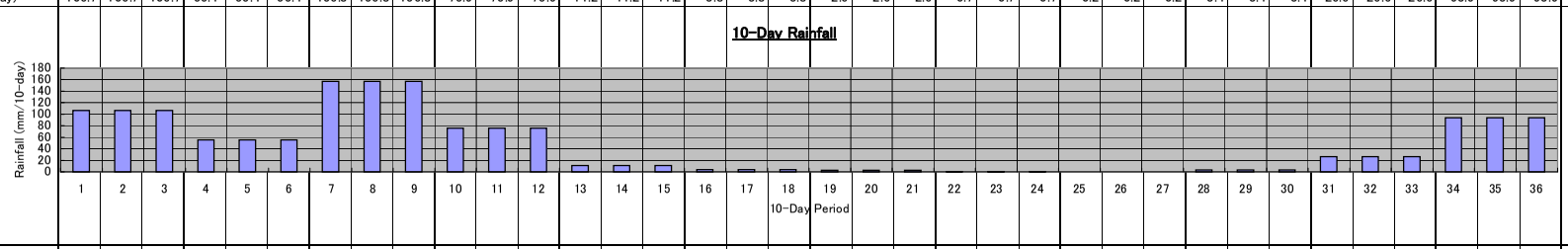
Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	208.1			232.9			124.1			18.2			7.8			0.0			0.1			0.1			0.3			9.5			67.9			189.3			858.3
10-day Rainfall (mm/10-day)	69.4	69.4	69.4	77.6	77.6	77.6	41.4	41.4	41.4	6.1	6.1	6.1	2.6	2.6	2.6	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	3.2	3.2	3.2	22.6	22.6	22.6	63.1	63.1	63.1	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Maize (Grain) (S) 100 %	0	0	0	0	0	0	0.09	0.1																									0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0.22	0.53	0.75	1.02	1.23	1.28	1.3	1.31	1.29	1.07																	W1-Ma
Maize (Green) (W2) 100 %																					0.34	0.34	0.38	0.62	0.88	1.13	1.34	1.35	1.32	1.27	1.06	0.56						W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0	0	0	0	0.09	0.1																									0	0	0	0	
Winter Crop (W1)									0	0	0.22	0.53	0.75	1.02	1.23	1.28	1.3	1.31	1.29	1.07																	
Winter Crop (W2)																					0.34	0.34	0.38	0.62	0.88	1.13	1.34	1.35	1.32	1.27	1.06	0.56					
Total	0	0	0	0	0	0	0.09	0.1	0	0	0.22	0.53	0.75	1.02	1.23	1.28	1.3	1.31	1.29	1.07	0.34	0.34	0.38	0.62	0.88	1.13	1.34	1.35	1.32	1.27	1.06	0.56	0	0	0	0	



Note : 1/ : Refer to Table A.2-4 (7)

Table A2-3 (8) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Salima ADD

Meteorological Station : Nkhotakota Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	320.0			266.3			470.6			227.8			33.5			11.5			7.9			2.1			0.7			10.2			79.8			281.6			1,712.0
10-day Rainfall (mm/10-day)	106.7	106.7	106.7	55.4	55.4	55.4	156.8	156.8	156.8	75.9	75.9	75.9	11.2	11.2	11.2	3.8	3.8	3.8	2.6	2.6	2.6	0.7	0.7	0.7	0.2	0.2	0.2	3.4	3.4	3.4	26.6	26.6	26.6	93.9	93.9	93.9	
																																					
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 70 %																																					S-Ma
Rice (S) 15 %		Nurser																																	Nursery		S-Ri
Rice (S) 15 %																																					
Maize (Grain) (W1) 70 %																																					W1-Ma
Maize (Green) (W2) 30 %																																					W2-Ma
Maize (Grain) (W2) 70 %																																					W3-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 2/																																					
Maize (Grain) (S) 70 %	0	0	0	0	0	0	0	0																									0	0	0	0	S-Ma
Rice (S) 15 %	0	0.49	0.49	0.51	0.53	0.55	0.6	0.61	0.61	0.11	0.06	0.02	1.44																						0	0	S-Ri
Rice (S) 15 %	0	0	0	0.5	0.5	0.5	0.52	0.55	0.57	0.1	0.11	0.26	1.61																								S-Ri
Maize (Grain) (W1) 70 %									0	0	0	0	0.22	0.89	1.28	1.33	1.38	1.42	1.41	1.18																	W1-Ma
Maize (Green) (W2) 30 %																					0.38	0.39	0.44	0.71	1.01	1.31	1.55	1.56	1.54	1.48	1.3	0.66					W2-Ma
Maize (Grain) (W2) 70 %																					0.38	0.39	0.44	0.71	1.01	1.31	1.55	1.56	1.54	1.48	1.3	0.66					W3-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0.07	0.07	0.15	0.15	0.16	0.17	0.17																									0	0	0	0	
Winter Crop (W1)									0	0	0	0	0.15	0.62	0.9	0.93	0.97	0.99	0.99	0.83																	
Winter Crop (W2) +(W3)																					0.38	0.39	0.44	0.71	1.01	1.31	1.55	1.56	1.54	1.48	1.3	0.66					
Total	0	0.07	0.07	0.15	0.15	0.16	0.17	0.17	0	0	0	0	0.15	0.62	0.9	0.93	0.97	0.99	0.99	0.83	0.38	0.39	0.44	0.71	1.01	1.31	1.55	1.56	1.54	1.48	1.3	0.66	0	0	0	0	

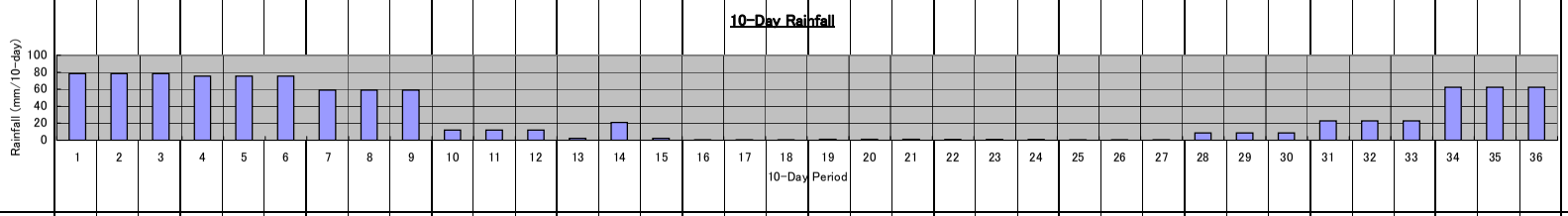
1/ : Refer to Table A.2-5 (2)

2/ : Refer to Table A.2-4 (8) .

Table A2-3 (9) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Salima ADD

Meteorological Station : Salima Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	234.8			226.5			176.4			36.1			6.3			1.4			2.9			1.9			1.6			25.4			68.7			187.4			969.4
10-day Rainfall (mm/10-day)	78.3	78.3	78.3	75.5	75.5	75.5	58.8	58.8	58.8	12	12	12	2.1	21	2.1	0.5	0.5	0.5	1	1	1	0.6	0.6	0.6	0.5	0.5	0.5	8.5	8.5	8.5	22.9	22.9	22.9	62.5	62.5	62.5	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Maize (Grain) (S) 100 %	0	0	0.14	0.12	0.1	0.11	0.14	0.04																										0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0.05	0.43	0.7	0.94	1.12	1.16	1.16	1.21	1.2	1.02																	W1-Ma
Maize (Green) (W2) 100 %																					0.33	0.35	0.4	0.67	0.98	1.31	1.58	1.52	1.5	1.5	1.36	0.9					W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0.14	0.12	0.1	0.11	0.14	0.04																										0	0	0	0	
Winter Crop (W1)									0	0	0.05	0.43	0.7	0.94	1.12	1.16	1.16	1.21	1.2	1.02																	
Winter Crop (W2)																					0.33	0.35	0.4	0.67	0.98	1.31	1.58	1.52	1.5	1.5	1.36	0.9					
Total	0	0	0.14	0.12	0.1	0.11	0.14	0.04	0	0	0.05	0.43	0.7	0.94	1.12	1.16	1.16	1.21	1.2	1.02	0.33	0.35	0.4	0.67	0.98	1.31	1.58	1.52	1.5	1.5	1.36	0.9	0	0	0	0	

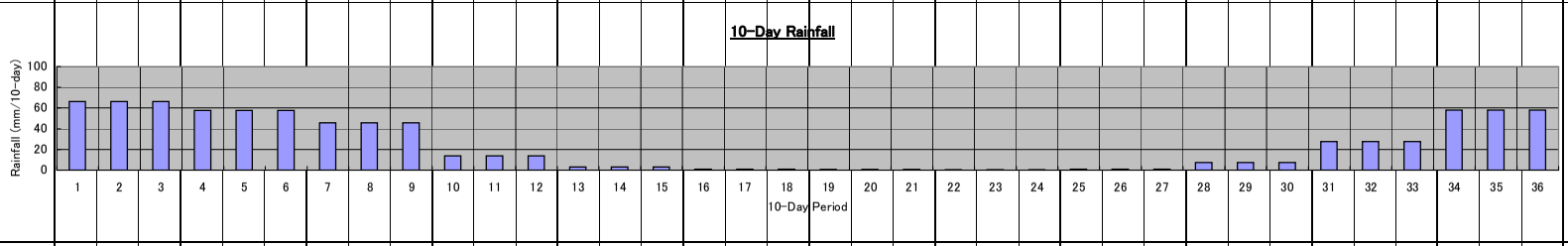


Note : 1/ : Refer to Table A.2-4 (9)

Table A2-3 (10) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Lilongwe ADD

Meteorological Station : Chileka Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	199.0			173.0			137.0			41.0			9.0			3.0			2.0			1.0			3.0			22.0			83.0			174.0			847.0
10-day Rainfall (mm/10-day)	66.3	66.3	66.3	57.7	57.7	57.7	45.7	45.7	45.7	13.7	13.7	13.7	3	3	3	1	1	1	0.7	0.7	0.7	0.3	0.3	0.3	1	1	1	7.3	7.3	7.3	27.7	27.7	27.7	58	58	58	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Unit GWR (lit/sec/ha)																																					
Maize (Grain) (S) 100 %	0	0	0.15	0.14	0.13	0.14	0.15	0.04																										0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0	0.24	0.5	0.7	0.82	0.83	0.84	0.86	0.86	0.73																	W1-Ma
Maize (Green) (W2) 100 %																					0.24	0.26	0.3	0.51	0.76	1.02	1.26	1.26	1.24	1.18	1.02	0.63						W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0.15	0.14	0.13	0.14	0.15	0.04																										0	0	0	0	
Winter Crop (W1)									0	0	0	0.24	0.5	0.7	0.82	0.83	0.84	0.86	0.86	0.73																	
Winter Crop (W2)																					0.24	0.26	0.3	0.51	0.76	1.02	1.26	1.26	1.24	1.18	1.02	0.63					
Total	0	0	0.15	0.14	0.13	0.14	0.15	0.04	0	0	0	0.24	0.5	0.7	0.82	0.83	0.84	0.86	0.86	0.73	0.24	0.26	0.3	0.51	0.76	1.02	1.26	1.26	1.24	1.18	1.02	0.63	0	0	0	0	

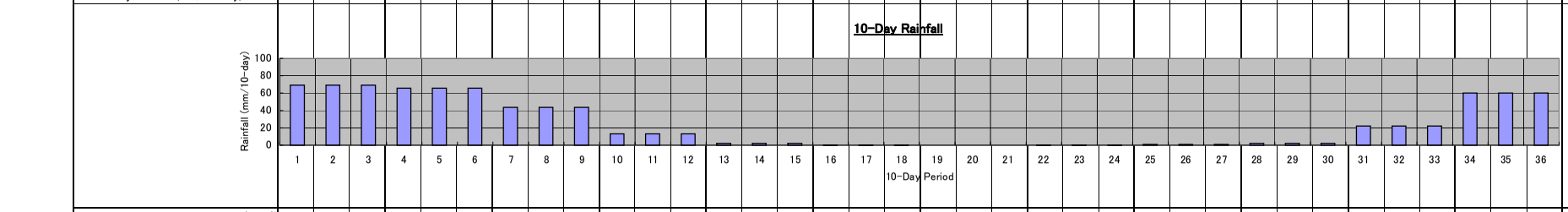


Note : 1/ : Refer to Table A.2-4 (10)

Table A2-3 (11) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Lilongwe ADD

Meteorological Station : Lilongwe Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	208.0			197.0			131.0			39.0			7.0			1.0			0.0			1.0			3.0			7.0			66.0			180.0			840.0
10-day Rainfall (mm/10-day)	69.3	69.3	69.3	65.7	65.7	65.7	43.7	43.7	43.7	13	13	13	2.3	2.3	2.3	0.3	0.3	0.3	0	0	0	0.3	0.3	0.3	1	1	1	2.3	2.3	2.3	22	22	22	60	60	60	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Unit GWR (lit/sec/ha)																																					
Maize (Grain) (S) 100 %	0	0	0	0	0	0.03	0.07	0.01																									0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0	0.25	0.51	0.7	0.84	0.86	0.88	0.9	0.91	0.78																	W1-Ma
Maize (Green) (W2) 100 %																					0.26	0.27	0.32	0.54	0.8	1.07	1.33	1.39	1.42	1.42	1.24	0.74					W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0	0	0	0.03	0.07	0.01																									0	0	0	0	
Winter Crop (W1)									0	0	0	0.25	0.51	0.7	0.84	0.86	0.88	0.9	0.91	0.78																	
Winter Crop (W2)																					0.26	0.27	0.32	0.54	0.8	1.07	1.33	1.39	1.42	1.42	1.24	0.74					
Total	0	0	0	0	0	0.03	0.07	0.01	0	0	0	0.25	0.51	0.7	0.84	0.86	0.88	0.9	0.91	0.78	0.26	0.27	0.32	0.54	0.8	1.07	1.33	1.39	1.42	1.42	1.24	0.74	0	0	0	0	

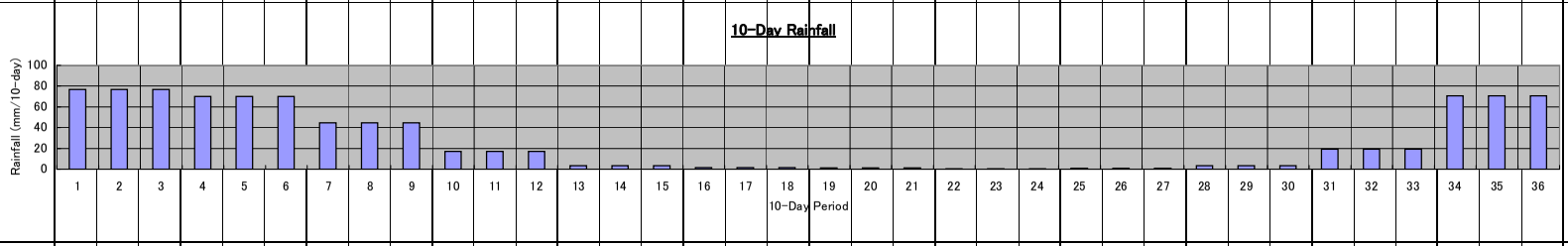


Note : 1/ : Refer to Table A.2-4 (11)

Table A2-3 (12) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Lilongwe ADD

Meteorological Station : Dedza Station

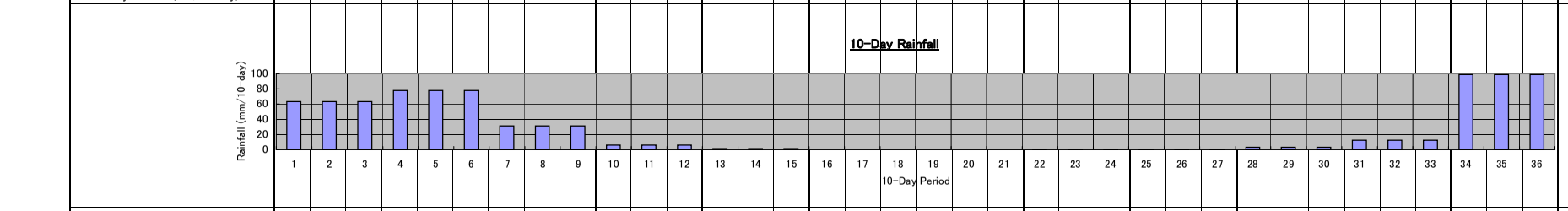
Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	230.5			210.2			134.5			51.4			10.1			4.2			3.2			1.2			2.9			10.3			58.2			211.5			928.2
10-day Rainfall (mm/10-day)	76.8	76.8	76.8	70.1	70.1	70.1	44.8	44.8	44.8	17.1	17.1	17.1	3.4	3.4	3.4	1.4	1.4	1.4	1.1	1.1	1.1	0.4	0.4	0.4	1	1	1	3.4	3.4	3.4	19.4	19.4	19.4	70.5	70.5	70.5	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Unit GWR (lit/sec/ha)																																					
Maize (Grain) (S) 100 %	0	0	0	0	0	0	0	0																									0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0	0.15	0.45	0.66	0.79	0.82	0.84	0.86	0.87	0.75																	W1-Ma
Maize (Green) (W2) 100 %																					0.25	0.26	0.31	0.52	0.77	1.04	1.29	1.35	1.38	1.37	1.28	0.77						W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0	0	0	0	0	0																									0	0	0	0	
Winter Crop (W1)									0	0	0	0.15	0.45	0.66	0.79	0.82	0.84	0.86	0.87	0.75																	
Winter Crop (W2)																					0.25	0.26	0.31	0.52	0.77	1.04	1.29	1.35	1.38	1.37	1.28	0.77					
Total	0	0	0	0	0	0	0	0	0	0	0	0.15	0.45	0.66	0.79	0.82	0.84	0.86	0.87	0.75	0.25	0.26	0.31	0.52	0.77	1.04	1.29	1.35	1.38	1.37	1.28	0.77	0	0	0	0	



Note : 1/ : Refer to Table A.2-4 (12)

Table A2-3 (13) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Machinga ADD

Meteorological Station : Monkey Bay Station

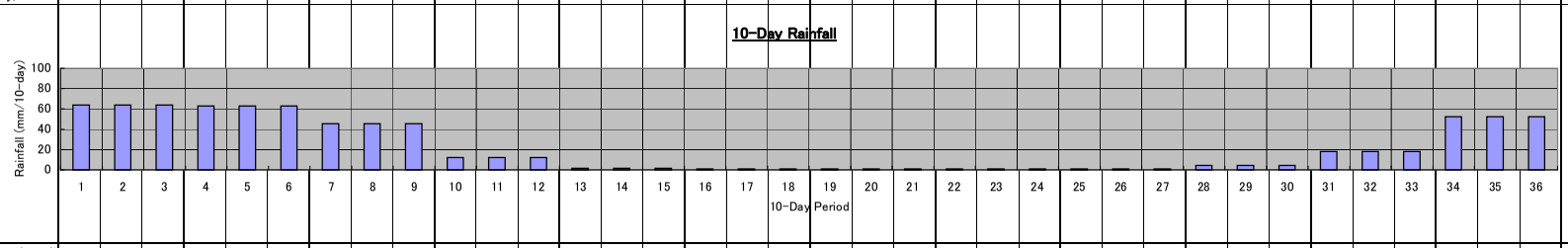
Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	190.3			234.0			93.9			18.7			4.7			0.0			0.4			1.2			0.7			9.4			37.8			296.6			887.7
10-day Rainfall (mm/10-day)	63.4	63.4	63.4	78.0	78.0	78.0	31.3	31.3	31.3	6.2	6.2	6.2	1.6	1.6	1.6	0	0	0	0.1	0.1	0.1	0.4	0.4	0.4	0.2	0.2	0.2	3.1	3.1	3.1	12.6	12.6	12.6	98.9	98.9	98.9	
																																				
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Maize (Grain) (S) 100 %	0	0	0	0.02	0.09	0.2	0.33	0.31																									0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0.08	0.45	0.78	1.07	1.3	1.35	1.38	1.4	1.39	1.16																	W1-Ma
Maize (Green) (W2) 100 %																					0.4	0.4	0.45	0.73	1.04	1.34	1.58	1.69	1.56	1.51	1.43	1					W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0	0.02	0.09	0.2	0.33	0.31																									0	0	0	0	
Winter Crop (W1)									0	0	0.08	0.45	0.78	1.07	1.3	1.35	1.38	1.4	1.39	1.16																	
Winter Crop (W2)																					0.4	0.4	0.45	0.73	1.04	1.34	1.58	1.69	1.56	1.51	1.43	1					
Total (22.0 ha)	0	0	0	0.02	0.09	0.2	0.33	0.31	0	0	0.08	0.45	0.78	1.07	1.3	1.35	1.38	1.4	1.39	1.16	0.4	0.4	0.45	0.73	1.04	1.34	1.58	1.69	1.56	1.51	1.43	1	0	0	0	0	

Note : 1/ : Refer to Table A.2-4 (13)

Table A2-3 (14) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Machinga ADD

Meteorological Station : Mangochi Station

Item		Month																																		Remarks
		Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																						Total Rainfall =
Monthly Rainfall (mm/month)		191.3			188.7			136.5			36.2			4.5			2.7			2.5			1.8			2.8			13.1			54.0			156.8			790.9
10-day Rainfall (mm/10-day)		63.8	63.8	63.8	62.9	62.9	62.9	45.5	45.5	45.5	12.1	12.1	12.1	1.5	1.5	1.5	0.9	0.9	0.9	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	4.4	4.4	4.4	18	18	18	52.3	52.3	52.3	
2. Cropping Pattern	Area %																																					
Maize (Grain) (S)	70 %																																					S-Ma
Rice (S)	15 %																																					S-Ri
Rice (S)	15 %																																					S-Ri
Maize (Grain) (W1)	70 %																																					W1-Ma
Maize (Green) (W2)	30 %																																					W2-Ma
Maize (Grain) (W2)	70 %																																					W3-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 2/																																						
Maize (Grain) (S)	70 %	0	0	0.03	0.04	0.07	0.13	0.21	0.14																										0	0	0	0	S-Ma
Rice (S)	15 %	0.53	0.18	0.18	0.15	0.17	0.25	0.83	0.85	0.85	1.57	1.52	1.47	1.67																							0	0.74	S-Ri
Rice (S)	15 %	0	0.51	0.51	0.14	0.14	0.26	0.75	0.78	0.88	1.56	1.58	1.6	1.84	1.79	1.74																						S-Ri
Maize (Grain) (W1)	70 %									0	0	0.08	0.45	0.78	1.07	1.3	1.35	1.38	1.4	1.39	1.16																	W1-Ma
Maize (Green) (W2)	30 %																					0.37	0.38	0.43	0.7	1	1.3	1.55	1.58	1.56	1.5	1.3	0.82					W2-Ma
Maize (Grain) (W3)	70 %																					0.37	0.38	0.43	0.7	1	1.3	1.55	1.58	1.56	1.5	1.3	0.82					W3-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																						
Summer Crop (S)		0.08	0.1	0.12	0.07	0.1	0.17	0.38	0.34																										0	0	0	0.11	
Winter Crop (W1)										0	0	0.06	0.32	0.55	0.75	0.91	0.95	0.97	0.98	0.97	0.81																	
Winter Crop (W2)+(W3)																						0.37	0.38	0.43	0.7	1	1.3	1.55	1.58	1.56	1.5	1.3	0.82					
Total		0.08	0.1	0.12	0.07	0.1	0.17	0.38	0.34	0	0	0.06	0.32	0.55	0.75	0.91	0.95	0.97	0.98	0.97	0.81	0.37	0.38	0.43	0.7	1	1.3	1.55	1.58	1.56	1.5	1.3	0.82	0	0	0	0.11	



1/ : Refer to Table A.2-5 (3)

2/ : Refer to Table A.2-4 (14)

Table A2-3 (15) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Blantyre ADD

Meteorological Station : Thyolo Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	222.8			201.7			212.1			97.6			26.0			28.3			32.5			13.2			9.3			39.0			103.0			253.3			1,238.8
10-day Rainfall (mm/10-day)	74.3	74.3	74.3	67.2	67.2	67.2	70.7	70.7	70.7	32.5	32.5	32.5	8.7	8.7	8.7	9.4	9.4	9.4	10.8	10.8	10.8	4.4	4.4	4.4	3.1	3.1	3.1	13	13	13	34.3	34.3	34.3	84.4	84.4	84.4	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Unit GWR (lit/sec/ha)																																					
Maize (Grain) (S) 100 %	0	0	0.03	0.01	0	0	0	0																									0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0	0	0.13	0.36	0.56	0.63	0.63	0.6	0.55	0.4																	W1-Ma
Maize (Green) (W2) 100 %																					0	0.15	0.28	0.48	0.73	1	1.21	1.13	1.11	1.16	1.02	0.53					W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0	0.03	0.01	0	0	0	0																									0	0	0	0	
Winter Crop (W1)									0	0	0	0	0.13	0.36	0.56	0.63	0.63	0.6	0.55	0.4																	
Winter Crop (W2)																					0	0.15	0.28	0.48	0.73	1	1.21	1.13	1.11	1.16	1.02	0.53					
Total	0	0	0.03	0.01	0	0	0	0	0	0	0	0	0.13	0.36	0.56	0.63	0.63	0.6	0.55	0.4	0	0.15	0.28	0.48	0.73	1	1.21	1.13	1.11	1.16	1.02	0.53	0	0	0	0	

Note : 1/ : Refer to Table A.2-4 (15)

Table A2-3 (16) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Blantyre ADD

Meteorological Station : Mulanje Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	318.0			316.0			340.0			172.0			71.0			60.0			34.0			36.0			18.0			67.0			188.0			288.0			1,908.0
10-day Rainfall (mm/10-day)	106	106	106	105.3	105.3	105.3	113.3	113.3	113.3	57.3	57.3	57.3	23.7	23.7	23.7	20	20	20	11.3	11.3	11.3	12	12	12	6	6	6	22.3	22.3	22.3	62.7	62.7	62.7	96	96	96	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
																		10-Day Period																			
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 70 %	———	———	———	———	———	———	———	———	———																								———	———	———	———	S-Ma
Rice (S) 15 %	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····																						·····	·····	S-Ri
Rice (S) 15 %		·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····																			S-Ri
Maize (Grain) (W1) 70 %									———	———	———	———	———	———	———	———	———	———	———	———																		W1-Ma
Maize (Green) (W2) 30 %																					———	———	———	———	———	———	———	———	———	———	———	———	———				W2-Ma
Maize (Grain) (W2) 70 %																					———	———	———	———	———	———	———	———	———	———	———	———	———				W3-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 2/																																					
Maize (Grain) (S) 70 %	0	0	0	0	0	0	0	0																									0	0	0	0	S-Ma
Rice (S) 15 %	0	0.51	0.51	0.52	0.54	0.57	0.56	0.57	0.58	0.27	0.24	0.21	0.71																						0	0	S-Ri
Rice (S) 15 %	0	0	0	0.51	0.51	0.51	0.5	0.52	0.54	0.26	0.28	0.33	0.8	0.77	0.75																					S-Ri
Maize (Grain) (W1) 70 %									0	0	0	0	0	0	0.16	0.25	0.33	0.44	0.56	0.54																W1-Ma
Maize (Green) (W2) 30 %																					0.2	0.21	0.24	0.37	0.51	0.64	0.77	0.77	0.73	0.68	0.57	0.26					W2-Ma
Maize (Grain) (W2) 70 %																					0.2	0.21	0.24	0.37	0.51	0.64	0.77	0.77	0.73	0.68	0.57	0.26					W3-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0.08	0.08	0.15	0.16	0.16	0.16	0.16	0.17	0.08	0.08	0.08	0.23	0.12	0.11																			0	0	0	0	
Winter Crop (W1)									0	0	0	0	0	0	0.11	0.18	0.23	0.31	0.39	0.38																	
Winter Crop (W2)																					0.2	0.21	0.24	0.37	0.51	0.64	0.77	0.77	0.73	0.68	0.57	0.26					
Total	0	0.08	0.08	0.15	0.16	0.16	0.16	0.16	0.17	0.08	0.08	0.08	0.23	0.12	0.22	0.18	0.23	0.31	0.39	0.38	0.2	0.21	0.24	0.37	0.51	0.64	0.77	0.77	0.73	0.68	0.57	0.26	0	0	0	0	

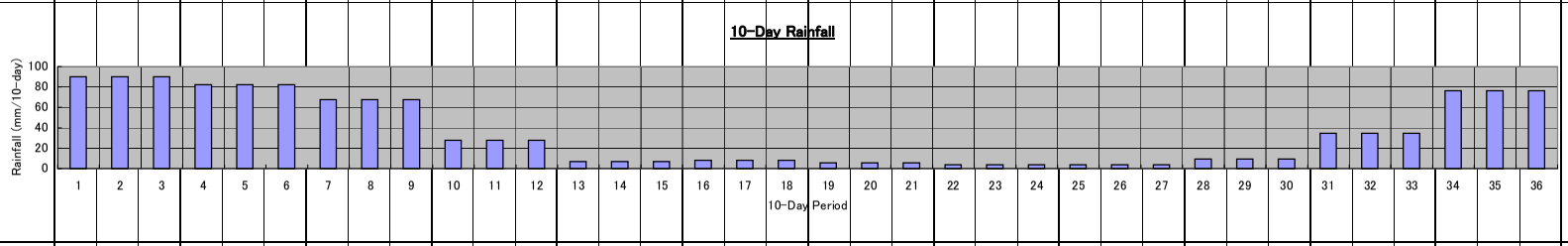
1/ : Refer to Table A.2-5 (4)

2/ : Refer to Table A.2-4 (16)

Table A2-3 (17) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Shire Valley ADD

Meteorological Station : Bvumbwe Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	270.0			247.0			203.0			83.0			21.0			24.0			17.0			11.0			11.0			28.0			104.0			229.0			1,248.0
10-day Rainfall (mm/10-day)	90	90	90	82.3	82.3	82.3	67.7	67.7	67.7	27.7	27.7	27.7	7	7	7	8	8	8	5.7	5.7	5.7	3.7	3.7	3.7	3.6	3.6	3.6	9.3	9.3	9.3	34.7	34.7	34.7	76.3	76.3	76.3	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 70 %	———																																———				S-Ma
Rice (S) 15 %	·····																																			·····	S-Ri
Rice (S) 15 %		·····																																			S-Ri
Maize (Grain) (W1) 70 %									———																												W1-Ma
Maize (Green) (W2) 30 %																					———																W2-Ma
Maize (Grain) (W2) 70 %																					———																W3-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 2/																																					
Maize (Grain) (S) 70 %	0	0	0	0	0	0	0	0																									0	0	0	0	S-Ma
Rice (S) 15 %	0.52	0.5	0.5	0.51	0.53	0.55	0.18	0.2	0.2	0.85	0.82	0.78	1.2																						0.01	0.29	S-Ri
Rice (S) 15 %	0	0.03	0.03	0.5	0.5	0.5	0.12	0.14	0.23	0.84	0.85	0.88	1.29	1.26	1.24																						S-Ri
Maize (Grain) (W1) 70 %									0	0	0	0	0.17	0.43	0.65	0.7	0.7	0.65	0.59	0.44																	W1-Ma
Maize (Green) (W2) 30 %																					0.03	0.16	0.26	0.44	0.66	0.89	1.08	1.06	1.03	0.96	0.78	0.38					W2-Ma
Maize (Grain) (W2) 70 %																					0.03	0.16	0.26	0.44	0.66	0.89	1.08	1.06	1.03	0.96	0.78	0.38					W3-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0.08	0.08	0.08	0.15	0.15	0.16	0.05	0.05	0.06	0.25	0.25	0.25	0.37	0.19	0.19																		0	0	0	0.04	
Winter Crop (W1)									0	0	0	0	0.12	0.3	0.46	0.49	0.49	0.46	0.41	0.31																	
Winter Crop (W2)																					0.03	0.16	0.26	0.44	0.66	0.89	1.08	1.06	1.03	0.96	0.78	0.38					
Total	0.08	0.08	0.08	0.15	0.15	0.16	0.05	0.05	0.06	0.25	0.25	0.25	0.49	0.49	0.65	0.49	0.49	0.46	0.41	0.31	0.03	0.16	0.26	0.44	0.66	0.89	1.08	1.06	1.03	0.96	0.78	0.38	0	0	0	0.04	



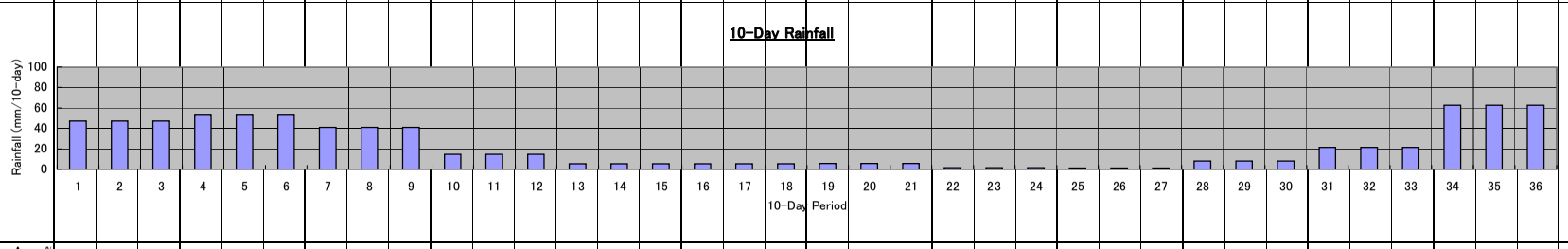
1/ : Refer to Table A.2-5 (5)

2/ : Refer to Table A.2-4 (17) .

Table A2-3 (18) Estimation of Unit Gross Irrigation Water Requirements (GWR) for Shire Valley ADD

Meteorological Station : Ngabu Station

Item	Month																																	Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall																																					Total Rainfall =
Monthly Rainfall (mm/month)	141.7			161.1			122.9			43.6			15.7			15.7			17.1			4.7			4.2			23.7			64.4			187.7			802.5
10-day Rainfall (mm/10-day)	47.2	47.2	47.2	53.7	53.7	53.7	41	41	41	14.5	14.5	14.5	5.2	5.2	5.2	5.2	5.2	5.2	5.7	5.7	5.7	1.5	1.5	1.5	1.2	1.2	1.2	7.9	7.9	7.9	21.5	21.5	21.5	62.6	62.6	62.6	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 100 %																																					S-Ma
Maize (Green) (W1) 100 %																																					W1-Ma
Maize (Green) (W2) 100 %																																					W2-Ma
3. Unit Gross Water requirement (GWR) (lit./sec/ha) 1/																																					
Unit GWR (lit/sec/ha)																																					
Maize (Grain) (S) 100 %	0	0.14	0.34	0.35	0.34	0.35	0.34	0.2																									0	0	0	0	S-Ma
Maize (Green) (W1) 100 %									0	0	0.03	0.39	0.71	1.02	1.22	1.27	1.29	1.28	1.24	1.03																	W1-Ma
Maize (Green) (W2) 100 %																					0.29	0.37	0.45	0.75	1.1	1.45	1.73	1.63	1.64	1.71	1.57	1					W2-Ma
4. Gross Irrigation Water Requirements (GWR) (lit/sec/ha)																																					
Summer Crop (S)	0	0.14	0.34	0.35	0.34	0.35	0.34	0.2																									0	0	0	0	
Winter Crop (W1)									0	0	0.03	0.39	0.71	1.02	1.22	1.27	1.29	1.28	1.24	1.03																	
Winter Crop (W2)																					0.29	0.37	0.45	0.75	1.1	1.45	1.73	1.63	1.64	1.71	1.57	1					
Total	0	0.14	0.34	0.35	0.34	0.35	0.34	0.2	0	0	0.03	0.39	0.71	1.02	1.22	1.27	1.29	1.28	1.24	1.03	0.29	0.37	0.45	0.75	1.1	1.45	1.73	1.63	1.64	1.71	1.57	1	0	0	0	0	



Note : 1/ : Refer to Table A.2-4 (18)

Table A2-4 (1) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Karonga ADD

Meteorological Station : Chitipa Station

Reference Evapo-Transpiration (ETo), and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥CHITIPA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.50	187.0	131.0
February	3.39	223.0	143.4
March	3.49	189.0	131.8
April	3.99	53.0	48.5
May	3.94	1.0	1.0
June	3.62	0.0	0.0
July	3.92	2.0	2.0
August	4.94	0.0	0.0
September	6.42	0.0	0.0
October	7.23	7.0	6.9
November	5.77	58.0	52.6
December	3.91	255.0	150.5
Total (mm/Year)	1647.75	975.0	667.7

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ...
... (Total R. < 250 mm/month),
Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥10KARO~1¥01CHIT~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	55.61	100.00	0.30	16.68	48.86	31.97	0.00	0.00
1/12	52.45	100.00	0.30	15.73	71.04	42.70	0.00	0.00
11/12	48.77	100.00	0.33	16.23	82.02	48.50	0.00	0.00
21/12	44.72	100.00	0.54	23.91	81.44	49.35	0.00	0.00
31/12	38.50	100.00	0.76	29.26	70.33	45.18	0.00	0.00
10/1	37.92	100.00	0.99	37.40	67.52	44.79	0.00	0.00
20/1	37.62	100.00	1.18	44.30	67.48	45.57	0.00	0.00
30/1	37.18	100.00	1.20	44.62	69.23	46.93	0.00	0.00
9/2	36.64	100.00	1.20	43.97	71.65	48.30	0.00	0.00
19/2	36.04	100.00	1.20	43.24	73.08	48.86	0.00	0.00
1/3	35.43	100.00	1.16	41.28	71.55	47.67	0.00	0.00
11/3	34.86	100.00	0.96	33.31	65.30	43.92	0.00	0.00
21/3	34.40	100.00	0.72	24.84	53.35	37.11	0.00	0.00
31/3	17.08	100.00	0.55	9.34	20.49	15.07	0.00	0.00
Total	547.23			424.10	913.34	595.93	0.00	[0.00]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥10KARO~1¥01CHIT~1¥FWS.TXT

Table A2-4 (1) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Karonga_ADD

Meteorological Station : Chitipa Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥CHITIPA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.50	187.0	131.0
February	3.39	223.0	143.4
March	3.49	189.0	131.8
April	3.99	53.0	48.5
May	3.94	1.0	1.0
June	3.62	0.0	0.0
July	3.92	2.0	2.0
August	4.94	0.0	0.0
September	6.42	0.0	0.0
October	7.23	7.0	6.9
November	5.77	58.0	52.6
December	3.91	255.0	150.5
Total (mm/Year)	1647.75	975.0	667.7

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥10KARO~1¥01CHIT~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2008/01/08 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	34.40	100.00	0.30	10.32	53.35	37.11	0.00	0.00
31/3	34.10	100.00	0.30	10.23	36.21	27.43	0.00	0.00
10/4	34.00	100.00	0.33	11.35	16.82	15.51	0.00	0.00
20/4	34.15	100.00	0.54	18.32	2.12	2.12	16.20	0.38
30/4	34.58	100.00	0.76	26.33	0.08	0.05	26.28	0.61
10/5	35.30	100.00	0.99	34.83	0.00	0.00	34.83	0.81
20/5	36.33	100.00	1.18	42.79	0.00	0.00	42.79	0.99
30/5	37.68	100.00	1.20	45.21	0.00	0.00	45.21	1.05
9/6	39.31	100.00	1.20	47.18	0.00	0.00	47.18	1.09
19/6	41.22	100.00	1.20	49.46	0.00	0.00	49.46	1.14
29/6	43.35	100.00	1.16	50.48	0.00	0.00	50.48	1.17
9/7	45.66	100.00	0.96	43.56	0.00	0.00	43.56	1.01
19/7	48.08	100.00	0.72	34.65	0.00	0.00	34.65	0.80
29/7	24.96	100.00	0.55	13.64	0.00	0.00	13.64	0.63
Total	523.12			438.34	108.57	82.22	404.27	[0.69]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥10KARO~1¥01CHIT~1¥02W1-M~1¥FWS.TXT

Table A2-4 (1) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Karonga ADD

Meteorological Station : Chitipa Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥CHITIPA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.50	187.0	131.0
February	3.39	223.0	143.4
March	3.49	189.0	131.8
April	3.99	53.0	48.5
May	3.94	1.0	1.0
June	3.62	0.0	0.0
July	3.92	2.0	2.0
August	4.94	0.0	0.0
September	6.42	0.0	0.0
October	7.23	7.0	6.9
November	5.77	58.0	52.6
December	3.91	255.0	150.5
Total (mm/Year)	1647.75	975.0	667.7

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥10KARO~1¥01CHIT~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2008/01/08 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	48.57	100.00	0.30	14.57	0.00	0.00	14.57	0.34
31/7	51.04	100.00	0.30	15.31	0.00	0.00	15.31	0.35
10/8	53.45	100.00	0.33	17.86	0.00	0.00	17.86	0.41
20/8	55.72	100.00	0.54	29.92	0.00	0.00	29.92	0.69
30/8	57.76	100.00	0.76	44.01	0.00	0.00	44.01	1.02
9/9	59.49	100.00	0.99	58.70	0.00	0.00	58.70	1.36
19/9	60.80	100.00	1.18	71.60	0.00	0.00	71.60	1.66
29/9	61.63	100.00	1.20	73.95	0.00	0.00	73.95	1.71
9/10	61.89	100.00	1.20	74.27	0.00	0.00	74.27	1.72
19/10	61.53	100.00	1.20	73.84	0.23	0.22	73.62	1.70
29/10	60.51	100.00	1.16	70.52	0.05	0.05	70.46	1.63
8/11	58.82	100.00	0.96	56.21	13.05	12.04	44.17	1.02
18/11	56.45	100.00	0.72	40.79	40.68	28.02	12.77	0.30
28/11	27.14	100.00	0.55	14.84	30.16	18.73	0.00	0.00
Total	774.81			656.40	84.16	59.07	601.22	[1.03]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥10KARO~1¥01CHIT~1¥03W2-M~1¥FWS.TXT

Table A2-4 (2) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Karonga ADD

Meteorological Station : Karonga Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥KARONGA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.07	191.0	132.6
February	4.06	150.0	114.0
March	3.85	328.0	157.8
April	4.21	210.0	139.4
May	3.99	32.0	30.4
June	3.54	6.0	5.9
July	3.75	1.0	1.0
August	4.28	2.0	2.0
September	5.17	0.0	0.0
October	5.78	4.0	4.0
November	5.31	43.0	40.0
December	4.36	154.0	116.1
Total (mm/Year)	1593.06	1121.0	743.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥10KARO~1¥02KARO~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FSW

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	51.33	100.00	0.30	15.40	27.88	23.19	0.00	0.00
1/12	50.00	100.00	0.30	15.00	40.13	31.48	0.00	0.00
11/12	48.33	100.00	0.33	16.11	49.96	37.59	0.00	0.00
21/12	46.37	100.00	0.54	24.83	56.63	41.23	0.00	0.00
31/12	43.26	100.00	0.76	32.91	52.17	39.51	0.00	0.00
10/1	42.99	100.00	0.99	42.39	51.62	38.58	3.81	0.09
20/1	42.77	100.00	1.18	50.35	54.18	38.76	11.59	0.27
30/1	42.39	100.00	1.20	50.86	59.52	40.09	10.78	0.25
9/2	41.86	100.00	1.20	50.23	67.31	42.54	7.70	0.18
19/2	41.23	100.00	1.20	49.47	76.52	45.77	3.70	0.09
1/3	40.51	100.00	1.16	47.20	85.51	49.10	0.00	0.00
11/3	39.76	100.00	0.96	37.98	92.18	51.65	0.00	0.00
21/3	39.01	100.00	0.72	28.17	94.31	52.38	0.00	0.00
31/3	19.24	100.00	0.55	10.52	45.99	25.64	0.00	0.00
Total	589.05			471.44	853.92	557.50	37.58	[0.06]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥10KARO~1¥02KARO~1¥01S-MA~1¥FSW.TXT

Table A2-4 (2) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Karonga ADD

Meteorological Station : Karonga Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥KARONGA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.07	191.0	132.6
February	4.06	150.0	114.0
March	3.85	328.0	157.8
April	4.21	210.0	139.4
May	3.99	32.0	30.4
June	3.54	6.0	5.9
July	3.75	1.0	1.0
August	4.28	2.0	2.0
September	5.17	0.0	0.0
October	5.78	4.0	4.0
November	5.31	43.0	40.0
December	4.36	154.0	116.1
Total (mm/Year)	1593.06	1121.0	743.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥10KARO~1¥02KARO~1¥03W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	39.01	100.00	0.30	11.70	94.31	52.38	0.00	0.00
31/3	38.32	100.00	0.30	11.50	89.95	50.36	0.00	0.00
10/4	37.72	100.00	0.33	12.58	77.92	44.90	0.00	0.00
20/4	37.25	100.00	0.54	19.97	58.41	35.91	0.00	0.00
30/4	36.94	100.00	0.76	28.12	33.69	24.14	3.98	0.09
10/5	36.83	100.00	0.99	36.32	9.01	8.67	27.65	0.64
20/5	36.93	100.00	1.18	43.49	0.00	0.00	43.49	1.01
30/5	37.25	100.00	1.20	44.71	0.26	0.17	44.54	1.03
9/6	37.81	100.00	1.20	45.37	0.00	0.00	45.37	1.05
19/6	38.58	100.00	1.20	46.30	0.00	0.00	46.30	1.07
29/6	39.57	100.00	1.16	46.09	0.00	0.00	46.09	1.07
9/7	40.74	100.00	0.96	38.88	0.00	0.00	38.88	0.90
19/7	42.06	100.00	0.72	30.33	0.00	0.00	30.33	0.70
29/7	21.57	100.00	0.55	11.79	0.00	0.00	11.79	0.55
Total	520.59			427.14	363.57	216.53	338.41	[0.58]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥10KARO~1¥02KARO~1¥03W1-M~1¥FWS.TXT

Table A2-4 (2) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Karonga ADD

Meteorological Station : Karonga Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥KARONGA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.07	191.0	132.6
February	4.06	150.0	114.0
March	3.85	328.0	157.8
April	4.21	210.0	139.4
May	3.99	32.0	30.4
June	3.54	6.0	5.9
July	3.75	1.0	1.0
August	4.28	2.0	2.0
September	5.17	0.0	0.0
October	5.78	4.0	4.0
November	5.31	43.0	40.0
December	4.36	154.0	116.1
Total (mm/Year)	1593.06	1121.0	743.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥10KARO~1¥02KARO~1¥04W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2008/01/10 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	42.35	100.00	0.30	12.70	0.00	0.00	12.70	0.29
31/7	43.80	100.00	0.30	13.14	0.00	0.00	13.14	0.30
10/8	45.32	100.00	0.33	15.14	0.00	0.00	15.14	0.35
20/8	46.84	100.00	0.54	25.15	0.00	0.00	25.15	0.58
30/8	48.32	100.00	0.76	36.81	0.00	0.00	36.81	0.85
9/9	49.68	100.00	0.99	49.02	0.00	0.00	49.02	1.13
19/9	50.88	100.00	1.18	59.92	0.00	0.00	59.92	1.39
29/9	51.84	100.00	1.20	62.21	0.00	0.00	62.21	1.44
9/10	52.53	100.00	1.20	63.04	0.00	0.00	63.04	1.46
19/10	52.89	100.00	1.20	63.46	0.33	0.33	63.13	1.46
29/10	52.87	100.00	1.16	61.60	2.84	2.84	58.76	1.36
8/11	52.46	100.00	0.96	50.11	11.51	10.99	39.13	0.91
18/11	51.65	100.00	0.72	37.29	23.98	20.42	16.88	0.39
28/11	25.40	100.00	0.55	13.89	16.83	13.60	0.29	0.01
Total	666.83			563.49	55.50	48.18	515.31	[0.88]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥10KARO~1¥02KARO~1¥04W2-M~1¥FWS.TXT

Table A2-4(2) Estimated Field Water Supply for Maize (Grain) (W3-Ma) in Karonga ADD

Meteorological Station : Karonga Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

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                                                                RAIN

ddddd                                                    CropWat 4 Windows Ver 4.3
********************************************************************************

                            ETo and Rainfall Data

********************************************************************************
Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥KARONGA.CLI
--------------------------------------------------------------------------------
  Month                ETo          Total Rainfall        Effective Rain
                     (mm/d)           (mm/month)            (mm/month)
--------------------------------------------------------------------------------
  January            4.07              191.0                 132.6
  February           4.06              150.0                 114.0
  March              3.85              328.0                 157.8
  April              4.21              210.0                 139.4
  May                3.99               32.0                  30.4
  June               3.54                6.0                   5.9
  July               3.75                1.0                   1.0
  August             4.28                2.0                   2.0
  September          5.17                0.0                   0.0
  October            5.78                4.0                   4.0
  November           5.31               43.0                  40.0
  December           4.36              154.0                 116.1
--------------------------------------------------------------------------------
  Total (mm/Year)    1593.06           1121.0                743.2
--------------------------------------------------------------------------------

  N.B.    Effective rainfall calculated using the USSCS formulas:

          Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ...
                                                  ... (Total R. < 250 mm/month),
          Effective R. = 0.1 * Total R. - 125    ... (Total R. > 250 mm/month).
********************************************************************************
C:¥CROPWATW¥REPORTS¥10KARO~1¥02KARO~1¥05W-MA~1¥RAIN.TXT
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Field Water Supply (FWS)

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                                                                FWS

ddddd                                                    CropWat 4 Windows Ver 4.3
********************************************************************************

                          Crop Water Requirements Report

********************************************************************************

- Crop  # 1              : MAIZE  (Grain)
- Block #                : [All blocks]
- Planting date          : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

--------------------------------------------------------------------------------
Date     ETo      Planted  Crop      CWR      Total    Effect.    Irr.      FWS
       (mm/period)  Area     Kc      (ETm)     Rain     Rain      Req.
                    (%)              ---------- (mm/period) ----------    (l/s/ha)
--------------------------------------------------------------------------------
21/7     42.35    100.00    0.30     12.70     0.00     0.00     12.70     0.29
31/7     43.80    100.00    0.30     13.14     0.00     0.00     13.14     0.30
10/8     45.32    100.00    0.33     15.14     0.00     0.00     15.14     0.35
20/8     46.84    100.00    0.54     25.15     0.00     0.00     25.15     0.58
30/8     48.32    100.00    0.76     36.81     0.00     0.00     36.81     0.85
9/9      49.68    100.00    0.99     49.02     0.00     0.00     49.02     1.13
19/9     50.88    100.00    1.18     59.92     0.00     0.00     59.92     1.39
29/9     51.84    100.00    1.20     62.21     0.00     0.00     62.21     1.44
9/10     52.53    100.00    1.20     63.04     0.00     0.00     63.04     1.46
19/10    52.89    100.00    1.20     63.46     0.33     0.33     63.13     1.46
29/10    52.87    100.00    1.16     61.60     2.84     2.84     58.76     1.36
8/11     52.46    100.00    0.96     50.11    11.51    10.99     39.13     0.91
18/11    51.65    100.00    0.72     37.29    23.98    20.42     16.88     0.39
28/11    25.40    100.00    0.55     13.89    16.83    13.60      0.29     0.01
--------------------------------------------------------------------------------
Total    666.83                     563.49    55.50    48.18    515.31   [0.88]
--------------------------------------------------------------------------------

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.
********************************************************************************
C:¥CROPWATW¥REPORTS¥10KARO~1¥02KARO~1¥05W3-M~1¥FWS.TXT
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Table A2-4 (3) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Mzuzu ADD

Meteorological Station : Bolero Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥BOLERO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	2.98	164.7	121.3
February	3.17	165.2	121.5
March	3.87	121.2	97.7
April	4.21	34.4	32.5
May	4.31	3.5	3.5
June	3.97	0.5	0.5
July	4.54	0.2	0.2
August	5.11	0.0	0.0
September	6.06	0.7	0.7
October	6.34	6.2	6.1
November	3.64	34.5	32.6
December	3.31	163.3	120.6
Total (mm/Year)	1569.42	694.4	537.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ...
... (Total R. < 250 mm/month),
Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥01BOLE~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	43.61	100.00	0.30	13.08	28.70	22.76	0.00	0.00
1/12	40.81	100.00	0.30	12.24	43.19	32.56	0.00	0.00
11/12	37.84	100.00	0.33	12.60	52.78	38.97	0.00	0.00
21/12	34.81	100.00	0.54	18.61	56.77	41.60	0.00	0.00
31/12	32.65	100.00	0.76	24.85	54.23	39.72	0.00	0.00
10/1	32.80	100.00	0.99	32.36	55.66	40.59	0.00	0.00
20/1	33.07	100.00	1.18	38.94	57.09	41.63	0.00	0.00
30/1	33.39	100.00	1.20	40.06	57.53	42.19	0.00	0.00
9/2	33.77	100.00	1.20	40.52	56.40	41.85	0.00	0.00
19/2	34.22	100.00	1.20	41.06	53.29	40.24	0.82	0.02
1/3	34.75	100.00	1.16	40.48	47.97	37.08	3.40	0.08
11/3	35.38	100.00	0.96	33.77	40.47	32.25	1.52	0.04
21/3	36.11	100.00	0.72	26.04	31.22	25.89	0.16	0.00
31/3	18.36	100.00	0.55	10.04	11.80	10.19	0.00	0.00
Total	481.54			384.65	647.10	487.52	5.89	[0.01]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥01BOLE~1¥01S-MA~1¥FWS.TXT

Table A2-4 (3) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Mzuzu ADD

Meteorological Station : Bolero Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥BOLERO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	2.98	164.7	121.3
February	3.17	165.2	121.5
March	3.87	121.2	97.7
April	4.21	34.4	32.5
May	4.31	3.5	3.5
June	3.97	0.5	0.5
July	4.54	0.2	0.2
August	5.11	0.0	0.0
September	6.06	0.7	0.7
October	6.34	6.2	6.1
November	3.64	34.5	32.6
December	3.31	163.3	120.6
Total (mm/Year)	1569.42	694.4	537.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥01BOLE~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	36.11	100.00	0.30	10.83	31.22	25.89	0.00	0.00
31/3	36.95	100.00	0.30	11.08	21.03	18.45	0.00	0.00
10/4	37.90	100.00	0.33	12.66	11.29	10.80	1.86	0.04
20/4	38.96	100.00	0.54	20.91	3.93	3.93	16.98	0.39
30/4	40.12	100.00	0.76	30.56	0.78	0.77	29.79	0.69
10/5	41.37	100.00	0.99	40.82	0.00	0.00	40.82	0.95
20/5	42.70	100.00	1.18	50.29	0.00	0.00	50.29	1.16
30/5	44.09	100.00	1.20	52.90	0.00	0.00	52.90	1.22
9/6	45.51	100.00	1.20	54.61	0.00	0.00	54.61	1.26
19/6	46.93	100.00	1.20	56.32	0.00	0.00	56.32	1.30
29/6	48.33	100.00	1.16	56.29	0.00	0.00	56.29	1.30
9/7	49.66	100.00	0.96	47.40	0.00	0.00	47.40	1.10
19/7	50.89	100.00	0.72	36.71	0.00	0.00	36.71	0.85
29/7	25.87	100.00	0.55	14.14	0.00	0.00	14.14	0.65
Total	585.37			495.53	68.24	59.83	458.11	[0.79]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥01BOLE~1¥02W1-M~1¥FWS.TXT

Table A2-4 (3) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Mzuzu ADD

Meteorological Station : Bolero Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥BOLERO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	2.98	164.7	121.3
February	3.17	165.2	121.5
March	3.87	121.2	97.7
April	4.21	34.4	32.5
May	4.31	3.5	3.5
June	3.97	0.5	0.5
July	4.54	0.2	0.2
August	5.11	0.0	0.0
September	6.06	0.7	0.7
October	6.34	6.2	6.1
November	3.64	34.5	32.6
December	3.31	163.3	120.6
Total (mm/Year)	1569.42	694.4	537.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),
Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥01BOLE~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	51.13	100.00	0.30	15.34	0.00	0.00	15.34	0.36
31/7	52.18	100.00	0.30	15.65	0.00	0.00	15.65	0.36
10/8	53.05	100.00	0.33	17.71	0.00	0.00	17.71	0.41
20/8	53.68	100.00	0.54	28.80	0.00	0.00	28.80	0.67
30/8	54.05	100.00	0.76	41.15	0.00	0.00	41.15	0.95
9/9	54.11	100.00	0.99	53.36	0.00	0.00	53.36	1.24
19/9	53.83	100.00	1.18	63.39	0.00	0.00	63.39	1.47
29/9	53.20	100.00	1.20	63.84	0.00	0.00	63.84	1.48
9/10	52.18	100.00	1.20	62.62	0.00	0.00	62.62	1.45
19/10	50.79	100.00	1.20	60.94	0.28	0.27	60.67	1.40
29/10	49.01	100.00	1.16	57.12	0.15	0.15	56.96	1.32
8/11	46.87	100.00	0.96	44.80	8.04	7.69	37.11	0.86
18/11	44.40	100.00	0.72	32.10	23.79	19.40	12.69	0.29
28/11	21.19	100.00	0.55	11.59	17.90	13.80	0.00	0.00
Total	689.67			568.41	50.17	41.32	529.30	[0.91]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥01BOLE~1¥03W2-M~1¥FWS.TXT

Table A2-4 (4) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Mzuzu ADD

Meteorological Station : Mzuzu Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MZUZU.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.33	210.0	139.4
February	3.41	200.0	136.0
March	3.04	241.0	148.1
April	3.07	227.0	144.6
May	2.61	46.0	42.6
June	2.31	41.0	38.3
July	2.39	37.0	34.8
August	3.02	18.0	17.5
September	3.88	20.0	19.4
October	4.86	20.0	19.4
November	4.58	83.0	72.0
December	3.97	201.0	136.4
Total (mm/Year)	1230.50	1344.0	948.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥02MZUZ~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	44.50	100.00	0.30	13.35	40.53	28.85	0.00	0.00
1/12	43.54	100.00	0.30	13.06	46.83	32.77	0.00	0.00
11/12	42.12	100.00	0.33	14.04	52.89	36.54	0.00	0.00
21/12	40.30	100.00	0.54	21.58	58.51	40.02	0.00	0.00
31/12	38.02	100.00	0.76	28.93	71.17	47.34	0.00	0.00
10/1	37.51	100.00	0.99	36.99	74.62	49.24	0.00	0.00
20/1	36.88	100.00	1.18	43.42	76.34	50.14	0.00	0.00
30/1	36.00	100.00	1.20	43.20	77.12	50.48	0.00	0.00
9/2	34.92	100.00	1.20	41.90	76.90	50.22	0.00	0.00
19/2	33.66	100.00	1.20	40.39	75.64	49.35	0.00	0.00
1/3	32.28	100.00	1.16	37.62	73.36	47.87	0.00	0.00
11/3	30.83	100.00	0.96	29.47	70.13	45.84	0.00	0.00
21/3	29.38	100.00	0.72	21.23	66.04	43.29	0.00	0.00
31/3	14.16	100.00	0.55	7.74	31.25	20.55	0.00	0.00
Total	494.11			392.92	891.33	592.50	0.00	[0.00]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥02MZUZ~1¥01S-MA~1¥FWS.TXT

Table A2-4 (4) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Muzuz ADD

Meteorological Station : Muzuz Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MZUZU.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.33	210.0	139.4
February	3.41	200.0	136.0
March	3.04	241.0	148.1
April	3.07	227.0	144.6
May	2.61	46.0	42.6
June	2.31	41.0	38.3
July	2.39	37.0	34.8
August	3.02	18.0	17.5
September	3.88	20.0	19.4
October	4.86	20.0	19.4
November	4.58	83.0	72.0
December	3.97	201.0	136.4
Total (mm/Year)	1230.50	1344.0	948.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥02MZUZ~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	29.38	100.00	0.30	8.81	66.04	43.29	0.00	0.00
31/3	27.99	100.00	0.30	8.40	61.20	40.31	0.00	0.00
10/4	26.71	100.00	0.33	8.90	55.76	36.98	0.00	0.00
20/4	25.60	100.00	0.54	13.71	49.87	33.38	0.00	0.00
30/4	24.71	100.00	0.76	18.80	43.68	29.63	0.00	0.00
10/5	24.08	100.00	0.99	23.74	37.38	25.81	0.00	0.00
20/5	23.75	100.00	1.18	27.96	31.13	22.02	5.94	0.14
30/5	23.73	100.00	1.20	28.48	25.09	18.38	10.11	0.23
9/6	24.05	100.00	1.20	28.86	19.41	14.96	13.90	0.32
19/6	24.69	100.00	1.20	29.63	14.24	11.85	17.78	0.41
29/6	25.65	100.00	1.16	29.87	9.71	9.12	20.75	0.48
9/7	26.91	100.00	0.96	25.67	5.93	5.93	19.74	0.46
19/7	28.43	100.00	0.72	20.49	3.00	3.00	17.48	0.40
29/7	14.85	100.00	0.55	8.12	0.69	0.69	7.43	0.34
Total	350.53			281.44	423.13	295.36	113.12	[0.19]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥02MZUZ~1¥02W1-M~1¥FWS.TXT

Table A2-4 (4) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Muzuz ADD

Meteorological Station : Muzuz Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MZUZU.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.33	210.0	139.4
February	3.41	200.0	136.0
March	3.04	241.0	148.1
April	3.07	227.0	144.6
May	2.61	46.0	42.6
June	2.31	41.0	38.3
July	2.39	37.0	34.8
August	3.02	18.0	17.5
September	3.88	20.0	19.4
October	4.86	20.0	19.4
November	4.58	83.0	72.0
December	3.97	201.0	136.4
Total (mm/Year)	1230.50	1344.0	948.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥02MZUZ~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	28.76	100.00	0.30	8.63	2.53	2.53	6.10	0.14
31/7	30.53	100.00	0.30	9.16	0.71	0.71	8.45	0.20
10/8	32.46	100.00	0.33	10.85	0.01	0.01	10.85	0.25
20/8	34.47	100.00	0.54	18.52	0.10	0.10	18.43	0.43
30/8	36.50	100.00	0.76	27.82	1.19	1.19	26.64	0.62
9/9	38.48	100.00	0.99	37.98	3.32	3.32	34.66	0.80
19/9	40.32	100.00	1.18	47.49	6.39	6.39	41.10	0.95
29/9	41.95	100.00	1.20	50.34	10.30	9.94	40.40	0.94
9/10	43.30	100.00	1.20	51.96	14.97	12.95	39.02	0.90
19/10	44.30	100.00	1.20	53.16	20.28	16.26	36.90	0.85
29/10	44.90	100.00	1.16	52.30	26.10	19.88	32.42	0.75
8/11	45.04	100.00	0.96	43.01	32.27	23.72	19.30	0.45
18/11	44.70	100.00	0.72	32.27	38.61	27.66	4.61	0.11
28/11	22.07	100.00	0.55	12.07	21.69	15.32	0.00	0.00
Total	527.79			455.58	178.47	139.96	318.87	[0.55]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥02MZUZ~1¥03W2-M~1¥FWS.TXT

Table A2-4 (5) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Muzuz ADD

Meteorological Station : Nkhata Bay Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2008/01/10 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥NKHATA-B.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.50	273.0	152.3
February	3.93	214.0	140.7
March	3.83	376.0	162.6
April	3.92	273.0	152.3
May	3.52	65.0	58.2
June	3.27	40.0	37.4
July	3.28	23.0	22.2
August	3.98	6.0	5.9
September	4.92	4.0	4.0
October	5.49	18.0	17.5
November	5.15	88.0	75.6
December	4.10	217.0	141.7
Total (mm/Year)	1486.54	1597.0	970.4

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥03NKHA~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2008/01/10 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	48.82	100.00	0.30	14.65	44.07	33.68	0.00	0.00
1/12	47.21	100.00	0.30	14.16	58.16	40.71	0.00	0.00
11/12	45.17	100.00	0.33	15.05	70.47	45.85	0.00	0.00
21/12	42.76	100.00	0.54	22.88	79.71	48.76	0.00	0.00
31/12	40.40	100.00	0.76	30.75	72.74	45.98	0.00	0.00
10/1	40.48	100.00	0.99	39.92	78.26	47.52	0.00	0.00
20/1	40.46	100.00	1.18	47.64	86.40	49.85	0.00	0.00
30/1	40.22	100.00	1.20	48.27	94.50	52.11	0.00	0.00
9/2	39.78	100.00	1.20	47.73	101.41	53.93	0.00	0.00
19/2	39.15	100.00	1.20	46.98	106.12	54.96	0.00	0.00
1/3	38.39	100.00	1.16	44.73	107.87	54.96	0.00	0.00
11/3	37.53	100.00	0.96	35.86	106.16	53.75	0.00	0.00
21/3	36.64	100.00	0.72	26.46	100.85	51.29	0.00	0.00
31/3	17.99	100.00	0.55	9.84	47.36	24.34	0.00	0.00
Total	554.99			444.92	1154.07	657.69	0.00	[0.00]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥03NKHA~1¥01S-MA~1¥FWS.TXT

Table A2-4 (5) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Mzuzu ADD

Meteorological Station : Nkhata Bay Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MZUZU.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.33	210.0	139.4
February	3.41	200.0	136.0
March	3.04	241.0	148.1
April	3.07	227.0	144.6
May	2.61	46.0	42.6
June	2.31	41.0	38.3
July	2.39	37.0	34.8
August	3.02	18.0	17.5
September	3.88	20.0	19.4
October	4.86	20.0	19.4
November	4.58	83.0	72.0
December	3.97	201.0	136.4
Total (mm/Year)	1230.50	1344.0	948.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥02MZUZ~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	36.64	100.00	0.30	10.99	100.85	51.29	0.00	0.00
31/3	35.76	100.00	0.30	10.73	92.14	47.63	0.00	0.00
10/4	34.96	100.00	0.33	11.66	80.58	42.93	0.00	0.00
20/4	34.28	100.00	0.54	18.37	66.99	37.47	0.00	0.00
30/4	33.77	100.00	0.76	25.70	52.45	31.60	0.00	0.00
10/5	33.46	100.00	0.99	33.00	38.14	25.69	7.31	0.17
20/5	33.39	100.00	1.18	39.32	25.29	20.15	19.17	0.44
30/5	33.59	100.00	1.20	40.30	15.00	14.60	25.70	0.59
9/6	34.05	100.00	1.20	40.86	8.07	8.07	32.79	0.76
19/6	34.78	100.00	1.20	41.74	4.81	4.81	36.93	0.85
29/6	35.77	100.00	1.16	41.66	4.82	4.82	36.84	0.85
9/7	36.99	100.00	0.96	35.30	6.73	6.25	29.05	0.67
19/7	38.41	100.00	0.72	27.69	7.96	5.52	22.16	0.51
29/7	19.79	100.00	0.55	10.81	3.14	2.03	8.79	0.41
Total	475.63			388.12	506.97	302.85	218.74	[0.38]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥03NKHA~1¥02W1-M~1¥FWS.TXT

Table A2-4 (5) Estimated Field Water Supply for Maize (Green) (W2-Ma-) in Muzuz ADD

Meteorological Station : Nkhata Bay Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2008/01/10 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥NKHATA-B.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.50	273.0	152.3
February	3.93	214.0	140.7
March	3.83	376.0	162.6
April	3.92	273.0	152.3
May	3.52	65.0	58.2
June	3.27	40.0	37.4
July	3.28	23.0	22.2
August	3.98	6.0	5.9
September	4.92	4.0	4.0
October	5.49	18.0	17.5
November	5.15	88.0	75.6
December	4.10	217.0	141.7
Total (mm/Year)	1486.54	1597.0	970.4

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥03NKHA~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2008/01/10 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	38.71	100.00	0.30	11.61	7.79	5.21	6.40	0.15
31/7	40.31	100.00	0.30	12.09	2.78	1.95	10.15	0.23
10/8	42.00	100.00	0.33	14.04	0.00	0.00	14.04	0.32
20/8	43.73	100.00	0.54	23.48	0.00	0.00	23.48	0.54
30/8	45.41	100.00	0.76	34.60	0.00	0.00	34.60	0.80
9/9	46.98	100.00	0.99	46.36	0.00	0.00	46.36	1.07
19/9	48.36	100.00	1.18	56.96	0.93	0.69	56.26	1.30
29/9	49.49	100.00	1.20	59.39	4.69	3.13	56.26	1.30
9/10	50.29	100.00	1.20	60.35	5.73	5.24	55.11	1.28
19/10	50.71	100.00	1.20	60.85	8.45	8.45	52.40	1.21
29/10	50.69	100.00	1.16	59.06	15.26	15.08	43.98	1.02
8/11	50.20	100.00	0.96	47.95	26.17	23.13	24.82	0.57
18/11	49.21	100.00	0.72	35.54	39.76	31.32	4.22	0.10
28/11	24.08	100.00	0.55	13.17	25.28	18.54	0.00	0.00
Total	630.17			535.44	136.84	112.75	428.07	[0.73]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥03NKHA~1¥03W2-M~1¥FWS.TXT

Table A2-4 (6) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Muzuz ADD

Meteorological Station : Mzimba Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MZIMBA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.43	235.0	146.6
February	3.39	192.0	133.0
March	3.59	172.0	124.7
April	3.98	37.0	34.8
May	4.07	2.0	2.0
June	3.50	1.0	1.0
July	3.76	1.0	1.0
August	4.62	1.0	1.0
September	5.88	1.0	1.0
October	6.86	4.0	4.0
November	5.79	61.0	55.0
December	3.94	163.0	120.5
Total (mm/Year)	1607.79	870.0	624.6

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥04MZIM~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	53.96	100.00	0.30	16.19	31.54	26.68	0.00	0.00
1/12	51.18	100.00	0.30	15.35	42.47	33.55	0.00	0.00
11/12	47.89	100.00	0.33	15.95	53.05	39.05	0.00	0.00
21/12	44.23	100.00	0.54	23.65	62.54	43.10	0.00	0.00
31/12	38.51	100.00	0.76	29.27	65.95	43.61	0.00	0.00
10/1	38.14	100.00	0.99	37.62	70.60	45.61	0.00	0.00
20/1	38.02	100.00	1.18	44.77	74.28	47.65	0.00	0.00
30/1	37.74	100.00	1.20	45.28	75.71	49.02	0.00	0.00
9/2	37.31	100.00	1.20	44.78	74.24	49.22	0.00	0.00
19/2	36.79	100.00	1.20	44.15	69.58	47.77	0.00	0.00
1/3	36.22	100.00	1.16	42.20	61.79	44.32	0.00	0.00
11/3	35.64	100.00	0.96	34.05	51.33	38.70	0.00	0.00
21/3	35.12	100.00	0.72	25.35	39.06	31.06	0.00	0.00
31/3	17.39	100.00	0.55	9.51	14.69	12.17	0.00	0.00
Total	548.15			428.12	786.82	551.50	0.00	[0.00]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥04MZIM~1¥01S-MA~1¥FWS.TXT

Table A2-4 (6) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Mzuzu ADD

Meteorological Station : Mzimba Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MZIMBA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.43	235.0	146.6
February	3.39	192.0	133.0
March	3.59	172.0	124.7
April	3.98	37.0	34.8
May	4.07	2.0	2.0
June	3.50	1.0	1.0
July	3.76	1.0	1.0
August	4.62	1.0	1.0
September	5.88	1.0	1.0
October	6.86	4.0	4.0
November	5.79	61.0	55.0
December	3.94	163.0	120.5
Total (mm/Year)	1607.79	870.0	624.6

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥04MZIM~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	35.12	100.00	0.30	10.54	39.06	31.06	0.00	0.00
31/3	34.70	100.00	0.30	10.41	26.22	21.96	0.00	0.00
10/4	34.44	100.00	0.33	11.49	14.34	12.54	0.00	0.00
20/4	34.39	100.00	0.54	18.44	5.19	4.62	13.82	0.32
30/4	34.57	100.00	0.76	26.32	0.56	0.53	25.80	0.60
10/5	35.02	100.00	0.99	34.55	0.00	0.00	34.55	0.80
20/5	35.76	100.00	1.18	42.11	0.00	0.00	42.11	0.97
30/5	36.78	100.00	1.20	44.14	0.00	0.00	44.14	1.02
9/6	38.10	100.00	1.20	45.72	0.00	0.00	45.72	1.06
19/6	39.68	100.00	1.20	47.61	0.00	0.00	47.61	1.10
29/6	41.49	100.00	1.16	48.32	0.00	0.00	48.32	1.12
9/7	43.50	100.00	0.96	41.50	0.00	0.00	41.50	0.96
19/7	45.65	100.00	0.72	32.90	0.00	0.00	32.90	0.76
29/7	23.66	100.00	0.55	12.93	0.00	0.00	12.93	0.60
Total	512.85			426.98	85.37	70.71	389.40	[0.67]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥04MZIM~1¥02W1-M~1¥FWS.TXT

Table A2-4 (6) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Mzuzu ADD

Meteorological Station : Mzimba Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MZIMBA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.43	235.0	146.6
February	3.39	192.0	133.0
March	3.59	172.0	124.7
April	3.98	37.0	34.8
May	4.07	2.0	2.0
June	3.50	1.0	1.0
July	3.76	1.0	1.0
August	4.62	1.0	1.0
September	5.88	1.0	1.0
October	6.86	4.0	4.0
November	5.79	61.0	55.0
December	3.94	163.0	120.5
Total (mm/Year)	1607.79	870.0	624.6

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),
Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥04MZIM~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	46.09	100.00	0.30	13.83	0.00	0.00	13.83	0.32
31/7	48.32	100.00	0.30	14.50	0.00	0.00	14.50	0.34
10/8	50.54	100.00	0.33	16.89	0.00	0.00	16.89	0.39
20/8	52.67	100.00	0.54	28.28	0.00	0.00	28.28	0.65
30/8	54.62	100.00	0.76	41.61	0.00	0.00	41.61	0.96
9/9	56.31	100.00	0.99	55.56	0.00	0.00	55.56	1.29
19/9	57.65	100.00	1.18	67.90	0.00	0.00	67.90	1.57
29/9	58.57	100.00	1.20	70.28	0.00	0.00	70.28	1.63
9/10	58.98	100.00	1.20	70.78	0.00	0.00	70.78	1.64
19/10	58.84	100.00	1.20	70.61	0.65	0.63	69.97	1.62
29/10	58.08	100.00	1.16	67.68	8.09	7.59	60.09	1.39
8/11	56.70	100.00	0.96	54.18	17.81	16.20	37.99	0.88
18/11	54.69	100.00	0.72	39.51	28.29	24.39	15.12	0.35
28/11	26.40	100.00	0.55	14.44	18.23	14.98	0.00	0.00
Total	738.46			626.05	73.06	63.79	562.80	[0.97]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥11MZUZ~1¥04MZIM~1¥03W2-M~1¥FWS.TXT

Table A2-4 (7) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Kasung ADD

Meteorological Station : Kasung Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥KASUNGU.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.04	208.1	138.8
February	3.42	232.9	146.1
March	4.05	124.1	99.5
April	4.73	18.2	17.7
May	4.72	7.8	7.7
June	4.42	0.0	0.0
July	4.59	0.1	0.1
August	4.52	0.1	0.1
September	5.23	0.3	0.3
October	5.18	9.5	9.4
November	4.49	67.9	60.5
December	3.35	189.3	132.0
Total (mm/Year)	1574.81	858.3	612.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥12KASU~1¥01KASU~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	41.61	100.00	0.30	12.48	38.69	30.12	0.00	0.00
1/12	39.71	100.00	0.30	11.91	51.90	37.69	0.00	0.00
11/12	37.70	100.00	0.33	12.56	61.25	42.66	0.00	0.00
21/12	35.63	100.00	0.54	19.07	66.33	45.07	0.00	0.00
31/12	33.45	100.00	0.76	25.46	67.88	44.96	0.00	0.00
10/1	34.18	100.00	0.99	33.72	73.68	47.28	0.00	0.00
20/1	35.11	100.00	1.18	41.35	78.03	49.36	0.00	0.00
30/1	36.05	100.00	1.20	43.27	79.22	50.32	0.00	0.00
9/2	37.00	100.00	1.20	44.40	76.35	49.53	0.00	0.00
19/2	37.92	100.00	1.20	45.51	69.15	46.53	0.00	0.00
1/3	38.83	100.00	1.16	45.23	58.05	41.13	4.10	0.09
11/3	39.71	100.00	0.96	37.91	44.16	33.48	4.43	0.10
21/3	40.57	100.00	0.72	29.26	29.17	24.16	5.10	0.12
31/3	20.60	100.00	0.55	11.26	9.21	8.36	2.90	0.13
Total	508.06			413.38	803.08	550.65	16.52	[0.03]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥12KASU~1¥01KASU~1¥01S-MA~1¥FWS.TXT

Table A2-4 (7) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Kasung ADD

Meteorological Station : Kasungu Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥KASUNGU.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.04	208.1	138.8
February	3.42	232.9	146.1
March	4.05	124.1	99.5
April	4.73	18.2	17.7
May	4.72	7.8	7.7
June	4.42	0.0	0.0
July	4.59	0.1	0.1
August	4.52	0.1	0.1
September	5.23	0.3	0.3
October	5.18	9.5	9.4
November	4.49	67.9	60.5
December	3.35	189.3	132.0
Total (mm/Year)	1574.81	858.3	612.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥12KASU~1¥01KASU~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	40.57	100.00	0.30	12.17	29.17	24.16	0.00	0.00
31/3	41.40	100.00	0.30	12.42	15.26	14.28	0.00	0.00
10/4	42.21	100.00	0.33	14.10	4.80	4.80	9.29	0.22
20/4	43.00	100.00	0.54	23.07	0.21	0.21	22.86	0.53
30/4	43.77	100.00	0.76	33.34	0.91	0.81	32.53	0.75
10/5	44.53	100.00	0.99	43.93	0.00	0.00	43.93	1.02
20/5	45.27	100.00	1.18	53.31	0.00	0.00	53.31	1.23
30/5	45.98	100.00	1.20	55.18	0.00	0.00	55.18	1.28
9/6	46.67	100.00	1.20	56.01	0.00	0.00	56.01	1.30
19/6	47.33	100.00	1.20	56.79	0.00	0.00	56.79	1.31
29/6	47.93	100.00	1.16	55.83	0.00	0.00	55.83	1.29
9/7	48.48	100.00	0.96	46.29	0.00	0.00	46.29	1.07
19/7	48.95	100.00	0.72	35.32	0.00	0.00	35.32	0.82
29/7	24.62	100.00	0.55	13.46	0.00	0.00	13.46	0.62
Total	610.71			511.21	50.36	44.27	480.80	[0.82]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥12KASU~1¥01KASU~1¥02W1-M~1¥FWS.TXT

Table A2-4 (7) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Kasungu ADD

Meteorological Station : Kasungu Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥KASUNGU.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.04	208.1	138.8
February	3.42	232.9	146.1
March	4.05	124.1	99.5
April	4.73	18.2	17.7
May	4.72	7.8	7.7
June	4.42	0.0	0.0
July	4.59	0.1	0.1
August	4.52	0.1	0.1
September	5.23	0.3	0.3
October	5.18	9.5	9.4
November	4.49	67.9	60.5
December	3.35	189.3	132.0
Total (mm/Year)	1574.81	858.3	612.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥12KASU~1¥01KASU~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	49.03	100.00	0.30	14.71	0.00	0.00	14.71	0.34
31/7	49.39	100.00	0.30	14.82	0.00	0.00	14.82	0.34
10/8	49.64	100.00	0.33	16.57	0.00	0.00	16.57	0.38
20/8	49.75	100.00	0.54	26.68	0.00	0.00	26.68	0.62
30/8	49.70	100.00	0.76	37.83	0.00	0.00	37.83	0.88
9/9	49.49	100.00	0.99	48.80	0.00	0.00	48.80	1.13
19/9	49.08	100.00	1.18	57.79	0.00	0.00	57.79	1.34
29/9	48.47	100.00	1.20	58.17	0.00	0.00	58.17	1.35
9/10	47.64	100.00	1.20	57.17	0.00	0.00	57.17	1.32
19/10	46.59	100.00	1.20	55.91	0.94	0.94	54.97	1.27
29/10	45.32	100.00	1.16	52.82	6.92	6.92	45.90	1.06
8/11	43.84	100.00	0.96	41.89	18.99	17.58	24.32	0.56
18/11	42.15	100.00	0.72	30.45	34.20	27.43	3.03	0.07
28/11	20.39	100.00	0.55	11.15	22.57	16.95	0.00	0.00
Total	640.49			524.76	83.62	69.81	460.75	[0.79]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥12KASU~1¥01KASU~1¥03W2-M~1¥FWS.TXT

Table A2-4 (8) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Salima ADD

Meteorological Station : Nkhotakota Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2008/01/10 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥NHKOTAKO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.18	320.0	157.0
February	3.63	266.3	151.6
March	4.13	470.6	172.1
April	4.10	227.8	144.8
May	4.92	33.5	31.7
June	5.07	11.5	11.3
July	4.95	7.9	7.8
August	5.31	2.1	2.1
September	5.84	0.7	0.7
October	6.03	10.2	10.0
November	5.18	79.8	69.6
December	3.67	281.6	153.2
Total (mm/Year)	1705.23	1712.0	911.9

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥13SALI~1¥01NKHO~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2008/01/10 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	47.22	100.00	0.30	14.17	52.46	35.02	0.00	0.00
1/12	44.59	100.00	0.30	13.38	74.78	43.88	0.00	0.00
11/12	41.80	100.00	0.33	13.92	91.19	49.49	0.00	0.00
21/12	38.93	100.00	0.54	20.82	100.60	51.92	0.00	0.00
31/12	35.59	100.00	0.76	27.07	93.27	49.92	0.00	0.00
10/1	35.66	100.00	0.99	35.17	94.56	49.38	0.00	0.00
20/1	36.02	100.00	1.18	42.41	99.26	49.79	0.00	0.00
30/1	36.45	100.00	1.20	43.74	105.97	51.04	0.00	0.00
9/2	36.96	100.00	1.20	44.35	113.85	53.00	0.00	0.00
19/2	37.56	100.00	1.20	45.07	121.48	55.27	0.00	0.00
1/3	38.24	100.00	1.16	44.54	127.05	57.21	0.00	0.00
11/3	39.02	100.00	0.96	37.24	128.50	58.04	0.00	0.00
21/3	39.88	100.00	0.72	28.77	123.90	56.92	0.00	0.00
31/3	20.30	100.00	0.55	11.09	57.92	27.23	0.00	0.00
Total	528.20			421.75	1384.80	688.10	0.00	[0.00]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥13SALI~1¥01NKHO~1¥01S-MA~1¥FWS.TXT

Table A2-4 (8) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Salima ADD

Meteorological Station : Nkhotakota Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥NHKOTAKO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.18	320.0	157.0
February	3.63	266.3	151.6
March	4.13	470.6	172.1
April	4.10	227.8	144.8
May	4.92	33.5	31.7
June	5.07	11.5	11.3
July	4.95	7.9	7.8
August	5.31	2.1	2.1
September	5.84	0.7	0.7
October	6.03	10.2	10.0
November	5.18	79.8	69.6
December	3.67	281.6	153.2
Total (mm/Year)	1705.23	1712.0	911.9

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥13SALI~1¥01NKHO~1¥03W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	39.88	100.00	0.30	11.97	123.90	56.92	0.00	0.00
31/3	40.85	100.00	0.30	12.25	111.80	53.13	0.00	0.00
10/4	41.90	100.00	0.33	14.00	91.73	46.23	0.00	0.00
20/4	43.04	100.00	0.54	23.10	64.76	36.31	0.00	0.00
30/4	44.26	100.00	0.76	33.72	34.15	24.27	9.45	0.22
10/5	45.54	100.00	0.99	44.94	6.70	6.68	38.26	0.89
20/5	46.88	100.00	1.18	55.21	0.00	0.00	55.21	1.28
30/5	48.24	100.00	1.20	57.89	0.73	0.53	57.36	1.33
9/6	49.61	100.00	1.20	59.54	0.00	0.00	59.54	1.38
19/6	50.97	100.00	1.20	61.16	0.00	0.00	61.16	1.42
29/6	52.27	100.00	1.16	60.88	0.00	0.00	60.88	1.41
9/7	53.50	100.00	0.96	51.07	0.00	0.00	51.07	1.18
19/7	54.61	100.00	0.72	39.39	0.00	0.00	39.39	0.91
29/7	27.68	100.00	0.55	15.13	0.00	0.00	15.13	0.70
Total	639.24			540.24	433.78	224.07	447.44	[0.77]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥13SALI~1¥01NKHO~1¥03W1-M~1¥FWS.TXT

Table A2-4 (8) Estimated Field Water Supply for Maize (Geenr) (W2-Ma) in Salima ADD

Meteorological Station : Nkhotakota Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥NHKOTAKO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.18	320.0	157.0
February	3.63	266.3	151.6
March	4.13	470.6	172.1
April	4.10	227.8	144.8
May	4.92	33.5	31.7
June	5.07	11.5	11.3
July	4.95	7.9	7.8
August	5.31	2.1	2.1
September	5.84	0.7	0.7
October	6.03	10.2	10.0
November	5.18	79.8	69.6
December	3.67	281.6	153.2
Total (mm/Year)	1705.23	1712.0	911.9

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥13SALI~1¥01NKHO~1¥04W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	54.82	100.00	0.30	16.45	0.00	0.00	16.45	0.38
31/7	55.75	100.00	0.30	16.73	0.00	0.00	16.73	0.39
10/8	56.50	100.00	0.33	18.86	0.00	0.00	18.86	0.44
20/8	57.03	100.00	0.54	30.59	0.00	0.00	30.59	0.71
30/8	57.30	100.00	0.76	43.62	0.00	0.00	43.62	1.01
9/9	57.29	100.00	0.99	56.50	0.00	0.00	56.50	1.31
19/9	56.97	100.00	1.18	67.08	0.00	0.00	67.08	1.55
29/9	56.32	100.00	1.20	67.58	0.00	0.00	67.58	1.56
9/10	55.32	100.00	1.20	66.39	0.00	0.00	66.39	1.54
19/10	53.98	100.00	1.20	64.77	0.79	0.78	63.99	1.48
29/10	52.29	100.00	1.16	60.94	4.81	4.81	56.13	1.30
8/11	50.28	100.00	0.96	48.06	21.15	19.41	28.65	0.66
18/11	47.96	100.00	0.72	34.66	45.09	31.83	2.83	0.07
28/11	23.03	100.00	0.55	12.60	31.60	19.74	0.00	0.00
Total	734.84			604.82	103.44	76.56	535.39	[0.92]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥13SALI~1¥01NKHO~1¥04W2-M~1¥FWS.TXT

Table A2-4 (8) Estimated Field Water Supply for Maize (Grain) (W3-Ma) in SalimaADD

Meteorological Station : Nkhotakota Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥NHKOTAKO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.18	320.0	157.0
February	3.63	266.3	151.6
March	4.13	470.6	172.1
April	4.10	227.8	144.8
May	4.92	33.5	31.7
June	5.07	11.5	11.3
July	4.95	7.9	7.8
August	5.31	2.1	2.1
September	5.84	0.7	0.7
October	6.03	10.2	10.0
November	5.18	79.8	69.6
December	3.67	281.6	153.2
Total (mm/Year)	1705.23	1712.0	911.9

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥13SALI~1¥01NKHO~1¥05W-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	54.82	100.00	0.30	16.45	0.00	0.00	16.45	0.38
31/7	55.75	100.00	0.30	16.73	0.00	0.00	16.73	0.39
10/8	56.50	100.00	0.33	18.86	0.00	0.00	18.86	0.44
20/8	57.03	100.00	0.54	30.59	0.00	0.00	30.59	0.71
30/8	57.30	100.00	0.76	43.62	0.00	0.00	43.62	1.01
9/9	57.29	100.00	0.99	56.50	0.00	0.00	56.50	1.31
19/9	56.97	100.00	1.18	67.08	0.00	0.00	67.08	1.55
29/9	56.32	100.00	1.20	67.58	0.00	0.00	67.58	1.56
9/10	55.32	100.00	1.20	66.39	0.00	0.00	66.39	1.54
19/10	53.98	100.00	1.20	64.77	0.79	0.78	63.99	1.48
29/10	52.29	100.00	1.16	60.94	4.81	4.81	56.13	1.30
8/11	50.28	100.00	0.96	48.06	21.15	19.41	28.65	0.66
18/11	47.96	100.00	0.72	34.66	45.09	31.83	2.83	0.07
28/11	23.03	100.00	0.55	12.60	31.60	19.74	0.00	0.00
Total	734.84			604.82	103.44	76.56	535.39	[0.92]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥13SALI~1¥01NKHO~1¥05W3-M~1¥FWS.TXT

Table A2-4 (9) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Salima ADD

Meteorological Station : Salima Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥SALIMA.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.35	234.8	146.6
February	4.26	226.5	144.4
March	4.65	176.4	126.6
April	4.64	36.1	34.0
May	4.31	6.3	6.2
June	4.09	1.4	1.4
July	4.24	2.9	2.9
August	4.90	1.9	1.9
September	5.78	1.6	1.6
October	6.72	25.4	24.4
November	6.27	68.7	61.1
December	4.81	187.4	131.2
Total (mm/Year)	1796.06	969.4	682.3

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥13SALI~1¥02SALI~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	58.48	100.00	0.30	17.54	36.12	28.70	0.00	0.00
1/12	56.63	100.00	0.30	16.99	49.31	36.40	0.00	0.00
11/12	54.32	100.00	0.33	18.10	60.90	42.52	0.00	0.00
21/12	51.64	100.00	0.54	27.64	69.35	46.31	0.00	0.00
31/12	47.47	100.00	0.76	36.11	70.46	45.45	0.00	0.00
10/1	47.26	100.00	0.99	46.61	75.45	47.29	0.00	0.00
20/1	47.16	100.00	1.18	55.52	79.88	49.43	6.09	0.14
30/1	46.85	100.00	1.20	56.22	82.09	51.02	5.20	0.12
9/2	46.36	100.00	1.20	55.63	81.17	51.45	4.18	0.10
19/2	45.72	100.00	1.20	54.86	76.54	50.11	4.75	0.11
1/3	44.97	100.00	1.16	52.40	68.06	46.53	5.87	0.14
11/3	44.16	100.00	0.96	42.19	56.14	40.46	1.73	0.04
21/3	43.35	100.00	0.72	31.30	41.76	32.05	0.00	0.00
31/3	21.38	100.00	0.55	11.69	15.15	12.32	0.00	0.00
Total	655.74			522.81	862.37	580.04	27.83	[0.05]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥13SALI~1¥02SALI~1¥01S-MA~1¥FWS.TXT

Table A2-4 (9) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Salima ADD

Meteorological Station : Salima Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥SALIMA.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.35	234.8	146.6
February	4.26	226.5	144.4
March	4.65	176.4	126.6
April	4.64	36.1	34.0
May	4.31	6.3	6.2
June	4.09	1.4	1.4
July	4.24	2.9	2.9
August	4.90	1.9	1.9
September	5.78	1.6	1.6
October	6.72	25.4	24.4
November	6.27	68.7	61.1
December	4.81	187.4	131.2
Total (mm/Year)	1796.06	969.4	682.3

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥13SALI~1¥02SALI~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	43.35	100.00	0.30	13.01	41.76	32.05	0.00	0.00
31/3	42.59	100.00	0.30	12.78	26.55	22.02	0.00	0.00
10/4	41.93	100.00	0.33	13.99	12.81	11.86	2.13	0.05
20/4	41.42	100.00	0.54	22.21	3.53	3.53	18.68	0.43
30/4	41.11	100.00	0.76	31.29	0.85	0.85	30.45	0.70
10/5	41.03	100.00	0.99	40.47	0.00	0.00	40.47	0.94
20/5	41.21	100.00	1.18	48.53	0.00	0.00	48.53	1.12
30/5	41.66	100.00	1.20	49.99	0.00	0.00	49.99	1.16
9/6	42.39	100.00	1.20	50.87	0.00	0.00	50.87	1.18
19/6	43.39	100.00	1.20	52.07	0.00	0.00	52.07	1.21
29/6	44.65	100.00	1.16	52.00	0.00	0.00	52.00	1.20
9/7	46.13	100.00	0.96	44.03	0.00	0.00	44.03	1.02
19/7	47.81	100.00	0.72	34.47	0.00	0.00	34.47	0.80
29/7	24.57	100.00	0.55	13.43	0.00	0.00	13.43	0.62
Total	583.27			479.13	85.50	70.31	437.11	[0.75]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥13SALI~1¥02SALI~1¥02W1-M~1¥FWS.TXT

Table A2-4 (9) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Salima ADD

Meteorological Station : Salima Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥SALIMA.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.35	234.8	146.6
February	4.26	226.5	144.4
March	4.65	176.4	126.6
April	4.64	36.1	34.0
May	4.31	6.3	6.2
June	4.09	1.4	1.4
July	4.24	2.9	2.9
August	4.90	1.9	1.9
September	5.78	1.6	1.6
October	6.72	25.4	24.4
November	6.27	68.7	61.1
December	4.81	187.4	131.2
Total (mm/Year)	1796.06	969.4	682.3

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥13SALI~1¥02SALI~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	48.16	100.00	0.30	14.45	0.00	0.00	14.45	0.33
31/7	49.99	100.00	0.30	15.00	0.00	0.00	15.00	0.35
10/8	51.88	100.00	0.33	17.33	0.00	0.00	17.33	0.40
20/8	53.77	100.00	0.54	28.87	0.00	0.00	28.87	0.67
30/8	55.59	100.00	0.76	42.35	0.00	0.00	42.35	0.98
9/9	57.25	100.00	0.99	56.50	0.00	0.00	56.50	1.31
19/9	58.70	100.00	1.18	69.12	1.06	0.82	68.31	1.58
29/9	59.83	100.00	1.20	71.80	7.78	6.10	65.70	1.52
9/10	60.60	100.00	1.20	72.72	8.39	7.77	64.95	1.50
19/10	60.94	100.00	1.20	73.12	8.24	8.24	64.88	1.50
29/10	60.79	100.00	1.16	70.82	11.88	11.87	58.96	1.36
8/11	60.13	100.00	0.96	57.44	20.25	18.56	38.88	0.90
18/11	58.94	100.00	0.72	42.56	32.17	26.28	16.28	0.38
28/11	28.86	100.00	0.55	15.78	21.07	16.16	0.00	0.00
Total	765.42			647.87	110.83	95.79	552.45	[0.95]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥13SALI~1¥02SALI~1¥03W2-M~1¥FWS.TXT

Table A2-4 (10) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Lilongwe ADD

Meteorological Station : Chileka Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥CHILEKA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.18	199.0	135.6
February	4.07	173.0	125.1
March	3.81	137.0	107.0
April	3.72	41.0	38.3
May	3.19	9.0	8.9
June	2.74	3.0	3.0
July	2.99	2.0	2.0
August	3.78	1.0	1.0
September	4.76	3.0	3.0
October	5.49	22.0	21.2
November	5.12	83.0	72.0
December	4.41	174.0	125.6
Total (mm/Year)	1467.51	847.0	642.7

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥14LILO~1¥01CHIL~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	51.21	100.00	0.30	15.36	38.66	30.84	0.00	0.00
1/12	50.27	100.00	0.30	15.08	48.51	36.47	0.00	0.00
11/12	48.87	100.00	0.33	16.29	56.39	40.63	0.00	0.00
21/12	47.09	100.00	0.54	25.21	61.53	43.07	0.00	0.00
31/12	44.40	100.00	0.76	33.78	61.55	42.72	0.00	0.00
10/1	44.02	100.00	0.99	43.41	63.60	43.84	0.00	0.00
20/1	43.54	100.00	1.18	51.26	65.00	44.86	6.40	0.15
30/1	42.77	100.00	1.20	51.33	64.85	45.25	6.07	0.14
9/2	41.76	100.00	1.20	50.11	62.70	44.64	5.47	0.13
19/2	40.53	100.00	1.20	48.64	58.33	42.72	5.92	0.14
1/3	39.16	100.00	1.16	45.63	51.77	39.29	6.35	0.15
11/3	37.69	100.00	0.96	36.02	43.36	34.29	1.73	0.04
21/3	36.19	100.00	0.72	26.15	33.68	27.91	0.00	0.00
31/3	17.55	100.00	0.55	9.59	13.05	11.24	0.00	0.00
Total	585.04			467.88	722.99	527.77	31.94	[0.05]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥14LILO~1¥01CHIL~1¥01S-MA~1¥FWS.TXT

Table A2-4 (10) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Lilongwe ADD

Meteorological Station : Chileka Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥CHILEKA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.18	199.0	135.6
February	4.07	173.0	125.1
March	3.81	137.0	107.0
April	3.72	41.0	38.3
May	3.19	9.0	8.9
June	2.74	3.0	3.0
July	2.99	2.0	2.0
August	3.78	1.0	1.0
September	4.76	3.0	3.0
October	5.49	22.0	21.2
November	5.12	83.0	72.0
December	4.41	174.0	125.6
Total (mm/Year)	1467.51	847.0	642.7

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥14LILO~1¥01CHIL~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	36.19	100.00	0.30	10.86	33.68	27.91	0.00	0.00
31/3	34.74	100.00	0.30	10.42	23.63	20.58	0.00	0.00
10/4	33.38	100.00	0.33	11.13	14.30	13.12	0.00	0.00
20/4	32.19	100.00	0.54	17.24	7.01	6.74	10.50	0.24
30/4	31.22	100.00	0.76	23.75	2.07	2.06	21.69	0.50
10/5	30.52	100.00	0.99	30.09	0.00	0.00	30.09	0.70
20/5	30.11	100.00	1.18	35.45	0.00	0.00	35.45	0.82
30/5	30.03	100.00	1.20	36.04	0.00	0.00	36.04	0.83
9/6	30.29	100.00	1.20	36.35	0.00	0.00	36.35	0.84
19/6	30.90	100.00	1.20	37.07	0.00	0.00	37.07	0.86
29/6	31.83	100.00	1.16	37.07	0.00	0.00	37.07	0.86
9/7	33.08	100.00	0.96	31.56	0.00	0.00	31.56	0.73
19/7	34.60	100.00	0.72	24.94	0.00	0.00	24.94	0.58
29/7	17.95	100.00	0.55	9.81	0.00	0.00	9.81	0.45
Total	437.04			351.79	80.69	70.41	310.58	[0.53]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥14LILO~1¥01CHIL~1¥02W1-M~1¥FWS.TXT

Table A2-4 (10) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Lilongwe ADD

Meteorological Station : Chileka Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥CHILEKA.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.18	199.0	135.6
February	4.07	173.0	125.1
March	3.81	137.0	107.0
April	3.72	41.0	38.3
May	3.19	9.0	8.9
June	2.74	3.0	3.0
July	2.99	2.0	2.0
August	3.78	1.0	1.0
September	4.76	3.0	3.0
October	5.49	22.0	21.2
November	5.12	83.0	72.0
December	4.41	174.0	125.6
Total (mm/Year)	1467.51	847.0	642.7

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥14LILO~1¥01CHIL~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	34.94	100.00	0.30	10.48	0.00	0.00	10.48	0.24
31/7	36.73	100.00	0.30	11.02	0.00	0.00	11.02	0.26
10/8	38.69	100.00	0.33	12.93	0.00	0.00	12.93	0.30
20/8	40.74	100.00	0.54	21.89	0.00	0.00	21.89	0.51
30/8	42.83	100.00	0.76	32.64	0.00	0.00	32.64	0.76
9/9	44.86	100.00	0.99	44.28	0.00	0.00	44.28	1.02
19/9	46.76	100.00	1.18	55.07	0.80	0.60	54.46	1.26
29/9	48.44	100.00	1.20	58.13	4.77	3.52	54.62	1.26
9/10	49.85	100.00	1.20	59.82	6.85	6.39	53.43	1.24
19/10	50.90	100.00	1.20	61.08	10.11	10.11	50.96	1.18
29/10	51.53	100.00	1.16	60.03	16.28	15.83	44.20	1.02
8/11	51.71	100.00	0.96	49.38	25.17	22.31	27.08	0.63
18/11	51.40	100.00	0.72	37.10	35.51	28.94	8.16	0.19
28/11	25.43	100.00	0.55	13.90	21.65	16.78	0.00	0.00
Total	614.80			527.76	121.15	104.49	426.15	[0.73]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥14LILO~1¥01CHIL~1¥03W2-M~1¥FWS.TXT

Table A2-4 (11) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Lilongwe ADD

Meteorological Station : Lilongwe Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥LILONGWE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.79	208.0	138.8
February	3.71	197.0	134.9
March	3.65	131.0	103.5
April	3.72	39.0	36.6
May	3.25	7.0	6.9
June	2.89	1.0	1.0
July	3.18	0.0	0.0
August	3.94	1.0	1.0
September	4.88	3.0	3.0
October	5.79	7.0	6.9
November	5.18	66.0	59.0
December	4.09	180.0	128.2
Total (mm/Year)	1462.37	840.0	619.8

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥14LILO~1¥02LILO~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	50.42	100.00	0.30	15.13	36.71	29.18	0.00	0.00
1/12	48.90	100.00	0.30	14.67	49.06	36.48	0.00	0.00
11/12	46.92	100.00	0.33	15.64	58.29	41.45	0.00	0.00
21/12	44.56	100.00	0.54	23.85	64.00	44.14	0.00	0.00
31/12	40.96	100.00	0.76	31.16	65.24	44.20	0.00	0.00
10/1	40.64	100.00	0.99	40.07	69.07	46.03	0.00	0.00
20/1	40.31	100.00	1.18	47.46	71.59	47.50	0.00	0.00
30/1	39.75	100.00	1.20	47.70	71.59	47.92	0.00	0.00
9/2	38.97	100.00	1.20	46.77	68.56	46.92	0.00	0.00
19/2	38.02	100.00	1.20	45.63	62.47	44.25	1.38	0.03
1/3	36.95	100.00	1.16	43.06	53.75	39.88	3.18	0.07
11/3	35.81	100.00	0.96	34.22	43.26	33.99	0.23	0.01
21/3	34.66	100.00	0.72	25.04	32.13	26.98	0.00	0.00
31/3	16.92	100.00	0.55	9.25	12.04	10.67	0.00	0.00
Total	553.79			439.63	757.76	539.59	4.78	[0.01]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥14LILO~1¥02LILO~1¥01S-MA~1¥FWS.TXT

Table A2-4 (11) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Lilongwe ADD

Meteorological Station : Lilongwe Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥LILONGWE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.79	208.0	138.8
February	3.71	197.0	134.9
March	3.65	131.0	103.5
April	3.72	39.0	36.6
May	3.25	7.0	6.9
June	2.89	1.0	1.0
July	3.18	0.0	0.0
August	3.94	1.0	1.0
September	4.88	3.0	3.0
October	5.79	7.0	6.9
November	5.18	66.0	59.0
December	4.09	180.0	128.2
Total (mm/Year)	1462.37	840.0	619.8

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥14LILO~1¥02LILO~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	34.66	100.00	0.30	10.40	32.13	26.98	0.00	0.00
31/3	33.57	100.00	0.30	10.07	21.62	19.45	0.00	0.00
10/4	32.59	100.00	0.33	10.87	12.87	12.21	0.00	0.00
20/4	31.78	100.00	0.54	17.03	6.57	6.23	10.80	0.25
30/4	31.19	100.00	0.76	23.74	1.93	1.79	21.95	0.51
10/5	30.86	100.00	0.99	30.43	0.00	0.00	30.43	0.70
20/5	30.82	100.00	1.18	36.29	0.00	0.00	36.29	0.84
30/5	31.08	100.00	1.20	37.30	0.00	0.00	37.30	0.86
9/6	31.66	100.00	1.20	37.99	0.00	0.00	37.99	0.88
19/6	32.55	100.00	1.20	39.06	0.00	0.00	39.06	0.90
29/6	33.74	100.00	1.16	39.29	0.00	0.00	39.29	0.91
9/7	35.19	100.00	0.96	33.57	0.00	0.00	33.57	0.78
19/7	36.87	100.00	0.72	26.57	0.00	0.00	26.57	0.62
29/7	19.12	100.00	0.55	10.45	0.00	0.00	10.45	0.48
Total	445.68			363.06	75.12	66.65	323.70	[0.56]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥14LILO~1¥02LILO~1¥02W1-M~1¥FWS.TXT

Table A2-4 (11) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Lilongwe ADD

Meteorological Station : Lilongwe Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥LILONGWE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.79	208.0	138.8
February	3.71	197.0	134.9
March	3.65	131.0	103.5
April	3.72	39.0	36.6
May	3.25	7.0	6.9
June	2.89	1.0	1.0
July	3.18	0.0	0.0
August	3.94	1.0	1.0
September	4.88	3.0	3.0
October	5.79	7.0	6.9
November	5.18	66.0	59.0
December	4.09	180.0	128.2
Total (mm/Year)	1462.37	840.0	619.8

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥14LILO~1¥02LILO~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	37.23	100.00	0.30	11.17	0.00	0.00	11.17	0.26
31/7	39.12	100.00	0.30	11.74	0.00	0.00	11.74	0.27
10/8	41.11	100.00	0.33	13.74	0.00	0.00	13.74	0.32
20/8	43.14	100.00	0.54	23.17	0.00	0.00	23.17	0.54
30/8	45.14	100.00	0.76	34.40	0.00	0.00	34.40	0.80
9/9	47.01	100.00	0.99	46.40	0.00	0.00	46.40	1.07
19/9	48.69	100.00	1.18	57.35	0.00	0.00	57.35	1.33
29/9	50.10	100.00	1.20	60.12	0.00	0.00	60.12	1.39
9/10	51.15	100.00	1.20	61.38	0.00	0.00	61.38	1.42
19/10	51.80	100.00	1.20	62.15	0.77	0.77	61.39	1.42
29/10	51.97	100.00	1.16	60.55	7.03	7.03	53.52	1.24
8/11	51.64	100.00	0.96	49.32	18.63	17.22	32.11	0.74
18/11	50.78	100.00	0.72	36.67	32.59	26.61	10.06	0.23
28/11	24.91	100.00	0.55	13.62	21.33	16.40	0.00	0.00
Total	633.79			541.78	80.35	68.02	476.55	[0.82]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥14LILO~1¥02LILO~1¥03W2-M~1¥FWS.TXT

Table A2-4 (12) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Lilongwe ADD

Meteorological Station : Dedza Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥DEDZA.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.53	230.5	145.5
February	3.43	210.2	139.5
March	3.52	134.5	105.6
April	3.35	51.4	47.2
May	3.12	10.1	9.9
June	2.83	4.2	4.2
July	2.91	3.2	3.2
August	3.76	1.2	1.2
September	4.95	2.9	2.9
October	5.57	10.3	10.1
November	4.99	58.2	52.8
December	3.74	211.5	139.9
Total (mm/Year)	1390.29	928.2	662.0

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥14LILO~1¥03DEDZ~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	48.25	100.00	0.30	14.48	39.38	29.47	0.00	0.00
1/12	46.56	100.00	0.30	13.97	56.41	38.94	0.00	0.00
11/12	44.41	100.00	0.33	14.80	68.44	45.22	0.00	0.00
21/12	41.89	100.00	0.54	22.41	74.68	48.10	0.00	0.00
31/12	37.97	100.00	0.76	28.88	74.25	47.33	0.00	0.00
10/1	37.70	100.00	0.99	37.18	77.14	48.73	0.00	0.00
20/1	37.47	100.00	1.18	44.12	78.50	49.71	0.00	0.00
30/1	37.00	100.00	1.20	44.40	77.12	49.58	0.00	0.00
9/2	36.31	100.00	1.20	43.58	72.66	48.07	0.00	0.00
19/2	35.46	100.00	1.20	42.55	65.30	45.06	0.00	0.00
1/3	34.47	100.00	1.16	40.17	55.73	40.65	0.00	0.00
11/3	33.43	100.00	0.96	31.94	44.97	35.08	0.00	0.00
21/3	32.38	100.00	0.72	23.38	34.23	28.75	0.00	0.00
31/3	15.81	100.00	0.55	8.64	13.40	11.88	0.00	0.00
Total	519.10			410.50	832.19	566.56	0.00	[0.00]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥14LILO~1¥03DEDZ~1¥01S-MA~1¥FWS.TXT

Table A2-4 (12) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Lilongwe ADD

Meteorological Station : Dedza Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥DEDZA.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.53	230.5	145.5
February	3.43	210.2	139.5
March	3.52	134.5	105.6
April	3.35	51.4	47.2
May	3.12	10.1	9.9
June	2.83	4.2	4.2
July	2.91	3.2	3.2
August	3.76	1.2	1.2
September	4.95	2.9	2.9
October	5.57	10.3	10.1
November	4.99	58.2	52.8
December	3.74	211.5	139.9
Total (mm/Year)	1390.29	928.2	662.0

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥14LILO~1¥03DEDZ~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	32.38	100.00	0.30	9.71	34.23	28.75	0.00	0.00
31/3	31.38	100.00	0.30	9.41	24.60	22.09	0.00	0.00
10/4	30.50	100.00	0.33	10.17	16.72	15.55	0.00	0.00
20/4	29.79	100.00	0.54	15.96	10.32	9.39	6.57	0.15
30/4	29.29	100.00	0.76	22.29	3.15	2.85	19.44	0.45
10/5	29.05	100.00	0.99	28.65	0.00	0.00	28.65	0.66
20/5	29.10	100.00	1.18	34.26	0.00	0.00	34.26	0.79
30/5	29.45	100.00	1.20	35.34	0.00	0.00	35.34	0.82
9/6	30.11	100.00	1.20	36.13	0.00	0.00	36.13	0.84
19/6	31.07	100.00	1.20	37.28	0.00	0.00	37.28	0.86
29/6	32.32	100.00	1.16	37.64	0.00	0.00	37.64	0.87
9/7	33.83	100.00	0.96	32.28	0.00	0.00	32.28	0.75
19/7	35.56	100.00	0.72	25.62	0.00	0.00	25.62	0.59
29/7	18.48	100.00	0.55	10.10	0.00	0.00	10.10	0.47
Total	422.29			344.85	89.03	78.62	303.31	[0.52]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥14LILO~1¥03DEDZ~1¥02W1-M~1¥FWS.TXT

Table A2-4 (12) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Lilongwe ADD

Meteorological Station : Dedza Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥DEDZA.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.53	230.5	145.5
February	3.43	210.2	139.5
March	3.52	134.5	105.6
April	3.35	51.4	47.2
May	3.12	10.1	9.9
June	2.83	4.2	4.2
July	2.91	3.2	3.2
August	3.76	1.2	1.2
September	4.95	2.9	2.9
October	5.57	10.3	10.1
November	4.99	58.2	52.8
December	3.74	211.5	139.9
Total (mm/Year)	1390.29	928.2	662.0

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥14LILO~1¥03DEDZ~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	35.92	100.00	0.30	10.78	0.00	0.00	10.78	0.25
31/7	37.84	100.00	0.30	11.35	0.00	0.00	11.35	0.26
10/8	39.85	100.00	0.33	13.32	0.00	0.00	13.32	0.31
20/8	41.88	100.00	0.54	22.49	0.00	0.00	22.49	0.52
30/8	43.85	100.00	0.76	33.41	0.00	0.00	33.41	0.77
9/9	45.68	100.00	0.99	45.09	0.00	0.00	45.09	1.04
19/9	47.31	100.00	1.18	55.71	0.00	0.00	55.71	1.29
29/9	48.63	100.00	1.20	58.36	0.00	0.00	58.36	1.35
9/10	49.59	100.00	1.20	59.51	0.00	0.00	59.51	1.38
19/10	50.11	100.00	1.20	60.14	0.77	0.77	59.37	1.37
29/10	50.16	100.00	1.16	58.43	3.19	3.19	55.25	1.28
8/11	49.67	100.00	0.96	47.45	15.23	14.31	33.14	0.77
18/11	48.66	100.00	0.72	35.14	33.70	26.18	8.96	0.21
28/11	23.78	100.00	0.55	13.01	23.82	17.07	0.00	0.00
Total	612.93			524.20	76.70	61.52	466.75	[0.80]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥14LILO~1¥03DEDZ~1¥03W2-M~1¥FWS.TXT

Table A2-4 (13) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Machinga ADD

Meteorological Station : Monkey Bay Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥MONKYBY.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.62	190.3	132.4
February	3.88	234.0	146.4
March	4.76	93.9	79.8
April	5.17	18.7	18.1
May	5.32	4.7	4.7
June	5.07	0.0	0.0
July	5.19	0.4	0.4
August	5.70	1.2	1.2
September	6.19	0.7	0.7
October	6.38	9.4	9.3
November	4.70	37.8	35.5
December	3.93	296.6	154.7
Total (mm/Year)	1824.44	887.7	583.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥15MACH~1¥01MONK~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	48.48	100.00	0.30	14.54	51.38	28.77	0.00	0.00
1/12	46.13	100.00	0.30	13.84	81.03	42.20	0.00	0.00
11/12	43.67	100.00	0.33	14.55	95.29	49.87	0.00	0.00
21/12	41.17	100.00	0.54	22.03	93.32	51.33	0.00	0.00
31/12	39.05	100.00	0.76	29.73	80.44	47.82	0.00	0.00
10/1	39.60	100.00	0.99	39.07	77.31	48.45	0.00	0.00
20/1	40.33	100.00	1.18	47.50	74.80	48.95	0.00	0.00
30/1	41.11	100.00	1.20	49.34	71.69	48.42	0.91	0.02
9/2	41.94	100.00	1.20	50.33	67.25	46.40	3.93	0.09
19/2	42.80	100.00	1.20	51.37	60.86	42.56	8.80	0.20
1/3	43.71	100.00	1.16	50.91	52.07	36.83	14.08	0.33
11/3	44.64	100.00	0.96	42.61	40.84	29.42	13.19	0.31
21/3	45.61	100.00	0.72	32.89	27.74	20.90	11.99	0.28
31/3	23.18	100.00	0.55	12.67	8.72	7.17	5.50	0.25
Total	581.42			471.37	882.71	549.08	58.41	[0.10]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥15MACH~1¥01MONK~1¥01S-MA~1¥FWS.TXT

Table A2-4 (13) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Machinga ADD

Meteorological Station : Monkey Bay Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥MONKYBY.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.62	190.3	132.4
February	3.88	234.0	146.4
March	4.76	93.9	79.8
April	5.17	18.7	18.1
May	5.32	4.7	4.7
June	5.07	0.0	0.0
July	5.19	0.4	0.4
August	5.70	1.2	1.2
September	6.19	0.7	0.7
October	6.38	9.4	9.3
November	4.70	37.8	35.5
December	3.93	296.6	154.7
Total (mm/Year)	1824.44	887.7	583.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥15MACH~1¥01MONK~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	43.39	100.00	0.30	13.02	33.34	27.47	0.00	0.00
31/3	43.98	100.00	0.30	13.19	22.13	19.46	0.00	0.00
10/4	44.60	100.00	0.33	14.89	12.22	11.56	3.33	0.08
20/4	45.27	100.00	0.54	24.29	5.05	5.04	19.25	0.45
30/4	46.00	100.00	0.76	35.03	1.18	1.17	33.86	0.78
10/5	46.80	100.00	0.99	46.17	0.00	0.00	46.17	1.07
20/5	47.66	100.00	1.18	56.12	0.00	0.00	56.12	1.30
30/5	48.58	100.00	1.20	58.29	0.00	0.00	58.29	1.35
9/6	49.56	100.00	1.20	59.47	0.00	0.00	59.47	1.38
19/6	50.57	100.00	1.20	60.69	0.00	0.00	60.69	1.40
29/6	51.61	100.00	1.16	60.12	0.00	0.00	60.12	1.39
9/7	52.65	100.00	0.96	50.26	0.00	0.00	50.26	1.16
19/7	53.66	100.00	0.72	38.71	0.00	0.00	38.71	0.90
29/7	27.19	100.00	0.55	14.86	0.00	0.00	14.86	0.69
Total	651.52			545.12	73.92	64.70	501.13	[0.86]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥15MACH~1¥02MANG~1¥03W1-M~1¥FWS.TXT

Table A2-4 (13) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Machinga ADD

Meteorological Station : Monkey Bay Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥MONKYBY.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.62	190.3	132.4
February	3.88	234.0	146.4
March	4.76	93.9	79.8
April	5.17	18.7	18.1
May	5.32	4.7	4.7
June	5.07	0.0	0.0
July	5.19	0.4	0.4
August	5.70	1.2	1.2
September	6.19	0.7	0.7
October	6.38	9.4	9.3
November	4.70	37.8	35.5
December	3.93	296.6	154.7
Total (mm/Year)	1824.44	887.7	583.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥15MACH~1¥01MONK~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	57.65	100.00	0.30	17.29	0.00	0.00	17.29	0.40
31/7	58.21	100.00	0.30	17.46	0.00	0.00	17.46	0.40
10/8	58.60	100.00	0.33	19.56	0.00	0.00	19.56	0.45
20/8	58.80	100.00	0.54	31.53	0.00	0.00	31.53	0.73
30/8	58.78	100.00	0.76	44.74	0.00	0.00	44.74	1.04
9/9	58.52	100.00	0.99	57.70	0.00	0.00	57.70	1.34
19/9	58.00	100.00	1.18	68.29	0.00	0.00	68.29	1.58
29/9	57.21	100.00	1.20	68.65	0.00	0.00	68.65	1.59
9/10	56.14	100.00	1.20	67.37	0.00	0.00	67.37	1.56
19/10	54.79	100.00	1.20	65.74	0.30	0.30	65.44	1.51
29/10	53.16	100.00	1.16	61.95	0.00	0.00	61.95	1.43
8/11	51.27	100.00	0.96	49.00	6.61	5.77	43.23	1.00
18/11	49.16	100.00	0.72	35.52	40.51	24.01	11.51	0.27
28/11	23.72	100.00	0.55	12.97	33.34	17.77	0.00	0.00
Total	753.99			617.79	80.77	47.85	574.74	[0.99]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥15MACH~1¥01MONK~1¥03W2-M~1¥FWS.TXT

Table A2-4 (14) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Machinga ADD

Meteorological Station : Mangochi Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥MANGOCHI.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.58	191.3	132.7
February	3.86	188.7	131.7
March	4.48	136.5	106.7
April	4.84	36.2	34.1
May	4.99	4.5	4.5
June	4.63	2.7	2.7
July	4.81	2.5	2.5
August	5.34	1.8	1.8
September	6.03	2.8	2.8
October	6.24	13.1	12.8
November	5.16	54.0	49.3
December	3.78	156.8	117.5
Total (mm/Year)	1757.70	790.9	599.1

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥15MACH~1¥02MANG~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	49.45	100.00	0.30	14.84	30.60	25.29	0.00	0.00
1/12	47.07	100.00	0.30	14.12	41.84	32.63	0.00	0.00
11/12	44.47	100.00	0.33	14.81	50.84	38.03	0.00	0.00
21/12	41.74	100.00	0.54	22.33	56.98	41.27	0.00	0.00
31/12	38.49	100.00	0.76	29.29	58.52	41.40	0.00	0.00
10/1	39.00	100.00	0.99	38.48	62.88	43.53	0.00	0.00
20/1	39.72	100.00	1.18	46.78	66.35	45.49	1.29	0.03
30/1	40.41	100.00	1.20	48.49	67.68	46.55	1.94	0.04
9/2	41.05	100.00	1.20	49.27	66.20	46.23	3.03	0.07
19/2	41.66	100.00	1.20	50.00	61.66	44.21	5.78	0.13
1/3	42.25	100.00	1.16	49.21	54.22	40.33	8.88	0.21
11/3	42.81	100.00	0.96	40.88	44.46	34.64	6.24	0.14
21/3	43.39	100.00	0.72	31.30	33.34	27.47	3.83	0.09
31/3	21.91	100.00	0.55	11.98	12.42	10.75	1.23	0.06
Total	573.45			461.78	708.01	517.83	32.22	[0.06]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥15MACH~1¥02MANG~1¥01S-MA~1¥FWS.TXT

Table A2-4 (14) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Machinga ADD

Meteorological Station : Mangochi Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥MANGOCHI.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.58	191.3	132.7
February	3.86	188.7	131.7
March	4.48	136.5	106.7
April	4.84	36.2	34.1
May	4.99	4.5	4.5
June	4.63	2.7	2.7
July	4.81	2.5	2.5
August	5.34	1.8	1.8
September	6.03	2.8	2.8
October	6.24	13.1	12.8
November	5.16	54.0	49.3
December	3.78	156.8	117.5
Total (mm/Year)	1757.70	790.9	599.1

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥15MACH~1¥02MANG~1¥03W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	43.39	100.00	0.30	13.02	33.34	27.47	0.00	0.00
31/3	43.98	100.00	0.30	13.19	22.13	19.46	0.00	0.00
10/4	44.60	100.00	0.33	14.89	12.22	11.56	3.33	0.08
20/4	45.27	100.00	0.54	24.29	5.05	5.04	19.25	0.45
30/4	46.00	100.00	0.76	35.03	1.18	1.17	33.86	0.78
10/5	46.80	100.00	0.99	46.17	0.00	0.00	46.17	1.07
20/5	47.66	100.00	1.18	56.12	0.00	0.00	56.12	1.30
30/5	48.58	100.00	1.20	58.29	0.00	0.00	58.29	1.35
9/6	49.56	100.00	1.20	59.47	0.00	0.00	59.47	1.38
19/6	50.57	100.00	1.20	60.69	0.00	0.00	60.69	1.40
29/6	51.61	100.00	1.16	60.12	0.00	0.00	60.12	1.39
9/7	52.65	100.00	0.96	50.26	0.00	0.00	50.26	1.16
19/7	53.66	100.00	0.72	38.71	0.00	0.00	38.71	0.90
29/7	27.19	100.00	0.55	14.86	0.00	0.00	14.86	0.69
Total	651.52			545.12	73.92	64.70	501.13	[0.86]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥15MACH~1¥02MANG~1¥03W1-M~1¥FWS.TXT

Table A2-4 (14) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Machinga ADD

Meteorological Station : Mangochi Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥MANGOCHI.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.58	191.3	132.7
February	3.86	188.7	131.7
March	4.48	136.5	106.7
April	4.84	36.2	34.1
May	4.99	4.5	4.5
June	4.63	2.7	2.7
July	4.81	2.5	2.5
August	5.34	1.8	1.8
September	6.03	2.8	2.8
October	6.24	13.1	12.8
November	5.16	54.0	49.3
December	3.78	156.8	117.5
Total (mm/Year)	1757.70	790.9	599.1

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥15MACH~1¥02MANG~1¥04W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	53.85	100.00	0.30	16.16	0.00	0.00	16.16	0.37
31/7	54.78	100.00	0.30	16.43	0.00	0.00	16.43	0.38
10/8	55.60	100.00	0.33	18.56	0.00	0.00	18.56	0.43
20/8	56.27	100.00	0.54	30.18	0.00	0.00	30.18	0.70
30/8	56.75	100.00	0.76	43.21	0.00	0.00	43.21	1.00
9/9	57.01	100.00	0.99	56.23	0.00	0.00	56.23	1.30
19/9	57.01	100.00	1.18	67.12	0.00	0.00	67.12	1.55
29/9	56.71	100.00	1.20	68.05	0.00	0.00	68.05	1.58
9/10	56.08	100.00	1.20	67.30	0.00	0.00	67.30	1.56
19/10	55.11	100.00	1.20	66.14	1.27	1.26	64.88	1.50
29/10	53.79	100.00	1.16	62.68	6.64	6.64	56.05	1.30
8/11	52.12	100.00	0.96	49.81	15.30	14.36	35.45	0.82
18/11	50.11	100.00	0.72	36.21	26.99	22.82	13.38	0.31
28/11	24.21	100.00	0.55	13.24	17.96	14.43	0.00	0.00
Total	739.39			611.31	68.16	59.51	552.99	[0.95]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥15MACH~1¥02MANG~1¥04W2-M~1¥FWS.TXT

Table A2-4 (14) Estimated Field Water Supply for Maize (Grain) (W3-Ma) in Machinga ADD

Meteorological Station : Mangochi Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥MANGOCHI.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.58	191.3	132.7
February	3.86	188.7	131.7
March	4.48	136.5	106.7
April	4.84	36.2	34.1
May	4.99	4.5	4.5
June	4.63	2.7	2.7
July	4.81	2.5	2.5
August	5.34	1.8	1.8
September	6.03	2.8	2.8
October	6.24	13.1	12.8
November	5.16	54.0	49.3
December	3.78	156.8	117.5
Total (mm/Year)	1757.70	790.9	599.1

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥15MACH~1¥02MANG~1¥05W-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	53.85	100.00	0.30	16.16	0.00	0.00	16.16	0.37
31/7	54.78	100.00	0.30	16.43	0.00	0.00	16.43	0.38
10/8	55.60	100.00	0.33	18.56	0.00	0.00	18.56	0.43
20/8	56.27	100.00	0.54	30.18	0.00	0.00	30.18	0.70
30/8	56.75	100.00	0.76	43.21	0.00	0.00	43.21	1.00
9/9	57.01	100.00	0.99	56.23	0.00	0.00	56.23	1.30
19/9	57.01	100.00	1.18	67.12	0.00	0.00	67.12	1.55
29/9	56.71	100.00	1.20	68.05	0.00	0.00	68.05	1.58
9/10	56.08	100.00	1.20	67.30	0.00	0.00	67.30	1.56
19/10	55.11	100.00	1.20	66.14	1.27	1.26	64.88	1.50
29/10	53.79	100.00	1.16	62.68	6.64	6.64	56.05	1.30
8/11	52.12	100.00	0.96	49.81	15.30	14.36	35.45	0.82
18/11	50.11	100.00	0.72	36.21	26.99	22.82	13.38	0.31
28/11	24.21	100.00	0.55	13.24	17.96	14.43	0.00	0.00
Total	739.39			611.31	68.16	59.51	552.99	[0.95]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥15MACH~1¥02MANG~1¥05W3-M~1¥FWS.TXT

Table A2-4 (15) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Blantyre ADD

Meteorological Station : Thyolo Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥THYOLO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.13	222.8	143.4
February	4.03	201.7	136.6
March	3.73	212.1	140.1
April	3.33	97.6	82.4
May	2.87	26.0	24.9
June	2.42	28.3	27.0
July	2.53	32.5	30.8
August	3.53	13.2	12.9
September	4.77	9.3	9.2
October	5.54	39.0	36.6
November	5.14	103.0	86.0
December	4.20	253.3	150.3
Total (mm/Year)	1405.07	1238.8	880.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥16BLAN~1¥01THYO~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	51.48	100.00	0.30	15.44	54.11	37.20	0.00	0.00
1/12	50.42	100.00	0.30	15.13	71.05	44.12	0.00	0.00
11/12	48.83	100.00	0.33	16.28	81.90	48.56	0.00	0.00
21/12	46.77	100.00	0.54	25.04	84.76	50.03	0.00	0.00
31/12	43.55	100.00	0.76	33.13	76.73	47.39	0.00	0.00
10/1	43.24	100.00	0.99	42.64	76.32	48.19	0.00	0.00
20/1	42.79	100.00	1.18	50.38	76.50	49.25	1.13	0.03
30/1	41.98	100.00	1.20	50.38	76.05	49.87	0.51	0.01
9/2	40.85	100.00	1.20	49.02	74.52	49.73	0.00	0.00
19/2	39.44	100.00	1.20	47.33	71.60	48.59	0.00	0.00
1/3	37.83	100.00	1.16	44.09	67.12	46.30	0.00	0.00
11/3	36.07	100.00	0.96	34.49	61.06	42.86	0.00	0.00
21/3	34.27	100.00	0.72	24.76	53.61	38.36	0.00	0.00
31/3	16.46	100.00	0.55	9.00	23.67	17.23	0.00	0.00
Total	573.99			457.11	949.00	617.69	1.64	[0.00]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥16BLAN~1¥01THYO~1¥01S-MA~1¥FWS.TXT

Table A2-4 (15) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Blantyre ADD

Meteorological Station : Thyolo Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥THYOLO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.13	222.8	143.4
February	4.03	201.7	136.6
March	3.73	212.1	140.1
April	3.33	97.6	82.4
May	2.87	26.0	24.9
June	2.42	28.3	27.0
July	2.53	32.5	30.8
August	3.53	13.2	12.9
September	4.77	9.3	9.2
October	5.54	39.0	36.6
November	5.14	103.0	86.0
December	4.20	253.3	150.3
Total (mm/Year)	1405.07	1238.8	880.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥16BLAN~1¥01THYO~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	34.27	100.00	0.30	10.28	53.61	38.36	0.00	0.00
31/3	32.49	100.00	0.30	9.75	45.12	33.05	0.00	0.00
10/4	30.81	100.00	0.33	10.27	36.08	27.25	0.00	0.00
20/4	29.32	100.00	0.54	15.70	27.11	21.40	0.00	0.00
30/4	28.08	100.00	0.76	21.36	18.87	15.95	5.41	0.13
10/5	27.15	100.00	0.99	26.76	12.02	11.34	15.42	0.36
20/5	26.57	100.00	1.18	31.29	7.15	7.15	24.14	0.56
30/5	26.39	100.00	1.20	31.66	4.63	4.63	27.03	0.63
9/6	26.61	100.00	1.20	31.93	4.57	4.57	27.36	0.63
19/6	27.24	100.00	1.20	32.69	6.62	6.62	26.07	0.60
29/6	28.28	100.00	1.16	32.93	9.89	9.36	23.57	0.55
9/7	29.70	100.00	0.96	28.33	12.77	11.06	17.27	0.40
19/7	31.45	100.00	0.72	22.66	12.73	10.69	11.97	0.28
29/7	16.48	100.00	0.55	9.00	4.50	3.91	5.10	0.24
Total	394.84			314.60	255.66	205.34	183.32	[0.31]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥16BLAN~1¥01THYO~1¥02W1-M~1¥FWS.TXT

Table A2-4 (15) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Blantyre ADD

Meteorological Station : Thyolo Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥THYOLO.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.13	222.8	143.4
February	4.03	201.7	136.6
March	3.73	212.1	140.1
April	3.33	97.6	82.4
May	2.87	26.0	24.9
June	2.42	28.3	27.0
July	2.53	32.5	30.8
August	3.53	13.2	12.9
September	4.77	9.3	9.2
October	5.54	39.0	36.6
November	5.14	103.0	86.0
December	4.20	253.3	150.3
Total (mm/Year)	1405.07	1238.8	880.2

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥16BLAN~1¥01THYO~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	31.84	100.00	0.30	9.55	12.08	10.17	0.00	0.00
31/7	33.94	100.00	0.30	10.18	3.90	3.56	6.62	0.15
10/8	36.24	100.00	0.33	12.12	0.00	0.00	12.12	0.28
20/8	38.67	100.00	0.54	20.79	0.00	0.00	20.79	0.48
30/8	41.15	100.00	0.76	31.37	0.00	0.00	31.37	0.73
9/9	43.58	100.00	0.99	43.02	0.00	0.00	43.02	1.00
19/9	45.86	100.00	1.18	54.02	2.78	1.83	52.19	1.21
29/9	47.91	100.00	1.20	57.49	15.06	8.89	48.60	1.13
9/10	49.62	100.00	1.20	59.54	13.39	11.40	48.14	1.11
19/10	50.91	100.00	1.20	61.10	10.97	10.97	50.12	1.16
29/10	51.72	100.00	1.16	60.25	16.28	16.28	43.98	1.02
8/11	51.99	100.00	0.96	49.65	29.97	26.57	23.08	0.53
18/11	51.69	100.00	0.72	37.31	48.42	34.81	2.50	0.06
28/11	25.55	100.00	0.55	13.97	31.20	20.31	0.00	0.00
Total	600.68			520.37	184.06	144.79	382.54	[0.66]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥16BLAN~1¥01THYO~1¥03W2-M~1¥FWS.TXT

Table A2-4 (16) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Blantyre ADD

Meteorological Station : Mulanje Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MULANJE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.08	318.0	156.8
February	4.01	316.0	156.6
March	3.43	340.0	159.0
April	3.24	172.0	124.7
May	2.64	71.0	62.9
June	2.18	60.0	54.2
July	2.46	34.0	32.2
August	3.25	36.0	33.9
September	4.15	18.0	17.5
October	5.22	67.0	59.8
November	4.65	188.0	131.4
December	4.17	288.0	153.8
Total (mm/Year)	1321.63	1908.0	1142.8

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥16BLAN~1¥02MULA~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	48.37	100.00	0.30	14.51	70.02	40.07	0.00	0.00
1/12	47.74	100.00	0.30	14.32	78.18	43.59	0.00	0.00
11/12	46.63	100.00	0.33	15.55	85.64	46.73	0.00	0.00
21/12	45.11	100.00	0.54	24.16	92.19	49.38	0.00	0.00
31/12	42.79	100.00	0.76	32.56	105.57	53.77	0.00	0.00
10/1	42.39	100.00	0.99	41.80	108.84	55.38	0.00	0.00
20/1	41.79	100.00	1.18	49.20	109.77	56.11	0.00	0.00
30/1	40.86	100.00	1.20	49.03	109.20	56.16	0.00	0.00
9/2	39.63	100.00	1.20	47.56	107.10	55.49	0.00	0.00
19/2	38.15	100.00	1.20	45.78	103.51	54.10	0.00	0.00
1/3	36.49	100.00	1.16	42.53	98.51	52.03	0.00	0.00
11/3	34.70	100.00	0.96	33.17	92.27	49.36	0.00	0.00
21/3	32.87	100.00	0.72	23.76	84.96	46.15	0.00	0.00
31/3	15.75	100.00	0.55	8.62	39.47	21.74	0.00	0.00
Total	553.27			442.53	1285.23	680.05	0.00	[0.00]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥16BLAN~1¥02MULA~1¥01S-MA~1¥FWS.TXT

Table A2-4 (16) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Blantyre ADD

Meteorological Station : Mulanje Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MULANJE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.08	318.0	156.8
February	4.01	316.0	156.6
March	3.43	340.0	159.0
April	3.24	172.0	124.7
May	2.64	71.0	62.9
June	2.18	60.0	54.2
July	2.46	34.0	32.2
August	3.25	36.0	33.9
September	4.15	18.0	17.5
October	5.22	67.0	59.8
November	4.65	188.0	131.4
December	4.17	288.0	153.8
Total (mm/Year)	1321.63	1908.0	1142.8

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ...
... (Total R. < 250 mm/month),
Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥16BLAN~1¥02MULA~1¥03W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	32.87	100.00	0.30	9.86	84.96	46.15	0.00	0.00
31/3	31.07	100.00	0.30	9.32	76.82	42.53	0.00	0.00
10/4	29.37	100.00	0.33	9.78	68.07	38.60	0.00	0.00
20/4	27.84	100.00	0.54	14.90	58.98	34.48	0.00	0.00
30/4	26.54	100.00	0.76	20.18	49.80	30.31	0.00	0.00
10/5	25.53	100.00	0.99	25.17	40.78	26.19	0.00	0.00
20/5	24.86	100.00	1.18	29.26	32.17	22.24	7.02	0.16
30/5	24.54	100.00	1.20	29.45	24.20	18.59	10.86	0.25
9/6	24.61	100.00	1.20	29.53	17.07	15.32	14.21	0.33
19/6	25.06	100.00	1.20	30.08	10.97	10.97	19.11	0.44
29/6	25.90	100.00	1.16	30.16	6.04	6.04	24.12	0.56
9/7	27.10	100.00	0.96	25.85	2.43	2.43	23.43	0.54
19/7	28.62	100.00	0.72	20.62	0.29	0.29	20.33	0.47
29/7	14.97	100.00	0.55	8.18	0.00	0.00	8.18	0.38
Total	368.89			292.36	472.60	294.15	127.25	[0.22]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥16BLAN~1¥02MULA~1¥03W1-M~1¥FWS.TXT

Table A2-4 (16) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Blantyre ADD

Meteorological Station : Mulanje Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MULANJE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.08	318.0	156.8
February	4.01	316.0	156.6
March	3.43	340.0	159.0
April	3.24	172.0	124.7
May	2.64	71.0	62.9
June	2.18	60.0	54.2
July	2.46	34.0	32.2
August	3.25	36.0	33.9
September	4.15	18.0	17.5
October	5.22	67.0	59.8
November	4.65	188.0	131.4
December	4.17	288.0	153.8
Total (mm/Year)	1321.63	1908.0	1142.8

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥16BLAN~1¥02MULA~1¥04W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/25 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	28.96	100.00	0.30	8.69	0.12	0.12	8.57	0.20
31/7	30.82	100.00	0.30	9.25	0.00	0.00	9.25	0.21
10/8	32.89	100.00	0.33	11.00	0.44	0.44	10.56	0.24
20/8	35.11	100.00	0.54	18.87	2.77	2.77	16.10	0.37
30/8	37.40	100.00	0.76	28.51	6.52	6.52	21.99	0.51
9/9	39.67	100.00	0.99	39.16	11.53	11.53	27.63	0.64
19/9	41.84	100.00	1.18	49.29	17.67	16.21	33.08	0.77
29/9	43.84	100.00	1.20	52.60	24.77	19.54	33.06	0.77
9/10	45.56	100.00	1.20	54.68	32.65	23.20	31.47	0.73
19/10	46.95	100.00	1.20	56.34	41.10	27.09	29.25	0.68
29/10	47.93	100.00	1.16	55.83	49.88	31.09	24.74	0.57
8/11	48.44	100.00	0.96	46.26	58.75	35.08	11.18	0.26
18/11	48.47	100.00	0.72	34.98	67.47	38.95	0.00	0.00
28/11	24.08	100.00	0.55	13.17	36.89	20.85	0.00	0.00
Total	551.96			478.61	350.57	233.39	256.87	[0.44]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥16BLAN~1¥02MULA~1¥04W2-M~1¥FWS.TXT

Table A2-4 (16) Estimated Field Water Supply for Maize (Grain) (W3-Ma) in Blantyre ADD

Meteorological Station : Mulanje Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/25 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥MULANJE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.08	318.0	156.8
February	4.01	316.0	156.6
March	3.43	340.0	159.0
April	3.24	172.0	124.7
May	2.64	71.0	62.9
June	2.18	60.0	54.2
July	2.46	34.0	32.2
August	3.25	36.0	33.9
September	4.15	18.0	17.5
October	5.22	67.0	59.8
November	4.65	188.0	131.4
December	4.17	288.0	153.8
Total (mm/Year)	1321.63	1908.0	1142.8

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥16BLAN~1¥02MULA~1¥05W-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	28.96	100.00	0.30	8.69	0.12	0.12	8.57	0.20
31/7	30.82	100.00	0.30	9.25	0.00	0.00	9.25	0.21
10/8	32.89	100.00	0.33	11.00	0.44	0.44	10.56	0.24
20/8	35.11	100.00	0.54	18.87	2.77	2.77	16.10	0.37
30/8	37.40	100.00	0.76	28.51	6.52	6.52	21.99	0.51
9/9	39.67	100.00	0.99	39.16	11.53	11.53	27.63	0.64
19/9	41.84	100.00	1.18	49.29	17.67	16.21	33.08	0.77
29/9	43.84	100.00	1.20	52.60	24.77	19.54	33.06	0.77
9/10	45.56	100.00	1.20	54.68	32.65	23.20	31.47	0.73
19/10	46.95	100.00	1.20	56.34	41.10	27.09	29.25	0.68
29/10	47.93	100.00	1.16	55.83	49.88	31.09	24.74	0.57
8/11	48.44	100.00	0.96	46.26	58.75	35.08	11.18	0.26
18/11	48.47	100.00	0.72	34.98	67.47	38.95	0.00	0.00
28/11	24.08	100.00	0.55	13.17	36.89	20.85	0.00	0.00
Total	551.96			478.61	350.57	233.39	256.87	[0.44]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥16BLAN~1¥02MULA~1¥05W3-M~1¥FWS.TXT

Table A2-4 (17) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Shire Valley ADD

Meteorological Station : Bvumbwe Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

2007/12/26 CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥BVUMBWE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.71	270.0	152.0
February	3.60	247.0	149.4
March	3.56	203.0	137.1
April	3.24	83.0	72.0
May	2.78	21.0	20.3
June	2.27	24.0	23.1
July	2.71	17.0	16.5
August	3.24	11.0	10.8
September	4.07	11.0	10.8
October	4.93	28.0	26.7
November	4.61	104.0	86.7
December	3.64	229.0	145.1
Total (mm/Year)	1288.17	1248.0	850.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥17SHIR~1¥01BVUM~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

2007/12/26 CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	45.15	100.00	0.30	13.55	49.47	36.58	0.00	0.00
1/12	44.29	100.00	0.30	13.29	63.05	42.66	0.00	0.00
11/12	42.99	100.00	0.33	14.33	74.26	46.91	0.00	0.00
21/12	41.33	100.00	0.54	22.13	81.97	49.14	0.00	0.00
31/12	38.44	100.00	0.76	29.25	85.15	49.53	0.00	0.00
10/1	38.43	100.00	0.99	37.90	87.30	50.91	0.00	0.00
20/1	38.33	100.00	1.18	45.13	88.15	51.97	0.00	0.00
30/1	37.93	100.00	1.20	45.51	87.24	52.32	0.00	0.00
9/2	37.24	100.00	1.20	44.69	84.35	51.69	0.00	0.00
19/2	36.31	100.00	1.20	43.57	79.44	49.92	0.00	0.00
1/3	35.17	100.00	1.16	40.99	72.61	46.96	0.00	0.00
11/3	33.89	100.00	0.96	32.40	64.13	42.84	0.00	0.00
21/3	32.54	100.00	0.72	23.51	54.39	37.73	0.00	0.00
31/3	15.76	100.00	0.55	8.62	23.30	16.71	0.00	0.00
Total	517.80			414.85	994.81	625.88	0.00	[0.00]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥17SHIR~1¥01BVUM~1¥01S-MA~1¥FWS.TXT

Table A2-4(17) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Shire Valley ADD

Meteorological Station : Bvumbwe Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥BVUMBWE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.71	270.0	152.0
February	3.60	247.0	149.4
March	3.56	203.0	137.1
April	3.24	83.0	72.0
May	2.78	21.0	20.3
June	2.27	24.0	23.1
July	2.71	17.0	16.5
August	3.24	11.0	10.8
September	4.07	11.0	10.8
October	4.93	28.0	26.7
November	4.61	104.0	86.7
December	3.64	229.0	145.1
Total (mm/Year)	1288.17	1248.0	850.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥17SHIR~1¥01BVUM~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	32.54	100.00	0.30	9.76	54.39	37.73	0.00	0.00
31/3	31.18	100.00	0.30	9.35	43.93	31.90	0.00	0.00
10/4	29.88	100.00	0.33	9.96	33.38	25.70	0.00	0.00
20/4	28.69	100.00	0.54	15.36	23.39	19.54	0.00	0.00
30/4	27.68	100.00	0.76	21.05	14.64	13.81	7.24	0.17
10/5	26.89	100.00	0.99	26.51	7.72	7.72	18.79	0.43
20/5	26.37	100.00	1.18	31.05	3.10	3.10	27.95	0.65
30/5	26.15	100.00	1.20	31.38	1.03	1.03	30.35	0.70
9/6	26.25	100.00	1.20	31.50	1.45	1.45	30.04	0.70
19/6	26.67	100.00	1.20	32.00	3.91	3.88	28.12	0.65
29/6	27.40	100.00	1.16	31.92	7.43	6.29	25.62	0.59
9/7	28.45	100.00	0.96	27.14	10.40	8.01	19.13	0.44
19/7	29.76	100.00	0.72	21.45	10.46	8.04	13.41	0.31
29/7	15.45	100.00	0.55	8.44	3.48	2.92	5.52	0.26
Total	383.35			306.88	218.72	171.12	206.17	[0.35]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥17SHIR~1¥01BVUM~1¥02W1-M~1¥FWS.TXT

Table A2-4(17) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Shire Valley ADD

Meteorological Station : Bvumbwe Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥BVUMBWE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.71	270.0	152.0
February	3.60	247.0	149.4
March	3.56	203.0	137.1
April	3.24	83.0	72.0
May	2.78	21.0	20.3
June	2.27	24.0	23.1
July	2.71	17.0	16.5
August	3.24	11.0	10.8
September	4.07	11.0	10.8
October	4.93	28.0	26.7
November	4.61	104.0	86.7
December	3.64	229.0	145.1
Total (mm/Year)	1288.17	1248.0	850.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥17SHIR~1¥01BVUM~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	30.05	100.00	0.30	9.02	9.85	7.66	1.36	0.03
31/7	31.64	100.00	0.30	9.49	2.77	2.51	6.98	0.16
10/8	33.40	100.00	0.33	11.17	0.00	0.00	11.17	0.26
20/8	35.27	100.00	0.54	18.95	0.00	0.00	18.95	0.44
30/8	37.19	100.00	0.76	28.35	0.00	0.00	28.35	0.66
9/9	39.07	100.00	0.99	38.57	0.00	0.00	38.57	0.89
19/9	40.85	100.00	1.18	48.11	1.89	1.55	46.56	1.08
29/9	42.44	100.00	1.20	50.92	7.36	5.24	45.68	1.06
9/10	43.77	100.00	1.20	52.52	8.88	8.11	44.41	1.03
19/10	44.78	100.00	1.20	53.73	12.28	12.28	41.45	0.96
29/10	45.40	100.00	1.16	52.88	19.85	19.29	33.59	0.78
8/11	45.59	100.00	0.96	43.54	31.37	26.95	16.59	0.38
18/11	45.32	100.00	0.72	32.72	45.20	34.47	0.00	0.00
28/11	22.42	100.00	0.55	12.26	27.91	19.78	0.00	0.00
Total	537.18			462.22	167.36	137.85	333.65	[0.57]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥17SHIR~1¥01BVUM~1¥03W2-M~1¥FWS.TXT

Table A2-4 (17) Estimated Field Water Supply for Maize (Grain) (W3-Ma) in Shire Valley ADD

Meteorological Station : Bvumbwe Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWA~1¥AFRICA~1¥MALAWI~1¥BVUMBWE.CLI

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	3.71	270.0	152.0
February	3.60	247.0	149.4
March	3.56	203.0	137.1
April	3.24	83.0	72.0
May	2.78	21.0	20.3
June	2.27	24.0	23.1
July	2.71	17.0	16.5
August	3.24	11.0	10.8
September	4.07	11.0	10.8
October	4.93	28.0	26.7
November	4.61	104.0	86.7
December	3.64	229.0	145.1
Total (mm/Year)	1288.17	1248.0	850.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥17SHIR~1¥01BVUM~1¥05W-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	30.05	100.00	0.30	9.02	9.85	7.66	1.36	0.03
31/7	31.64	100.00	0.30	9.49	2.77	2.51	6.98	0.16
10/8	33.40	100.00	0.33	11.17	0.00	0.00	11.17	0.26
20/8	35.27	100.00	0.54	18.95	0.00	0.00	18.95	0.44
30/8	37.19	100.00	0.76	28.35	0.00	0.00	28.35	0.66
9/9	39.07	100.00	0.99	38.57	0.00	0.00	38.57	0.89
19/9	40.85	100.00	1.18	48.11	1.89	1.55	46.56	1.08
29/9	42.44	100.00	1.20	50.92	7.36	5.24	45.68	1.06
9/10	43.77	100.00	1.20	52.52	8.88	8.11	44.41	1.03
19/10	44.78	100.00	1.20	53.73	12.28	12.28	41.45	0.96
29/10	45.40	100.00	1.16	52.88	19.85	19.29	33.59	0.78
8/11	45.59	100.00	0.96	43.54	31.37	26.95	16.59	0.38
18/11	45.32	100.00	0.72	32.72	45.20	34.47	0.00	0.00
28/11	22.42	100.00	0.55	12.26	27.91	19.78	0.00	0.00
Total	537.18			462.22	167.36	137.85	333.65	[0.57]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥17SHIR~1¥01BVUM~1¥05W3-M~1¥FWS.TXT

Table A2-4 (18) Estimated Field Water Supply for Maize (Grain) (S-Ma) in Shire Valley ADD

Meteorological Station : Ngabu Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥NGABU.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.22	141.7	109.6
February	4.34	161.1	119.6
March	4.61	122.9	98.7
April	4.78	43.6	40.6
May	4.74	15.7	15.3
June	4.44	15.7	15.3
July	4.56	17.1	16.6
August	5.85	4.7	4.7
September	6.80	4.2	4.2
October	7.16	23.7	22.8
November	6.38	64.4	57.8
December	4.37	187.7	131.3
Total (mm/Year)	1894.33	802.5	636.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥17SHIR~1¥02NGAB~1¥01S-MA~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/11
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/11	59.78	100.00	0.30	17.93	38.20	29.19	0.00	0.00
1/12	56.99	100.00	0.30	17.10	52.33	37.45	0.00	0.00
11/12	53.75	100.00	0.33	17.90	60.64	42.42	0.00	0.00
21/12	50.19	100.00	0.54	26.85	61.35	43.20	0.00	0.00
31/12	45.00	100.00	0.76	34.22	55.42	38.99	0.00	0.00
10/1	45.01	100.00	0.99	44.39	54.55	38.41	5.98	0.14
20/1	45.22	100.00	1.18	53.25	53.79	38.63	14.62	0.34
30/1	45.27	100.00	1.20	54.32	52.49	39.11	15.22	0.35
9/2	45.17	100.00	1.20	54.20	50.40	39.41	14.80	0.34
19/2	44.96	100.00	1.20	53.95	47.38	38.98	14.97	0.35
1/3	44.67	100.00	1.16	52.04	43.37	37.23	14.81	0.34
11/3	44.36	100.00	0.96	42.37	38.42	33.69	8.68	0.20
21/3	44.07	100.00	0.72	31.81	32.70	28.16	3.65	0.08
31/3	21.95	100.00	0.55	12.00	14.03	11.45	0.55	0.03
Total	646.38			512.34	655.08	496.32	93.26	[0.16]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥17SHIR~1¥02NGAB~1¥01S-MA~1¥FWS.TXT

Table A2-4 (18) Estimated Field Water Supply for Maize (Grain) (W1-Ma) in Shire Valley ADD

Meteorological Station : Ngabu Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥NGABU.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.22	141.7	109.6
February	4.34	161.1	119.6
March	4.61	122.9	98.7
April	4.78	43.6	40.6
May	4.74	15.7	15.3
June	4.44	15.7	15.3
July	4.56	17.1	16.6
August	5.85	4.7	4.7
September	6.80	4.2	4.2
October	7.16	23.7	22.8
November	6.38	64.4	57.8
December	4.37	187.7	131.3
Total (mm/Year)	1894.33	802.5	636.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥17SHIR~1¥02NGAB~1¥02W1-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/3
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/3	44.07	100.00	0.30	13.22	32.70	28.16	0.00	0.00
31/3	43.86	100.00	0.30	13.16	26.48	20.96	0.00	0.00
10/4	43.77	100.00	0.33	14.61	20.12	13.13	1.47	0.03
20/4	43.85	100.00	0.54	23.52	14.05	6.80	16.72	0.39
30/4	44.12	100.00	0.76	33.59	8.71	2.91	30.69	0.71
10/5	44.62	100.00	0.99	44.02	4.53	0.00	44.02	1.02
20/5	45.36	100.00	1.18	53.41	1.84	0.52	52.90	1.22
30/5	46.34	100.00	1.20	55.61	0.84	0.84	54.77	1.27
9/6	47.57	100.00	1.20	57.09	1.52	1.52	55.57	1.29
19/6	49.03	100.00	1.20	58.83	3.56	3.56	55.28	1.28
29/6	50.68	100.00	1.16	59.02	6.23	5.52	53.51	1.24
9/7	52.49	100.00	0.96	50.09	8.31	5.41	44.69	1.03
19/7	54.41	100.00	0.72	39.23	7.98	4.44	34.79	0.81
29/7	27.94	100.00	0.55	15.27	2.43	1.49	13.78	0.64
Total	638.11			530.67	139.30	95.25	458.17	[0.79]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

C:¥CROPWATW¥REPORTS¥17SHIR~1¥02NGAB~1¥02W1-M~1¥FWS.TXT

Table A2-4 (18) Estimated Field Water Supply for Maize (Green) (W2-Ma) in Shire Valley ADD

Meteorological Station : Ngabu Station

Reference Evapo-Transpiration (ETo) and Effective Rainfall

RAIN

ddddd CropWat 4 Windows Ver 4.3

ETo and Rainfall Data

Data Source: C:¥CROPWATW¥CLIMATE¥NGABU.CRM

Month	ETo (mm/d)	Total Rainfall (mm/month)	Effective Rain (mm/month)
January	4.22	141.7	109.6
February	4.34	161.1	119.6
March	4.61	122.9	98.7
April	4.78	43.6	40.6
May	4.74	15.7	15.3
June	4.44	15.7	15.3
July	4.56	17.1	16.6
August	5.85	4.7	4.7
September	6.80	4.2	4.2
October	7.16	23.7	22.8
November	6.38	64.4	57.8
December	4.37	187.7	131.3
Total (mm/Year)	1894.33	802.5	636.5

N.B. Effective rainfall calculated using the USSCS formulas:

Effective R. = (125 - 0.2 * Total R.)* Total R. / 125 ... (Total R. < 250 mm/month),

Effective R. = 0.1 * Total R. - 125 ... (Total R. > 250 mm/month).

C:¥CROPWATW¥REPORTS¥17SHIR~1¥02NGAB~1¥03W2-M~1¥RAIN.TXT

Field Water Supply (FWS)

FWS

ddddd CropWat 4 Windows Ver 4.3

Crop Water Requirements Report

- Crop # 1 : MAIZE (Grain)
- Block # : [All blocks]
- Planting date : 21/7
- Calculation time step = 10 Day(s)
- Irrigation Efficiency = 50%

Date	ETo (mm/period)	Planted Area (%)	Crop Kc	CWR (ETm) (mm/period)	Total Rain (mm/period)	Effect. Rain (mm/period)	Irr. Req. (mm/period)	FWS (l/s/ha)
21/7	54.80	100.00	0.30	16.44	7.41	4.11	12.33	0.29
31/7	56.77	100.00	0.30	17.03	1.72	1.25	15.78	0.37
10/8	58.71	100.00	0.33	19.61	0.00	0.00	19.61	0.45
20/8	60.54	100.00	0.54	32.50	0.00	0.00	32.50	0.75
30/8	62.20	100.00	0.76	47.38	0.00	0.00	47.38	1.10
9/9	63.59	100.00	0.99	62.74	0.00	0.00	62.74	1.45
19/9	64.64	100.00	1.18	76.12	2.02	1.38	74.74	1.73
29/9	65.28	100.00	1.20	78.34	12.17	8.02	70.32	1.63
9/10	65.44	100.00	1.20	78.53	8.74	7.52	71.02	1.64
19/10	65.08	100.00	1.20	78.09	4.15	4.15	73.95	1.71
29/10	64.14	100.00	1.16	74.74	6.91	6.91	67.83	1.57
8/11	62.62	100.00	0.96	59.84	17.82	16.71	43.13	1.00
18/11	60.52	100.00	0.72	43.72	33.38	26.36	17.36	0.40
28/11	29.30	100.00	0.55	16.02	22.60	16.64	0.00	0.00
Total	833.63			701.10	116.92	93.05	608.67	[1.04]

* ETo data is distributed using polynomial curve fitting.
* Rainfall data is distributed using polynomial curve fitting.

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Table A2-5 Schedule of Land Preparation Works and Water Distribution

Irrigation Block	Irrigation Unit	Date																																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1 Block	A Unit	P2				P2				PL	PL				P1	RL	L				H	P				TP									
	B Unit		P2				P2				PL	PL				P1	RL	L				H	P				TP								
	C Unit			P2				P2				PL	PL				P1	RL	L				H	P				TP							
	D Unit				P2				P2				PL	PL				P1	RL	L				H	P				TP						
2 Block	A Unit		P2				P2				PL	PL				P1	RL	L				H	P				TP								
	B Unit			P2				P2				PL	PL				P1	RL	L				H	P				TP								
	C Unit				P2				P2				PL	PL				P1	RL	L				H	P				TP							
	D Unit					P2				P2				PL	PL				P1	RL	L				H	P				TP						
3 Block	A Unit			P2				P2				PL	PL				P1	RL	L				H	P				TP							
	B Unit				P2				P2				PL	PL				P1	RL	L				H	P				TP							
	C Unit					P2				P2				PL	PL				P1	RL	L				H	P				TP						
	D Unit						P2				P2				PL	PL				P1	RL	L				H	P				TP					
4 Block	A Unit				P2				P2				PL	PL				P1	RL	L				H	P				TP							
	B Unit					P2				P2				PL	PL				P1	RL	L				H	P				TP						
	C Unit						P2				P2				PL	PL				P1	RL	L				H	P				TP					
	D Unit							P2				P2				PL	PL				P1	RL	L				H	P				TP				
5 Block	A Unit					P2				P2				PL	PL				P1	RL	L				H	P				TP						
	B Unit						P2				P2				PL	PL				P1	RL	L				H	P				TP					
	C Unit							P2				P2				PL	PL				P1	RL	L				H	P				TP				
	D Unit								P2				P2				PL	PL				P1	RL	L				H	P				TP			
6 Block	A Unit						P2				P2				PL	PL				P1	RL	L				H	P				TP				
	B Unit							P2				P2				PL	PL				P1	RL	L				H	P				TP				
	C Unit								P2				P2				PL	PL				P1	RL	L				H	P				TP			
	D Unit									P2				P2				PL	PL				P1	RL	L				H	P				TP		

Note: P2 : 1st Irrigation
P1 : 2nd Irrigation
P : 3rd Irrigation

PL : Plowing
RL : Clean and Repair of Levee
L : Plaster of Levee
H : Harrowing
TP : Transplanting

Table A2-6 (1) Water Requirement for Land Soaking and Preparation (Karonga Station)

Type of Paddy : Summer (Wet) Season Paddy 1
Land Preparation Period : Dec. 21 – Jan. 10

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	4.2	mm	x	7.5 day			=	32 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								129 mm

The total amounts of 129mm is planned to be supplied with two times at 65 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	4.2	mm	x	6.5 day			=	27 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								34 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	4.2	mm	x	3.5 day			=	15 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								19 mm
	Total								182 mm

Table A.2-6(2) Water Requirement for Land Soaking and Preparation (Karonga Station)

Type of Paddy : Summer (Wet) Season Paddy 2
Land Preparation Period : Jan. 11 – Jan. 31

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	4.1	mm	x	7.5 day			=	31 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								128 mm

The total amounts of 128mm is planned to be supplied with two times at 64 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	4.1	mm	x	6.5 day			=	27 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								34 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	4.1	mm	x	3.5 day			=	14 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								18 mm
	Total								180 mm

Table A2-6 (3) Water Requirement for Land Soaking and Preparation (Nkhotakota Station)

Type of Paddy : Summer (Wet) Season Paddy 1
Land Preparation Period : Dec. 21 – Jan. 10

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	3.4	mm	x	7.5 day			=	26 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								123 mm

The total amounts of 123mm is planned to be supplied with two times at 62 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	3.4	mm	x	6.5 day			=	22 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								29 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	3.4	mm	x	3.5 day			=	12 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								16 mm
	Total								168 mm

Table A2-6 (4) Water Requirement for Land Soaking and Preparation (Nkhotakota Station)

Type of Paddy : Summer (Wet) Season Paddy 2
Land Preparation Period : Jan. 11 – Jan. 31

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	3.2	mm	x	7.5 day			=	24 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								121 mm

The total amounts of 121mm is planned to be supplied with two times at 61 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	3.2	mm	x	6.5 day			=	21 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								28 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	3.2	mm	x	3.5 day			=	11 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								15 mm
	Total								164 mm

Table A2-6 (5) Water Requirement for Land Soaking and Preparation (Mangochi Station)

Type of Paddy : Summer (Wet) Season Paddy 1
Land Preparation Period : Dec. 21 – Jan. 10

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	3.7	mm	x	7.5 day			=	28 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								125 mm

The total amounts of 125mm is planned to be supplied with two times at 63 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	3.7	mm	x	6.5 day			=	24 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								31 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	3.7	mm	x	3.5 day			=	13 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								17 mm
	Total								173 mm

Table A2-6 (6) Water Requirement for Land Soaking and Preparation (Mangochi Station)

Type of Paddy : Summer (Wet) Season Paddy 2
Land Preparation Period : Jan. 11 – Jan. 31

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	3.6	mm	x	7.5 day			=	27 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								124 mm

The total amounts of 124mm is planned to be supplied with two times at 62 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	3.6	mm	x	6.5 day			=	23 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								30 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	3.6	mm	x	3.5 day			=	13 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								17 mm
	Total								171 mm

Table A2-6 (7) Water Requirement for Land Soaking and Preparation (Mulanje Station)

Type of Paddy : Summer (Wet) Season Paddy 1
Land Preparation Period : Dec. 21 – Jan. 10

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	4.1	mm	x	7.5 day			=	31 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								128 mm

The total amounts of 128mm is planned to be supplied with two times at 64 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	4.1	mm	x	6.5 day			=	27 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								34 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	4.1	mm	x	3.5 day			=	14 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								18 mm
	Total								180 mm

Table A2-6 (8) Water Requirement for Land Soaking and Preparation (Mulanje Station)

Type of Paddy : Summer (Wet) Season Paddy 2
Land Preparation Period : Jan. 11 – Jan. 31

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	4.1	mm	x	7.5 day			=	31 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								128 mm

The total amounts of 128mm is planned to be supplied with two times at 64 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	4.1	mm	x	6.5 day			=	27 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								34 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	4.1	mm	x	3.5 day			=	14 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								18 mm
	Total								180 mm

Table A2-6 (9) Water Requirement for Land Soaking and Preparation (Bvumbwe Station)

Type of Paddy : Summer (Wet) Season Paddy 1
Land Preparation Period : Dec. 21 – Jan. 10

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	3.7	mm	x	7.5 day			=	28 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								125 mm

The total amounts of 124mm is planned to be supplied with two times at 62 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	3.7	mm	x	6.5 day			=	24 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								31 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	3.7	mm	x	3.5 day			=	13 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								17 mm
	Total								173 mm

Table A2-6 (10) Water Requirement for Land Soaking and Preparation (Bvumbwe Station)

Type of Paddy : Summer (Wet) Season Paddy 2
Land Preparation Period : Jan. 11 – Jan. 31

1st Irrigation (P2)

1.	Saturation of Top Soil	150	mm	x	0.5	x	0.65	=	49 mm
	(Saturation Depth x Porosity x (1 – Soil Moisture)								
2.	Evaporation for 7.5 days	3.7	mm	x	7.5 day			=	28 mm
3.	Percolation for 7.5 days	1	mm	x	7.5 day			=	8 mm
4.	Standing Water							=	40 mm
	Sub-Total								125 mm

The total amounts of 125mm is planned to be supplied with two times at 63 mm each time on the date of eight and three days before plowing.

2nd Irrigation (P1)

1.	Evaporation for 6.5 days	3.7	mm	x	6.5 day			=	24 mm
2.	Percolation for 6.5 days	1	mm	x	6.5 day			=	7 mm
	Sub-Total								31 mm

3rd Irrigation (P)

1.	Evaporation for 3.5 days	3.9	mm	x	3.5 day			=	14 mm
2.	Percolation for 3.5days	1	mm	x	3.5 day			=	4 mm
	Sub-Total								18 mm
	Total								174 mm

Table A2-7 (1) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 1 (Karonga Station)

- Period of Land Preparation Works : Dec. 21- Jan. 10
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
11/Dec.- 20/Dec	43.6	1.5		1.5	50	3	1.5	0	0
21/Dec.- 30/Dec.	43.6	1.5	91	92.5	50	100	50	42.5	0.848
31/Dec.- 10/Jan	40.7	1.4	91	92.4	60.8	100	60.8	31.6	0.631

1/ : Refer to Table A2-4(2)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6(1))
4/ : Refer to Table A2-4(2)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + LP) x 10 day ; 100 %
R10 > (N + LP) x 10 day ; (N + LP) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (1) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 2 (Karonga Station)

- Period of Land Preparation Works : Jan. 11- Jan. 31
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
1/Jan.- 10/Jan.	40.7	1.4		1.4	62	2.3	1.4	0	0
11/Jan.- 20/Jan.	40.7	1.4	90	91.4	62	100	62	29.4	0.587
21/Jan.- 30/Jan.	40.7	1.4	90	91.4	62	100	62	29.4	0.587

1/ : Refer to Table A2-4 (2)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6(2))
4/ : Refer to Table A2-4 (2)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + LP) x 10 day ; 100 %
R10 > (N + LP) x 10 day ; (N + LP) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (2) Crop Water Requirements for Summer Season Paddy 1 under Karonga Station

- Crop : Summer (Wet) Season Paddy 1
- Planting Date : Jan. 11/Jan. 31
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Karonga Station
- Percolation Rate (P) : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS 5/
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall 3/	% of Effective Rainfall 4/	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
11/Jan.- 20/Jan.	40.7	100	1.14	46.4	30	76.4	62.0	100.0	62	14.4	0.287
21/Jan.- 30/Jan.	40.6	100	1.14	46.28	30	76.28	62.0	100.0	62	14.3	0.285
31/Jan.- 9/Feb.	40.6	100	1.15	46.69	30	76.69	66.5	100.0	66.5	10.2	0.203
10/Feb.- 19/Feb.	40.6	100	1.18	47.91	30	77.91	67.0	100.0	67	10.9	0.218
20/Feb.- 1/Mar.	40.4	100	1.21	48.88	30	78.88	64.7	100.0	64.7	14.2	0.283
2/Mar.-11/Mar.	38.5	100	1.24	47.74	30	77.74	44.0	100.0	44	33.7	0.673
12/Mar.- 21/Mar.	38.5	100	1.26	48.51	30	78.51	44.0	100.0	44	34.5	0.689
22/Mar.- 31/Mar.	38.5	100	1.26	48.51	30	78.51	44.0	100.0	44	34.5	0.689
1/Apr.- 10/Apr.	42.1	100	1.25	52.63	30	82.63	12.0	100.0	12	70.6	1.409
11/Apr.- 20/Apr.	42.1	100	1.2	50.52	30	80.52	12.0	100.0	12	68.5	1.367
21/Apr.- 30/Apr.	42.1	100	1.15	48.42	30	78.42	12.0	100.0	12	66.4	1.325
1/May.- 10/May	39.9	100	1.08	43.09	30	73.09	1.0	0.0	0	73.1	1.459

1/ : Refere to Table A2-4 (2)
2/ : Refere to Figure A2-1 (1)
3/ : 10-day rainfall (R10) was estimated based on monthly rainfall in accordance with 10-day periods.
4/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (P + Eto) x 10 day ; 100 %
R10 > (P + Eto) x 10 day ; (P + Eto) x 10 day x 100/R10
5/ : FWS = Irrigation Requirement (mm/10 day)/(86.4 x Irrigation Efficiency/100)

Table A2-7 (2) Crop Water Requirements for Summer Season Paddy 2 under Karonga Station

- Crop : Summer (Wet) Season Paddy 2
- Planting Date : Feb. 1/Feb. 21
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Karonga Station
- Percolation Rate : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall	% of Effective Rainfall	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
1/Feb.- 10/Feb.	40.6	100	1.14	46.28	30	76.28	54.0	100.0	54	22.3	0.445
11/Feb.- 20/Feb.	40.6	100	1.14	46.28	30	76.28	54.0	100.0	54	22.3	0.445
21/Feb.- 2/Mar	40.6	100	1.14	46.28	30	76.28	64.4	100.0	64.4	11.9	0.237
3/Mar.- 12/Mar.	38.5	100	1.15	44.28	30	74.28	106.0	45.8	48.5	25.8	0.514
13/Mar.- 22/Mar.	38.5	100	1.18	45.43	30	75.43	106.0	45.8	48.5	26.9	0.537
23/Mar.- 1/Apr.	38.5	100	1.21	46.59	30	76.59	102.4	47.4	48.5	28.1	0.561
2/Apr.- 11/Apr.	42.1	100	1.24	52.2	30	82.2	70.0	100.0	70	12.2	0.243
12/Apr.- 21/Apr.	42.1	100	1.26	53.05	30	83.05	70.0	100.0	70	13.1	0.26
22/Apr.- 1/May	42.1	100	1.26	53.05	30	83.05	64.0	100.0	64	19.1	0.38
2/May - 11/May	39.9	100	1.25	49.88	30	79.88	10.0	0.0	0	79.9	1.594
12/May- 21/May	39.9	100	1.2	47.88	30	77.88	10.0	0.0	0	77.9	1.554
22/May- 31/May	39.9	100	1.15	45.89	30	75.89	10.0	0.0	0	75.9	1.514

Table A2-7 (3) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 1 (Nkhotakota Station)

- Period of Land Preparation Works : Dec. 21- Jan. 10
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
11/Dec.- 20/Dec	36.7	1.3		1.3	91	1.4	1.3	0	0
21/Dec.- 30/Dec.	36.7	1.3	84	85.3	91	93.7	85.3	0	0
31/Dec.- 10/Jan	31.8	1.1	84	85.1	101.8	83.6	85.1	0	0

1/ : Refer to Table A2-4 (8)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6(3))
4/ : Refer to Table A2-4 (8)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + LP) x 10 day ; 100 %
R10 > (N + LP) x 10 day ; (N + LP) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (3) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 2 (Nkhotakota Station)

- Period of Land Preparation Works : Jan. 11- Jan. 31
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
1/Jan.- 10/Jan.	31.8	1.1		1.1	103	1.1	1.1	0	0
11/Jan.- 20/Jan.	31.8	1.1	82	83.1	103	80.7	83.1	0	0
21/Jan.- 30/Jan.	31.8	1.1	82	83.1	103	80.7	83.1	0	0

1/ : Refer to Table A2-4 (8)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6 (4))
4/ : Refer to Table A2-4 (8)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + NP) x 10 day ; 100 %
R10 > (N + NP) x 10 day ; (N + Lp) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (4) Crop Water Requirements for Summer Season Paddy 1 under Nkhotakota Station

- Crop : Summer (Wet) Season Paddy 1
- Planting Date : Jan. 11/Jan. 31
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Nkhotakota Station
- Percolation Rate (P) : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS 5/
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall 3/	% of Effective Rainfall 4/	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
11/Jan.- 20/Jan.	31.8	100	1.14	36.25	30	66.25	103.0	40.6	41.8	24.5	0.488
21/Jan.- 30/Jan.	31.8	100	1.14	36.25	30	66.25	103.0	40.6	41.8	24.5	0.488
31/Jan.- 9/Feb.	35.8	100	1.15	41.17	30	71.17	95.8	47.8	45.8	25.4	0.506
10/Feb.- 19/Feb.	36.3	100	1.18	42.83	30	72.83	95.0	48.7	46.3	26.5	0.529
20/Feb.- 1/Mar.	36.8	100	1.21	44.53	30	74.53	100.7	46.5	46.8	27.7	0.553
2/Mar.-11/Mar.	41.3	100	1.24	51.21	30	81.21	152.0	33.8	51.3	29.9	0.597
12/Mar.- 21/Mar.	41.3	100	1.26	52.04	30	82.04	152.0	33.8	51.3	30.7	0.613
22/Mar.- 31/Mar.	41.3	100	1.26	52.04	30	82.04	152.0	33.8	51.3	30.7	0.613
1/Apr.- 10/Apr.	41	100	1.25	51.25	30	81.25	76.0	100.0	76	5.3	0.105
11/Apr.- 20/Apr.	41	100	1.2	49.2	30	79.2	76.0	100.0	76	3.2	0.064
21/Apr.- 30/Apr.	41	100	1.15	47.15	30	77.15	76.0	100.0	76	1.2	0.023
1/May.- 10/May	49.2	100	1.08	53.14	30	83.14	11.0	100.0	11	72.1	1.44

1/ : Refere to Table A2-4 (8)
2/ : Refere to Figure A2-1 (1)
3/ : 10-day rainfall (R10) was estimated based on monthly rainfall in accordance with 10-day periods.
4/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (P + Eto) x 10 day ; 100 %
R10 > (P + Eto) x 10 day ; (P + Eto) x 10 day x 100/R10
5/ : FWS = Irrigation Requirement (mm/10 day)/(86.4 x Irrigation Efficiency/100)

Table A2-7 (4) Crop Water Requirements for Summer Season Paddy 2 under Nkotakota Station

- Crop : Summer (Wet) Season Paddy 2
- Planting Date : Feb. 1/Feb. 21
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Nkotakota Station
- Percolation Rate : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall	% of Effective Rainfall	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
1/Feb.- 10/Feb.	36.3	100	1.14	41.38	30	71.38	95.0	48.7	46.3	25.1	0.5
11/Feb.- 20/Feb.	36.3	100	1.14	41.38	30	71.38	95.0	48.7	46.3	25.1	0.5
21/Feb.- 2/Mar	37.3	100	1.14	42.52	30	72.52	106.4	44.5	47.3	25.2	0.503
3/Mar.- 12/Mar.	41.3	100	1.15	47.5	30	77.5	152.0	33.8	51.3	26.2	0.523
13/Mar.- 22/Mar.	41.3	100	1.18	48.73	30	78.73	152.0	33.8	51.3	27.4	0.547
23/Mar.- 1/Apr.	41.3	100	1.21	49.97	30	79.97	144.4	35.5	51.3	28.7	0.572
2/Apr.- 11/Apr.	41	100	1.24	50.84	30	80.84	76.0	100.0	76	4.8	0.097
12/Apr.- 21/Apr.	41	100	1.26	51.66	30	81.66	76.0	100.0	76	5.7	0.113
22/Apr.- 1/May	41.8	100	1.26	52.67	30	82.67	69.6	100.0	69.6	13.1	0.261
2/May - 11/May	49.2	100	1.25	61.5	30	91.5	11.0	100.0	11	80.5	1.606
12/May- 21/May	49.2	100	1.2	59.04	30	89.04	11.0	100.0	11	78.0	1.557
22/May- 31/May	49.2	100	1.15	56.58	30	86.58	11.0	100.0	11	75.6	1.508

Table A2-7 (5) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 1 (Mangochi Station)

- Period of Land Preparation Works : Dec. 21- Jan. 10
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
11/Dec.- 20/Dec	37.8	1.3		1.3	51	2.5	1.3	0	0
21/Dec.- 30/Dec.	37.8	1.3	87	88.3	51	100	51	37.3	0.744
31/Dec.- 10/Jan	35.8	1.1	87	88.1	60.9	100	60.9	27.2	0.543

1/ : Refer to Table A2-4 (14)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6 (5))
4/ : Refer to Table A2-4 (14)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + LP) x 10 day ; 100 %
R10 > (N + LP) x 10 day ; (N + LP) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (5) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 2 (Mangochi Station)

- Period of Land Preparation Works : Jan. 11- Jan. 31
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
1/Jan.- 10/Jan.	35.8	1.3		1.3	62	2.1	1.3	0	0
11/Jan.- 20/Jan.	35.8	1.3	86	87.3	62	100	62	25.3	0.505
21/Jan.- 30/Jan.	35.8	1.3	86	87.3	62	100	62	25.3	0.505

1/ : Refer to Table A2-4 (14)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6 (6))
4/ : Refer to Table A2-4 (14)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + NP) x 10 day ; 100 %
R10 > (N + NP) x 10 day ; (N + Lp) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (6) Crop Water Requirements for Summer Season Paddy 1 under Mangochi Station

- Crop : Summer (Wet) Season Paddy 1
- Planting Date : Jan. 11/Jan. 31
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Mangochi Station
- Percolation Rate (P) : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS 5/
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall 3/	% of Effective Rainfall 4/	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
11/Jan.- 20/Jan.	35.8	100	1.14	40.81	30	70.81	62.0	100.0	62	8.8	0.176
21/Jan.- 30/Jan.	35.8	100	1.14	40.81	30	70.81	62.0	100.0	62	8.8	0.176
31/Jan.- 9/Feb.	38.3	100	1.15	44.05	30	74.05	66.5	100.0	66.5	7.6	0.151
10/Feb.- 19/Feb.	38.6	100	1.18	45.55	30	75.55	67.0	100.0	67	8.6	0.171
20/Feb.- 1/Mar.	39.2	100	1.21	47.43	30	77.43	64.7	100.0	64.7	12.7	0.254
2/Mar.-11/Mar.	44.8	100	1.24	55.55	30	85.55	44.0	100.0	44	41.6	0.829
12/Mar.- 21/Mar.	44.8	100	1.26	56.45	30	86.45	44.0	100.0	44	42.5	0.847
22/Mar.- 31/Mar.	44.8	100	1.26	56.45	30	86.45	44.0	100.0	44	42.5	0.847
1/Apr.- 10/Apr.	48.4	100	1.25	60.5	30	90.5	12.0	100.0	12	78.5	1.566
11/Apr.- 20/Apr.	48.4	100	1.2	58.08	30	88.08	12.0	100.0	12	76.1	1.518
21/Apr.- 30/Apr.	48.4	100	1.15	55.66	30	85.66	12.0	100.0	12	73.7	1.47
1/May.- 10/May	49.9	100	1.08	53.89	30	83.89	1.0	0.0	0	83.9	1.674

1/ : Refere to Table A2-4 (14)
2/ : Refere to Figure A2-1 (1)
3/ : 10-day rainfall (R10) was estimated based on monthly rainfall in accordance with 10-day periods.
4/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (P + Eto) x 10 day ; 100 %
R10 > (P + Eto) x 10 day ; (P + Eto) x 10 day x 100/R10
5/ : FWS = Irrigation Requirement (mm/10 day)/(86.4 x Irrigation Efficiency/100)

Table A2-7 (6) Crop Water Requirements for Summer Season Paddy 2 Under Mangochi Station

- Crop : Summer (Wet) Season Paddy 2
- Planting Date : Feb. 1/Feb. 21
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Mangochi Station
- Percolation Rate : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall	% of Effective Rainfall	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
1/Feb.- 10/Feb.	38.6	100	1.14	44	30	74	67.0	100.0	67	7.0	0.14
11/Feb.- 20/Feb.	38.6	100	1.14	44	30	74	67.0	100.0	67	7.0	0.14
21/Feb.- 2/Mar	39.8	100	1.14	45.37	30	75.37	62.4	100.0	62.4	13.0	0.259
3/Mar.- 12/Mar.	44.8	100	1.15	51.52	30	81.52	44.0	100.0	44	37.5	0.749
13/Mar.- 22/Mar.	44.8	100	1.18	52.86	30	82.86	44.0	100.0	44	38.9	0.775
23/Mar.- 1/Apr.	45.2	100	1.21	54.69	30	84.69	40.8	100.0	40.8	43.9	0.876
2/Apr.- 11/Apr.	48.4	100	1.24	60.02	30	90.02	12.0	100.0	12	78.0	1.557
12/Apr.- 21/Apr.	48.4	100	1.26	60.98	30	90.98	12.0	100.0	12	79.0	1.576
22/Apr.- 1/May	48.6	100	1.26	61.24	30	91.24	10.9	100.0	10.9	80.3	1.603
2/May - 11/May	49.9	100	1.25	62.38	30	92.38	1.0	0.0	0	92.4	1.843
12/May- 21/May	49.9	100	1.2	59.88	30	89.88	1.0	0.0	0	89.9	1.794
22/May- 31/May	49.9	100	1.15	57.39	30	87.39	1.0	0.0	0	87.4	1.744

Table A2-7 (7) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 1 (Mulanje Station)

- Period of Land Preparation Works : Dec. 21- Jan. 10
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
11/Dec.- 20/Dec	41.7	1.5		1.5	93	1.6	1.5	0	0
21/Dec.- 30/Dec.	41.7	1.5	90	91.5	93	98.4	91.5	0	0
31/Dec.- 10/Jan	40.8	1.4	90	91.4	102	89.6	91.4	0	0

1/ : Refer to Table A2-4 (16)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6(7))
4/ : Refer to Table A2-4 (16)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + LP) x 10 day ; 100 %
R10 > (N + LP) x 10 day ; (N + LP) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (7) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 2 (Mulanje Station)

- Period of Land Preparation Works : Jan. 11- Jan. 31
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
1/Jan.- 10/Jan.	41.8	1.5		1.5	103	1.5	1.5	0	0
11/Jan.- 20/Jan.	41.8	1.5	90	91.5	103	88.8	91.5	0	0
21/Jan.- 30/Jan.	41.8	1.5	90	91.5	103	88.8	91.5	0	0

1/ : Refer to Table A2-4 (16)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6(8))
4/ : Refer to Table A2-4 (16)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + NP) x 10 day ; 100 %
R10 > (N + NP) x 10 day ; (N + Lp) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (8) Crop Water Requirements for Summer Season Paddy 1 under Mulanje Station

- Crop : Summer (Wet) Season Paddy 1
- Planting Date : Jan. 11/Jan. 31
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Mulanje Station
- Percolation Rate (P) : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS 5/
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall 3/	% of Effective Rainfall 4/	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
11/Jan.- 20/Jan.	40.8	100	1.14	46.51	30	76.51	103.0	49.3	50.8	25.7	0.513
21/Jan.- 30/Jan.	40.8	100	1.14	46.51	30	76.51	103.0	49.3	50.8	25.7	0.513
31/Jan.- 9/Feb.	40.2	100	1.15	46.23	30	76.23	112.0	44.8	50.2	26.0	0.519
10/Feb.- 19/Feb.	40.1	100	1.18	47.32	30	77.32	113.0	44.3	50.1	27.2	0.543
20/Feb.- 1/Mar.	39.5	100	1.21	47.8	30	77.8	112.7	43.9	49.5	28.3	0.565
2/Mar.-11/Mar.	34.3	100	1.24	42.53	30	72.53	110.0	40.3	44.3	28.2	0.563
12/Mar.- 21/Mar.	34.3	100	1.26	43.22	30	73.22	110.0	40.3	44.3	28.9	0.577
22/Mar.- 31/Mar.	34.3	100	1.26	43.22	30	73.22	110.0	40.3	44.3	28.9	0.577
1/Apr.- 10/Apr.	32.4	100	1.25	40.5	30	70.5	57.0	100.0	57	13.5	0.269
11/Apr.- 20/Apr.	32.4	100	1.2	38.88	30	68.88	57.0	100.0	57	11.9	0.237
21/Apr.- 30/Apr.	32.4	100	1.15	37.26	30	67.26	57.0	100.0	57	10.3	0.205
1/May.- 10/May	26.4	100	1.08	28.51	30	58.51	23.0	100.0	23	35.5	0.709

1/ : Refere to Table A2-4 (16)
2/ : Refere to Figure A2-1 (1)
3/ : 10-day rainfall (R10) was estimated based on monthly rainfall in accordance with 10-day periods.
4/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (P + Eto) x 10 day ; 100 %
R10 > (P + Eto) x 10 day ; (P + Eto) x 10 day x 100/R10
5/ : FWS = Irrigation Requirement (mm/10 day)/(86.4 x Irrigation Efficiency/100)

Table A2-7 (8) Crop Water Requirements for Summer Season Paddy 2 under Mulanje Station

- Crop : Summer (Wet) Season Paddy 2
- Planting Date : Feb. 1/Feb. 21
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Mulanje Station
- Percolation Rate : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall	% of Effective Rainfall	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
1/Feb.- 10/Feb.	40.1	100	1.14	45.71	30	75.71	113.0	44.3	50.1	25.6	0.511
11/Feb.- 20/Feb.	40.1	100	1.14	45.71	30	75.71	113.0	44.3	50.1	25.6	0.511
21/Feb.- 2/Mar	38.9	100	1.14	44.35	30	74.35	112.4	43.5	48.9	25.5	0.508
3/Mar.- 12/Mar.	34.3	100	1.15	39.45	30	69.45	110.0	40.3	44.3	25.2	0.502
13/Mar.- 22/Mar.	34.3	100	1.18	40.47	30	70.47	110.0	40.3	44.3	26.2	0.522
23/Mar.- 1/Apr.	34.1	100	1.21	41.26	30	71.26	104.7	42.1	44.1	27.2	0.542
2/Apr.- 11/Apr.	32.4	100	1.24	40.18	30	70.18	57.0	100.0	57	13.2	0.263
12/Apr.- 21/Apr.	32.4	100	1.26	40.82	30	70.82	57.0	100.0	57	13.8	0.276
22/Apr.- 1/May	31.8	100	1.26	40.07	30	70.07	53.6	100.0	53.6	16.5	0.329
2/May - 11/May	26.4	100	1.25	33	30	63	23.0	100.0	23	40.0	0.798
12/May- 21/May	26.4	100	1.2	31.68	30	61.68	23.0	100.0	23	38.7	0.772
22/May- 31/May	26.4	100	1.15	30.36	30	60.36	23.0	100.0	23	37.4	0.746

Table A2-7 (9) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 1 (Bvumbwee Station)

- Period of Land Preparation Works : Dec. 21- Jan. 10
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
11/Dec.- 20/Dec	36.4	1.3		1.3	74	0.8	0.6	0.7	0.014
21/Dec.- 30/Dec.	36.4	1.3	87	88.3	74	100	74	14.3	0.285
31/Dec.- 10/Jan	37.1	1.3	87	88.3	85.7	100	85.7	2.6	0.052

1/ : Refer to Table A2-4 (17)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6(9))
4/ : Refer to Table A2-4 (17)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + LP) x 10 day ; 100 %
R10 > (N + LP) x 10 day ; (N + LP) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (9) Water Requirements for Nursery and Land Preparation for Summer (Wet) Season Paddy 2 (Bvumbwe Station)

- Period of Land Preparation Works : Jan. 11- Jan. 31
- Calculation Time Step : 10-day(s)

Date	ETo 1/	Nursery and Land Preparation Water			Rainfall			Water Requirement for Nursery and Land Preparation Works	
		Nursery (N) 2/	Land Preparation (LP) 3/	Total	Total Rainfall 4/	% of Effective Rainfall 5/	Effective Rainfall		
	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(mm/10-day)	(%)	(mm/10-day)	(mm/10-day)	(lit/sec/ha) 6/
	(1)	(2)	(3)	(4)=(2)+(3)	(5)	(6)	(7)=(5)*(6)	(8)=(4)-(7)	(9)
1/Jan.- 10/Jan.	37.1	1.3		1.3	87	1.5	1.3	0	0
11/Jan.- 20/Jan.	37.1	1.3	87	88.3	87	100	87	1.3	0.026
21/Jan.- 30/Jan.	37.1	1.3	87	88.3	87	100	87	1.3	0.026

1/ : Refer to Table A2-4 (17)
2/ : Nursery Water Requirements = Nursery Areas (5%) x ETo x 0.7 (mm/10-day)
3/ : Water Requirements for Land Soaking and Preparation Works (Refer to Table A2-6(10))
4/ : Refer to Table A2-4 (17)
5/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (N + NP) x 10 day ; 100 %
R10 > (N + NP) x 10 day ; (N + Lp) x 10 day x 100/R10
6/ : (8) /(86.4 x Irrigation Efficiency 0.58)

Table A2-7 (10) Crop Water Requirements for Summer Season Paddy 1 under Bvumbwe Station

- Crop : Summer (Wet) Season Paddy 1
- Planting Date : Jan. 11/Jan. 31
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Bvumbwe Station
- Percolation Rate (P) : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS 5/
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall 3/	% of Effective Rainfall 4/	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
11/Jan.- 20/Jan.	37.1	100	1.14	42.29	30	72.29	87.0	54.1	47.1	25.2	0.503
21/Jan.- 30/Jan.	37.1	100	1.14	42.29	30	72.29	87.0	54.1	47.1	25.2	0.503
31/Jan.- 9/Feb.	36.1	100	1.15	41.52	30	71.52	87.9	52.4	46.1	25.4	0.507
10/Feb.- 19/Feb.	36	100	1.18	42.48	30	72.48	88.0	52.3	46	26.5	0.528
20/Feb.- 1/Mar.	36	100	1.21	43.56	30	73.56	85.7	53.7	46	27.6	0.55
2/Mar.-11/Mar.	35.6	100	1.24	44.14	30	74.14	65.0	100.0	65	9.1	0.182
12/Mar.- 21/Mar.	35.6	100	1.26	44.86	30	74.86	65.0	100.0	65	9.9	0.197
22/Mar.- 31/Mar.	35.6	100	1.26	44.86	30	74.86	65.0	100.0	65	9.9	0.197
1/Apr.- 10/Apr.	32.4	100	1.25	40.5	30	70.5	28.0	100.0	28	42.5	0.848
11/Apr.- 20/Apr.	32.4	100	1.2	38.88	30	68.88	28.0	100.0	28	40.9	0.816
21/Apr.- 30/Apr.	32.4	100	1.15	37.26	30	67.26	28.0	100.0	28	39.3	0.783
1/May.- 10/May	27.8	100	1.08	30.02	30	60.02	7.0	0.0	0	60.0	1.198

1/ : Refere to Table A2-4 (17)
2/ : Refere to Figure A2-4 (1)
3/ : 10-day rainfall (R10) was estimated based on monthly rainfall in accordance with 10-day periods.
4/ : Percentage of effective rainfall was estimated based on the following criteria;
R10 < 10 mm ; 0 %
R10 < (P + Eto) x 10 day ; 100 %
R10 > (P + Eto) x 10 day ; (P + Eto) x 10 day x 100/R10
5/ : FWS = Irrigation Requirement (mm/10 day)/(86.4 x Irrigation Efficiency/100)

Table A2-7 (10) Crop Water Requirements for Summer Season Paddy 2 under Bvumbwe Station

- Crop : Summer (Wet) Season Paddy 2
- Planting Date : Feb. 1/Feb. 21
- Calculation Time Step : 10-day(s)
- Irrigation Efficency : 58 %
- Climatological Data : Bvumbwe Station
- Percolation Rate : 1 mm/day

Date	ETo			CWR			Rainfall			Irrigation Requirement	FWS
	ETo 1/	Planted Area	Crop Kc 2/	ETc	P	Total	Total Rainfall	% of Effective Rainfall	Effective Rainfall		
	(mm/period)	(%)		(mm/period)	(mm/period)	(mm/period)	(mm/period)	(%)	(mm/period)	(mm/period)	(lit/sec/ha)
	(1)	(2)	(3)	(4)=(1)x(3)	(5)	(6)=(4)+(5)	(7)	(8)	(9)=(7)x(8)	(10)=(6)-(9)	(11)
1/Feb.- 10/Feb.	36	100	1.14	41.04	30	71.04	88.0	52.3	46	25.0	0.5
11/Feb.- 20/Feb.	36	100	1.14	41.04	30	71.04	88.0	52.3	46	25.0	0.5
21/Feb.- 2/Mar	35.9	100	1.14	40.93	30	70.93	83.4	55.0	45.9	25.0	0.499
3/Mar.- 12/Mar.	35.6	100	1.15	40.94	30	70.94	65.0	100.0	65	5.9	0.119
13/Mar.- 22/Mar.	35.6	100	1.18	42.01	30	72.01	65.0	100.0	65	7.0	0.14
23/Mar.- 1/Apr.	35.3	100	1.21	42.71	30	72.71	61.3	100.0	61.3	11.4	0.228
2/Apr.- 11/Apr.	32.4	100	1.24	40.18	30	70.18	28.0	100.0	28	42.2	0.842
12/Apr.- 21/Apr.	32.4	100	1.26	40.82	30	70.82	28.0	100.0	28	42.8	0.854
22/Apr.- 1/May	31.9	100	1.26	40.19	30	70.19	25.9	100.0	25.9	44.3	0.884
2/May - 11/May	27.8	100	1.25	34.75	30	64.75	7.0	0.0	0	64.8	1.292
12/May- 21/May	27.8	100	1.2	33.36	30	63.36	7.0	0.0	0	63.4	1.264
22/May- 31/May	27.8	100	1.15	31.97	30	61.97	7.0	0.0	0	62.0	1.237

Table A2-8(1) **Irrigation Water Supply for Dry Season Crops at Each Verification Site**

Verification Sites	Crops	1st Survey			2nd Survey			3rd Survey			4th Survey			5th Survey			6th Survey			7th Survey		
		Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.
1 Bethani-A	Maize	5/1	6 hr	2 time/w	5/22	4 hr	2 time/w	6/5	6 hr	1 time/w	6/18	8-10hr/0.7 ha	1 time/w	7/2	3 hr/0.1 ha	2 time/w	7/16	12hr/0.8 ha	1time/2w	7/30	2hr/0.1ha	1 time/w
	Beans																					
	Tomato																					
	Irish Potato																					
	Onion																					
Bethani-B	Maize	not used			5/22	4 hr	2 time/w	6/5	3-4 hr	2 time/w	6/18	6 hr	1 time/w	7/2	6 hr	1 time/w	7/16	6 hr	1 time/w	7/30	8 hr/1 ha, 0.5 hr/0.05 ha	
	Beans							6/5	3-4 hr	2 time/w	6/18	6 hr	1 time/w	7/2	6 hr	1 time/w	7/16	6 hr	1 time/w	7/30		
	Tomato																					
	Irish Potato																					
	Onion																					
	Unplanted land																				whole day/0.4 ha	
2 Mantha	Maize	5/21	not used		6/4	3 hr	none	6/19	3 hr		7/3	3 hr	not defined	7/17	no pattern followed	no pattern followed	7/31	not irrigation	not irrigation	8/14	not irrigation	not irrigation
	Cabbage																					
	Tomato				6/4	3 hr	none	6/19	3 hr		7/3	3 hr	daily	7/17	no pattern followed	no pattern followed	7/31	no pattern followed	no pattern followed	8/14	no pattern followed	no pattern followed
	Mustard				6/4	3 hr	none	6/19	3 hr	daily	7/3	3 hr	daily	7/17	no pattern followed	no pattern followed	7/31	no pattern followed	no pattern followed	8/14	no pattern followed	no pattern followed
3 Chiwoza Dam	Maize	5/20	9hr	1 time/w	6/3	9 hr	1 time/w	6/17	3-9 hr	1 time/w	7/1	4,7 hr	1 time/w	7/15	6 hr	1 time /2 w	7/29	9.5 hr	1 time /2 w	8/12	8-10 hr	1 time /2 w
	Paprika				6/3	12 hr	1 time/w	6/17	2-6 hr	1 time/w	7/1	4,12 hr	1 time/w	7/15	8 hr	1 time /2 w	7/29	10 hr	1 time /2 w	8/12	8-10 hr	1 time /2 w
	Cabbage							6/17	9 hr	1 time/w	7/1	4,12 hr	1 time/w	7/15	8 hr	1 time /2 w	7/29	10 hr	1 time /2 w	8/12	8-10 hr	1 time /2 w
	Tomato				6/3	12 hr	1 time/w	6/17	2-6 hr	1 time/w	7/1	4,12 hr	1 time/w	7/15	8 hr	1 time /2 w	7/29			8/12	8-10 hr	1 time /2 w
	Vegetables				6/3	12 hr	1 time/w	6/17	2-6 hr	1 time/w	7/1	4,12 hr	1 time/w	7/15	4 hr/0.03ha	1 time /2 w	7/29			8/12	1 hr	1 time/w
4 Kachere	Maize	5/19	no irrigation		6/2	no irrigation		6/30	no irrigation		7/14	no irrigation		7/28	no irrigation		8/11	no irrigation		8/28	1hr/0.014 ha 2hr/025ha 4.5 hr/0.06 ha	1 time/w
	Cabbage																					
	Tomato																					
5 Titukulane	Maize	5/15	missing*	1 time/w	28-May	2 hr	2 time/w	6/11	0.5 hr	2 time/w	6/25	missing*	missing*	7/10	missing*	2 time/w	7/23	0.5 hr	2 time/w on training plot,irregular the rest of scheme.	8/6	30 min.others without pattern.	2 time/w on training plot,irregular the rest of scheme.
	Tomato	5/15	missing*	1 time/w	5/28	2 hr	2 time/w	6/11	30 min	2 time/w	6/25	missing*	missing*	7/10	missing*	2 time/w	7/23	0.5 hr	2 time/w on training plot,irregular the rest of scheme.	8/6	30 min.others without pattern.	2 time/w on training plot,irregular the rest of scheme.
	Carrot																					
	Cabbage																					

Verification Sites	Crops	1st Survey			2nd Survey			3rd Survey			4th Survey			5th Survey			6th Survey			7th Survey		
		Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.
	Peaches	5/15	missing*	1 time/w	5/28	2 hr	2 time/w	6/11	30 min	2 time/w	6/25	missing*	missing*	7/10	missing*	2 time/w	7/23	0.5 hr	2 time/w on training plot,irregular the rest of scheme.	8/6	30 min.others without pattern.	2 time/w on training plot,irregular the rest of scheme.
	Vegetables	5/15	missing*	1 time/w	28-May	2 hr	2 time/w	6/11	0.5 hr	2 time/w	6/25	missing*	missing*	7/10	missing*	2 time/w	7/23	0.5 hr	2 time/w on training plot,irregular the rest of scheme.	8/6	30 min.others without pattern.	2 time/w on training plot,irregular the rest of scheme.
	Peas							6/11	0.5 hr	2 time/w	6/25	missing*	missing*	7/10	missing*	2 time/w	7/23	30 min	2 time/w on training plot,irregular the rest of scheme.	8/6	30 min.others without pattern.	2 time/w on training plot,irregular the rest of scheme.
	Irish potatoes																7/23	30 min	2 time/w on training plot,irregular the rest of scheme.	8/6	30 min.others without pattern.	2 time/w on training plot,irregular the rest of scheme.
6 Chaseta	Maize	5/14	no irrigation		29-May	no irrigation		6/12	no irrigation		7/11	no irrigation		7/24	no irrigation		8/7	no irrigation		8/21	no irrigation	
	Beans																					
	Cabbage																					
	Tomato																					
7 Bawi	Maize	5/12	3 hr(weir # 7)	1 time/w(we	5/26	2 hr(both weir	1 time/w	6/9	3 hr(weir # 5) 1 hr(weir # 7)	1 time/w	6/23	missing*	missing*	7/8	3-4 hr(# 5 and 7 weirs)	1 time/w	7/22	2 hr (weir# 5) 2-4 hr (weir # 7)	1 time/w	8/4	2 hr (weir# 5) 2-4 hr(weir # 7)	1 time/w
	Cabbage				5/26	2 hr(both weir	1 time/w	6/9	3 hr(weir # 5) 1 hr(weir # 7)	1 time/w	6/23	missing*	missing*	7/8	3-4 hr(# 5 and 7 weirs)	1 time/w	7/22	2 hr (weir# 5) 2-4 hr (weir # 7)	1 time/w	8/4	2 hr (weir# 5) 2-4 hr(weir # 7)	1 time/w
	Tomato				5/26	2 hr(both weir	1 time/w	6/9	3 hr(weir # 5) 1 hr(weir # 7)	1 time/w	6/23	missing*	missing*	7/8	3-4 hr(# 5 and 7 weirs)	1 time/w	7/22	2 hr (weir# 5) 2-4 hr (weir # 7)	1 time/w	8/4	2 hr (weir# 5) 2-4 hr(weir # 7)	1 time/w
	Mustard				5/26	2 hr(both weir	1 time/w	6/9	3 hr(weir # 5) 1 hr(weir # 7)	1 time/w			missing*									
	Onion				5/26	2 hr(both weir	1 time/w	6/9	3 hr(weir # 5) 1 hr(weir # 7)	1 time/w	6/23	missing*	missing*	7/8	3-4 hr(# 5 and 7 weirs)	1 time/w	7/22	2 hr (weir# 5) 2-4 hr (weir # 7)	1 time/w	8/4	2 hr (weir# 5) 2-4 hr(weir # 7)	1 time/w
	Cassava																					
	Sweet potato				5/26	2 hr(both weir	1 time/w															
	Millet																					
8 Chibwana	Paddy Rice	5/13	no irrigation		5/27	no irrigation		6/10	no irrigation		6/24	no irrigation	missing	7/9	no irrigation		7/21	no irrigation				
	Maize																			8/5	used but not defined	not yet
	Tomato																					

Note: Irri. Hr : Irrigation Hours (hr) Irri. Int. : Irrigation Interval (time/week) Ave. Irri. Hr : Average Irrigation Hours (hr/0.1 ha)

Table A2-8(2) **Irrigation Water Supply for Dry Season Crops at Each Verification Site**

Verification Sites	Crops	8th Survey			9th Survey			10th Survey			11th Survey			12th Survey			13th Survey			Average	
		Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Irrigation Hour	Irri. Int.
1 Bethani-A	Maize	8/13	4 hr/0.1 ha	1 time/w	8/27	12 hr/rot	1 time/w	9/10	12 hr/rot	1 time/w	9/24	12 hr/rot	1 time/w	10/8	12 hr/rot	1 time/w	10/22	12 hr/rot	1 time/w	7 hr/rot	1 time/w
	Beans																				
	Tomato																				
	Irish Potato																				
	Onion																				
Bethani-B	Maize	8/13	8 hr/0.4 ha	1 time/w	8/27	12 hr/rot	1 time/w	9/10	12 hr/rot	1 time/w	9/24	12 hr/rot	1 time/w	10/8	12 hr/rot	1 time/w	10/22	12 hr/rot	1 time/w	8 hr/rot	1 time/w
	Beans	8/13	8 hr/0.4 ha	1 time/w	8/27	12 hr/rot	1 time/w	9/10	12 hr/rot	1 time/w	9/24	12 hr/rot	1 time/w	10/8	12 hr/rot	1 time/w	10/22	12 hr/rot	1 time/w	8 hr/rot	1 time/w
	Tomato																				
	Irish Potato																				
	Onion																				
2 Mantha	Maize	8/28	not irrigation	not irrigation	9/11	1-2 hr	1 time/w	9/25	almost daily	no pattern followed	10/9	0.5-0.75 hr	1 time/w	10/25	0.5-0.75 hr	no pattern followed	11/6	no irrigation	no irrigation	2 hr/rot	1time/w
	Cabbage																				
	Tomato	8/28	almost daily	almost daily	9/11																
	Mustard	8/28	almost daily	almost daily	9/11																
3 Chiwoza Dam	Maize	8/26	4.52 hr,pump,13 hr ,gravity right bank,2.5 hr gravity left bank.	1 time/2w	9/9	9 hr right bank,gravity,65hr btwn 26th-30th Aug,left bank, gravity	1 time/2w	9/23	no pattern because of water shortage,but irrigated for a week.	1 time/2w	10/7	no pattern because of water shortage,but irrigated for a week.	1 time/2w	10/21	no pattern because of water shortage,but irrigated for a week.	1 time/2w	11/4	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	9 hr/rot	1 time/2w
	Paprika	8/26	13 hr,gravity right bank,2.5 hr gravity left bank.	1 time/2w	9/9	9 hr right bank,gravity,65hr btwn 26th-30th Aug,left bank, gravity	1 time/2w	9/23	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	10/7	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	10/21	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	11/4	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	9 hr/rot	1 time/2w
	Cabbage	8/26	13 hr,gravity right bank,2.5 hr gravity left bank.	1 time/2w	9/9	9 hr right bank,gravity,65hr btwn 26th-30th Aug,left bank, gravity	1 time/2w	9/23	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	10/7	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	10/21	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	11/4	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	9 hr/rot	1 time/2w
	Tomato	8/26			9/9	9 hr right bank,gravity,65hr btwn 26th-30th Aug,left bank, gravity	1 time/2w	9/23	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	10/7	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	10/21	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	11/4	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	9 hr/rot	1 time/2w
	Vegetables	8/26			9/9	9 hr right bank,gravity,65hr btwn 26th-30th Aug,left bank, gravity.	1 time/2w	9/23	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	10/7	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	10/21	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	11/4	no pattern because of water shortage,but irrigated for a wk.	1 time/2w	9 hr/rot	1 time/2w
4 Kachere	Maize	9/8	1-7hr	everyday since 26th Aug.	9/22	1.45 hr	1 time/2w	10/6	not recorded*	1 time/2w	10/20	1.44 hr	1 time/2w	11/3	3.28 hr	1 time/w	11/17	3 hr	pump used almost dailv.	3 hr	1 time/w
	Cabbage																				
	Tomato	9/8	1-7hr	everyday since 26th Aug.	9/22	1.45 hr	1 time/2w	10/6	not recorded*	1 time/2w	10/20	1.44 hr	1 time/2w	11/3	3.28 hr	1 time/w	11/17	3 hr	pump used almost dailv.	3 hr	1 time/w
5 Titukulane	Maize	8/20	0.5 hrothers without pattern.	2 time/w on training plot,irregular the rest of scheme.	9/3	not known*	1 time/w	9/17	continous and without pattern.	no pattern followed.	10/1	continous and without pattern.	no pattern followed.	10/15	missing*	missing*	10/30	continous and without pattern.	no pattern followed.	0.67 hr	2 times/w

Verification Sites	Crops	8th Survey			9th Survey			10th Survey			11th Survey			12th Survey			13th Survey			Average	
		Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Date	Irrigation Hour	Irri. Int.	Irrigation Hour	Irri. Int.
	Tomato	8/20	0.5 hrothers without pattern.	2 time/w on training plot,irregular the rest of scheme.	9/3	not known*	1 time/w	9/17	continous and without pattern.	no pattern followed.	10/1	continous and without pattern.	no pattern followed.	10/15	missing*	missing*	10/30	continous and without pattern.	no pattern followed.	0.67 hr	2 times/w
	Carrot																				
	Cabbage																				
	Peaches	8/20	0.5 hr, others without pattern.	2 time/w on training plot,irregular the rest of scheme.																0.67 hr	2 times/w
	Vegetables	8/20	0.5 hr, others without pattern.	2 time/w on training plot,irregular the rest of scheme.													10/30	continous and without pattern.	no pattern followed.	0.67 hr	2 times/w
	Peas	8/20	0.5 hr, others without pattern.	2 time/w on training plot,irregular the rest of scheme.																0.67 hr	2 times/w
	Irish potatoes	8/20	0.5 hr, others without pattern.	2 time/w on training plot,irregular the rest of scheme.	9/3	not known*	1 time/w	9/17	continous and without pattern.	no pattern followed.	10/1	continous and without pattern.	no pattern followed.	10/15	missing*	missing*	10/30	continous and without pattern.	no pattern followed.	0.67 hr	2 times/w
6 Chaseta	Maize	9/4	used watering canes but not defined.	no pattern	9/18	used watering canes but not defined.	no pattern	10/2	used watering canes but not defined.	no pattern	10/16	missing*	missing*	10/30	1 hr(pump testing);watering canes used almost daily.	no pattern followed.	11/13	no irr.		1 hr	1 time/w
	Beans	9/4	used watering canes but not defined.	no pattern	9/18	used watering canes but not defined.	no pattern	10/2	used watering canes but not defined.	no pattern	10/16	missing*	missing*	10/30	1 hr(pump testing);watering canes used almost daily.	no pattern followed.	11/13	no irr.		1 hr	1 time/w
	Cabbage	9/4	used watering canes but not defined.	no pattern	9/18	used watering canes but not defined.	no pattern	10/2	used watering canes but not defined.	no pattern	10/16	missing*	missing*	10/30	1 hr(pump testing);watering canes used almost daily.	no pattern followed.	11/13	no irr.		1 hr	1 time/w
	Tomato	9/4	used watering canes but not defined.	no pattern	9/18	used watering canes but not defined.	no pattern	10/2	used watering canes but not defined.	no pattern	10/16	missing*	missing*	10/30	1 hr(pump testing);watering canes used almost daily.	no pattern followed.	11/13	no irr.		1 hr	1 time/w
	Peas	9/4	used watering canes but not defined.	no pattern	9/18	used watering canes but not defined.	no pattern	10/2	used watering canes but not defined.	no pattern	10/16	missing*	missing*	10/30	1 hr(pump testing);watering canes used almost daily.	no pattern followed.	11/13	no irr.		1 hr	1 time/w
	Onions	9/4	used watering canes but not defined.	no pattern	9/18	used watering canes but not defined.	no pattern	10/2	used watering canes but not defined.	no pattern	10/16									1 hr	1 time/w
7 Bawi	Maize	8/18	2 hr (both weirs)	1 time/w	9/1	2 hr(weir # 5)	1 time/w	9/15	1 hr(both weirs)	1 time/w	9/29	1.5 hr(weir # 5);2 hr(weir # 7)	1 time/w	10/13	missing*	missing*	(10/28	2 hr(weir # 5) 1.5 hr(weir # 7)	1 time/w	2.5 hr	1 time/w
	Cabbage	8/18	2 hr (both weirs)	1 time/w	9/1	2 hr(weir # 5)	1 time/w													2.5 hr	1 time/w
	Tomato	8/18	2 hr (both weirs)	1 time/w	9/1	2 hr(weir # 5)	1 time/w	9/15	1 hr(both weirs)	1 time/w	9/29	1.5 hr(weir # 5);2 hr(weir # 7)	1 time/w				10/28	2 hr(weir # 5) 1.5 hr(weir # 7)	1 time/w	2.5 hr	1 time/w
	Pumpkin leaves				9/1	2 hr(weir # 5)	1 time/w	9/15	1 hr(both weirs)	1 time/w	9/29	1.5 hr(weir # 5);2 hr(weir # 7)	1 time/w				10/28	2 hr(weir # 5) 1.5 hr(weir # 7)	1 time/w	2.5 hr	1 time/w
	Onion	8/18	2 hr (both weirs)	1 time/w	9/1	2 hr(weir # 5)	1 time/w													2.5 hr	1 time/w
	Cassava																			2.5 hr	1 time/w
	Sweet potato																			2.5 hr	1 time/w
	Millet																			2.5 hr	1 time/w
																				2.5 hr	1 time/w
8 Chibwana	Paddy Rice																10/28	24 hr/rot(all blocks)	1 time/2 w	24 hr/rot(all blocks)	1 time/2 w
	Maize	8/19	not defined	1 time/w	9/2	not defined	1 time/w	9/16	24 hr/rot(all blocks)	1 time/w	9/30	24 hr/rot(all blocks)	1 time/w	10/14	missing*	missing*	10/28	24 hr/rot(all blocks)	1 time/2 w	24 hr/rot(all blocks)	1 time/2 w
	Tomato				9/2	not defined	1 time/w	9/16	24 hr/rot(all blocks)	1 time/w	9/30	24 hr/rot(all blocks)	1 time/w				10/28	24 hr/rot(all blocks)	1 time/2 w	24 hr/rot(all blocks)	1 time/2 w
	Beans	8/19	not defined	1 time/w	9/2	not defined	1 time/w	9/16	24 hr/rot(all blocks)	1 time/w	9/30	24 hr/rot(all blocks)	1 time/w				10/28	24 hr/rot(all blocks)	1 time/2 w	24 hr/rot(all blocks)	1 time/2 w
	Pumpkins				9/2	not defined	1 time/w	9/16	24 hr/rot(all blocks)	1 time/w	9/30	24 hr/rot(all blocks)	1 time/w				10/28	24 hr/rot(all blocks)	1 time/2 w	24 hr/rot(all blocks)	1 time/2 w

Note: Irri. Hr : Irrigation Hours (hr) Irri. Int. : Irrigation Interval (times/week) Ave. Irri. Hr : Average Irrigation Hours (hr/0.1 ha)

Table A3-1 Probability Analysis of Annual Rainfall at Kasungu Station

Year	Rainfall(X_i) (mm)
1970/71	959.1
1971/72	432.1
1972/73	584.3
1973/74	936.6
1974/75	686.5
1975/76	379.6
1976/77	534.1
1977/78	880.5
1978/79	772.1
1979/80	1,063.8
1980/81	1,031.4
1981/82	718.9
1982/83	757.5
1983/84	635.9
1984/85	713.0
1985/86	1,086.5
1986/87	793.1
1987/88	830.7
1988/89	916.7
1989/90	887.5
1990/91	771.1
1991/92	516.4
1992/93	795.3
1993/94	837.0
1994/95	499.2
1995/96	910.9
1996/97	856.4
1997/98	868.8
1998/99	837.9
1999/00	546.3
2000/01	897.1
2001/02	596.8
2002/03	1,048.1
2003/04	815.8
2004/05	897.3
2005/06	553.1
Average	773.5 $(\overline{Xi})$

Order	Rainfall(X_i) (mm)	F=(1−n/(N+1)*100 (%)	$Log_{10}X_i$	$X_i + b$	$Y=Log(X_i+b)$	Y^2	Xi^2	Xi^3
1	379.6	97.3	2.579326204	379.8	2.57955	6.65408	144096	54698902.34
2	432.1	94.6	2.635584266	432.3	2.63579	6.94739	186710	80677568.16
3	499.2	91.9	2.698274577	499.2	2.69827	7.28066	249201	124400959.5
4	516.4	89.2	2.712986234	516.4	2.71299	7.36031	266669	137707850.9
5	534.1	86.5	2.727622578	534.1	2.72762	7.43991	285263	152358866.8
6	546.3	83.8	2.737431201	546.3	2.73743	7.49352	298444	163039787.8
7	553.1	81.1	2.742803658	553.1	2.7428	7.52295	305920	169204136.3
8	584.3	78.4	2.766635886	584.3	2.76664	7.6543	341406	199483812.1
9	596.8	75.7	2.775828814	596.8	2.77583	7.70523	356170	212562399.2
10	635.9	73.0	2.803388825	635.9	2.80339	7.859	404369	257138126.3
11	686.5	70.3	2.836640542	686.5	2.83664	8.04653	471282	323535264.6
12	713.0	67.6	2.85308953	713.0	2.85309	8.14012	508369	362467097
13	718.9	64.9	2.85666848	718.9	2.85667	8.16056	516817	371539892.3
14	757.5	62.2	2.879382637	757.5	2.87938	8.29083	573806	434658234.4
15	771.1	59.5	2.887110703	771.1	2.88711	8.3354	594595	458492366.4
16	772.1	56.8	2.88767355	772.1	2.88767	8.33864	596138	460278466.4
17	793.1	54.1	2.89932795	793.1	2.89933	8.40611	629008	498865935.5
18	795.3	51.4	2.900530982	795.3	2.90053	8.41307	632502	503028912.2
19	815.8	48.6	2.911583701	815.8	2.91158	8.4773	665530	542939080.3
20	830.7	45.9	2.91944421	830.7	2.91944	8.52313	690062	573234910.4
21	837.0	43.2	2.922725458	837.0	2.92273	8.54235	700569	586376253
22	837.9	40.5	2.92319219	837.9	2.92319	8.54504	702076	588269823.9
23	856.4	37.8	2.932676659	856.4	2.93268	8.60061	733421	628101710.1
24	868.8	35.1	2.938919812	868.8	2.93892	8.63725	754813	655781916.7
25	880.5	32.4	2.94472936	880.5	2.94473	8.67143	775280	682634260.1
26	887.5	29.7	2.948168362	887.5	2.94817	8.69171	787656	699044921.9
27	897.1	27.0	2.952840857	897.1	2.95284	8.71926	804788	721975682.6
28	897.3	24.3	2.952937668	897.3	2.95294	8.71985	805147	722458663.3
29	910.9	21.6	2.959470702	910.9	2.95947	8.75846	829739	755809082
30	916.7	18.9	2.962227231	916.7	2.96223	8.77481	840339	770338660.5
31	936.6	16.2	2.971554153	936.6	2.97155	8.83011	877220	821603839.9
32	959.1	13.5	2.981863891	959.1	2.98186	8.89149	919873	882250012.1
33	1,031.4	10.8	3.013427127	1,031.4	3.01343	9.08076	1063786	1097188839
34	1,048.1	8.1	3.020402721	1,048.1	3.0204	9.12282	1098514	1151352115
35	1,063.8	5.4	3.026859986	1,063.8	3.02686	9.16188	1131670	1203871014
36	1,086.5	2.7	3.036029731	1,086.5	3.03603	9.21748	1180482	1282593965
Average	773.5 $(\overline{Xi})$		2.87498223 $(Log_{10}X_g)$		2.87499 $(\overline{Y})$	8.278176 $(\overline{Y^2})$	631159 $(\overline{Xi^2})$	536943426 $(\overline{Xi^3})$

Caluculation of "bs"

$bs = (Xi*Xs - Xg^2)/(2*Xg - (Xi * Xs))$

Xi	Xs	Xi x Xs	Xi x Xs−Xg^2	Xi + Xs	2Xg−(Xi x Xs)	b_s
516.4	1,031.4	532614.96	−29,680	1547.8	−531115	0.1
499.2	1,048.1	523211.52	−39,084	1547.3	−521712	0.1
432.1	1,063.8	459667.98	−102,627	1495.9	−458168	0.2
379.6	1,086.5	412435.4	−149,860	1466.1	−410936	0.4
						0.2

Calculation of Probabilit Rainfall

Probability (Year)	E	1/a x E = 0.16091xE	$\overline{Y}$ + 1/a x E = 2.87499+0.16091xE	X+0.2	X
200	1.82150	0.2931	3.16809389	1472.6	1472.4
100	1.64500	0.2647	3.13969389	1379.4	1379.2
50	1.45200	0.23364	3.10863389	1284.2	1284.0
20	1.16300	0.18714	3.06213389	1153.8	1153.6
10	0.90620	0.14582	3.02081389	1049.1	1048.9
5	0.59510	0.09576	2.97075389	934.9	934.7
2	0.00000	0	2.87499389	749.9	749.7

N = 36

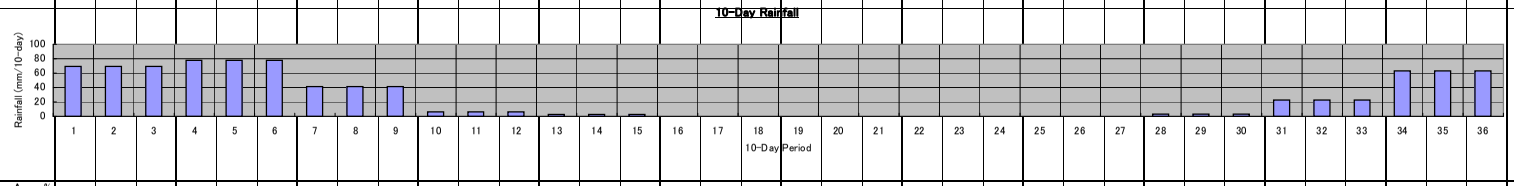
$Sx = \sqrt{((\overline{Y^2}) - (\overline{Y})^2)}$ = 0.11219

$1/a = \sqrt{(2N/(N-1)*Sx}$ = 0.16091

Table A3-2 (1) **Estimation of Unit Gross Irrigation Water Requirements (GWR) (Field Water Supply : FWS) for Chiwoza Dam Irrigation Scheme**
(Case : Normal Year)

Irrigation Scheme : Chioza Irrigation Scheme (Kas-46)
Irrigation Area : 10 ha

Item	Month																																		Remarks
	Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall (Station : Kasungu)																																					Total Rainfall =
Monthly Rainfall (mm/month)	208.1			232.9			124.1			18.2			7.8			0.0			0.1			0.1			0.3			9.5			67.9			189.3			858.3
10-day Rainfall (mm/10-day)	69.4	69.4	69.4	77.6	77.6	77.6	41.4	41.4	41.4	6.1	6.1	6.1	2.6	2.6	2.6	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	3.2	3.2	3.2	22.6	22.6	22.6	63.1	63.1	63.1	
2. Cropping Pattern Area %																																					
Maize (Grain) (S) 40 %																																					S-Ma-1
Maize (Grain) (S) 40 %																																					S-Ma-1
Maize (Grain) (S) 20 %																																					S-Ma-1
Cabbage (W1) 40 %									Nursery																												W1-Ca-1
Maize (Green) (W1) 40 %																																					W1-Ma-2
Tomato (W2) 40 %																		Nursery																			W2-To-1
Maize (Green) (W2) 40 %																																					W2-Ma-4
PapriKa (W) 20 %										Nursery																											W-Pa-1
3. Unit GWR (lit./sec/ha)																																					
Unit GWR (lit/sec/ha)																																					
Maize (Grain) (S) 40 %	0	0	0	0	0	0	0.09	0.1																									0	0	0	0	S-Ma-1
Maize (Grain) (S) 40 %	0	0	0	0	0	0	0.09	0.1																									0	0	0	0	S-Ma-1
Maize (Grain) (S) 20 %	0	0	0	0	0	0	0.09	0.1																									0	0	0	0	S-Ma-1
Cabbage (W1) 40 %									0.03	0.04	0.04	0.69	0.69	0.74	0.85	0.96	1.09	1.15	1.17	1.17																	W1-Ca-1
Maize (Green) (W1) 40 %									0	0	0.22	0.53	0.75	1.02	1.23	1.28	1.3	1.31	1.29	1.07																	W1-Ma-2
Tomato (W2) 40 %																		0.03	0.04	0.04	0.68	0.69	0.69	0.78	0.94	1.09	1.24	1.29	1.27	1.22	1.05	0.74					W2-To-1
Maize (Green) (W2) 40 %																					0.34	0.34	0.38	0.62	0.88	1.13	1.34	1.35	1.32	1.27	1.06	0.56					W2-Ma-4
PapriKa (W) 20 %										0.04	0.04	0.04	0.04	0.62	0.63	0.64	0.72	0.85	0.99	1.02	1.19	1.2	1.21	1.21	1.1	1.07	1.00	1.00	1.00	1.00							W-Pa-1
Ave. Unit GWR (lit/sec/ha)																																					
Summer Crop (S)	0	0	0	0	0	0	0.09	0.1																									0	0	0	0	
Winter Crop (W1)									0.01	0.02	0.1	0.49	1.68	0.7	0.83	0.9	0.96	0.98	0.98	0.9																	
Winter Crop (W2)																		0.01	0.02	0.02	0.27	0.28	0.28	0.31	0.38	0.44	0.5	0.52	0.51	0.49	0.42	0.3					
Winter Crop (W)										0.01	0.01	0.01	0.01	0.12	0.13	0.13	0.14	0.17	0.2	0.2	0.24	0.24	0.24	0.24	0.22	0.21	0.2	0.2	0.2	0.2							
4. Gross Irrigation Water Requirements (GWR)																																					
(lit/sec)																																					
Summer Crop (S)	0	0	0	0	0	0	0.9	1																									0	0	0	0	
Winter Crop (W1)									0.1	0.2	1	4.9	16.8	7	8.3	9	9.6	9.8	9.8	9																	
Winter Crop (W2)																		0.1	0.2	0.2	2.7	2.8	2.8	3.1	3.8	4.4	5	5.2	5.1	4.9	4.2	3					
Winter (W)										0.1	0.1	0.1	0.1	1.2	1.3	1.3	1.4	1.7	2	2	2.4	2.4	2.4	2.4	2.2	2.1	2	2	2	2							
Total (10 ha)	0	0	0	0	0	0	0.9	1	0.1	0.3	1.1	5	16.9	8.2	9.6	10.3	11	11.6	12	11.2	5.1	5.2	5.2	5.5	6	6.5	7	7.2	7.1	6.9	4.2	3	0	0	0	0	
Gravity Irrigation (R) (2.7 ha)	0	0	0	0	0	0	0.2	0.3	0	0.1	0.3	1.4	4.6	2.2	2.6	2.8	3	3.1	3.2	3	1.4	1.4	1.4	1.5	1.6	1.8	1.9	1.9	1.9	1.9	1.1	0.8	0	0	0	0	
Gravity Irrigation (L) (2.5 ha)	0	0	0	0	0	0	0.2	0.3	0	0.1	0.3	1.3	4.2	2.1	2.4	2.6	2.8	2.9	3	2.8	1.3	1.3	1.3	1.4	1.5	1.6	1.8	1.8	1.8	1.7	1.1	0.8	0	0	0	0	
Pump Irrigation (R) (3.3 ha)	0	0	0	0	0	0	0.3	0.3	0	0.1	0.4	1.7	5.6	2.7	3.2	3.4	3.6	3.8	4	3.7	1.7	1.7	1.7	1.8	2	2.1	2.3	2.4	2.3	2.3	1.4	1	0	0	0	0	
Pump Irrigation (L) (1.5 ha)	0	0	0	0	0	0	0.2	0.1	0.1	0	0.1	0.6	2.5	1.2	1.4	1.5	1.6	1.8	1.8	1.7	0.7	0.8	0.8	0.8	0.9	1	1	1.1	1.1	1	0.6	0.4	0	0	0	0	

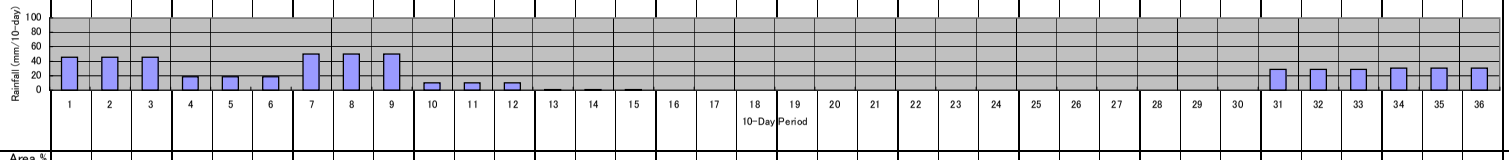


Note; Nursery water requirements of cabbage were estimated as shown below;
Nursery Water Requirements = ETo x 0.7 x Nursery Area (5%) x 10/(86.4 x Irrigation Efficiency 50%/100)
= 4.05 x 0.7 x 0.05 x 10/(86.4 x 0.50) = 0.033 lit/sec/ha (in March)

Table A3-2 (2) **Estimation of Unit Gross Irrigation Water Requirements (GWR) (Field Water Supply : FWS) for Chiwoza Dam Irrigation Scheme (Case : Drought Year)**

Irrigation Scheme : Chioza Irrigation Scheme (Kas-46)
Irrigation Area : 10 ha

Item		Month																																	Remarks
		Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall (Station : Kasungu)																																			Total Rainfall =
Monthly Rainfall (mm/month)		137.2			55.1			150.6			30.0			2.4			0.0			0.0			0.0			0.0			86.4			91.4			553.1
10-day Rainfall (mm/10-day)		45.7	45.7	45.7	18.4	18.4	18.4	50.2	50.2	50.2	10	10	10	0.8	0.8	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28.8	28.8	28.8	30.5	30.5	30.5	
2. Cropping Pattern	Area %																																				
Maize (Grain) (S)	40 %																																				S-Ma-1
Maize (Grain) (S)	40 %																																				S-Ma-1
Maize (Grain) (S)	20 %																																				S-Ma-1
											Nursery																									
Cabbage (W1)	40 %																																				W1-Ca-1
Maize (Green) (W1)	40 %																																				W1-Ma-2
																				Nursery																
Tomato (W2)	40 %																																				W2-To-1
Maize (Green) (W2)	40 %																																				W2-Ma-4
												Nursery																								
PapriKa (W)	20 %																																				W-Pa-1
3. Unit GWR (lit./sec/ha)																																					
Unit GWR (lit/sec/ha)																																					
Maize (Grain) (S)	40 %	0	0.19	0.38	0.41	0.4	0.37	0.34	0.18																									0	0	0	0	S-Ma-1
Maize (Grain) (S)	40 %	0	0.19	0.38	0.41	0.4	0.37	0.34	0.18																									0	0	0	0	S-Ma-1
Maize (Grain) (S)	20 %	0	0.19	0.38	0.41	0.4	0.37	0.34	0.18																									0	0	0	0	S-Ma-1
Cabbage (W1)	40 %									0.03	0.04	0.04	0.64	0.71	0.74	0.85	0.96	1.09	1.15	1.17	1.17																W1-Ca-1
Maize (Green) (W1)	40 %									0	0	0.04	0.46	0.77	1.02	1.23	1.28	1.3	1.31	1.29	1.07																W1-Ma-2
Tomato (W2)	40 %																		0.03	0.04	0.04	0.68	0.69	0.69	0.78	0.94	1.09	1.24	1.29	1.27	1.22	0.87	0.6				W2-To-1
Maize (Green) (W2)	40 %																					0.34	0.34	0.38	0.62	0.88	1.13	1.34	1.35	1.32	1.28	0.88	0.42				W2-Ma-4
PapriKa (W)	20 %										0.04	0.04	0.04	0.04	0.62	0.63	0.64	0.72	0.85	0.99	1.12	1.19	1.2	1.21	1.21	1.16	1.07	1.00	1.00	1.00	1.00							W-Pa-1
Ave. Unit GWR (lit/sec/ha)																																					
Summer Crop (S)		0	0.19	0.38	0.41	0.4	0.37	0.34	0.18																									0	0	0	0	
Winter Crop (W1)										0.01	0.02	0.03	0.44	1.73	0.7	0.83	0.9	0.96	0.98	0.98	0.9																
Winter Crop (W2)																			0.01	0.02	0.02	0.27	0.28	0.28	0.31	0.38	0.44	0.5	0.52	0.51	0.49	0.35	0.24				
Winter Crop (W)											0.01	0.01	0.01	0.01	0.12	0.13	0.13	0.14	0.17	0.2	0.22	0.24	0.24	0.24	0.24	0.23	0.21	0.2	0.2	0.2	0.2						
4. Gross Irrigation Water Requirements (GWR)																																					
(lit/sec)																																					
Summer Crop (S)		0	1.9	3.8	4.1	4	3.7	3.4	1.8																									0	0	0	0	
Winter Crop (W1)										0.1	0.2	0.3	4.4	17.3	7	8.3	9	9.6	9.8	9.8	9																
Winter Crop (W2)																			0.1	0.2	0.2	2.7	2.8	2.8	3.1	3.8	4.4	5	5.2	5.1	4.9	3.5	2.4				
Winter (W)											0.1	0.1	0.1	0.1	1.2	1.3	1.3	1.4	1.7	2	2.2	2.4	2.4	2.4	2.4	2.3	2.1	2	2	2	2						
Total (10 ha)		0	1.9	3.8	4.1	4	3.7	3.4	1.8	0.1	0.3	0.4	4.5	17.4	8.2	9.6	10.3	11	11.6	12	11.4	5.1	5.2	5.2	5.5	6.1	6.5	7	7.2	7.1	6.9	3.5	2.4	0	0	0	0	
Gravity Irrigation (R) (2.7 ha)		0	0.5	1	1.1	1.1	1	0.9	0.5	0	0.1	0.1	1.2	4.7	2.2	2.6	2.8	3	3.1	3.2	3.1	1.4	1.4	1.4	1.5	1.6	1.8	1.9	1.9	1.9	1.9	0.9	0.6	0	0	0	0	
Gravity Irrigation (L) (2.5 ha)		0	0.5	1	1	1	0.9	0.9	0.5	0	0.1	0.1	1.1	4.4	2.1	2.4	2.6	2.8	2.9	3	2.9	1.3	1.3	1.3	1.4	1.5	1.6	1.8	1.8	1.8	1.7	0.9	0.6	0	0	0	0	
Pump Irrigation (R) (3.3 ha)		0	0.6	1.3	1.4	1.3	1.2	1.1	0.6	0	0.1	0.1	1.5	5.7	2.7	3.2	3.4	3.6	3.8	4	3.8	1.7	1.7	1.7	1.8	2	2.1	2.3	2.4	2.3	2.3	1.2	0.8	0	0	0	0	
Pump Irrigation (L) (1.5 ha)		0	0.3	0.5	0.6	0.6	0.6	0.5	0.2	0.1	0	0.1	0.7	2.6	1.2	1.4	1.5	1.6	1.8	1.8	1.6	0.7	0.8	0.8	0.8	1	1	1	1.1	1.1	1	0.5	0.4	0	0	0	0	

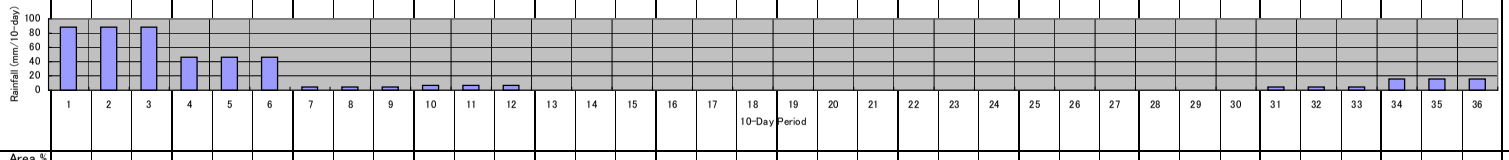


Note; Nursery water requirements of cabbage were estimated as shown below;
Nursery Water Requirements = ETo x 0.7 x Nursery Area (5%) x 10/(86.4 x Irrigation Efficiency 50%/100)
= 4.05 x 0.7 x 0.05 x 10/(86.4 x 0.50) = 0.033 lit/sec/ha (in March)

Table A3-2 (3) **Estimation of Unit Gross Irrigation Water Requirements (GWR) (Field Water Supply : FWS) for Chiwoza Irrigation Scheme (Case : Severe Drought Year)**

Irrigation Scheme : Chioza Irrigation Scheme (Kas-46)
Irrigation Area : 10 ha

Item		Month																																		Remarks
		Jan.			Feb.			Mar.			Apr.			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
1. Rainfall (Station : Kasungu)																																						Total Rainfall =
Monthly Rainfall (mm/month)			264.8			139.3			14.0			20.8			0.0			0.0			0.0			0.0			0.3			13.3			46.7			499.2
10-day Rainfall (mm/10-day)		88.3	88.3	88.3	46.4	46.4	46.4	4.7	4.7	4.7	6.9	6.9	6.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	4.4	4.4	4.4	15.6	15.6	15.6	
2. Cropping Pattern	Area %																																					
Maize (Grain) (S)	40 %																																					S-Ma-1
Maize (Grain) (S)	40 %																																					S-Ma-1
Maize (Grain) (S)	20 %																																					S-Ma-1
Cabbage (W1)	40 %										Nursery																											W1-Ca-1
Maize (Green) (W1)	40 %																																					W1-Ma-2
Tomato (W2)	40 %																		Nursery																			W2-To-1
Maize (Green) (W2)	40 %																																					W2-Ma-4
PapriKa (W)	20 %											Nursery																											W-Pa-1
3. Unit GWR (lit./sec/ha)																																						
Unit GWR (lit/sec/ha)																																						
Maize (Grain) (S)	40 %	0	0	0	0	0.09	0.52	0.96	0.88																									0.27	0.24	0	0	S-Ma-1
Maize (Grain) (S)	40 %	0	0	0	0	0.09	0.52	0.96	0.88																									0.27	0.24	0	0	S-Ma-1
Maize (Grain) (S)	20 %	0	0	0	0	0.09	0.52	0.96	0.88																									0.27	0.24	0	0	S-Ma-1
Cabbage (W1)	40 %									0.03	0.04	0.04	0.59	0.7	0.74	0.85	0.96	1.09	1.15	1.17	1.17																	W1-Ca-1
Maize (Green) (W1)	40 %									0.22	0.14	0.17	0.42	0.75	1.02	1.23	1.28	1.3	1.31	1.29	1.07																	W1-Ma-2
Tomato (W2)	40 %																		0.03	0.04	0.04	0.68	0.69	0.69	0.78	0.94	1.09	1.24	1.29	1.27	1.24	1.21	1.15					W2-To-1
Maize (Green) (W2)	40 %																					0.34	0.34	0.38	0.62	0.88	1.13	1.34	1.35	1.32	1.29	1.22	0.97					W2-Ma-4
PapriKa (W)	20 %										0.04	0.04	0.04	0.04	0.62	0.63	0.64	0.72	0.85	0.99	1.12	1.19	1.2	1.21	1.21	1.16	1.07	1.00	1.00	1.00	1.00							W-Pa-1
Ave. Unit GWR (lit/sec/ha)																																						
Summer Crop (S)		0	0	0	0	0.09	0.52	0.96	0.88																									0.27	0.24	0	0	
Winter Crop (W1)										0.1	0.07	0.08	0.4	0.58	0.7	0.83	0.9	0.96	0.98	0.98	0.9																	
Winter Crop (W2)																			0.01	0.02	0.02	0.27	0.28	0.28	0.31	0.38	0.44	0.5	0.52	0.51	0.5	0.48	0.46					
Winter Crop (W)											0.01	0.01	0.01	0.01	0.12	0.13	0.13	0.14	0.17	0.2	0.22	0.24	0.24	0.24	0.24	0.23	0.21	0.2	0.2	0.2	0.2							
4. Gross Irrigation Water Requirements (GWR)																																						
(lit/sec)																																						
Summer Crop (S)		0	0	0	0	0.9	5.2	9.6	8.8																									2.7	2.4	0	0	
Winter Crop (W1)										1	0.7	0.8	4	5.8	7	8.3	9	9.6	9.8	9.8	9																	
Winter Crop (W2)																			0.1	0.2	0.2	2.7	2.8	2.8	3.1	3.8	4.4	5	5.2	5.1	5	4.8	4.6					
Winter (W)											0.1	0.1	0.1	0.1	1.2	1.3	1.3	1.4	1.7	2	2.2	2.4	2.4	2.4	2.4	2.3	2.1	2	2	2	2							
Total (10 ha)		0	0	0	0	0.9	5.2	9.6	8.8	1	0.8	0.9	4.1	5.9	8.2	9.6	10.3	11	11.6	12	11.4	5.1	5.2	5.2	5.5	6.1	6.5	7	7.2	7.1	7	4.8	4.6	2.7	2.4	0	0	
Gravity Irrigation (R) (2.7 ha)		0	0	0	0	0.2	1.4	2.6	2.4	0.3	0.2	0.2	1.1	1.6	2.2	2.6	2.8	3	3.1	3.2	3.1	1.4	1.4	1.4	1.5	1.6	1.8	1.9	1.9	1.9	1.9	1.3	1.2	0.7	0.6	0	0	
Gravity Irrigation (L) (2.5 ha)		0	0	0	0	0.2	1.3	2.4	2.2	0.3	0.2	0.2	1	1.5	2.1	2.4	2.6	2.8	2.9	3	2.9	1.3	1.3	1.3	1.4	1.5	1.6	1.8	1.8	1.8	1.8	1.2	1.2	0.7	0.6	0	0	
Pump Irrigation (R) (3.3 ha)		0	0	0	0	0.3	1.7	3.2	2.9	0.3	0.3	0.3	1.4	1.9	2.7	3.2	3.4	3.6	3.8	4	3.8	1.7	1.7	1.7	1.8	2	2.1	2.3	2.4	2.3	2.3	1.6	1.5	0.9	0.8	0	0	
Pump Irrigation (L) (1.5 ha)		0	0	0	0	0.2	0.8	1.4	1.3	0.1	0.1	0.2	0.6	0.9	1.2	1.4	1.5	1.6	1.8	1.8	1.6	0.7	0.8	0.8	0.8	1	1	1	1.1	1.1	1	0.7	0.7	0.4	0.4	0	0	

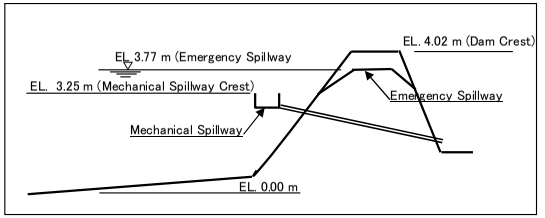


Note; Nursery water requirements of cabbage were estimated as shown below;
Nursery Water Requirements = ETo x 0.7 x Nursery Area (5%) x 10/(86.4 x Irrigation Efficiency 50%/100)
= 4.05 x 0.7 x 0.05 x 10/(86.4 x 0.50) = 0.033 lit/sec/ha (in March)

Table A3-3 (1) Reservoir Operation Study on Chiwoza Dam (Case : Normal Year)

Case : Normal Year
Total Irrigable Area : 10 ha
Cropping Area (Summer) : 10 ha
(Winter-1) : 8 ha
(Winter-2) : 8 ha
(Winter) : 2 ha
Ration of Winter Cropping: 46 %
Catchment Area : 2.4 sq.km
Initial Reservoir Capacity : 47 1,000 m^3

Section Area of Mechanical Spillway (A) : 1.5 sq.m
Width of Emergency Spillway (B) : 10 m
Crest Elevation of Machanical Spillway : 3.25 m
Crest Elevation of Emergency Spillway : 3.77 m



Month		Inflow Discharge to Reservoir			Reservoir Conditions						Outflow Discharges from Reservoir and Reservoir Water Losses															
					Assumed Reservoir Conditions			Final Reservoir Conditions			Irrigation Water Supply										Outflow from Spillway		Reservoir Water Losses				Total Outflow from Reservoir
											Irrigation Area				Average Unit GWR				Total Irrigation Water Requirements		Mechanical	Emergency	5-Day Evaporation from Water Surface		Reservoir Loss	Total Loss	
		5-Day Rainfall	Runoff Coefficient	Inflow	Storage Capacity	Water Depth	Water Surface Area	Storage Capacity	Water Depth	Water Surface Area	Summer	Winter-1	Winter-2	Winter	Summer	Winter-1	Winter-2	Winter									
		R (mm)	F (%)	Qin (1,000 m3)	V (1,000 m3)	H (m)	WA (1,000 m2)	V (1,000 m3)	H (m)	WA (1,000 m2)	A1 (ha)	A2 (ha)	A3 (ha)	A4 (ha)	qi1 (lit/sec/ha)	qi2 (lit/sec/ha)	qi3 (lit/sec/ha)	qi4 (lit/sec/ha)	Σqi (lit/sec)	Qi (1,000m3)	Qom (1,000m3)	Qoe (1,000m3)	ETo (mm)	V_{ETo} (1,000 m3)	Rlo (1,000 m3)	Qrl (1,000m3)	ΣQo (1,000 m3)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)				(11)				(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Mar.	4							47	3.25	33.44																
	5	20.7	60	29.8	76.8	4.07	33.92	47	3.25	33.44		3.68				0.01			0.0368	0	227.8	0	20.3	0.7	0.5	1.2	229
	6	20.7	60	29.8	76.8	4.07	33.92	47	3.25	33.44		3.68				0.01			0.0368	0	227.8	0	20.3	0.7	0.5	1.2	229
Apr.	1	3	60	4.3	51.3	3.38	33.73	47	3.25	33.44		3.68		0.92		0.02		0.01	0.0828	0	90.7	0	23.7	0.8	0.5	1.3	92
	2	3	60	4.3	51.3	3.38	33.73	47	3.25	33.44		3.68		0.92		0.02		0.01	0.0828	0	90.7	0	23.7	0.8	0.5	1.3	92
	3	3	60	4.3	51.3	3.38	33.73	47	3.25	33.44		3.68		0.92		0.1		0.01	0.3772	0.2	90.7	0	23.7	0.8	0.5	1.3	92.2
	4	3	60	4.3	51.3	3.38	33.73	47	3.25	33.44		3.68		0.92		0.1		0.01	0.3772	0.2	90.7	0	23.7	0.8	0.5	1.3	92.2
	5	3	60	4.3	51.3	3.38	33.73	47	3.25	33.44		3.68		0.92		0.49		0.01	1.8124	0.8	90.7	0	23.7	0.8	0.5	1.3	92.8
	6	3	60	4.3	51.3	3.38	33.73	47	3.25	33.44		3.68		0.92		0.49		0.01	1.8124	0.8	90.7	0	23.7	0.8	0.5	1.3	92.8
May	1	1.3	60	1.9	48.9	3.3	33.56	47	3.25	33.44		3.68		0.92		1.68		0.01	6.1916	2.7	56.2	0	23.6	0.8	0.5	1.3	60.2
	2	1.3	60	1.9	48.9	3.3	33.56	47	3.25	33.44		3.68		0.92		1.68		0.01	6.1916	2.7	56.2	0	23.6	0.8	0.5	1.3	60.2
	3	1.3	60	1.9	48.9	3.3	33.56	47	3.25	33.44		3.68		0.92		0.7		0.12	2.6864	1.2	56.2	0	23.6	0.8	0.5	1.3	58.7
	4	1.3	60	1.9	48.9	3.3	33.56	47	3.25	33.44		3.68		0.92		0.7		0.12	2.6864	1.2	56.2	0	23.6	0.8	0.5	1.3	58.7
	5	1.3	60	1.9	48.9	3.3	33.56	47	3.25	33.44		3.68		0.92		0.83		0.13	3.174	1.4	56.2	0	23.6	0.8	0.5	1.3	58.9
	6	1.3	60	1.9	48.9	3.3	33.56	47	3.25	33.44		3.68		0.92		0.83		0.13	3.174	1.4	56.2	0	23.6	0.8	0.5	1.3	58.9
June	1	0	60	0	47	3.24	33.41	44.3	3.15	33.16		3.68		0.92		0.9		0.13	3.4316	1.5	0	0	22.1	0.7	0.5	1.2	2.7
	2	0	60	0	44.3	3.15	33.16	41.7	3.07	32.9		3.68		0.92		0.9		0.13	3.4316	1.5	0	0	22.1	0.7	0.4	1.1	2.6
	3	0	60	0	41.7	3.07	32.9	39	2.97	32.53		3.68		0.92		0.96		0.14	3.6616	1.6	0	0	22.1	0.7	0.4	1.1	2.7
	4	0	60	0	39	2.97	32.53	36.3	2.88	32.16		3.68		0.92		0.96		0.14	3.6616	1.6	0	0	22.1	0.7	0.4	1.1	2.7
	5	0	60	0	36.3	2.88	32.16	33.4	2.77	31.65		3.68	3.68	0.92		0.98	0.1	0.17	4.1308	1.8	0	0	22.1	0.7	0.4	1.1	2.9
	6	0	60	0	33.4	2.77	31.65	30.6	2.66	31.08		3.68	3.68	0.92		0.98	0.1	0.17	4.1308	1.8	0	0	22.1	0.7	0.3	1	2.8
July	1	0	60	0	30.6	2.66	31.08	27.6	2.54	30.39		3.68	3.68	0.92		0.98	0.2	0.2	4.5264	2	0	0	23	0.7	0.3	1	3
	2	0	60	0	27.6	2.54	30.39	24.6	2.41	29.57		3.68	3.68	0.92		0.98	0.2	0.2	4.5264	2	0	0	23	0.7	0.3	1	3
	3	0	60	0	24.6	2.41	29.57	21.9	2.29	28.74		3.68	3.68	0.92		0.9	0.2	0.2	4.232	1.8	0	0	23	0.7	0.2	0.9	2.7
	4	0	60	0	21.9	2.29	28.74	19.2	2.15	27.68		3.68	3.68	0.92		0.9	0.2	0.2	4.232	1.8	0	0	23	0.7	0.2	0.9	2.7
	5	0	60	0	19.2	2.15	27.68	17.9	2.09	27.2			3.68	0.92			0.27	0.24	1.2144	0.5	0	0	23	0.6	0.2	0.8	1.3
	6	0	60	0	17.9	2.09	27.2	16.6	2.02	26.61			3.68	0.92			0.27	0.24	1.2144	0.5	0	0	23	0.6	0.2	0.8	1.3
Aug.	1	0	60	0	16.6	2.02	26.61	15.3	1.94	25.92			3.68	0.92			0.28	0.24	1.2512	0.5	0	0	22.6	0.6	0.2	0.8	1.3
	2	0	60	0	15.3	1.94	25.92	14	1.87	25.28			3.68	0.92			0.28	0.24	1.2512	0.5	0	0	22.6	0.6	0.2	0.8	1.3
	3	0	60	0	14	1.87	25.28	12.8	1.79	24.52			3.68	0.92			0.28	0.24	1.2512	0.5	0	0	22.6	0.6	0.1	0.7	1.2
	4	0	60	0	12.8	1.79	24.52	11.6	1.72	23.84			3.68	0.92			0.28	0.24	1.2512	0.5	0	0	22.6	0.6	0.1	0.7	1.2
	5	0	60	0	11.6	1.72	23.84	10.4	1.64	23.02			3.68	0.92			0.31	0.24	1.3616	0.6	0	0	22.6	0.5	0.1	0.6	1.2
	6	0	60	0	10.4	1.64	23.02	9.2	1.55	22.07			3.68	0.92			0.31	0.24	1.3616	0.6	0	0	22.6	0.5	0.1	0.6	1.2
Sept.	1	0	60	0	9.2	1.55	22.07	7.8	1.44	20.85			3.68	0.92			0.38	0.22	1.6008	0.7	0	0	26.2	0.6	0.1	0.7	1.4
	2	0	60	0	7.8	1.44	20.85	6.5	1.32	19.46			3.68	0.92			0.38	0.22	1.6008	0.7	0	0	26.2	0.5	0.1	0.6	1.3
	3	0	60	0	6.5	1.32	19.46	5.1	1.19	17.87			3.68	0.92			0.44	0.21	1.8124	0.8	0	0	26.2	0.5	0.1	0.6	1.4
	4	0	60	0	5.1	1.19	17.87	3.7	1.02	15.67			3.68	0.92			0.44	0.21	1.8124	0.8	0	0	26.2	0.5	0.1	0.6	1.4
	5	0	60	0	3.7	1.02	15.67	2.4	0.83	13.04			3.68	0.92			0.5	0.2	2.024	0.9	0	0	26.2	0.4	0	0.4	1.3
	6	0	60	0	2.4	0.83	13.04	1.2	0.52	8.38			3.68	0.92			0.5	0.2	2.024	0.9	0	0	26.2	0.3	0	0.3	1.2

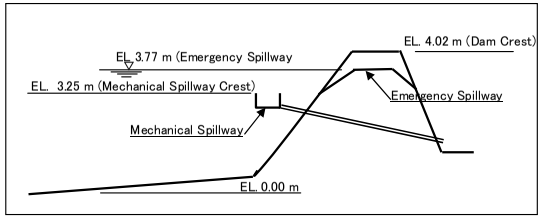
Month		Inflow Discharge to Reservoir			Reservoir Conditions						Outflow Discharges from Reservoir and Reservoir Water Losses															
					Assumed Reservoir Conditions			Final Reservoir Conditions			Irrigation Water Supply									Outflow from Spillway		Reservoir Water Losses				Total Outflow from Reservoir
		5-Day Rainfall	Runoff Coefficient	Inflow	Storage Capacity	Water Depth	Water Surface Area	Storage Capacity	Water Depth	Water Surface Area	Irrigation Area				Average Unit GWR				Total Irrigation Water Requirements		Mechanical	Emergency	5-Day Evaporation from Water Surface	Reservoir Loss	Total Loss	
											Summer	Winter-1	Winter-2	Winter	Summer	Winter-1	Winter-2	Winter								
		R (mm)	F (%)	Qin (1,000 m3)	V (1,000 m3)	H (m)	WA (1,000 m2)	V (1,000 m3)	H (m)	WA (1,000 m2)	A1 (ha)	A2 (ha)	A3 (ha)	A4 (ha)	qi1 (lit/sec/ha)	qi2 (lit/sec/ha)	qi3 (lit/sec/ha)	qi4 (lit/sec/ha)	Σqi (lit/sec)	Qi (1,000m3)	Qom (1,000m3)	Qoe (1,000m3)	ETo (mm)	V_{ETo} (1,000 m3)	Rlo (1,000 m3)	Qrl (1,000m3)	ΣQo (1,000 m3)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)				(11)				(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Oct.	1	1.6	60	2.3	3.5	1	15.4	2.4	0.83	13.04			3.68	0.92			0.52	0.2	2.0976	0.9	0	0	25.8	0.2	0	0.2	1.1
	2	1.6	60	2.3	4.7	1.14	17.24	3.5	1	15.4			3.68	0.92			0.52	0.2	2.0976	0.9	0	0	25.8	0.3	0	0.3	1.2
	3	1.6	60	2.3	5.8	1.26	18.73	4.5	1.12	16.98			3.68	0.92			0.51	0.2	2.0608	0.9	0	0	25.8	0.4	0	0.4	1.3
	4	1.6	60	2.3	6.8	1.35	19.81	5.5	1.23	18.37			3.68	0.92			0.51	0.2	2.0608	0.9	0	0	25.8	0.4	0	0.4	1.3
	5	1.6	60	2.3	7.8	1.44	20.85	6.3	1.31	19.34			3.68	0.92			0.49	0.2	1.9872	0.9	0	0	25.8	0.5	0.1	0.6	1.5
	6	1.6	60	2.3	8.6	1.5	21.53	7.1	1.38	20.16			3.68	0.92			0.49	0.2	1.9872	0.9	0	0	25.8	0.5	0.1	0.6	1.5
Nov.	1	11.3	60	16.3	23.4	2.36	29.23	22.1	2.3	28.81			3.68				0.42		1.5456	0.7	0	0	22.5	0.5	0.1	0.6	1.3
	2	11.3	60	16.3	38.4	2.95	32.45	36.9	2.9	32.24			3.68				0.42		1.5456	0.7	0	0	22.5	0.6	0.2	0.8	1.5
	3	11.3	60	16.3	53.2	3.43	33.82	51.6	3.25	33.44			3.68				0.3		1.104	0.5	0	0	22.5	0.7	0.4	1.1	1.6
	4	11.3	60	16.3	67.9	3.85	34.11	47	3.25	33.44			3.68				0.3		1.104	0.5	194.8	0	22.5	0.8	0.5	1.3	196.6
	5	11.3	60	16.3	63.3	3.72	34.11	47	3.25	33.44	10				0				0	0	172.4	0	22.5	0.8	0.5	1.3	173.7
	6	11.3	60	16.3	63.3	3.72	34.11	47	3.25	33.44	10				0				0	0	172.4	0	22.5	0.8	0.5	1.3	173.7
Dec.	1	31.6	60	45.5	92.5	4.45	33.03	47	3.25	33.44	10				0				0	0	275.5	33.2	16.8	0.6	0.5	1.1	309.8
	2	31.6	60	45.5	92.5	4.45	33.03	47	3.25	33.44	10				0				0	0	275.5	33.2	16.8	0.6	0.5	1.1	309.8
	3	31.6	60	45.5	92.5	4.45	33.03	47	3.25	33.44	10				0				0	0	275.5	33.2	16.8	0.6	0.5	1.1	309.8
	4	31.6	60	45.5	92.5	4.45	33.03	47	3.25	33.44	10				0				0	0	275.5	33.2	16.8	0.6	0.5	1.1	309.8
	5	31.6	60	45.5	92.5	4.45	33.03	47	3.25	33.44	10				0				0	0	275.5	33.2	16.8	0.6	0.5	1.1	309.8
	6	31.6	60	45.5	92.5	4.45	33.03	47	3.25	33.44	10				0				0	0	275.5	33.2	16.8	0.6	0.5	1.1	309.8
Jan.	1	34.7	60	50	97	4.55	32.68	47	3.25	33.44	10				0				0	0	286.8	68.8	15.2	0.5	0.5	1	356.6
	2	34.7	60	50	97	4.55	32.68	47	3.25	33.44	10				0				0	0	286.8	68.8	15.2	0.5	0.5	1	356.6
	3	34.7	60	50	97	4.55	32.68	47	3.25	33.44	10				0				0	0	286.8	68.8	15.2	0.5	0.5	1	356.6
	4	34.7	60	50	97	4.55	32.68	47	3.25	33.44	10				0				0	0	286.8	68.8	15.2	0.5	0.5	1	356.6
	5	34.7	60	50	97	4.55	32.68	47	3.25	33.44	10				0				0	0	286.8	68.8	15.2	0.5	0.5	1	356.6
	6	34.7	60	50	97	4.55	32.68	47	3.25	33.44	10				0				0	0	286.8	68.8	15.2	0.5	0.5	1	356.6
Feb.	1	38.8	60	55.9	102.9	4.67	32.2	47	3.25	33.44	10				0				0	0	299.7	121.6	17.1	0.6	0.5	1.1	422.4
	2	38.8	60	55.9	102.9	4.67	32.2	47	3.25	33.44	10				0				0	0	299.7	121.6	17.1	0.6	0.5	1.1	422.4
	3	38.8	60	55.9	102.9	4.67	32.2	47	3.25	33.44	10				0				0	0	299.7	121.6	17.1	0.6	0.5	1.1	422.4
	4	38.8	60	55.9	102.9	4.67	32.2	47	3.25	33.44	10				0				0	0	299.7	121.6	17.1	0.6	0.5	1.1	422.4
	5	38.8	60	55.9	102.9	4.67	32.2	47	3.25	33.44	10				0				0	0	299.7	121.6	17.1	0.6	0.5	1.1	422.4
	6	38.8	60	55.9	102.9	4.67	32.2	47	3.25	33.44	10				0				0	0	299.7	121.6	17.1	0.6	0.5	1.1	422.4
Mar.	1	20.7	60	29.8	76.8	4.07	33.92	47	3.25	33.44	10				0.09				0.9	0.4	227.8	0	20.3	0.7	0.5	1.2	229.4
	2	20.7	60	29.8	76.8	4.07	33.92	47	3.25	33.44	10				0.09				0.9	0.4	227.8	0	20.3	0.7	0.5	1.2	229.4
	3	20.7	60	29.8	76.8	4.07	33.92	47	3.25	33.44	10				0.1				1	0.4	227.8	0	20.3	0.7	0.5	1.2	229.4
	4	20.7	60	29.8	76.8	4.07	33.92	47	3.25	33.44	10				0.1				1	0.4	227.8	0	20.3	0.7	0.5	1.2	229.4
	5																										
	6																										
Total		858		1,236																48	7,960	1,342		45	25	70	9,420

Note:
(1) Refer to Table A3-2(1). Probable rainfall is given in Figure 4-7 in Appendix 4.
(2) Runoff coefficient was assumed at 60 %, considering the undulating topography with farm and brush land
(3) Inflow Qin = 24 R x F/1,000 (1,000m^3), 5-day rainfall less than 1.0 mm is assummed to be zero.
(7) Final storage capacity $V = V_{n-1} - \Sigma Q + Qin$ (1,000 m^3)
(8) Reservoir water depth (H) is obtained from reservoir stage (H) - capacity (V) curve. $Y = 5.3475\ X^2 - 3.2703\ X + 1.455$
(9) Water surface area (WA) is obtained from reservoir stage (H) - area (A) curve. $Y = -2.4217X^2 + 18.31\ X - 0.4911$
(10) Refer to Table A3-2(1).
(11) Refer to Table A3-2 (1).
(12) Total irrigation water requirement (Σqi) = $\Sigma(A_1 \times q_{i1} + A_2 \times q_{i2} + A_3 \times q_{i3} + A_4 \times q_{i4})$ (lit/sec)
(13) Total irrigation water requirement (Q_i) = 0.432 x Σq_i (1,000 m^3)
(14) Outflow from mechanical spillway (Qom) is calculated based on the following equation; $Qom = Cx\ A\ \sqrt{(2gH)}/1{,}000$ (1,000 m^3) C = 0.62, A = section area of mechanical spillway (m^2)
(15) Outflow from emergency spillway (Qoe) is calculated based on the following equation; $Qoe = K \times B \times H^{3/2}/1{,}000$ (1,000 m3) K = 1.7, B = width of emergency spillway (m)
(16) Evaporation from water surface (ETo) is referred to Table A2-4(7).
(17) 5-Day evaporation from water surface (V_{ETo}) = ETo x WA_{n-1}/1000 (1,000m^3)
(18) Reservoir loss (Rlo) is assumed at one percent of the storage capacity (V_{n-1}) $R_{lo} = V_{n-1} \times 1/100$ (1,000 m^3)
(19) Total loss (Qrl) = $V_{ETo} + R_{lo}$ (1,000 m^3)
(20) Total outflow (ΣQo) = Qi + Qom + Qoe +Qrl (1,000 m^3)

Table A3-3 (2) Reservoir Operation Study on Chiwoza Dam (Case : Drought Year)

Case : Drought Year
Total Irrigable Area : 10 ha
Cropping Area (Summer) : 10 ha
(Winter-1) : 8 ha
(Winter-2) : 8 ha
(Winter) : 2 ha
Ration of Winter Cropping: 18 %
Catchment Area : 2.4 sq.km
Initial Reservoir Capacity : 47 1,000 m^3

Section Area of Mechanical Spillway (A) : 1.5 sq.m
Width of Emergency Spillway (B) : 10 m
Crest Elevation of Machanical Spillway : 3.25 m
Crest Elevation of Emergency Spillway : 3.77 m



Month		Inflow Discharge to Reservoir			Reservoir Conditions						Outflow Discharges from Reservoir and Reservoir Water Losses																
					Assumed Reservoir Conditions			Final Reservoir Conditions			Irrigation Water Supply										Outflow from Spillway		Reservoir Water Losses				Total Outflow from Reservoir
		5-Day Rainfall	Runoff Coefficient	Inflow	Storage Capacity	Water Depth	Water Surface Area	Storage Capacity	Water Depth	Water Surface Area	Irrigation Area				Average Unit GWR				Total Irrigation Water Requirements		Mechanical	Emergency	5-Day Evaporation from Water Surface		Reservoir Loss	Total Loss	
											Summer	Winter-1	Winter-2	Winter	Summer	Winter-1	Winter-2	Winter									
		R (mm)	F (%)	Qin (1,000 m3)	V (1,000 m3)	H (m)	WA (1,000 m2)	V (1,000 m3)	H (m)	WA (1,000 m2)	A1 (ha)	A2 (ha)	A3 (ha)	A4 (ha)	qi1 (lit/sec/ha)	qi2 (lit/sec/ha)	qi3 (lit/sec/ha)	qi4 (lit/sec/ha)	Σqi (lit/sec)	Qi (1,000m3)	Qom (1,000m3)	Qoe (1,000m3)	ETo (mm)	V_{ETo} (1,000 m3)	Rlo (1,000 m3)	Qrl (1,000m3)	ΣQo (1,000 m3)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)				(11)				(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Mar.	4							47	3.25	33.44																
	5	25.1	60	36.1	83.1	4.23	33.63	47	3.25	33.44		1.44				0.01			0.0144	0	249	0	20.3	0.7	0.5	1.2	250.2
	6	25.1	60	36.1	83.1	4.23	33.63	47	3.25	33.44		1.44				0.01			0.0144	0	249	0	20.3	0.7	0.5	1.2	250.2
Apr.	1	5	60	7.2	54.2	3.46	33.87	47	3.25	33.44		1.44		0.36		0.02		0.01	0.0324	0	115.3	0	23.7	0.8	0.5	1.3	116.6
	2	5	60	7.2	54.2	3.46	33.87	47	3.25	33.44		1.44		0.36		0.02		0.01	0.0324	0	115.3	0	23.7	0.8	0.5	1.3	116.6
	3	5	60	7.2	54.2	3.46	33.87	47	3.25	33.44		1.44		0.36		0.03		0.01	0.0468	0	115.3	0	23.7	0.8	0.5	1.3	116.6
	4	5	60	7.2	54.2	3.46	33.87	47	3.25	33.44		1.44		0.36		0.03		0.01	0.0468	0	115.3	0	23.7	0.8	0.5	1.3	116.6
	5	5	60	7.2	54.2	3.46	33.87	47	3.25	33.44		1.44		0.36		0.44		0.01	0.6372	0.3	115.3	0	23.7	0.8	0.5	1.3	116.9
	6	5	60	7.2	54.2	3.46	33.87	47	3.25	33.44		1.44		0.36		0.44		0.01	0.6372	0.3	115.3	0	23.7	0.8	0.5	1.3	116.9
May	1	0.4	60	0	47	3.24	33.41	44.6	3.16	33.19		1.44		0.36		1.73		0.01	2.4948	1.1	0	0	23.6	0.8	0.5	1.3	2.4
	2	0.4	60	0	44.6	3.16	33.19	42.3	3.09	32.96		1.44		0.36		1.73		0.01	2.4948	1.1	0	0	23.6	0.8	0.4	1.2	2.3
	3	0.4	60	0	42.3	3.09	32.96	40.6	3.03	32.75		1.44		0.36		0.7		0.12	1.0512	0.5	0	0	23.6	0.8	0.4	1.2	1.7
	4	0.4	60	0	40.6	3.03	32.75	38.9	2.97	32.53		1.44		0.36		0.7		0.12	1.0512	0.5	0	0	23.6	0.8	0.4	1.2	1.7
	5	0.4	60	0	38.9	2.97	32.53	37.2	2.91	32.28		1.44		0.36		0.83		0.13	1.242	0.5	0	0	23.6	0.8	0.4	1.2	1.7
	6	0.4	60	0	37.2	2.91	32.28	35.5	2.85	32.02		1.44		0.36		0.83		0.13	1.242	0.5	0	0	23.6	0.8	0.4	1.2	1.7
June	1	0	60	0	35.5	2.85	32.02	33.8	2.79	31.74		1.44		0.36		0.9		0.13	1.3428	0.6	0	0	22.1	0.7	0.4	1.1	1.7
	2	0	60	0	33.8	2.79	31.74	32.2	2.72	31.4		1.44		0.36		0.9		0.13	1.3428	0.6	0	0	22.1	0.7	0.3	1	1.6
	3	0	60	0	32.2	2.72	31.4	30.6	2.66	31.08		1.44		0.36		0.96		0.14	1.4328	0.6	0	0	22.1	0.7	0.3	1	1.6
	4	0	60	0	30.6	2.66	31.08	29	2.6	30.74		1.44		0.36		0.96		0.14	1.4328	0.6	0	0	22.1	0.7	0.3	1	1.6
	5	0	60	0	29	2.6	30.74	27.4	2.53	30.33		1.44	1.44	0.36		0.98	0.01	0.17	1.4868	0.6	0	0	22.1	0.7	0.3	1	1.6
	6	0	60	0	27.4	2.53	30.33	25.8	2.46	29.9		1.44	1.44	0.36		0.98	0.01	0.17	1.4868	0.6	0	0	22.1	0.7	0.3	1	1.6
July	1	0	60	0	25.8	2.46	29.9	24.1	2.39	29.44		1.44	1.44	0.36		0.98	0.02	0.2	1.512	0.7	0	0	23	0.7	0.3	1	1.7
	2	0	60	0	24.1	2.39	29.44	22.5	2.31	28.88		1.44	1.44	0.36		0.98	0.02	0.2	1.512	0.7	0	0	23	0.7	0.2	0.9	1.6
	3	0	60	0	22.5	2.31	28.88	21	2.24	28.37		1.44	1.44	0.36		0.9	0.02	0.22	1.404	0.6	0	0	23	0.7	0.2	0.9	1.5
	4	0	60	0	21	2.24	28.37	19.5	2.17	27.84		1.44	1.44	0.36		0.9	0.02	0.22	1.404	0.6	0	0	23	0.7	0.2	0.9	1.5
	5	0	60	0	19.5	2.17	27.84	18.5	2.12	27.44			1.44	0.36			0.27	0.24	0.4752	0.2	0	0	23	0.6	0.2	0.8	1
	6	0	60	0	18.5	2.12	27.44	17.5	2.07	27.03			1.44	0.36			0.27	0.24	0.4752	0.2	0	0	23	0.6	0.2	0.8	1
Aug.	1	0	60	0	17.5	2.07	27.03	16.5	2.01	26.53			1.44	0.36			0.28	0.24	0.4896	0.2	0	0	22.6	0.6	0.2	0.8	1
	2	0	60	0	16.5	2.01	26.53	15.5	1.96	26.09			1.44	0.36			0.28	0.24	0.4896	0.2	0	0	22.6	0.6	0.2	0.8	1
	3	0	60	0	15.5	1.96	26.09	14.5	1.9	25.56			1.44	0.36			0.28	0.24	0.4896	0.2	0	0	22.6	0.6	0.2	0.8	1
	4	0	60	0	14.5	1.9	25.56	13.6	1.84	25			1.44	0.36			0.28	0.24	0.4896	0.2	0	0	22.6	0.6	0.1	0.7	0.9
	5	0	60	0	13.6	1.84	25	12.7	1.79	24.52			1.44	0.36			0.31	0.24	0.5328	0.2	0	0	22.6	0.6	0.1	0.7	0.9
	6	0	60	0	12.7	1.79	24.52	11.8	1.73	23.94			1.44	0.36			0.31	0.24	0.5328	0.2	0	0	22.6	0.6	0.1	0.7	0.9
Sept.	1	0	60	0	11.8	1.73	23.94	10.8	1.66	23.23			1.44	0.36			0.38	0.23	0.63	0.3	0	0	26.2	0.6	0.1	0.7	1
	2	0	60	0	10.8	1.66	23.23	9.8	1.59	22.5			1.44	0.36			0.38	0.23	0.63	0.3	0	0	26.2	0.6	0.1	0.7	1
	3	0	60	0	9.8	1.59	22.5	8.8	1.52	21.75			1.44	0.36			0.44	0.21	0.7092	0.3	0	0	26.2	0.6	0.1	0.7	1
	4	0	60	0	8.8	1.52	21.75	7.8	1.44	20.85			1.44	0.36			0.44	0.21	0.7092	0.3	0	0	26.2	0.6	0.1	0.7	1
	5	0	60	0	7.8	1.44	20.85	6.9	1.36	19.93			1.44	0.36			0.5	0.2	0.792	0.3	0	0	26.2	0.5	0.1	0.6	0.9
	6	0	60	0	6.9	1.36	19.93	6	1.28	18.98			1.44	0.36			0.5	0.2	0.792	0.3	0	0	26.2	0.5	0.1	0.6	0.9

Month		Inflow Discharge to Reservoir			Reservoir Conditions						Outflow Discharges from Reservoir and Reservoir Water Losses															
					Assumed Reservoir Conditions			Final Reservoir Conditions			Irrigation Water Supply										Outflow from Spillway		Reservoir Water Losses				Total Outflow from Reservoir
		5-Day Rainfall	Runoff Coefficient	Inflow	Storage Capacity	Water Depth	Water Surface Area	Storage Capacity	Water Depth	Water Surface Area	Irrigation Area				Average Unit GWR				Total Irrigation Water Requirements		Mechanical	Emergency	5-Day Evaporation from Water Surface	Reservoir Loss	Total Loss	
											Summer	Winter-1	Winter-2	Winter	Summer	Winter-1	Winter-2	Winter								
		R (mm)	F (%)	Qin (1,000 m3)	V (1,000 m3)	H (m)	WA (1,000 m2)	V (1,000 m3)	H (m)	WA (1,000 m2)	A1 (ha)	A2 (ha)	A3 (ha)	A4 (ha)	qi1 (lit/sec/ha)	qi2 (lit/sec/ha)	qi3 (lit/sec/ha)	qi4 (lit/sec/ha)	Σqi (lit/sec)	Qi (1,000m3)	Qom (1,000m3)	Qoe (1,000m3)	ETo (mm)	V_{ETo} (1,000 m3)	Rlo (1,000 m3)	Qrl (1,000m3)	ΣQo (1,000 m3)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)				(11)				(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Oct.	1	0	60	0	6	1.28	18.98	5	1.18	17.74			1.44	0.36			0.52	0.2	0.8208	0.4	0	0	25.8	0.5	0.1	0.6	1
	2	0	60	0	5	1.18	17.74	4.1	1.07	16.33			1.44	0.36			0.52	0.2	0.8208	0.4	0	0	25.8	0.5	0	0.5	0.9
	3	0	60	0	4.1	1.07	16.33	3.4	0.98	15.13			1.44	0.36			0.51	0.2	0.8064	0.3	0	0	25.8	0.4	0	0.4	0.7
	4	0	60	0	3.4	0.98	15.13	2.7	0.88	13.75			1.44	0.36			0.51	0.2	0.8064	0.3	0	0	25.8	0.4	0	0.4	0.7
	5	0	60	0	2.7	0.88	13.75	2	0.75	11.88			1.44	0.36			0.49	0.2	0.7776	0.3	0	0	25.8	0.4	0	0.4	0.7
	6	0	60	0	2	0.75	11.88	1.4	0.59	9.47			1.44	0.36			0.49	0.2	0.7776	0.3	0	0	25.8	0.3	0	0.3	0.6
Nov.	1	14.4	60	20.7	22.1	2.3	28.81	21.7	2.28	28.67			1.44				0.35		0.504	0.2	0	0	22.5	0.2	0	0.2	0.4
	2	14.4	60	20.7	42.4	3.09	32.96	41.4	3.06	32.86			1.44				0.35		0.504	0.2	0	0	22.5	0.6	0.2	0.8	1
	3	14.4	60	20.7	62.1	3.69	34.1	47	3.25	33.44			1.44				0.24		0.3456	0.1	125.8	0	22.5	0.7	0.4	1.1	127
	4	14.4	60	20.7	67.7	3.84	34.11	47	3.25	33.44			1.44				0.24		0.3456	0.1	193.2	0	22.5	0.8	0.5	1.3	194.6
	5	14.4	60	20.7	67.7	3.84	34.11	47	3.25	33.44	10				0				0	0	193.2	0	22.5	0.8	0.5	1.3	194.5
	6	14.4	60	20.7	67.7	3.84	34.11	47	3.25	33.44	10				0				0	0	193.2	0	22.5	0.8	0.5	1.3	194.5
Dec.	1	15.2	60	21.9	68.9	3.87	34.1	47	3.25	33.44	10				0				0	0	198.1	0	16.8	0.6	0.5	1.1	199.2
	2	15.2	60	21.9	68.9	3.87	34.1	47	3.25	33.44	10				0				0	0	198.1	0	16.8	0.6	0.5	1.1	199.2
	3	15.2	60	21.9	68.9	3.87	34.1	47	3.25	33.44	10				0				0	0	198.1	0	16.8	0.6	0.5	1.1	199.2
	4	15.2	60	21.9	68.9	3.87	34.1	47	3.25	33.44	10				0				0	0	198.1	0	16.8	0.6	0.5	1.1	199.2
	5	15.2	60	21.9	68.9	3.87	34.1	47	3.25	33.44	10				0				0	0	198.1	0	16.8	0.6	0.5	1.1	199.2
	6	15.2	60	21.9	68.9	3.87	34.1	47	3.25	33.44	10				0				0	0	198.1	0	16.8	0.6	0.5	1.1	199.2
Jan.	1	22.9	60	33	80	4.15	33.79	47	3.25	33.44	10				0				0	0	238.6	0	15.2	0.5	0.5	1	239.6
	2	22.9	60	33	80	4.15	33.79	47	3.25	33.44	10				0				0	0	238.6	0	15.2	0.5	0.5	1	239.6
	3	22.9	60	33	80	4.15	33.79	47	3.25	33.44	10				0.19				1.9	0.8	238.6	0	15.2	0.5	0.5	1	240.4
	4	22.9	60	33	80	4.15	33.79	47	3.25	33.44	10				0.19				1.9	0.8	238.6	0	15.2	0.5	0.5	1	240.4
	5	22.9	60	33	80	4.15	33.79	47	3.25	33.44	10				0.38				3.8	1.6	238.6	0	15.2	0.5	0.5	1	241.2
	6	22.9	60	33	80	4.15	33.79	47	3.25	33.44	10				0.38				3.8	1.6	238.6	0	15.2	0.5	0.5	1	241.2
Feb.	1	9.2	60	13.2	60.2	3.64	34.07	47	3.25	33.44	10				0.41				4.1	1.8	157.1	0	17.1	0.6	0.5	1.1	160
	2	9.2	60	13.2	60.2	3.64	34.07	47	3.25	33.44	10				0.41				4.1	1.8	157.1	0	17.1	0.6	0.5	1.1	160
	3	9.2	60	13.2	60.2	3.64	34.07	47	3.25	33.44	10				0.4				4	1.7	157.1	0	17.1	0.6	0.5	1.1	159.9
	4	9.2	60	13.2	60.2	3.64	34.07	47	3.25	33.44	10				0.4				4	1.7	157.1	0	17.1	0.6	0.5	1.1	159.9
	5	9.2	60	13.2	60.2	3.64	34.07	47	3.25	33.44	10				0.37				3.7	1.6	157.1	0	17.1	0.6	0.5	1.1	159.8
	6	9.2	60	13.2	60.2	3.64	34.07	47	3.25	33.44	10				0.37				3.7	1.6	157.1	0	17.1	0.6	0.5	1.1	159.8
Mar.	1	25.1	60	36.1	83.1	4.23	33.63	47	3.25	33.44	10				0.34				3.4	1.5	249	0	20.3	0.7	0.5	1.2	251.7
	2	25.1	60	36.1	83.1	4.23	33.63	47	3.25	33.44	10				0.34				3.4	1.5	249	0	20.3	0.7	0.5	1.2	251.7
	3	25.1	60	36.1	83.1	4.23	33.63	47	3.25	33.44	10				0.18				1.8	0.8	249	0	20.3	0.7	0.5	1.2	251
	4	25.1	60	36.1	83.1	4.23	33.63	47	3.25	33.44	10				0.18				1.8	0.8	249	0	20.3	0.7	0.5	1.2	251
	5																										
	6																										
Total		553.2		793																37	6,454	0		46	24	70	6,561

Note: (1) Refer to Table A3-2 (1). Probable rainfall is given in Figure 4-7 in Appendix 4.

(2) Runoff coefficient was assumed at 60 %, considering the undulating topography with farm and brush land

(3) Inflow Qin = 24 R x F/1,000 (1,000m^3), 5-day rainfall less than 1.0 mm is assummed to be zero.

(7) Final storage capacity $V = V_{n-1} - \Sigma Q + Qin$ (1,000 m^3)

(8) Reservoir water depth (H) is obtained from reservoir stage (H) – capacity (V) curve. $Y = 5.3475\ X^2 - 3.2703\ X + 1.455$

(9) Water surface area (WA) is obtained from reservoir stage (H) – area (A) curve. $Y = -2.4217X^2 + 18.31\ X - 0.4911$

(10) Refer to Table A3-2(2) .

(11) Refer to Table A3-2(2) .

(12) Total irrigation water requirement (Σqi) = $\Sigma(A_1 \times q_{i1} + A_2 \times q_{i2} + A_3 \times q_{i3} + A_4 \times q_{i4})$ (lit/sec)

(13) Total irrigation water requirement (Q_i) = 0.432 x Σq_i (1,000 m^3)

(14) Outflow from mechanical spillway (Qom) is calculated based on the following equation; $Qom = Cx\ A\ \sqrt{(2gH)}/1{,}000$ (1,000 m^3) C = 0.62, A = section area of mechanical spillway (m^2)

(15) Outflow from emergency spillway (Qoe) is calculated based on the following equation; $Qoe = K \times B \times H^{3/2}/1{,}000$ (1,000 m3) K = 1.7, B = width of emergency spillway (m)

(16) Evaporation from water surface (ETo) is referred to Table A2-4(7) .

(17) 5-Day evaporation from water surface (V_{ETo}) = ETo x WA_{n-1}/1000 (1,000m^3)

(18) Reservoir loss (Rlo) is assumed at one percent of the storage capacity (V_{n-1}) $R_{lo} = V_{n-1} \times 1/100$ (1,000 m^3)

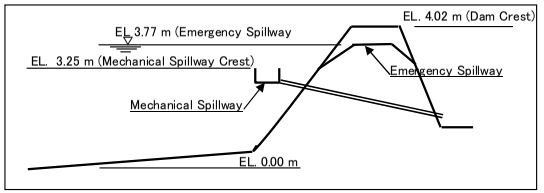
(19) Total loss (Qrl) = $V_{ETo} + R_{lo}$ (1,000 m^3)

(20) Total outflow (ΣQo) = Qi + Qom + Qoe +Qrl (1,000 m^3)

Table A3-3 (3) Reservoir Operation Study on Chiwoza Dam (Case : Severe Drought Year)

Case : Severe Drought Year
Total Irrigable Area : 10 ha
Cropping Area (Summer) : 10 ha
(Winter-1) : 8 ha
(Winter-2) : 8 ha
(Winter) : 2 ha
Ration of Winter Cropping: 21 %
Catchment Area : 2.4 sq.km
Initial Reservoir Capacity : 47 1,000 m^3

Section Area of Mechanical Spillway (A) : 1.5 sq.m
Width of Emergency Spillway (B) : 10 m
Crest Elevation of Machanical Spillway : 3.25 m
Crest Elevation of Emergency Spillway : 3.77 m

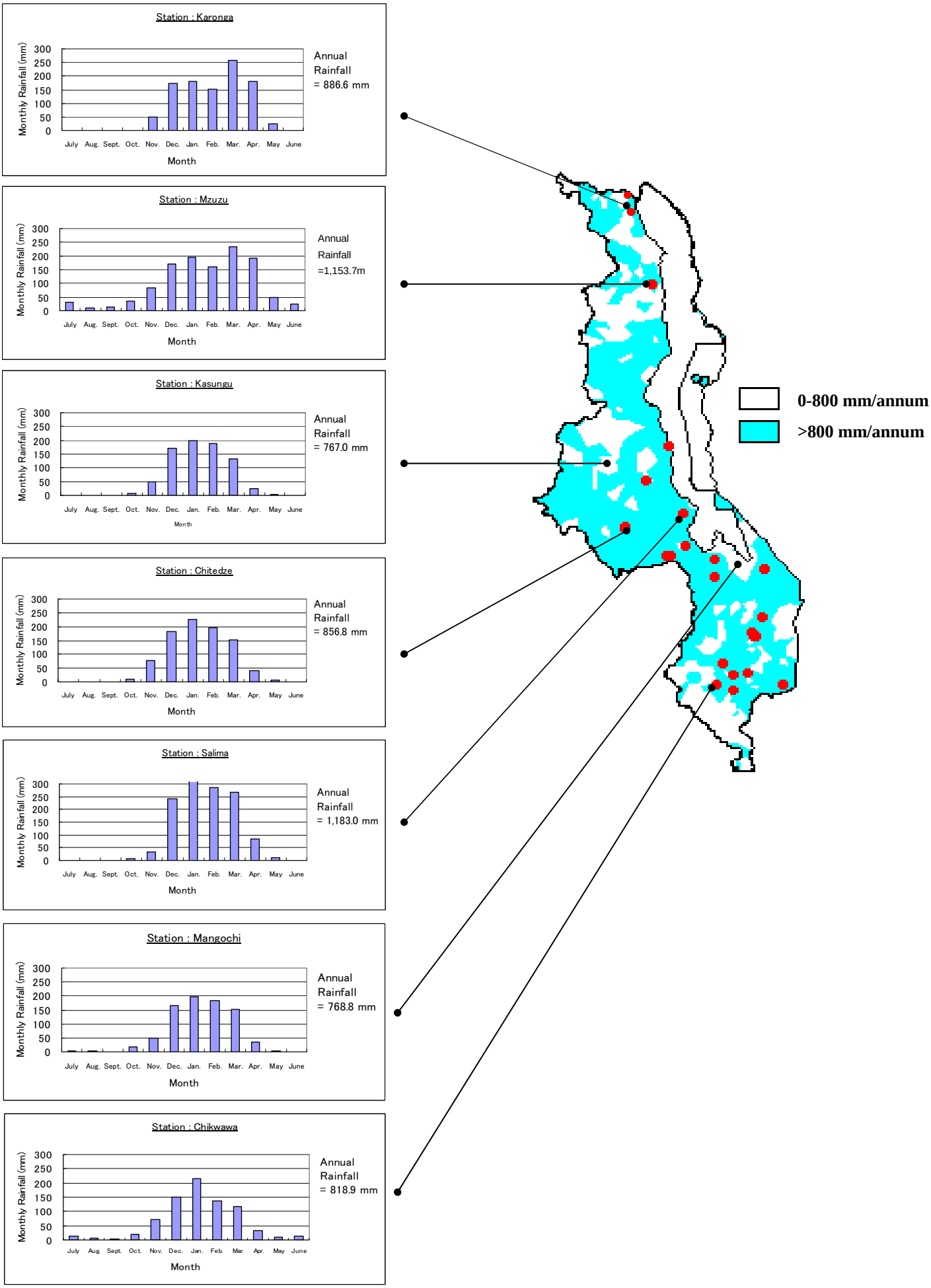


Month		Inflow Discharge to Reservoir			Reservoir Conditions						Outflow Discharges from Reservoir and Reservoir Water Losses															
					Assumed Reservoir Conditions			Final Reservoir Conditions			Irrigation Water Supply										Outflow from Spillway		Reservoir Water Losses				Total Outflow from Reservoir
		5-Day Rainfall	Runoff Coefficient	Inflow	Storage Capacity	Water Depth	Water Surface Area	Storage Capacity	Water Depth	Water Surface Area	Irrigation Area				Average Unit GWR				Total Irrigation Water Requirements		Mechanical	Emergency	5-Day Evaporation from Water Surface		Reservoir Loss	Total Loss	
											Summer	Winter-1	Winter-2	Winter	Summer	Winter-1	Winter-2	Winter									
		R (mm)	F (%)	Qin (1,000 m3)	V (1,000 m3)	H (m)	WA (1,000 m2)	V (1,000 m3)	H (m)	WA (1,000 m2)	A1 (ha)	A2 (ha)	A3 (ha)	A4 (ha)	qi1 (lit/sec/ha)	qi2 (lit/sec/ha)	qi3 (lit/sec/ha)	qi4 (lit/sec/ha)	Σqi (lit/sec)	Qi (1,000m3)	Qom (1,000m3)	Qoe (1,000m3)	ETo (mm)	V_{ETo} (1,000 m3)	Rlo (1,000 m3)	Qrl (1,000m3)	ΣQo (1,000 m3)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)				(11)				(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Mar.	4							47	3.25	33.44																
	5	2.3	60	3.3	50.3	3.34	33.65	47	3.25	33.44		1.68				0.01			0.0168	0	75.5	0	20.3	0.7	0.5	1.2	76.7
	6	2.3	60	3.3	50.3	3.34	33.65	47	3.25	33.44		1.68				0.01			0.0168	0	75.5	0	20.3	0.7	0.5	1.2	76.7
Apr.	1	3.5	60	5	52	3.4	33.77	47	3.25	33.44		1.68		0.42		0.07		0.01	0.1218	0.1	97.4	0	23.7	0.8	0.5	1.3	98.8
	2	3.5	60	5	52	3.4	33.77	47	3.25	33.44		1.68		0.42		0.07		0.01	0.1218	0.1	97.4	0	23.7	0.8	0.5	1.3	98.8
	3	3.5	60	5	52	3.4	33.77	47	3.25	33.44		1.68		0.42		0.08		0.01	0.1386	0.1	97.4	0	23.7	0.8	0.5	1.3	98.8
	4	3.5	60	5	52	3.4	33.77	47	3.25	33.44		1.68		0.42		0.08		0.01	0.1386	0.1	97.4	0	23.7	0.8	0.5	1.3	98.8
	5	3.5	60	5	52	3.4	33.77	47	3.25	33.44		1.68		0.42		0.4		0.01	0.6762	0.3	97.4	0	23.7	0.8	0.5	1.3	99
	6	3.5	60	5	52	3.4	33.77	47	3.25	33.44		1.68		0.42		0.4		0.01	0.6762	0.3	97.4	0	23.7	0.8	0.5	1.3	99
May	1	0	60	0	47	3.24	33.41	45.3	3.19	33.27		1.68		0.42		0.58		0.01	0.9786	0.4	0	0	23.6	0.8	0.5	1.3	1.7
	2	0	60	0	45.3	3.19	33.27	43.6	3.13	33.09		1.68		0.42		0.58		0.01	0.9786	0.4	0	0	23.6	0.8	0.5	1.3	1.7
	3	0	60	0	43.6	3.13	33.09	41.9	3.07	32.9		1.68		0.42		0.7		0.12	1.2264	0.5	0	0	23.6	0.8	0.4	1.2	1.7
	4	0	60	0	41.9	3.07	32.9	40.2	3.02	32.72		1.68		0.42		0.7		0.12	1.2264	0.5	0	0	23.6	0.8	0.4	1.2	1.7
	5	0	60	0	40.2	3.02	32.72	38.4	2.95	32.45		1.68		0.42		0.83		0.13	1.449	0.6	0	0	23.6	0.8	0.4	1.2	1.8
	6	0	60	0	38.4	2.95	32.45	36.6	2.89	32.2		1.68		0.42		0.83		0.13	1.449	0.6	0	0	23.6	0.8	0.4	1.2	1.8
June	1	0	60	0	36.6	2.89	32.2	34.8	2.82	31.88		1.68		0.42		0.9		0.13	1.5666	0.7	0	0	22.1	0.7	0.4	1.1	1.8
	2	0	60	0	34.8	2.82	31.88	33.1	2.76	31.6		1.68		0.42		0.9		0.13	1.5666	0.7	0	0	22.1	0.7	0.3	1	1.7
	3	0	60	0	33.1	2.76	31.6	31.4	2.69	31.24		1.68		0.42		0.96		0.14	1.6716	0.7	0	0	22.1	0.7	0.3	1	1.7
	4	0	60	0	31.4	2.69	31.24	30.3	2.65	31.02		1.68		0.42		0.06		0.14	0.1596	0.1	0	0	22.1	0.7	0.3	1	1.1
	5	0	60	0	30.3	2.65	31.02	28.6	2.58	30.63		1.68	1.68	0.42		0.98	0.01	0.17	1.7346	0.7	0	0	22.1	0.7	0.3	1	1.7
	6	0	60	0	28.6	2.58	30.63	26.9	2.51	30.21		1.68	1.68	0.42		0.98	0.01	0.17	1.7346	0.7	0	0	22.1	0.7	0.3	1	1.7
July	1	0	60	0	26.9	2.51	30.21	25.1	2.43	29.7		1.68	1.68	0.42		0.98	0.02	0.2	1.764	0.8	0	0	23	0.7	0.3	1	1.8
	2	0	60	0	25.1	2.43	29.7	23.3	2.35	29.16		1.68	1.68	0.42		0.98	0.02	0.2	1.764	0.8	0	0	23	0.7	0.3	1	1.8
	3	0	60	0	23.3	2.35	29.16	21.7	2.28	28.67		1.68	1.68	0.42		0.9	0.02	0.22	1.638	0.7	0	0	23	0.7	0.2	0.9	1.6
	4	0	60	0	21.7	2.28	28.67	20.1	2.2	28.07		1.68	1.68	0.42		0.9	0.02	0.22	1.638	0.7	0	0	23	0.7	0.2	0.9	1.6
	5	0	60	0	20.1	2.2	28.07	19.1	2.15	27.68			1.68	0.42			0.27	0.24	0.5544	0.2	0	0	23	0.6	0.2	0.8	1
	6	0	60	0	19.1	2.15	27.68	18.1	2.1	27.28			1.68	0.42			0.27	0.24	0.5544	0.2	0	0	23	0.6	0.2	0.8	1
Aug.	1	0	60	0	18.1	2.1	27.28	17.1	2.04	26.78			1.68	0.42			0.28	0.24	0.5712	0.2	0	0	22.6	0.6	0.2	0.8	1
	2	0	60	0	17.1	2.04	26.78	16.1	1.99	26.36			1.68	0.42			0.28	0.24	0.5712	0.2	0	0	22.6	0.6	0.2	0.8	1
	3	0	60	0	16.1	1.99	26.36	15.1	1.93	25.83			1.68	0.42			0.28	0.24	0.5712	0.2	0	0	22.6	0.6	0.2	0.8	1
	4	0	60	0	15.1	1.93	25.83	14.1	1.87	25.28			1.68	0.42			0.28	0.24	0.5712	0.2	0	0	22.6	0.6	0.2	0.8	1
	5	0	60	0	14.1	1.87	25.28	13.1	1.81	24.72			1.68	0.42			0.31	0.24	0.6216	0.3	0	0	22.6	0.6	0.1	0.7	1
	6	0	60	0	13.1	1.81	24.72	12.1	1.75	24.13			1.68	0.42			0.31	0.24	0.6216	0.3	0	0	22.6	0.6	0.1	0.7	1
Sept.	1	0	60	0	12.1	1.75	24.13	11.1	1.68	23.43			1.68	0.42			0.38	0.23	0.735	0.3	0	0	26.2	0.6	0.1	0.7	1
	2	0	60	0	11.1	1.68	23.43	10.1	1.61	22.71			1.68	0.42			0.38	0.23	0.735	0.3	0	0	26.2	0.6	0.1	0.7	1
	3	0	60	0	10.1	1.61	22.71	9	1.53	21.85			1.68	0.42			0.44	0.21	0.8274	0.4	0	0	26.2	0.6	0.1	0.7	1.1
	4	0	60	0	9	1.53	21.85	7.9	1.45	20.97			1.68	0.42			0.44	0.21	0.8274	0.4	0	0	26.2	0.6	0.1	0.7	1.1
	5	0	60	0	7.9	1.45	20.97	6.9	1.36	19.93			1.68	0.42			0.5	0.2	0.924	0.4	0	0	26.2	0.5	0.1	0.6	1
	6	0	60	0	6.9	1.36	19.93	5.9	1.27	18.86			1.68	0.42			0.5	0.2	0.924	0.4	0	0	26.2	0.5	0.1	0.6	1

Month		Inflow Discharge to Reservoir			Reservoir Conditions						Outflow Discharges from Reservoir and Reservoir Water Losses															
					Assumed Reservoir Conditions			Final Reservoir Conditions			Irrigation Water Supply										Outflow from Spillway		Reservoir Water Losses				Total Outflow from Reservoir
		5-Day Rainfall	Runoff Coefficient	Inflow	Storage Capacity	Water Depth	Water Surface Area	Storage Capacity	Water Depth	Water Surface Area	Irrigation Area				Average Unit GWR				Total Irrigation Water Requirements		Mechanical	Emergency	5-Day Evaporation from Water Surface		Reservoir Loss	Total Loss	
											Summer	Winter-1	Winter-2	Winter	Summer	Winter-1	Winter-2	Winter									
		R (mm)	F (%)	Qin (1,000 m3)	V (1,000 m3)	H (m)	WA (1,000 m2)	V (1,000 m3)	H (m)	WA (1,000 m2)	A1 (ha)	A2 (ha)	A3 (ha)	A4 (ha)	qi1 (lit/sec/ha)	qi2 (lit/sec/ha)	qi3 (lit/sec/ha)	qi4 (lit/sec/ha)	Σqi (lit/sec)	Qi (1,000m3)	Qom (1,000m3)	Qoe (1,000m3)	ETo (mm)	V_{ETo} (1,000 m3)	Rlo (1,000 m3)	Qrl (1,000m3)	ΣQo (1,000 m3)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)				(11)				(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Oct.	1	0.1	60	0	5.9	1.27	18.86	4.9	1.16	17.49			1.68	0.42			0.52	0.2	0.9576	0.4	0	0	25.8	0.5	0.1	0.6	1
	2	0.1	60	0	4.9	1.16	17.49	4	1.06	16.2			1.68	0.42			0.52	0.2	0.9576	0.4	0	0	25.8	0.5	0	0.5	0.9
	3	0.1	60	0	4	1.06	16.2	3.2	0.95	14.72			1.68	0.42			0.51	0.2	0.9408	0.4	0	0	25.8	0.4	0	0.4	0.8
	4	0.1	60	0	3.2	0.95	14.72	2.4	0.83	13.04			1.68	0.42			0.51	0.2	0.9408	0.4	0	0	25.8	0.4	0	0.4	0.8
	5	0.1	60	0	2.4	0.83	13.04	1.7	0.68	10.84			1.68	0.42			0.5	0.2	0.924	0.4	0	0	25.8	0.3	0	0.3	0.7
	6	0.1	60	0	1.7	0.68	10.84	1	0.39	6.28			1.68	0.42			0.5	0.2	0.924	0.4	0	0	25.8	0.3	0	0.3	0.7
Nov.	1	2.2	60	3.2	4.2	1.08	16.46	3.8	1.03	15.8			1.68				0.48		0.8064	0.3	0	0	22.5	0.1	0	0.1	0.4
	2	2.2	60	3.2	7	1.37	20.05	6.3	1.31	19.34			1.68				0.48		0.8064	0.3	0	0	22.5	0.4	0	0.4	0.7
	3	2.2	60	3.2	9.5	1.57	22.29	8.7	1.51	21.64			1.68				0.46		0.7728	0.3	0	0	22.5	0.4	0.1	0.5	0.8
	4	2.2	60	3.2	11.9	1.74	24.04	11	1.68	23.43			1.68				0.46		0.7728	0.3	0	0	22.5	0.5	0.1	0.6	0.9
	5	2.2	60	3.2	14.2	1.88	25.37	12.4	1.77	24.33	10				0.27				2.7	1.2	0	0	22.5	0.5	0.1	0.6	1.8
	6	2.2	60	3.2	15.6	1.96	26.09	13.8	1.86	25.19	10				0.27				2.7	1.2	0	0	22.5	0.5	0.1	0.6	1.8
Dec.	1	7.8	60	11.2	25	2.43	29.7	23.5	2.36	29.23	10				0.24				2.4	1	0	0	16.8	0.4	0.1	0.5	1.5
	2	7.8	60	11.2	34.7	2.82	31.88	33	2.75	31.55	10				0.24				2.4	1	0	0	16.8	0.5	0.2	0.7	1.7
	3	7.8	60	11.2	44.2	3.15	33.16	43.4	3.12	33.06	10				0				0	0	0	0	16.8	0.5	0.3	0.8	0.8
	4	7.8	60	11.2	54.6	3.47	33.89	47	3.25	33.44	10				0				0	0	75.5	0	16.8	0.6	0.4	1	76.5
	5	7.8	60	11.2	58.2	3.58	34.02	47	3.25	33.44	10				0				0	0	144.5	0	16.8	0.6	0.5	1.1	145.6
	6	7.8	60	11.2	58.2	3.58	34.02	47	3.25	33.44	10				0				0	0	144.5	0	16.8	0.6	0.5	1.1	145.6
Jan.	1	44.1	60	63.5	110.5	4.83	31.45	47	3.25	33.44	10				0				0	0	316.2	206.1	15.2	0.5	0.5	1	523.3
	2	44.1	60	63.5	110.5	4.83	31.45	47	3.25	33.44	10				0				0	0	316.2	206.1	15.2	0.5	0.5	1	523.3
	3	44.1	60	63.5	110.5	4.83	31.45	47	3.25	33.44	10				0				0	0	316.2	206.1	15.2	0.5	0.5	1	523.3
	4	44.1	60	63.5	110.5	4.83	31.45	47	3.25	33.44	10				0				0	0	316.2	206.1	15.2	0.5	0.5	1	523.3
	5	44.1	60	63.5	110.5	4.83	31.45	47	3.25	33.44	10				0				0	0	316.2	206.1	15.2	0.5	0.5	1	523.3
	6	44.1	60	63.5	110.5	4.83	31.45	47	3.25	33.44	10				0				0	0	316.2	206.1	15.2	0.5	0.5	1	523.3
Feb.	1	23.2	60	33.4	80.4	4.16	33.77	47	3.25	33.44	10				0				0	0	240	0	17.1	0.6	0.5	1.1	241.1
	2	23.2	60	33.4	80.4	4.16	33.77	47	3.25	33.44	10				0				0	0	240	0	17.1	0.6	0.5	1.1	241.1
	3	23.2	60	33.4	80.4	4.16	33.77	47	3.25	33.44	10				0.09				0.9	0.4	240	0	17.1	0.6	0.5	1.1	241.5
	4	23.2	60	33.4	80.4	4.16	33.77	47	3.25	33.44	10				0.09				0.9	0.4	240	0	17.1	0.6	0.5	1.1	241.5
	5	23.2	60	33.4	80.4	4.16	33.77	47	3.25	33.44	10				0.52				5.2	2.2	240	0	17.1	0.6	0.5	1.1	243.3
	6	23.2	60	33.4	80.4	4.16	33.77	47	3.25	33.44	10				0.52				5.2	2.2	240	0	17.1	0.6	0.5	1.1	243.3
Mar.	1	2.3	60	3.3	50.3	3.34	33.65	47	3.25	33.44	10				0.96				9.6	4.1	75.5	0	20.3	0.7	0.5	1.2	80.8
	2	2.3	60	3.3	50.3	3.34	33.65	47	3.25	33.44	10				0.96				9.6	4.1	75.5	0	20.3	0.7	0.5	1.2	80.8
	3	2.3	60	3.3	50.3	3.34	33.65	47	3.25	33.44	10				0.88				8.8	3.8	75.5	0	20.3	0.7	0.5	1.2	80.5
	4	2.3	60	3.3	50.3	3.34	33.65	47	3.25	33.44	10				0.88				8.8	3.8	75.5	0	20.3	0.7	0.5	1.2	80.5
	5																										
	6																										
Total		499.2		718																44	4,739	1,237		44	22	66	6,085

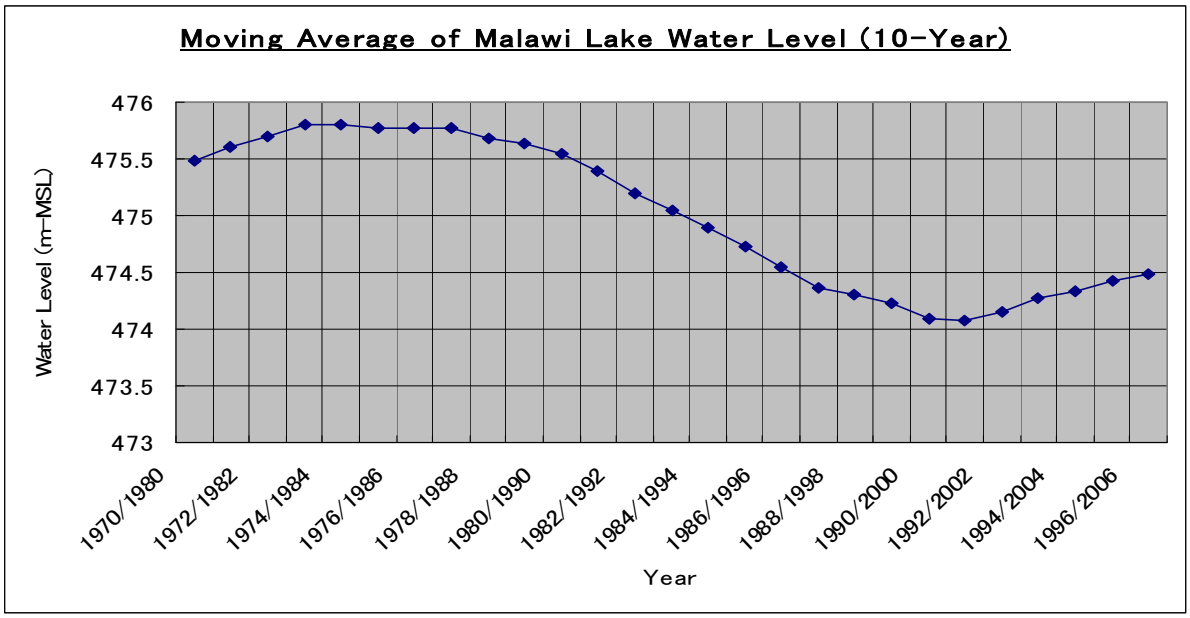
Note:
(1) Refer to Table A3-2(3). Probable rainfall is given in Figure 4-7 in Appendix 4.
(2) Runoff coefficient was assumed at 60 %, considering the undulating topography with farm and brush land
(3) Inflow Qin = 24 R x F/1,000 (1,000m^3), 5-day rainfall less than 1.0 mm is assummed to be zero.
(7) Final storage capacity $V = V_{n-1} - \Sigma Q + Qin$ (1,000 m^3)
(8) Reservoir water depth (H) is obtained from reservoir stage (H) – capacity (V) curve. $Y = 5.3475\ X^2 - 3.2703\ X + 1.455$
(9) Water surface area (WA) is obtained from reservoir stage (H) – area (A) curve. $Y = -2.4217X^2 + 18.31\ X - 0.4911$
(10) Refer to Table A3-2 (3).
(11) Refer to Table A3-2 (3).
(12) Total irrigation water requirement (Σqi) = $\Sigma(A_1 \times q_{i1} + A_2 \times q_{i2} + A_3 \times q_{i3} + A_4 \times q_{i4})$ (lit/sec)
(13) Total irrigation water requirement (Q_i) = 0.432 x Σq_i (1,000 m^3)
(14) Outflow from mechanical spillway (Qom) is calculated based on the following equation; $Qom = Cx\ A\ \sqrt{(2gH)}/1{,}000$ (1,000 m^3) C = 0.62, A = section area of mechanical spillway (m^2)
(15) Outflow from emergency spillway (Qoe) is calculated based on the following equation; $Qoe = K \times B \times H^{3/2}/1{,}000$ (1,000 m3) K = 1.7, B = width of emergency spillway (m)
(16) Evaporation from water surface (ETo) is referred to Table A2-4 (7).
(17) 5-Day evaporation from water surface (V_{ETo}) = ETo x WA_{n-1}/1000 (1,000m^3)
(18) Reservoir loss (Rlo) is assumed at one percent of the storage capacity (V_{n-1}) $R_{lo} = V_{n-1} \times 1/100$ (1,000 m^3)
(19) Total loss (Qrl) = $V_{ETo} + R_{lo}$ (1,000 m^3)
(20) Total outflow (ΣQo) = Qi + Qom + Qoe + Qrl (1,000 m^3)

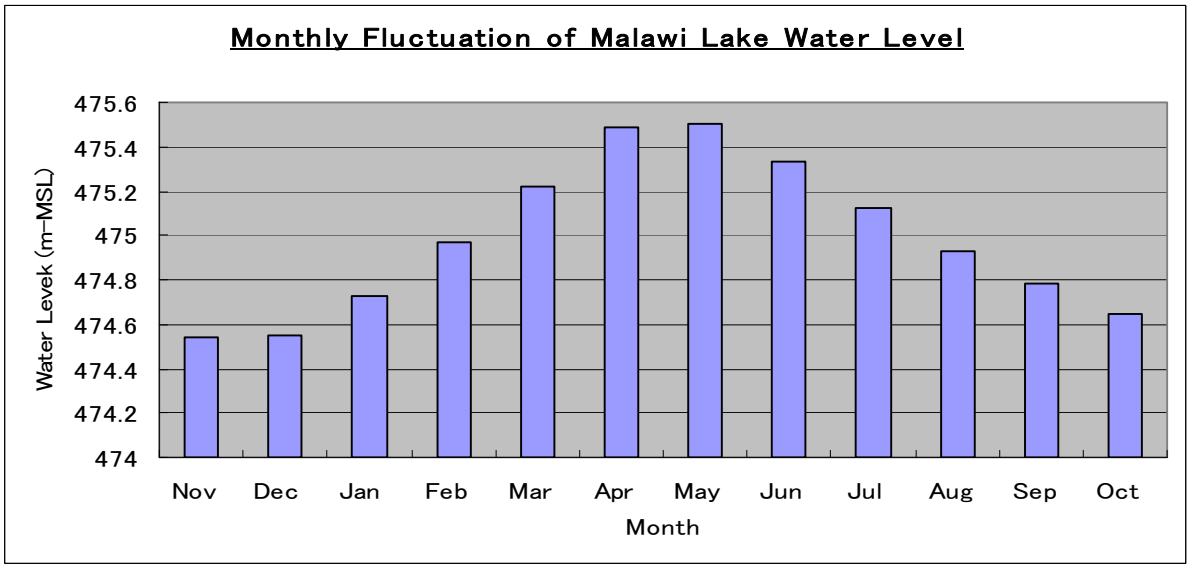
Figure A1-1 Monthly Rainfall Patterns at Representative Stations

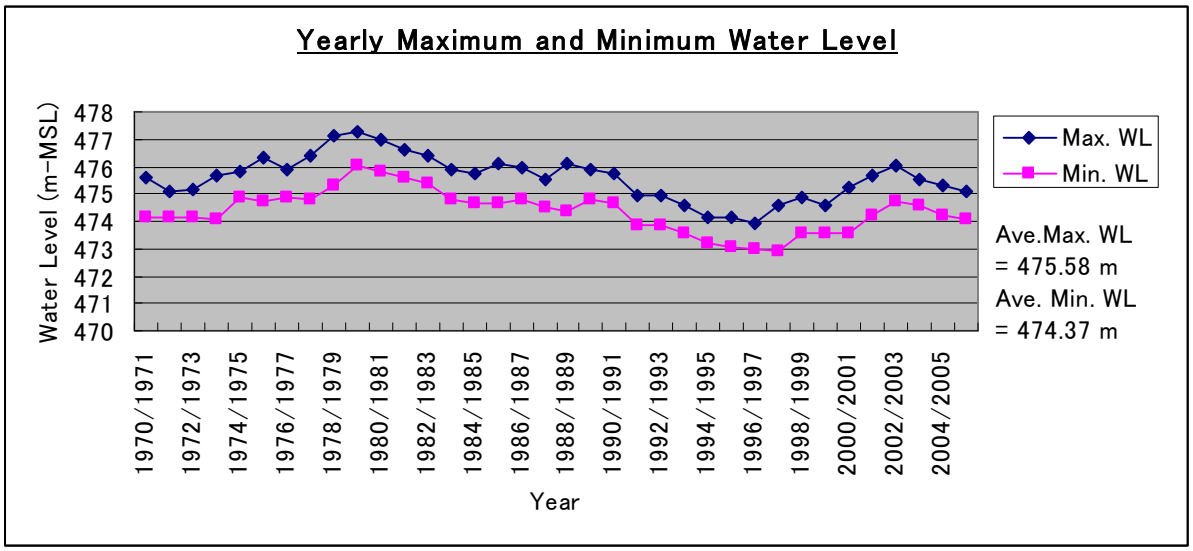


Data Source : Meteorological Department, Ministry of Transport and Public Works

Figure A1-2 Moving Average (10-Year), Monthly Fluctuation and Max. and Min. Water Level







Data source: Water Resources Department, MIWD

Figure A2-1 (1) Crop Coefficient (Kc) Values for Rice 1 (Summer (Wet) Season)

1. Planting Date : January/February

2. Length of Growing Stage :
   - Initial : 30 days
   - Crop Development : 25 days
   - Mid-Season : 35 days
   - Late-Season : 30 days Total 120 days

3. Kc Values
   - Kc Initial Stage : 1.15
   - Kc Mid-Season Stage : 1.25
   - Kc Late-Season Stage : 1.05

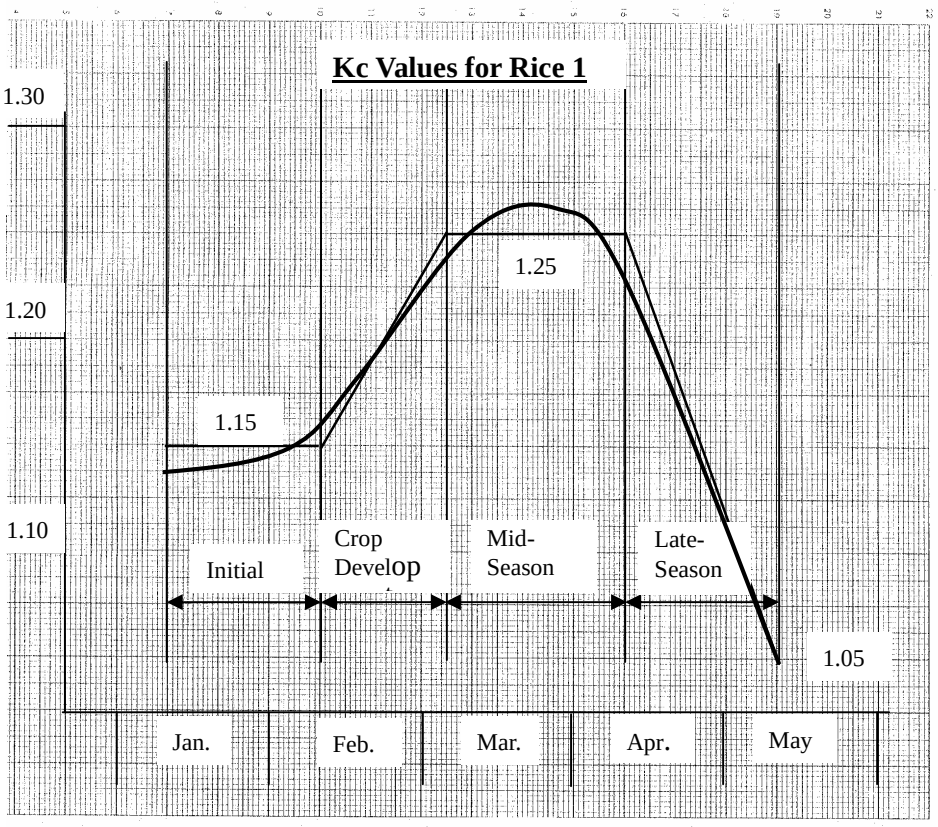


Figure A2-1 (2) **Crop Coefficient (Kc) Values for Rice 2 (Summer (Wet) Season)**

1. Planting Date : January/February

2. Length of Growing Stage :
   - Initial : 30 days
   - Crop Development : 25 days
   - Mid-Season : 35 days
   - Late-Season : 30 days Total 120 days

4. Kc Values
   - Kc Initial Stage : 1.15
   - Kc Mid-Season Stage : 1.25
   - Kc Late-Season Stage : 1.05

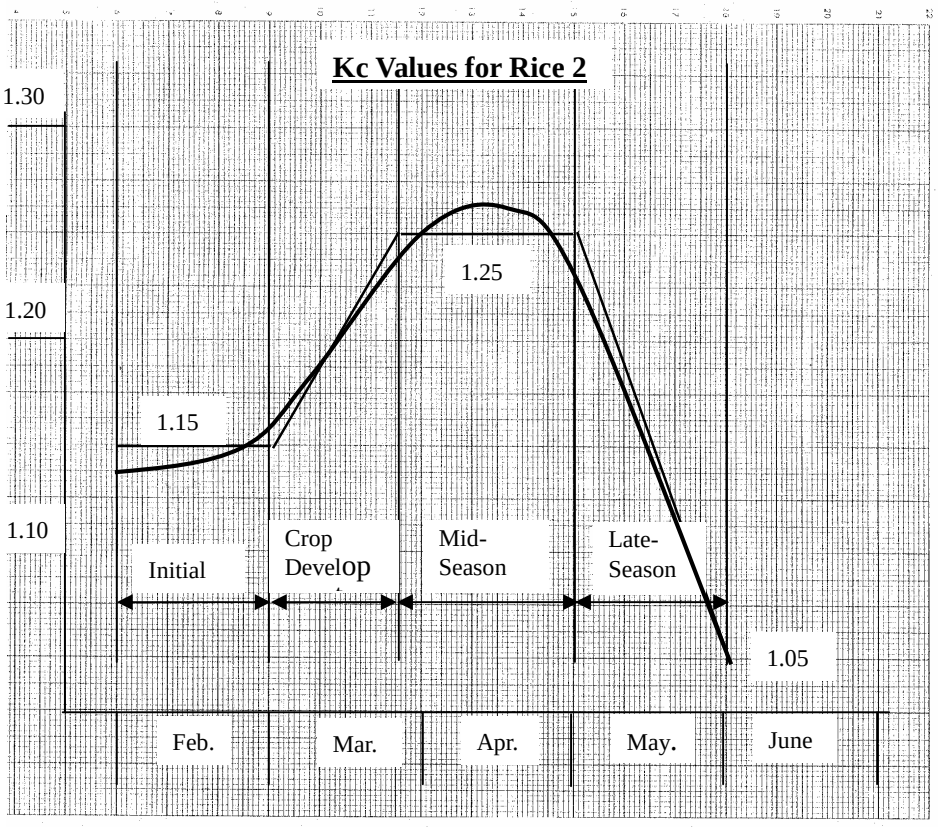


Figure A2-2 (1) Crop Coefficient (Kc) Values for Rice 1 (Winter (Dry) Season)

1. Planting Date : June/July

2. Length of Growing Stage :
   - Initial : 30 days
   - Crop Development : 25 days
   - Mid-Season : 35 days
   - Late-Season : 30 days Total 120 days

5. Kc Values
   - Kc Initial Stage : 1.15
   - Kc Mid-Season Stage : 1.25
   - Kc Late-Season Stage : 1.05

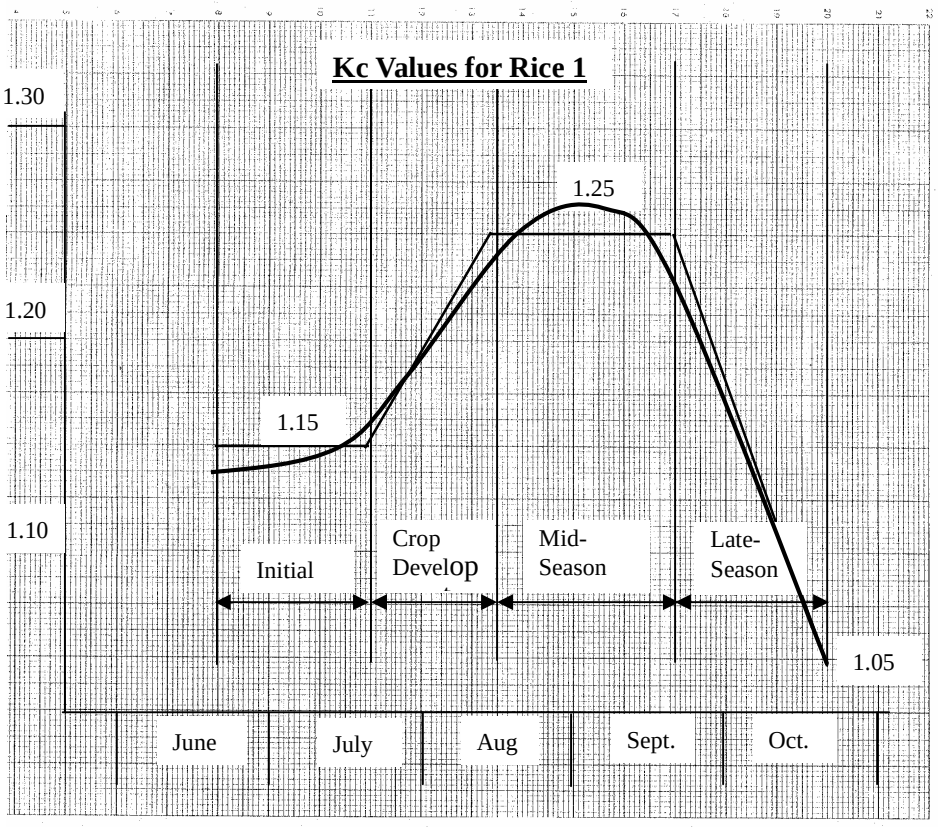


Figure A2-2 (2) **Crop Coefficient (Kc) Values for Rice 2 (Winter (Dry) Season)**

1. Planting Date : June/July

2. Length of Growing Stage :
   - Initial : 30 days
   - Crop Development : 25 days
   - Mid-Season : 35 days
   - Late-Season : 30 days Total 120 days

6. Kc Values
   - Kc Initial Stage : 1.15
   - Kc Mid-Season Stage : 1.25
   - Kc Late-Season Stage : 1.05

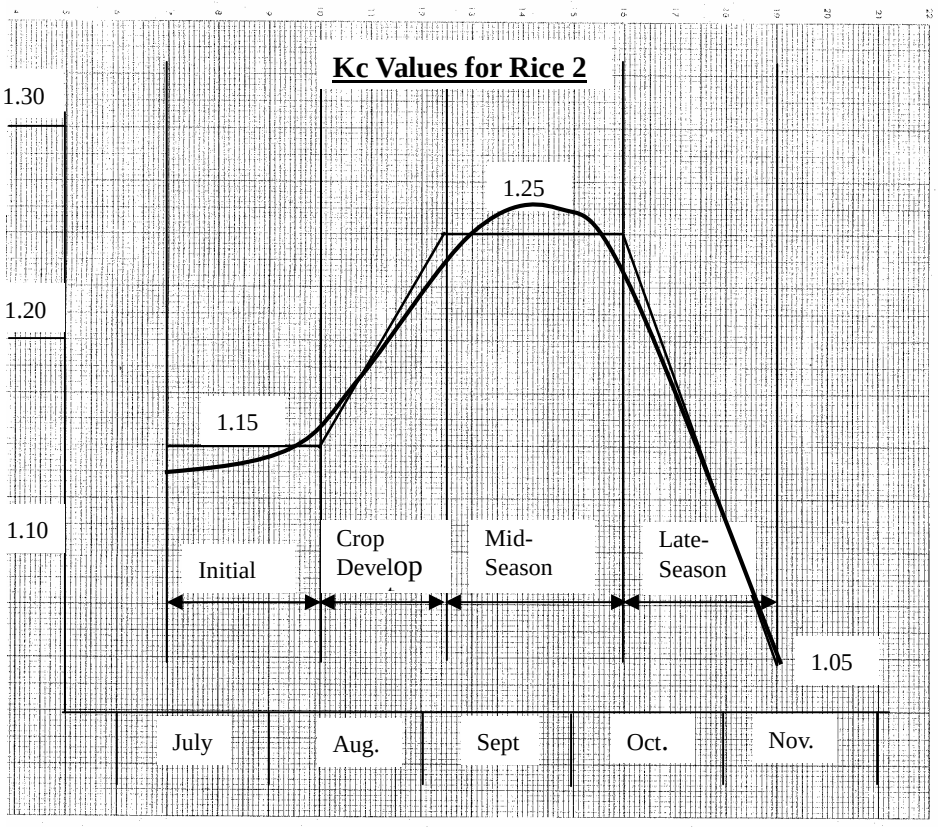


Table A4-1(1) Summary of Farmer Trainings on Water Management for 2008 Dry Season Cropping

Verification Scheme		Technology of Irrigation Scheme	Surveyed Date	Attendants to the Training Workshop		Training Module	Trained Water Management Issues	Issues to be Monitored/Evaluated
1.	Bethani Scheme	River Diversion	June 10, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 1 8 2 1 - 14	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods and irrigation schedule - Establishment of rotational irrigation systems coupled with secondary canal alignment decision at farm level - Data collection of record keepings on water management	Bethani-A - 3-day rotational irrigation systems for area of 8.0 ha covered by 9 division boxes. - Record keeping ways on water management for the sub-scheme Bethani-B - 4-day rotational irrigation systems for area of 14.0 ha with 14 division boxes. - Record keeping ways on water management for the sub-scheme	- Effective and smooth implementation of agreed rotational irrigation systems in each sub-scheme by operating stop-logs installed in each division boxes - Successful extension of irrigable areas of zone-4 in Bethani-B sub-scheme and their areas. - Undertaking of periodical (weekly basis) record keepings on water management by Committee members. The form of the record keepings has already been given to the Committee members by the Study Team.
			July 22, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 - 7 1 1 - 11	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods and irrigation schedule - Data Collection of record keepings on water management		
2.	Mantha Scheme	Motorized Pump	June 18, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 - 4 1 2 - 9	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods and irrigation schedule - Data collection of record keepings on water management	- 4-day rotational irrigation systems for area of 5.0 ha covered by 6 turnouts for zone-1, zone-2 and zone-3 areas. - Record keeping ways on water management for the scheme	- Effective and smooth implementation of agreed rotational irrigation systems by using sand-bags provided in each turnouts - Extension of remaining main irrigation canals covering zone-4 areas - Undertaking of periodical (daily basis) record keepings on water management by Committee members, especially items on daily pump operation activities such as river water level, pump operation hours, fuel consumption, etc. The form of the record keepings has already been given to the Committee members by the Study Team.
			July 9, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	1 - 5 2 - - 8	- Confirmation of existing/rehabilitated irrigation facilities - Establishment of rotational irrigation systems coupled with secondary canal alignment decision at farm level - Grasp of present water use		
3.	Chiwoza Dam Scheme	Impounding Dam	June 12, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 1 4 - 1 8	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods and irrigation schedules - Establishment of rotational irrigation systems coupled with secondary canal alignment decision at farm level - Training on adequate reservoir water use based on reservoir operation rule curve - Data collection of record keepings on water management	- Irrigation areas of 10.0 ha scheme are divided into following four zones depending on their irrigation systems and topography, and 4-day rotational irrigation systems were proposed. Right Bank ・ Pump irrigation area : 3.3 ha (irrigated by right main canal) ・ Gravity irrigation area : 2.7 ha (irrigated by PVC and flexible connected with outlet structure) Left Bank ・ Pump and gravity irrigation area : 1.5 ha (irrigated by left main canal receiving water by pump and PVC/ flexible pipes) ・ Gravity irrigation area : 2.5 ha (irrigated by PVC/ flexible pipes	- Effective and smooth implementation of agreed rotational irrigation systems for 4 zone applying different technologies of pump, gravity and their combination methods - Crop planting schedule considering reservoir operation rule curve - Undertaking of periodical (daily basis) record keepings on water management by Committee members, especially items on daily pump operation activities such as reservoir water level, pump operation hours, fuel consumption, etc. The form of the record keepings has already been given to the Committee members by the Study Team.
			July 14, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 - 4 1 1 - 8	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use		

Verification Scheme		Technology of Irrigation Scheme	Surveyed Date	Attendants to the Training Workshop		Training Module	Trained Water Management Issues	Issues to be Monitored/Evaluated
							connected with outlet structure) - Reservoir operation rule curve was formulated and reservoir operation was instructed on the basis of the rule curve. - Record keeping ways on water management for the scheme	
4.	Kachere Scheme	Motorized Pump	June 27, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 - 6 1 1 12 22	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods and irrigation schedule - Establishment of rotational irrigation systems coupled with secondary canal alighm, Establishment of rotational irrigation systems coupled with secondary canal alignment decision at farm level - Data collection of record keepings on water management	- 5-day rotational irrigation systems for area of 6.4 ha covered by 8 turnouts - Decisions of secondary canal alignments branching off from the main irrigation canal at on-farm level - Record keeping ways on water management for the scheme	- Effective and smooth implementation of agreed rotational irrigation systems by using sand-bags provided in each turnouts - Excavation of proposed all secondary canals under close cooperation and participation among the related farmers of the canal - Undertaking of periodical (daily basis) record keepings on water management by Committee members, especially items on daily pump operation activities such as Bua river water level, pump operation hours, fuel consumption, etc. The form of the record keepings has already been given to the Committee members by the Study Team.
			July 10, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	1 - 7 1 - - 9	- Explanation and discussion on water distribution methods and irrigation schedule - Establishment of rotational irrigation systems coupled with secondary canal alignment decisions at farm level		
5.	Titukulane Scheme	River Diversion	June 9, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 1 11 - 1 1 16	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods and irrigation schedule - Establishment of rotational irrigation systems coupled with secondary canal alignment decisions at farm level - Collection of record keepings on water management	- 3-day rotational irrigation systems for area of 7.0 ha covered by relative long main irrigation canals of 4.0 km - Record keeping ways on water management for the scheme	- Effective and smooth implementation of agreed rotational irrigation systems by using sand-bags to be provided. - Undertaking of periodical (weekly basis) record keepings on water management by Committee members. The form of the record keepings has already been given to the Committee members by the Study Team.
			July 8, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AED 5) IO from DAO 6) Others Total	2 - 15 - 1 - 18	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Data collection of record keepings on water management		
6.	Chaseta Scheme	Motorized Pump	May 27, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 1 10 2 2 - 17	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods and irrigation schedule - Establishment of rotational irrigation systems coupled with secondary canal alignment decision at farm level - Data collection of record keepings on water	- 5-day rotational irrigation systems for area of 12.0 ha covered by 6 turnouts - Decisions of secondary canal alignments branching off from the main irrigation canal at on-farm level - Improvement of drainage systems to cope with poor drainage conditions (water logging) at the north-eastern	- Effective and smooth implementation of agreed rotational irrigation systems by using sand-bags provided in each turnouts - Excavation of proposed all secondary canals under close cooperation and participation among the related farmers of the canal - Extension of remaining main irrigation canals covering zone-3 and zone-5 areas

Verification Scheme		Technology of Irrigation Scheme	Surveyed Date	Attendants to the Training Workshop		Training Module	Trained Water Management Issues	Issues to be Monitored/Evaluated
						management - Instructions of drainage improvement methods at farm level	parts of the scheme - Record keeping ways on water management for the scheme	- Improvement of drainage systems by consolidating existing small farm drains - Undertaking of periodical (daily basis) record keepings on water management by Committee members, especially items on daily pump operation activities such as Diamphwe river water level, pump operation hours, fuel consumption, etc. The form of the record keepings has already been given to the Committee members by the Study Team.
			July 11, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	1 - 10 1 - 1 13	- Confirmation of existing/Rehabilitated irrigation facilities. - Grasp of present water use. - Explanation and discussion on water distribution methods - Establishment of rotational irrigation systems coupled with secondary canal alignment decisions at farm level - Data collection of record keepings on water management - Instructions of drainage improvement methods at farm level		
7.	Bawi Scheme	River Diversion	May 29, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 1 11 - 2 - 16	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods and irrigation schedule - Data collection of record keepings on water management	- 3-day rotational irrigation systems for right and left irrigation areas located on the both banks of the Bawi river. The direct objective areas for the Bawi scheme is 3.5 ha for No. 5 sub-scheme and 2.8 ha for No.7 sub-scheme, out of the total Bawi irrigation areas of 14.7 ha covered by 12 diversion weir - Record keeping ways on water management forNo.5 and No.7 sub-schemes	- Effective and smooth implementation of agreed rotational irrigation water supply for right and left bank areas of the Bawi river in a coordinated manner. - Undertaking of periodical (weekly basis) record keepings on water management by Committee members. The form of the record keepings has already been given to the Committee members by the Study Team.
			July 12, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 - 1 - 2 - 5	- Confirmation of existing/rehabilitated irrigation facilities		
8.	Chibwana Scheme	River Diversion	June 3, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Others Total	2 1 10 - 1 1 15	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods and irrigation schedule - Establishment of rotational irrigation systems coupled with secondary canal alignment decisions at farm level - Collection of record keepings on water management - Instruction of drainage improvement methods at field level	- 5-day rotational irrigation systems for area of 34.0 ha covered by 6 division boxes, out of the total irrigation areas of 85.0 ha - Irrigation water supply methods by means of secondary canal systems regulated by division boxes - Record keeping ways on water management for the schemes	- Effective and smooth implementation of agreed rotational irrigation water supply for 6-rotational areas (total area of 34 ha) in a coordinated manner. - Cleaning and excavation of secondary irrigation canals of No.3 and No.5 - Undertaking of periodical (weekly basis) record keepings on water management by Committee members, especially main canal water depth at the installed staff gauge. The form of the record keepings has already been given to the Committee members by the Study Team. - Provision of sand-gags at diversion weir site to raise up water level of the Sumulu river
			July 2, 2008	1) Study Team 2) DoI Staff 3) Committee Member 4) AEDC/AEDO 5) IO from DAO 6) Other Total	2 - 3 2 - - 7	- Confirmation of existing/rehabilitated irrigation facilities - Grasp of present water use - Explanation and discussion on water distribution methods - Ways of record keeping on water management.		

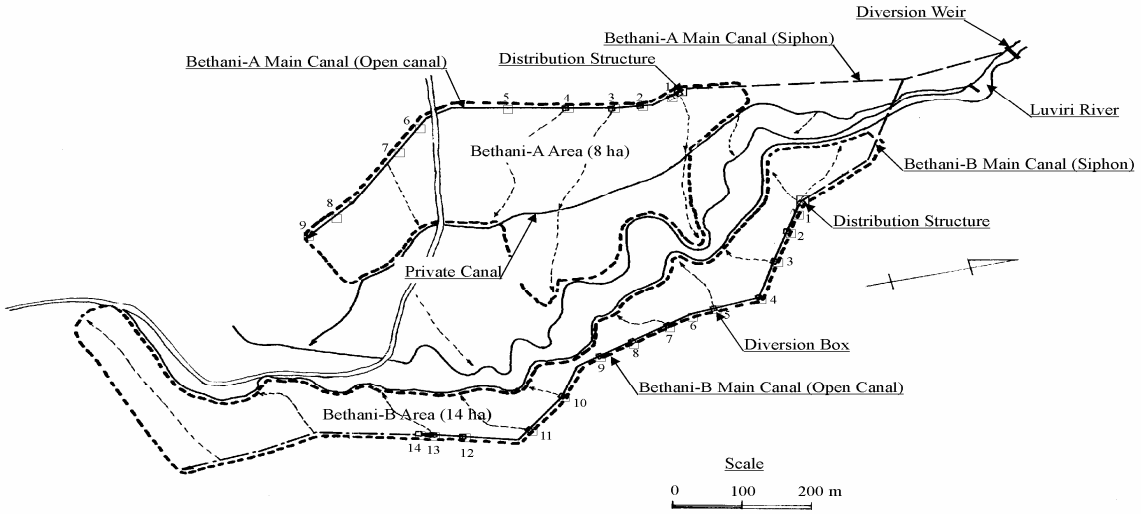
Table A4-1(2) Training Report on Water Management (Bethani 1/2)

1. Name of Scheme : Bethani Irrigation Scheme (Mz-11)
2. Date/Period : June 10 and 11, 2008
3. Attendants to Training Workshop;
   1) JICA Study Team : Water Management Expert (1) & Local (1)
   2) DoI Staff : Assistant Irrigation Officer (1)
   3) Farmers Committee : Committee Member, Total (8) = M (7) + F (1)
   4) AEDO/AEDC : AEDO and Staff (2), Mhuju EPA
   5) IO from DAO : Irrigation Officer (1), Rumphi DAO
4. Outlines of Training Workshop :

Item	Descriptions
1 Training Module ▪ Outline of the Scheme ▪ Existing/rehabilitated irrigation facilities ▪ Water Management Distribution and Rotation ▪ Water Management Record Keeping	**1. Outline of Scheme** (a) Water Sources; Luviri River (b) Scheme Areas; Bethani-A area (8 ha) and Bethani-B area (14 ha) (c) System; pipe lines and earthen open canals, of which designed discharges are 28 lit/sec, and assumed to bring enough amounts to each area. **2. Existing/Rehabilitated diversion weir and main canals** (a) Bethani-A; (800 m), and 9 Distribution Structures (b) Bethani-B ; (1,300 m), and 14 Distribution Structures (c) Condition of Distribution Structures; good except 10 that need stop-logs for easy water distribution. Plywood for fabrication had already provided by Study Team on 10th and 13th June 2008. **3. Water Management Distribution and Rotation** (a) Current Rotation; 3-day rotation for Bethani-A area and 4-day rotation for Bethani-B area, refer to fig. 2. These were discussed and arranged with farmer groups. (b) Proposes Rotation; 4-day rotation for Bethani B, i.e. considering the area planted. (c) Proposed method of distribution; on the basis of distribution structures for easy check up and maintenance. (d) Condition of Water Management; poor, lower areas of Bethani B, had not been irrigated in the dry season (e) Dry Season cropping; major crops are maize, onion, cabbage, mustard, etc. **4. Water Management Record Keeping** a) Collection Methods; instructions were given to the farmers groups. b) Output; At the time of visit the Secretary had not brought the report with him. However, the Study Team was much assured of the recordings systematically, and was agreed that the records would be checked later. c) New format of the record keepings; written in local dialogue of “Chichewa” and “Tumbuka” was provided to the Committee member to start records from June 2008.
2 Input/Procured Materials for the Training	1. Drawings; indicating proposed rotational irrigation system 2. Plywood (12mm thick), 244 by 124 cm for stop-logs provision. Selected distribution structures for the stop-logs were; A4S, A6S, A7SA8S and A9S for Bethani-A, and B6S, B8S, B9S, B11M, and B15S for Bethani-B.
3 Outcomes of the Training	1. **Farmers’ group work schedule** a. Stop log Making; Cutting the ply wood to make stop-logs; June 11th ,2008 to June 14th, 2008 b. De-silting and Clearing of Canal; Bethani A, from structure No.6 to No. 9 from June 16th, 2008 c. De-silting; Bethani B, 20 m of pipe after the structure and canal excavation ;within 16th to 20th June, 2008

Item	Descriptions
	2. **Comments**; IO from Rumphi DAO commented on the erosion problem at the site of the river crossing structures, and said the DAO office would look into it
4 Farmer's Group Opinion/ Suggestions and their comments	1. **Proposed Water Management Rotations**; the farmer groups welcomed the idea and are very much willing to follow the suggested/proposed rotational systems methods (see Item 1 above).
5 Requested Continuous Recordings	a. Recordings of design discharge and estimated gross irrigation water requirements (GWR) (weekly basis) b. Recordings of location of irrigation area and irrigated area (weekly basis) c. Recordings of water surplus or shortage conditions (weekly basis) d. Recordings of farming activities and encountered problems (weekly basis) e. Table1 shows the record keeping form written in English version.
6 Others	None.

Layout Map of Existing and Proposed Irrigation System for Bethani Irrigation Scheme (Mz-11)



Layout Map of Rotational Supply Plan for Bethani Irrigation Scheme (Mz-11)

Area	Rotation Area	Date of Water Supply
Bethani-A	A-①	Day 1
	A-②	Day 2
	A-③	Day 3
Bethani-B	B-①	Day 1
	B-②	Day 2
	B-③	Day 3
	B-④	Day-4

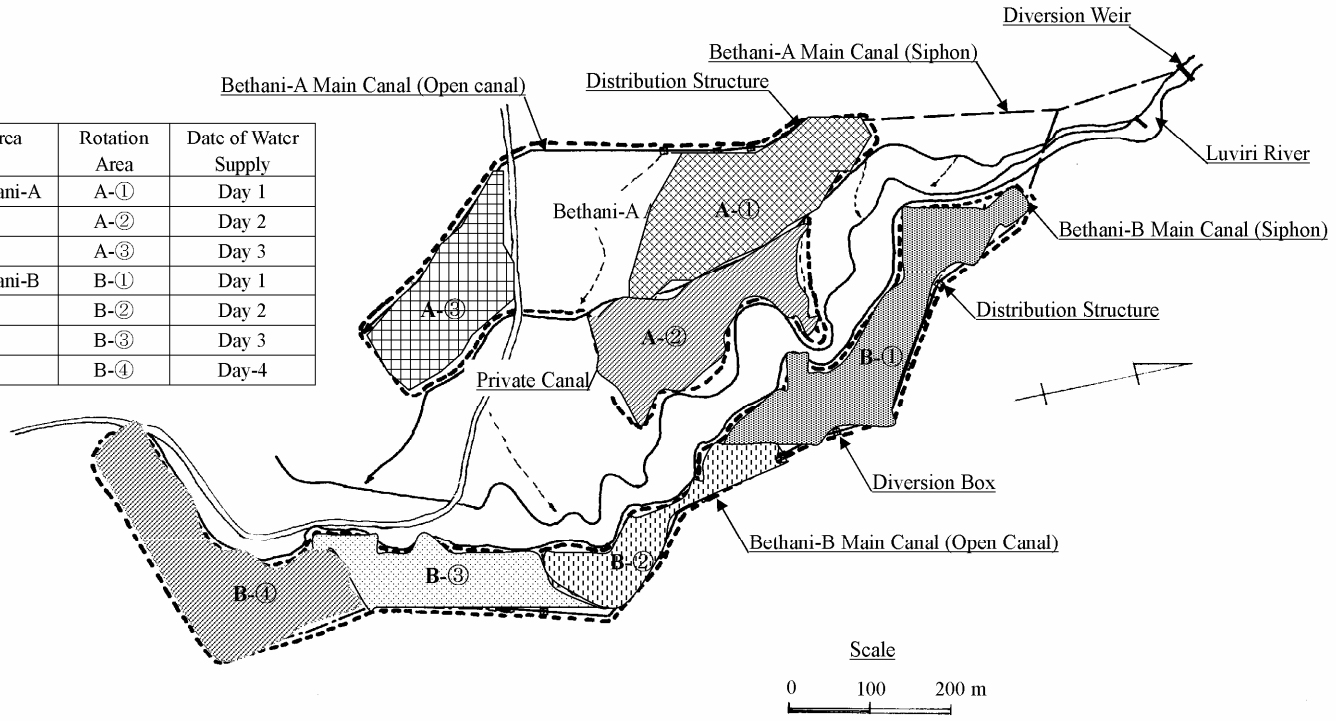


Table A4-1(3) Training Report on Water Management (Bethani 2/2)

1. Name of Scheme : Bethani Irrigation Scheme (Mz-11)
2. Date/Period : July 22, 2008
3. Place of Training : Bethani Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Members, Total (7) = M (7) + F (0)
   4) AEDC/AEDO : AEDO (1), Mhunju EPA
   5) IO from DAO : AIO(1), Rumphi DAO
   6) Others : None
5. Outlines of Training Workshop :

Item	Descriptions
1. Training Module - Rehabilitation Works - Water Management and Water Distribution Rotation - Water Management Record Keeping	**1. Rehabilitation Works** (a) Water Leakage at Bethani-A Main Canal; observed from the bottom of the main canal at the immediate upstream of road crossing due to ant-holes, (b) Rehabilitation Dates for the Canal; started since July 21, 2008. (c) Extent of Damage; According to the Assistant Irrigation Officer, Rumphi DAO, it was estimated at 110 m with usages of 160 mm of PVC pipes. (d) Rehabilitation works of river crossing at an immediate upstream of Zone-4 extension area in Bethani-B; excavation works of main canal were implemented under the supervision of Irrigation Officer of the Rumphi DAO. (e) Recommendation for Zone-4 rehabilitation; part of the excavated main canal is observed to be reverse gradient in slope hence additional assistances and supervisions by irrigation officer in Rumphi DAO will be needed. **2. Water Management and Distribution Rotation** (a) Irrigation water supply; irrigation water supply in Bethani-A areas was stopped due to canal rehabilitation works. (b) Water Rotation; Bethani-B areas, water is fully supplied to the Zone-2 area depending on the proposed 4-day rotational water supply systems. (c) Distribution Methods; explanations and discussions on water distribution methods were also made to the farmers' representatives. **3. Water Management Record Keeping** (a) Objectives of Record keeping; additional explanations on the objectives and methods were made to the newly elected Committee Members of the scheme.
2. Input/Procured Materials for Training	
3. Outcomes of the Training	**1. Water Management Lessons from the Chiwoza Dam Irrigation Scheme Tour (July 17, 2008).** Bethani Committee members were grateful for the tour and pointed out the following observations; (a) The Chiwoza farmers are very organized and work as one people. (b) The Chiwoza farmers are hard working despite the condition of their sandy soils. (c) Their programs in manure making are so advanced and they are committed in manure making. (d) The ways of water application during irrigation is so organized and systematic.

Item	Descriptions
	(e) The Chiwoza Committee is strong in terms of the leadership. **2. Actions Taken after the Tour** (a) As a result of this tour, the Bethani farmer decided to elect a new committee, and this happened on the July 8, 2008. (b) They will hold a meeting on July 25, 2008 to share with all the farmers what the Committee learnt from Chiwoza Dam scheme, and how they can promote it in the Bethani scheme.
4. Farmer's Group Opinion/ Suggestions	
5. Continuous Record Keepings	
6. Others	

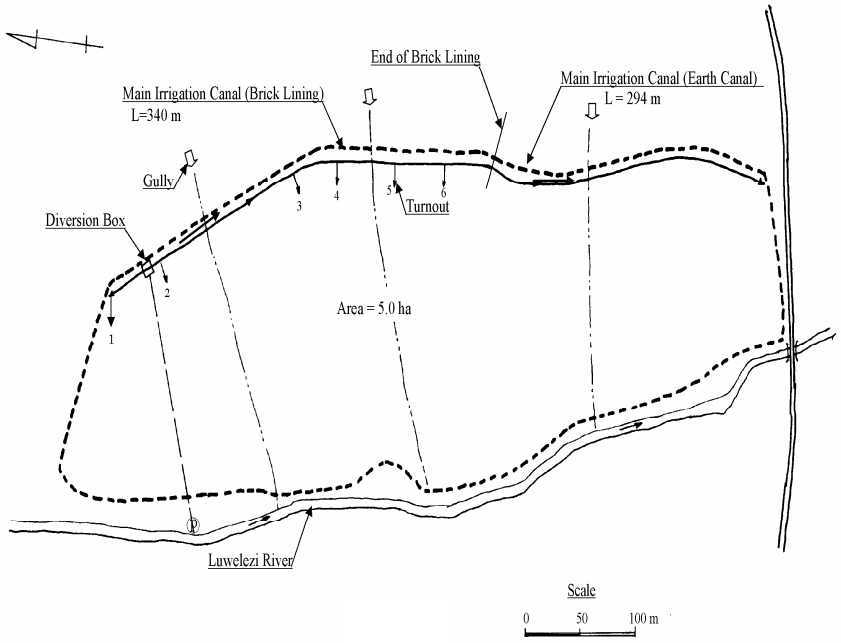
Table A4-1(4) Training Report on Water Management (Mantha 1/2)

1. Name of Scheme : Mantha Irrigation Scheme (Mz-4)
2. Date/Period : June 18, 2008
3. Place of Training : Manth Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Members, Total (4) = M (3) + F (1)
   4) AEDC/AEDO : AEDO, Luwelezi EPA
   5) IO from DAO : IO and AIO (2), Mzimba DAO
5. Outlines of Training Workshop :

Item	Descriptions
1. Training Module ▪ Pumping System ▪ Field Study on Irrigation Facilities ▪ Current Irrigation Water Supply ▪ Crop Practices ▪ Water Management and Rotation ▪ Water Management and Record Keeping	**1. Pumping System** (a) Characteristics of the Repaired Pump; Greaves Ltd. In India, 41Hp, 1,800 rpm, bore dia = 152 mm. (b) Pipeline; aluminum pipe 200 m , dia = 140 mm (c) Main Canal; brick lined (285 m), (d) Other Structures; 1 diversion box, five turn-outs, and three pipe gully crossing structures 2. **Field Study Results on Irrigation facilities**. a) Overflowing; the lifted discharges by pump overflowed in the canal b) Seepage; from the lined canal was observed, when pump operation was tested c) Backfill; part of main canal is protected by the backfill soils. d) Cracks; observed in the some parts of the main canal, especially immediate before first gully crossing. These cracks might be caused by erosion of foundation of canal-bed portions due to flood discharges at gully crossing. e) Comments for the Cracks; these portions should be rehabilitated before stating 2008 dry season crops. **3. Current Irrigation Water Supply.** (a) Water Conveyance; no water conveyance in the scheme at present due to unfinished work that had been done in the repairing of the pump. (b) Current situation; pump facilities were repaired, and they are presently functioning, although some rehabilitation works would be needed as mentioned above. (c) Farmers Opinions; Under the situations, the farmer's group is waiting for appropriate instructions from the Study Team for adjustments of pump operation speed to reduce the pump capacity. (d) Farmers Plans; after solving these problems the group is planning to start the dry season cropping **4. Crop Practices** (a) Land preparation works for dry season; started from the beginning of April. (b) Major Crops; for dry season cropping are maize, beans, tomato, vegetable, sugarcane, etc. **5. Water Management and Rotation.** (a) Proposed Water Distribution Rotation; 4-day rotation irrigation methods for 4-rotation blocks were proposed to the scheme

Item	Descriptions
	(b) Basis for the Rotation; based on the crop evapo-transpiration (ETc) and readily available soil moisture (RAM). (c) Training for the Rotation; explanation and discussions on the methods were made to the representative of farmer's group (refer to Figure 4). (d) Effectiveness of the Rotations; the Study Team emphasized the Committee member's cooperation and understandings to carry out the methods effectively and smoothly among the rotation blocks. **6. Water Management Record Keeping** a) Collection Methods; instructions had been given to the farmers groups. b) Output; Nothing had been collected since the Secretary was absent. The Chairman confirmed of their existence. c) Fixed Dates for Collection; within the following week or passed on to any monitoring team member that would visit to the scheme.
2. Input/Procured Materials for Training	1. Drawings; indicating proposed rotational irrigation systems. 2. Draft Technical Manual; for the farmers in regard to water management and drainage systems at farm level.
3. Outcomes of the Training	**1. Willingness of Farmers to follow Water Distribution Rotation** (a) The farmers are willing to adopt the proposed rotational irrigation system as per suggested by the Study Team. **2. Work Schedule (Farming)** (a) Farmers will start planting for dry season cropping once the engine would be adjusted and its proper use demonstrated to them. **3. Excavation of the remaining part of the Main Canal.** a) The farmers agreed to finish the work before starting the dry season cropping.
4. Farmer's Group Opinion/ Suggestions and their responses	3. Training on crop management and marketing (a) Requested training for some dry crops yet to be grown such as garlic and green beans.
5. Requested Continuous Recordings	1. Recordings of water level of the Luwelezi River (daily basis) 2. Recordings of water supply condition such as location of irrigation area, irrigated area, GWR, (daily basis) 3. Recordings of pump operation (actual head, pump discharge, pump operation hrs and fuel consumption, (daily basis) 4. Recordings of water surplus or shortage conditions (daily basis) 5. Recordings of farming activities and encountered problems (weekly basis) 6. Table 2 shows the record keeping form written in English version.
6. Others	**1. Study Teams' Recommendations** (a) Provision of simple weir; to raise water level in the Luwelezi river at the pump suction point to prevent from galling impeller of pump by means of by the river sediments. (b) Provision of simple hut; with thatched roof to keep pump facilities while in use during winter season at the pumping site (c) The farmers have planted beans and mustard at the lower areas of the scheme, relying on residual moisture. These are planted in nursery beds of 0.1 ha, and ten nurseries of them make it possible for cultivation of an approximate area of one hectare.

Layout Map of Proposed Irrigation System for Mantha Irrigation Scheme (Mz-4)



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Layout Map of Rotational Water Supply Plan for Mantha Irrigation Scheme (Mz-4)

Rotation Area	Date of Water Supply
①	Day 1
②	Day 2
③	Day 3
④	Day 4

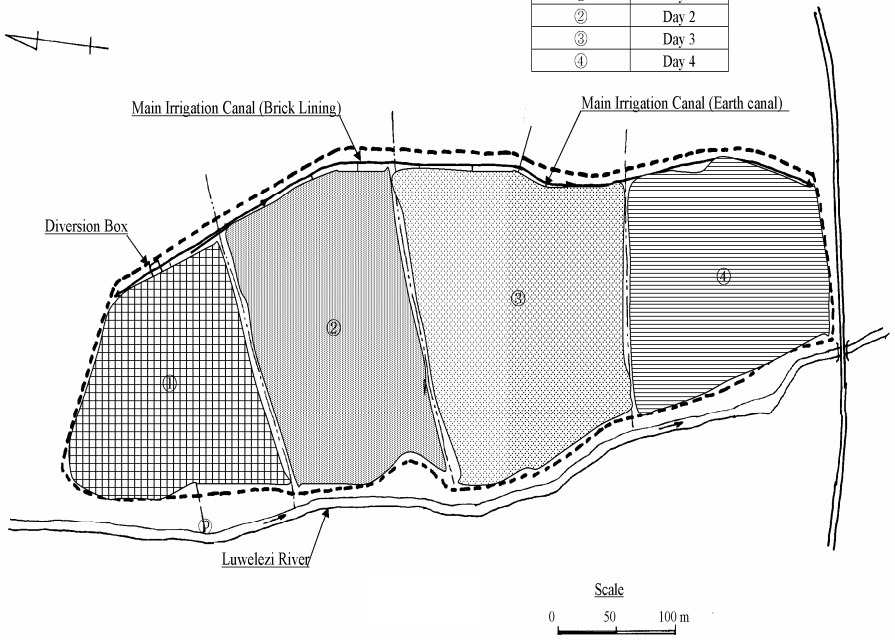

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Table A4-1(5) Training Report on Water Management (Mantha 2/2)

1. Name of Scheme : Mantha Irrigation Scheme (Mz-4)
2. Date/Period : July 9, 2008
3. Place of Training : Mantha Irrigation Scheme
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Members, Total (5)=M(5) + F (0)
   4) AEDC/AEDO : AEDC (1) and AEDO (1), Luwelezi EPA
   5) IO from DAO : Absent
5. Outlines of Training Workshop :

<table>
<tr><th>Item</th><th>Descriptions</th></tr>
<tr><td>1. Training Module
- Re-installation of Conveyance System
- Maintenance Works
- Farm Practices
- Water Management</td><td>
1. Reinstallation of Conveyance System.
(a) Conveyance pipes of 200m (aluminum pipes, dia = 140 mm) and direction changed
(b) Date; July 4, 2008.
2. Maintenance Works;
(a) Three gully crossing structures with pipes were build up as follows;
<table>
<tr><th>Gully Crossing</th><th>Original</th><th>Rehabilitated</th></tr>
<tr><td>No.1</td><td>1 PVC (130 mm)</td><td>2 Alum. (130 mm)</td></tr>
<tr><td>No.2</td><td>1 PVC (130 mm)</td><td>1 PVC (130 mm), 2 Alum. (100 mm)</td></tr>
<tr><td>No.3</td><td>1 PVC (130 mm)</td><td>1 PVC (130 mm), 2 Alum. (100 mm)</td></tr>
</table>
3. Farm Practices
(a) Dry Season; land cleaning and preparation works for winter season cropping have been done at a part of areas,
4. Water Management
(a) Water supply; not yet started.
(b) Scheduled period for Irrigation; farmers have a schedule to irrigate Zone No. 1 zone on July 15, 2008 in series,
(c) Proposed Rotation; 4-day rotational irrigation
</td></tr>
<tr><td>2. Input/Procured Materials for Training</td><td></td></tr>
<tr><td>3. Outcomes of the Training</td><td></td></tr>
<tr><td>4. Farmer’s Group Opinion/ Suggestions and Their Replies</td><td></td></tr>
<tr><td>5. Continuous Record Keepings requested by Study Team to Farmer’s Group</td><td></td></tr>
<tr><td>6. Others</td><td></td></tr>
</table>

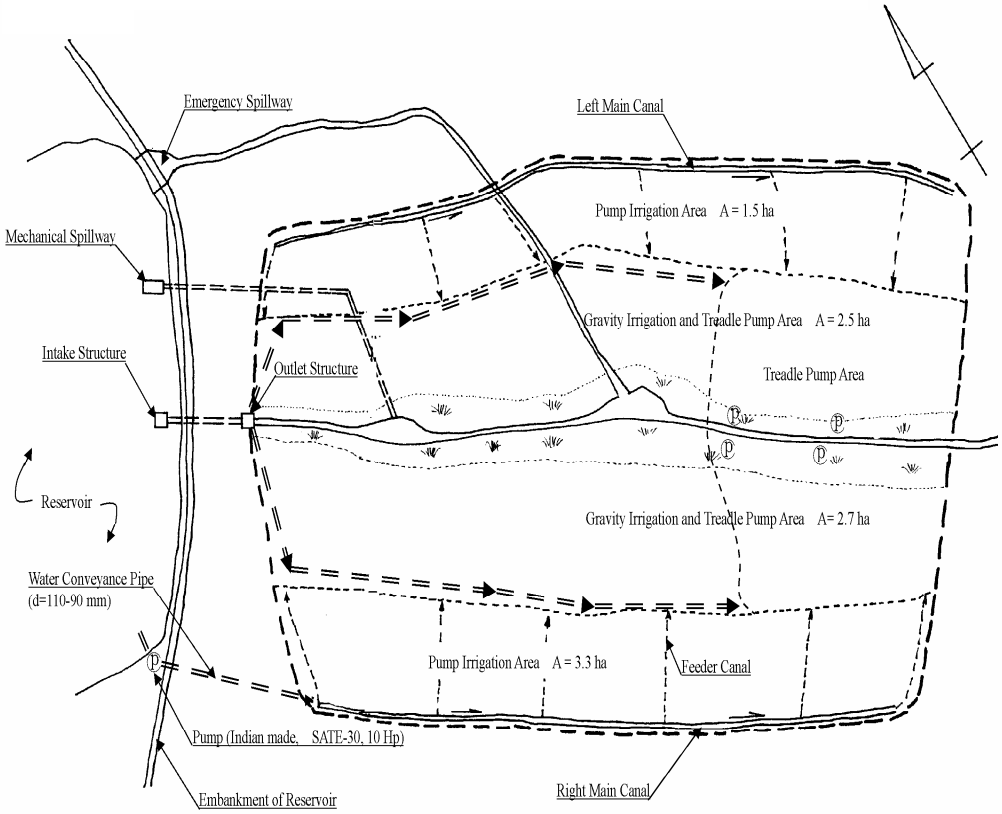
Table A4-1(6) Training Report on Water Management (Chiwoza 1/2)

1. Name of Scheme : Chiwoza Dam Irrigation Scheme (Kas-46)
2. Date/Period : June 12, 2008
3. Place of Training : Chiwoza Dam Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Irrigation Officer (1)
   3) Farmers Committee : Committee Members, Total (4) = M (2) + F (2)
   4) AEDC/AEDO : Absent
   5) IO from DAO : AIO (1), Kasungu DAO
5. Outlines of Training Workshop :

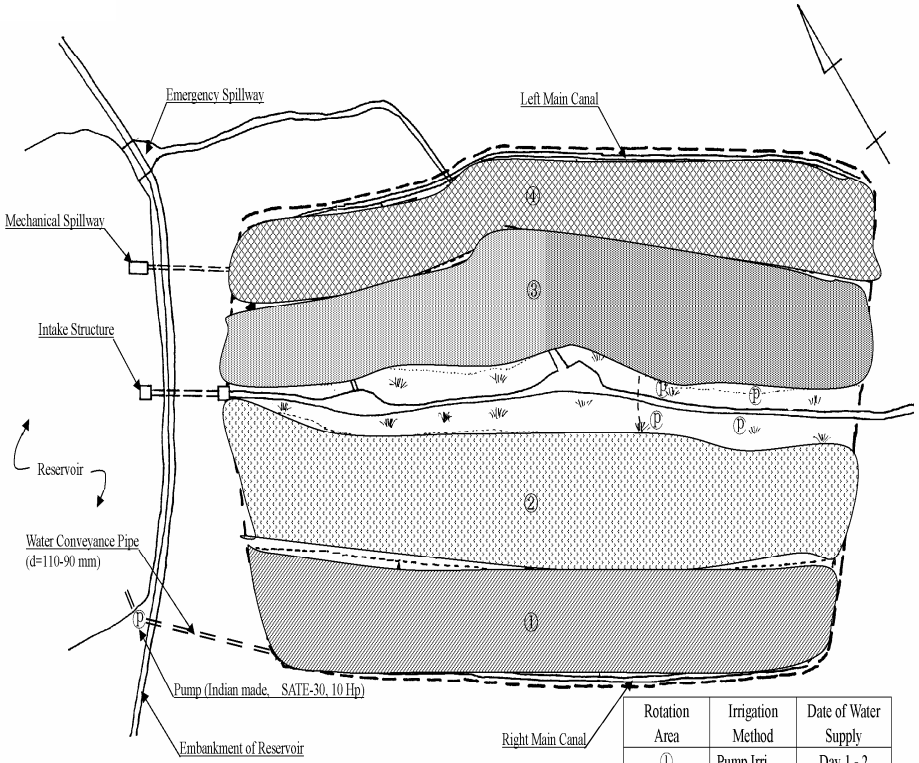
Item	Descriptions
1) Training Module - Chiwoza Scheme Layout - Pumping System - Cropping - Water Management and Rotation Distribution - Reservoir Rule Curve - Reservoir Condition - Water Management Record keeping	**1. Chiwoza Scheme Lay-out** (a) Reservoir characteristics; capacity of 47,000 m^3, mechanical and emergency spillways, intake structure, outlet structure, pump (SATE-30, 10 Hp), conveyance pipe, right and left main canals and turn-outs. (b) Zones for the Irrigated Area (i) Right Bank Pump irrigation area : 3.3 ha (irrigated by right main canal) Gravity irrigation area : 2.7 ha (irrigated by PVC and flexible pipes) (ii) Left Bank Pump irrigation area : 1.5 ha (irrigated by left main canal) Gravity irrigation area : 2.5 ha (irrigated by PVC and Flexible pipes) **2. Pumping System** (a) Pump facilities; were planned to be installed at the downstream portion of the outlet structures, close to Chisuwe river, (b) Current Pump Site; presently placed on the reservoir embankment at right side, and is connected to distribution structure with PVC pipes. (c) Problem related to Pump Site; according to the committee member, shifting the pump facilities to the left side on the embankment is hard because the pump does not have wheels. **3. Cropping** a) Major crops for dry season; maize, paprika, tomato, cabbage, etc. **4. Water Management and Rotation Distribution** (a) Proposed Rotation; 4-day rotation was proposed to the farmers' group and explanations and discussions on the methods were made to the representative of the Committee members. (b) Basis for the Rotation; the proposed days of the rotation were derived basing on the proposed ETc and typical readily available moisture (RAM) of the soils. **5. Reservoir Rule Curve** (a) Function; aims at operating reservoir effectively and minimize risk of crop damage due to water shortages in the dry season, was explained and demonstrated to the Committee members (refer to **Figure A4-1**)

Item	Descriptions
	(b) Recommendations for Chiwoza Reservoir (i) Wet Season; farmers can use **10 ha** land for irrigation because of enough reservoir inflow discharges. (ii) Dry Season; the following applies for these yearly conditions - *Normal year*, identified by the reservoir water level, maintaining 3.3 m on the staff gauges by the end of May. **46%** of the total irrigation area (10 ha), **4.6ha** could be irrigated. This is due to reduced reservoir capacity. - *Drought year*, identified by the reservoir water level, starting to decline at the end of April, only **1.8 ha** of land could be irrigated using reservoir water resources. Thus, farmers could cope with the risk of crop damage by reducing cropping areas in the season **6. Reservoir Conditions** (a) Present reservoir water level; as of June 12, 2008 it was observed to be 2.88 m on the staff gauges, i.e. normal year, (refer to **Figure A4-1)**. **7. Water Management Record Keeping** a) Collection of Records; Nothing had been collected since the Secretary was absent. The Chairman confirmed of their existence. b) Fixed Dates for Collection; within the following week
2) Input/Procured Materials for training	1. Drawings indicating proposed rotational irrigation systems.
3) Outcomes of the Training	1 Farmers Willingness to adopt the Rotation System; are very much willing to adopt the systems however they need more clarification even though they have already been practicing the rotational irrigation methods in the scheme.
4) Farmer's Group Opinion/ Suggestions and their responses	1. Proposed Activity; Excavation of the deposited soils in the reservoir to increase its storage capacity 2. Challenge; shortage of PVC and blue pipes 3. Threat; taking time of the pump to start working
5) Requested Continuous Recordings	1. Recordings of Chiwoza dam water level and stored volume (daily basis) 2. Recordings of water supply condition such as location of irrigation area, irrigated area, GWR, (daily basis) 3. Recordings of water supply by pump irrigation such as location of irrigation area, irrigated area, GWR, pump operation hours and consumption of fuels(daily basis) 4. Recordings of water surplus or shortage conditions (weekly basis) 5. Recordings of farming activities and encountered problems (weekly basis) 6. Table 3 shows the record keeping form written in English version.
6) Others	1. Request ; Study Team requested the Kasungu DAO Irrigation Officer to prepare topographic map of the Chiwoza Dam Irrigation Scheme based on the specification and ways suggested by the Study Team, in order to identify an acquittal irrigable areas and present land-use of the scheme.

Layout Mao of Existing and Proposed Irrigation Systems for Chiwoza Dam Irrigation Scheme (Kas-46)



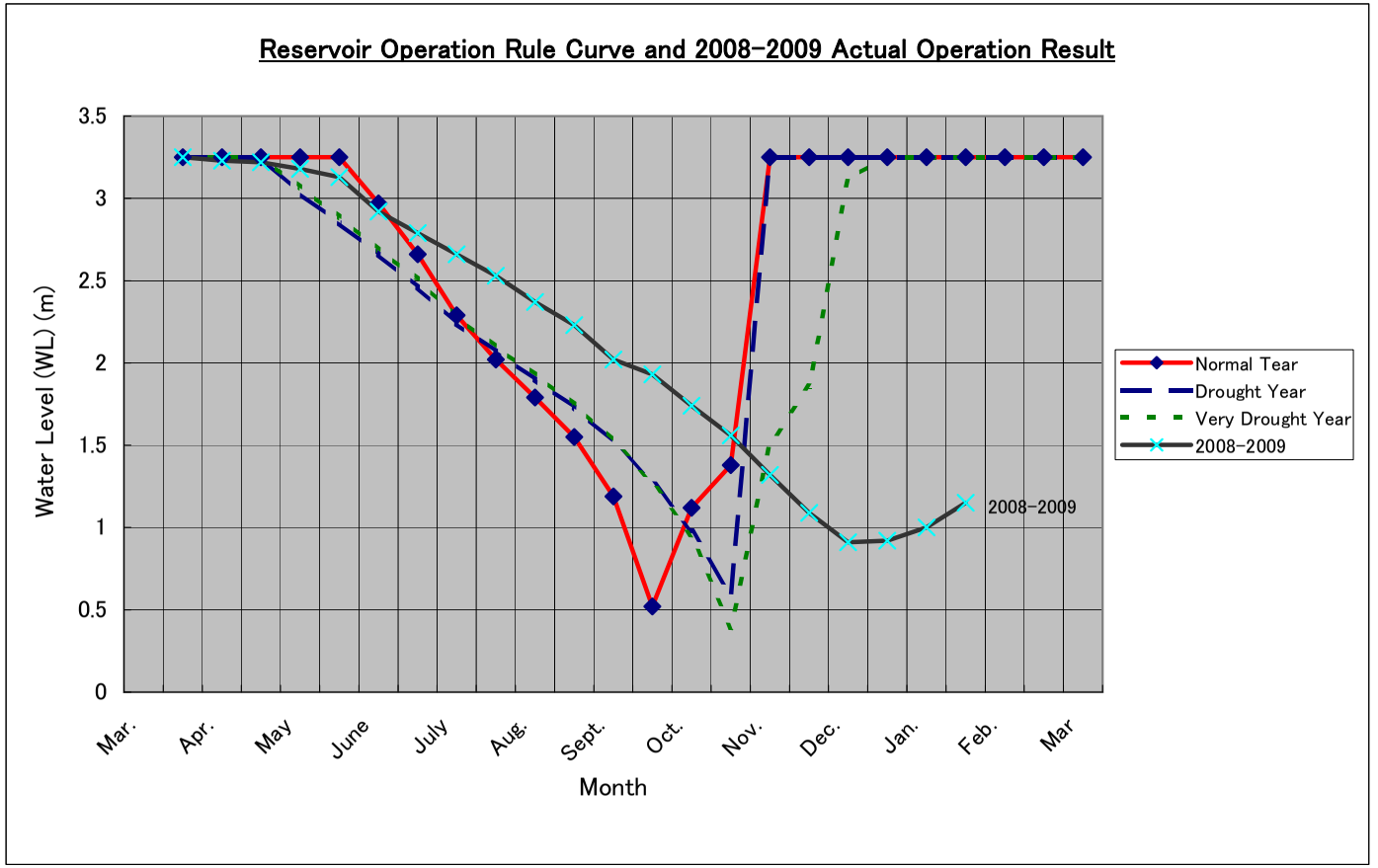
Layout Map of Rotational Water Supply Plan for Chiwoza Dam Irrigation Scheme (Kas-46)



Rotation Area	Irrigation Method	Date of Water Supply
①	Pump Irri.	Day 1 - 2
②	Gravity Irri	Day 2 - 3
③	Gravity Irri.	Day 3 - 4
④	Pump Irri.	Day 4 - 5

Figure A4-1 Chiwoza Dam Reservoir Operation Rule Curve and 2008-2009 Actual Operation Result

Month		Watre Level (m)			
		Normal Year	Drought Year	Very Drought Year	2008-2009
		P = 1/1.25	P = 1/5	P = 1/10	
Mar.	1				
	2	3.25	3.25	3.25	3.25
Apr.	1	3.25	3.25	3.25	3.23
	2	3.25	3.25	3.25	3.22
May	1	3.25	3.03	3.07	3.18
	2	3.25	2.85	2.89	3.13
June	1	2.97	2.66	2.69	2.92
	2	2.66	2.46	2.51	2.79
July	1	2.29	2.24	2.28	2.66
	2	2.02	2.07	2.1	2.53
Aug.	1	1.79	1.9	1.93	2.37
	2	1.55	1.73	1.75	2.23
Sept.	1	1.19	1.52	1.53	2.02
	2	0.52	1.28	1.27	1.93
Oct.	1	1.12	0.98	0.95	1.74
	2	1.38	0.59	0.39	1.56
Nov.	1	3.25	3.25	1.51	1.32
	2	3.25	3.25	1.86	1.09
Dec.	1	3.25	3.25	3.12	0.91
	2	3.25	3.25	3.25	0.92
Jan.	1	3.25	3.25	3.25	1
	2	3.25	3.25	3.25	1.15
Feb.	1	3.25	3.25	3.25	
	2	3.25	3.25	3.25	
Mar	1	3.25	3.25	3.25	



Irrigation area ;

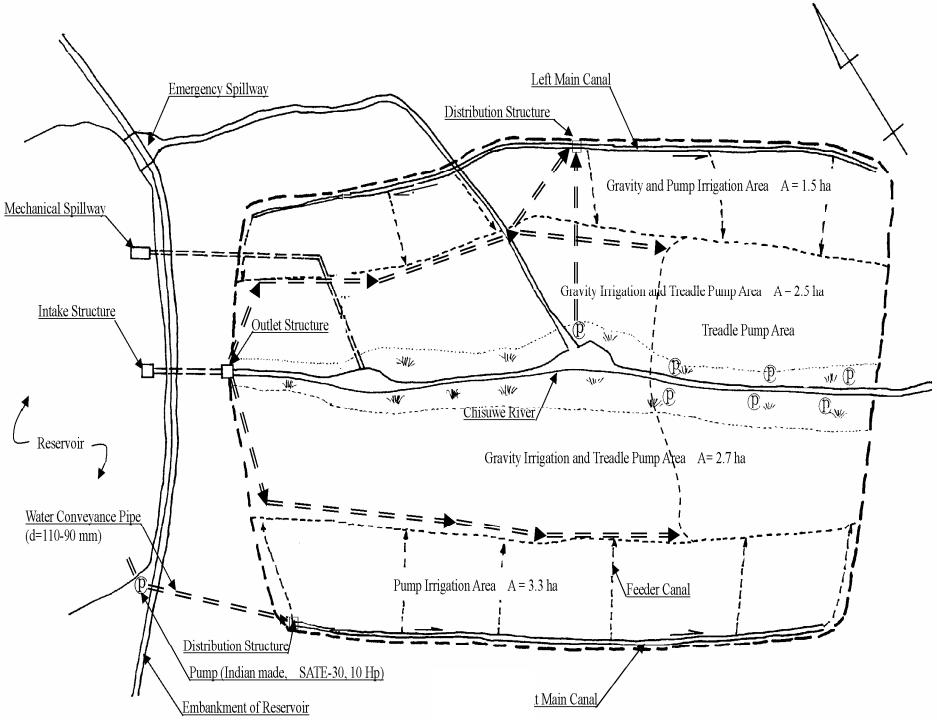
Case	Summer (Wet) Season	Winter (Dry) Season
Normal Year	10 ha(100%)	4.6 ha (46%)
Drought Year	10 ha(100%)	1.8 ha (18%)

Table A4-1(7) Training Report on Water Management (Chiwoza 2/2)

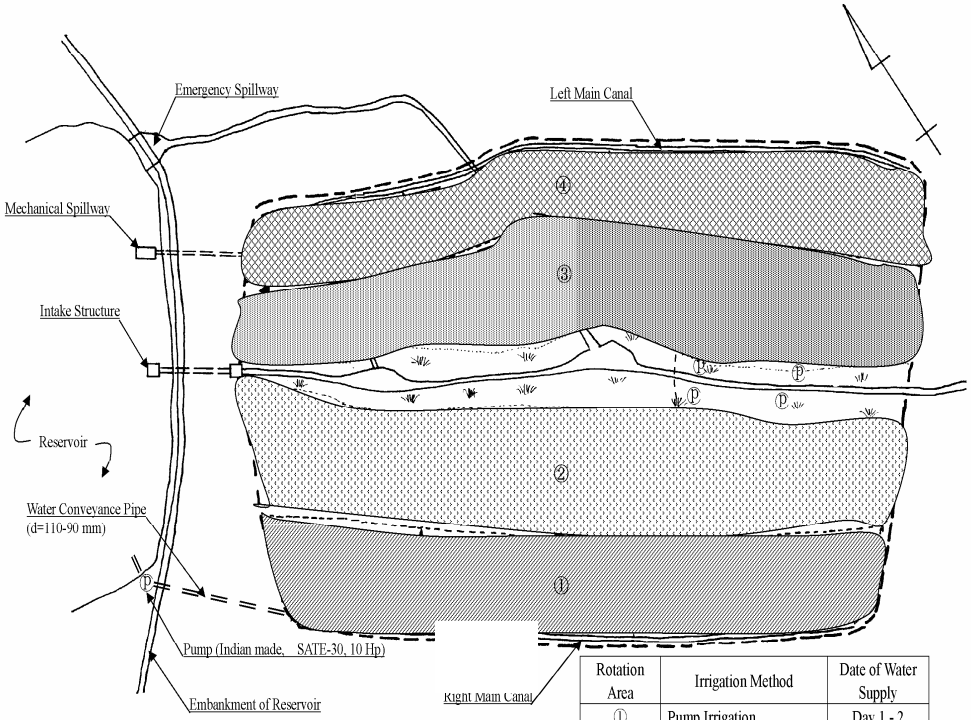
1. Name of Scheme : Chiwoza Dam Irrigation Scheme
2. Date/Period : July 14, 2008
3. Place of Training : Chiwoza Dam Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Members, Total (4) = M (3) + F (1)
   4) AEDC/AEDO : AEDO (1), Chulu EPA
   5) IO from DAO : Irrigation Officer (1), Kasungu DAO
   6) Others : None
5. Outlines of Training Workshop :

Item	Descriptions
1. Training Module - Pump System - Left Bank Pump Irrigation Zone - Farmers' Alternatives to the Left Bank - Methods of Irrigation in the Zones - Status of the Reservoir	**1. Pump System** (a) Motorized Pump; was shifted from the top of the reservoir embankment to the lower place adjacent to inland of the reservoir, in order to reduce the suction head of the pump. (b) Initiator; These activities were made based on the considerations of farmer's themselves. **2. Left Bank Pump Irrigation Zone** (a) Current Situation; 1.5 ha in size are not irrigated, rely on the stored water in the reservoir (b) Reason; because there is no provision of left main canals due to undulating topography in the areas, as well as no exists of long conveyance pipes connecting from the pump to the left main canals. **3. Farmers' Alternatives to the Left Bank** (a) Main canal lining; was provided in parallel with contour line in accordance with topography, (b) Division Box; one division box was provided at the highest portion of the main canal i.e. the main canal has two different directions in gradient. **4. Methods of Irrigation the Zones.** (a) gravity systems connected with outlet structure; water is supplied to the area by gravity systems through conveyance PVC and blue pipes, depending on the reservoir potential head, especially for the period from the end of March to the end of September (b) motorized pump systems; after September no reservoir potential head could be expected for gravity systems due to decreasing of reservoir water level, so that the areas will be irrigated by motorized pump installed along river (refer to Figure 8 and 9) **5. Status of the Reservoir** (a) Current Reservoir water level; 2.59 m on the staff gauges, (b) Compared with Previous Level; lower by 29 cm-compared to a month ago reading June 12, 2008.
2. Input/Procured Materials for Training	a. Revised drawings indication proposed irrigation and rotational systems
3. Outcomes of the Training	
4. Farmer's Group Opinion/ Suggestions	
5. Continuous Record Keepings	
6. Others	

Layout Map of Existing and Proposed Irrigation Systems for Chiwoza Dam Irrigation Scheme (Kas-46)



Layout Map of Rotational Water Supply Plan for Chiwoza Dam Irrigation Scheme (Kas-46)



Rotation Area	Irrigation Method	Date of Water Supply
①	Pump Irrigation	Day 1 - 2
②	Gravity Irrigation	Day 2 - 3
③	Gravity Irrigation	Day 3 - 4
④	Pump + Gravity Irrigation	Day 4 - 5

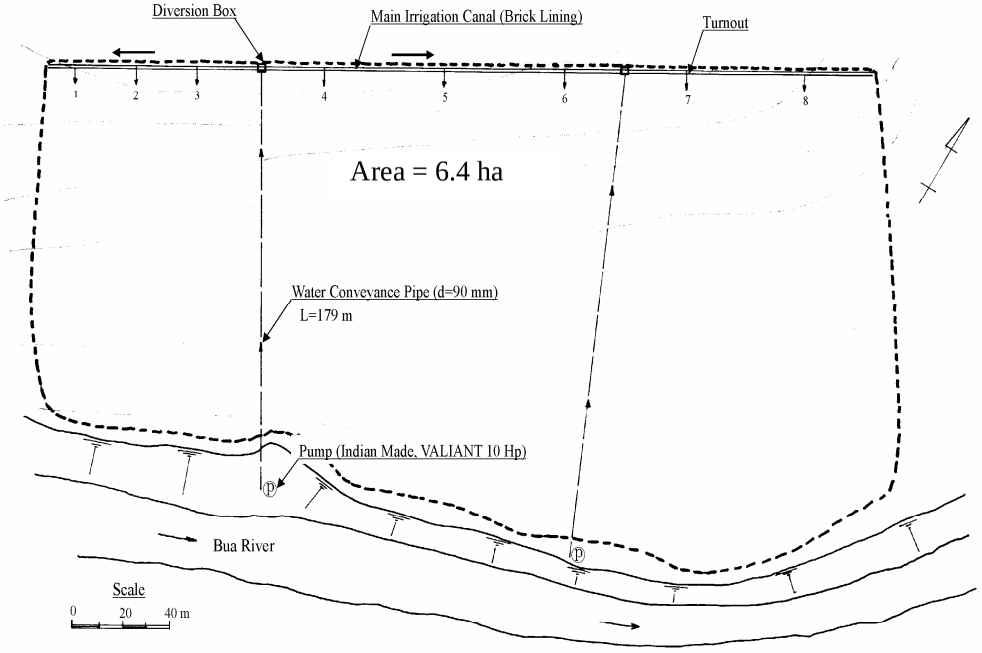
Table A4-1(8) Training Report on Water Management (Kachere 1/2)

1. Name of Scheme : Kachere Irrigation Scheme (Kas-40)
2. Date/Period : June 27, 2008
3. Place of Training : Kachere Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Members, Total (6) = M (5) + F (1)
   4) AEDC/AEDD : AEDO(1), Chipala EPA
   5) IO from DAO : AIO (1), Kasungu DAO
   6) Others : Farmers (12)
5. Outlines of Training Workshop :

Item	Descriptions
1) Training Module ▪ Pumping System ▪ Cropping ▪ Farmers Concerns on Water Supply ▪ Water Level in Bua River ▪ Water Management and Rotation ▪ Unfinished work ▪ Water Management and Record Keeping	**1. Pumping System** (a) Pump Characteristic; two unit of repaired pumps (VALIANT maid in India, 10 Hp, dia=90 mm), (b) Water conveyance pipes; (2) places with 180 m each, 360 m in total, two distribution boxes and seven turn-outs **2. Cropping** (a) 2007/08 Wet Season; most of the land was abandoned although land had been prepared. (b) 2008 Dry Season; farmers are planning to cultivate the following dry crops; maize, tomatoes, etc. from July 15, 2008. (c) Current status; presently, part of land is cleared and prepared for dry season crops e.g. maize and tomatoes. **3. Farmers' Concerns on water availability** (a) Warring about water distribution; from the main canal into the fields, since they think that the main canal are deep for divert irrigation water easily get in basins from the secondary canals in some areas. (b) Warring about start-up fuel; to start scheme operations. (c) Technical Guidance; asked to find some ways among themselves as how they can start-up and they all agreed to contribute 300 MK/farmer for a fuel charge as a starter-pack. **4. Water Level in Bua River** (a) Present water level; as of July 27 is 0.46 m on the staff gauges. But the staff gauges made of vinyl is deteriorated by the dirty river water and difficult to read the water level on the staff gauges. (b) Farmers' request; Committee members requested the replacement of the staff gauges.. **5. Water Management and Rotation** (a) Proposed Water Distribution Rotation; 5-day rotation was explaned and discussed as well as methods to the representative of the Committee members (refer to Figure 11). (b) Basis for Rotation; the proposed days of the rotation were derived basing on the proposed ETc and typical readily available moisture (RAM) of the soils. (c) Pump capacity and rotation; the Study Team emphasized that one unit of pump operation could be enough to meet the water requirements for dry season crop, when considering the repaired pump capacity

Item	Descriptions
	6. Unfinished work (a) Secondary canals; connected with main canal are not yet excavated at the farm level, (b) Request; Committee member requested for technical assistance to decide the alignments of the canals (c) Work Schedule; it was decided that those works would be done on July 10, 2008. **7. Water Management Record Keeping** (a) Data Collection; requested 207/08 wet season data was collected (b) Records; it was found out that the requested record keepings works were made until the end of March 2008, and could not continue because of lack of recording sheets. (c) New format of the record keepings; written in local dialogue of "Chichewa" and "Tumbuka" was provided to the Committee member to start records from July 2008.
2) Input/Procured Materials for Training	1. Drawings; indicating proposed rotational systems
3) Outcomes of the Training	2. Work Schedule; the Committee members and farmers made the following schedule: June 29 to July 9, 2008 to do the following; land cleaning and preparation works
4) Farmer's Group Opinion/ Suggestions and their comments	None
5) Requested Continuous Recordings	1. Recordings of water level of the Bua River (daily basis) 2. Recordings of water supply conditions such as location of irrigation area, irrigated area, and GWR (daily basis) 3. Recordings of pump operation such as actual head (Ha), pump discharge, pump operation hours and consumption of fuels (daily basis), 4. Recordings of water surplus or shortage conditions (daily basis) 5. Recordings of farming activities and encountered problems (weekly basis) 6. **Table 4** shows the record keeping form written in English version.
6) Others	1. Next visit to the scheme will be on July 10, 2008 to assist for deciding secondary canal alignments, and at that time the deteriorated staff gauges will be replaced by the new one.

Layout Map of Proposed Irrigation Systems for Kachere Irrigation Scheme (Kas40)



Layout Map of Rotational Water Supply for Kachere Irrigation Scheme (Kas-40)

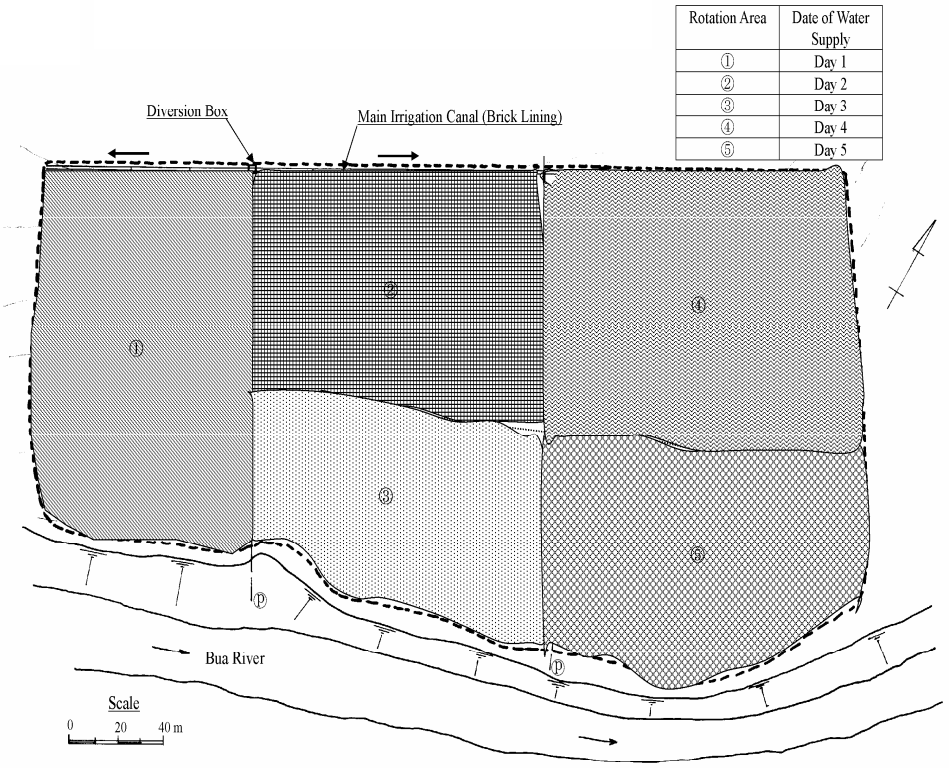


Table A4-1(9) Training Report on Water Management (Kachere 2/2)

1. Name of Scheme : Kachere Irrigation Scheme (Kas-40)
2. Date/Period : July 10, 2008
3. Place of Training : Kachere Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Members, Total (7) = M (3) + F (4)
   4) AEDC/AEDO : AEDO (1), Chipala EPA
   5) IO from DAO : Absent
   6) Others :
5. Outlines of Training Workshop :

Item	Descriptions
1. Training Module - Water management Rotation - Canal Alignment	1. Water Management Rotation; 5-day rotational irrigation methods was explained to the Committee members, prior to the commencement for deciding secondary canal alignments, which will be branched off from the main irrigation canal. 2. Canal Alignment**;** The Study Team assisted the Committee members to have alignments of the secondary canals in place, of which intervals are about 25m or 50 m depending on the turnout location in the main canal were made (refer to Figure 12).
2. Input/Procured Materials for Training	
3. Outcomes of the Training	3. Canal Construction; Based on secondary canal alignments, farmers related to the will excavate canals using their hoes and hovels. 4. Schedule for the Excavation; to start on July 17, 2008. 5. Recommendation; the Study Team recommended starting irrigation water supply for the zone areas, which have been provided with the secondary canals.
4. Farmer's Group Opinion/ Suggestions	None
5. Continuous Record Keepings	
6. Others	

Layout Map of Proposed Irrigation Schemes for Kachere Irrigation Scheme (Kas-40)

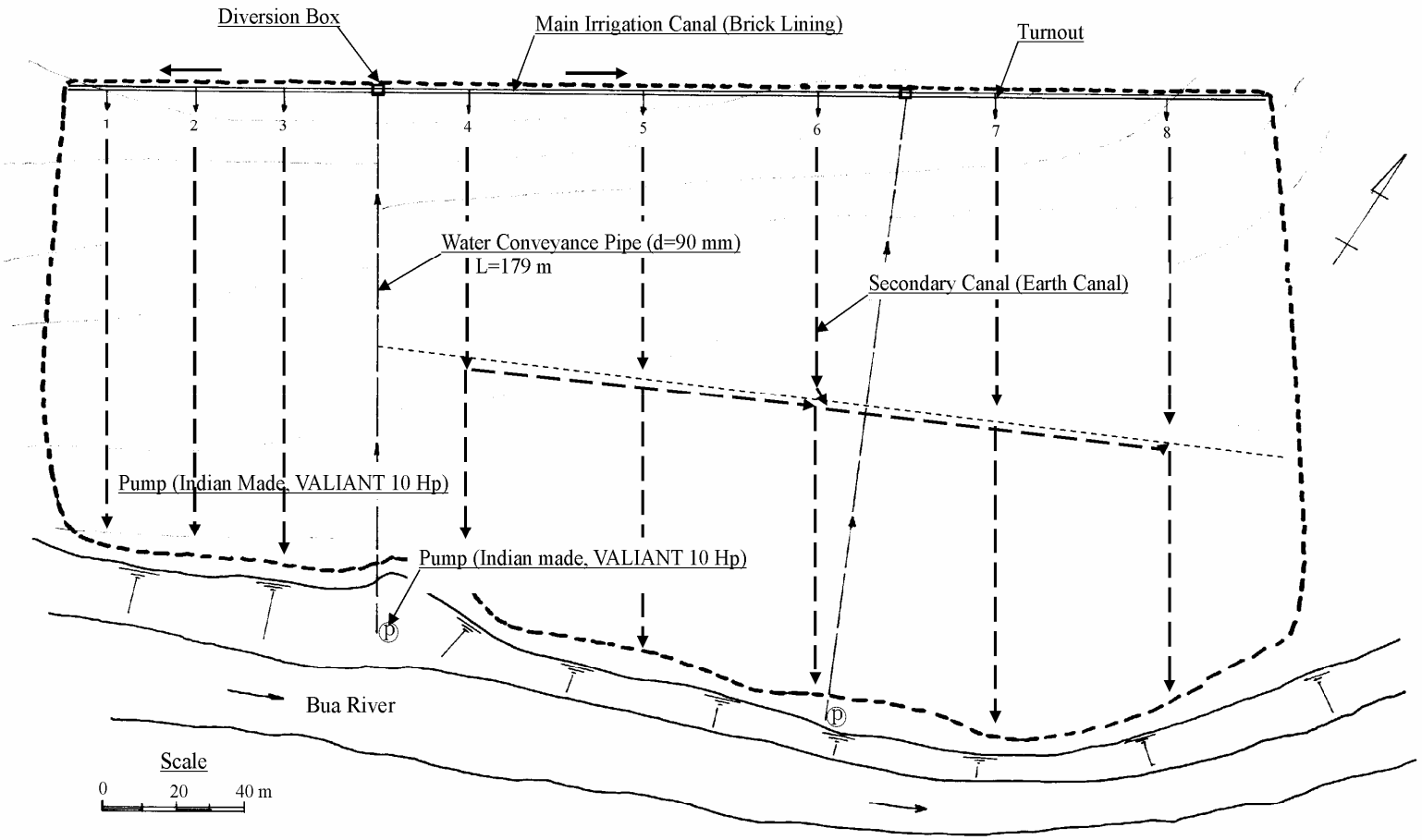


Table A4-1(10) Training Report on Water Management (Titukulane 1/2)

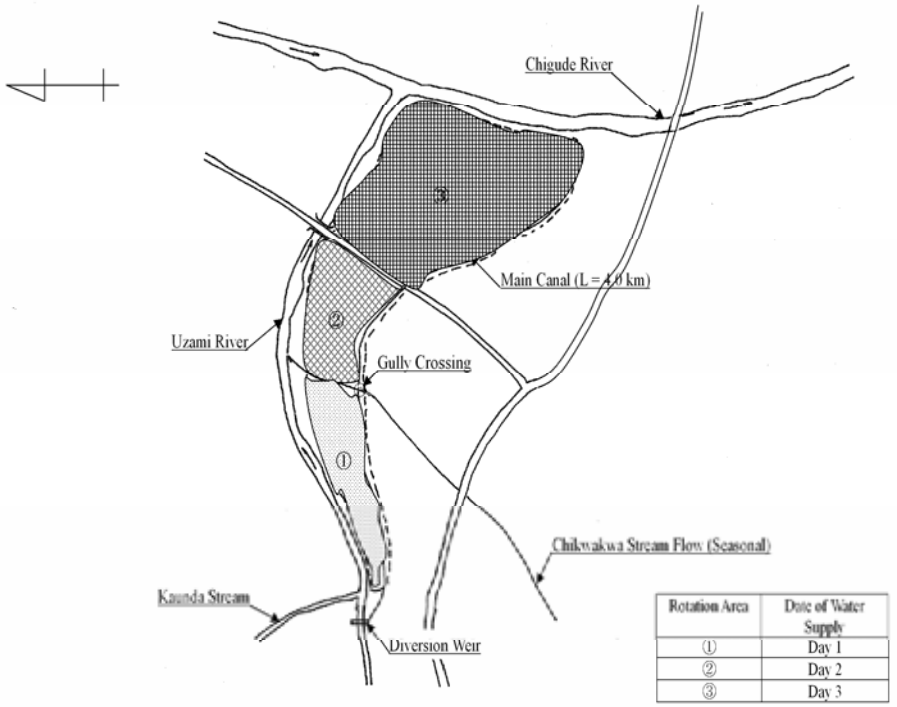
1. Name of Scheme : Titukulane Irrigation Scheme (Kas-47)
2. Date/Period : June 9,2008
3. Place of Training : Titukulane Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Irrigation Officer (1)
   3) Farmers Committee : Committee Member, Total (11) = M (8) + F (3)
   4) AEDC/AEDO : Absent
   5) IO from DAO : Irrigation Officer (1), Dowa DAO
   6) Others : Group Village Headman (1)
5. Outline of Training Workshop

Item	Descriptions
1. Training Module ▪ Rehabilitated Structures ▪ Water Management ▪ Water Management Record keeping	**1. Rehabilitated Structures** (a) Diversion weir; rehabilitated with masonry, (b) Intake Structure; newly provided with pipe (PVC) (c) Main Canal; rehabilitation of main canal (4 km), (d) Piped Crossing; rehabilitation of two places of piped river crossing (e) Installed intake pipe; connecting with the diversion weir was lowered by about 12 cm to abstract more water. **2. Water Management** (a) Present irrigation water supplies; only supplied to a small area using water from Chikwakwa stream, (b) Irrigated Area; the sizes of irrigated areas is 0.35 ha and is used for peach cultivation. (c) Irrigation Operation hours for the area; two hours , irrigation interval of twice a week, Mon and Fri(3-day rotation). (d) Reason for less usage of water; incompletion rehabilitation works of irrigation systems, especially two places of river crossing and their related structures. (e) Proposed Water Distrubution Rotation; 3-day rotation irrigation systems (refer to Figure 14) and was accepted by the farmer's group, after instruction of water distribution methods and irrigation scheduling to the farmer's group. (f) Assesment of Water Distribution Rotation; it was found out that the farmer's group needs more guidance on water distribution and scheduling, besides the fact that they are already familiar with rotational irrigation systems. (g) Topographic Survey; the proposed detailed irrigation systems with 3-day rotation will be much intensified when topographic survey is completed to come up with the exact boundary of the scheme. **3. Water Management Record Keeping** a) Collection Methods; instructions were given to the farmers groups. b) Output; at the time of visit the Secretary had not brought the report with him. However, the Study Team was much assured of the recordings systematically, and was agreed that the records would be checked later. c) New format of the record keepings; written in local dialogue of "Chichewa" was provided to the Committee member to start records from June 2008.
2. Input/Procured Materials for training	1. Drawings; indicating the proposed rotational irrigation systems
3. Outcomes of the Training	**1. Farmer Group Work Schedule** (a) Putting sand-bags along the intake areas within the 3-day of the Study Team's visit (b) Making an embankment on the left side of the canal at the first river crossing.

Item	Descriptions
	2. Farmer's groups Willingness to Adopt Rotation (a) Willingness; ere very willing to adopt the rotational use of water, and the suggested demarcations of 3-day rotational systems were fully accepted. **3. Dry Season Cropping** (a) Scheduled Dates; the farmers already started preparations since the 20th of May, 2008. (b) Crops planted; are maize, Irish potatoes, peas, tomatoes, pumpkins, and okra. (c) Source of Water for Planted Crops; Chikwakwa stream, because the water level in the Uzami river is not enough to cross over. The river crossing pipe.
4. Farmer's Group Opinion/ Suggestions and Their Replies	1. Assistance; Need more assistance at the intake site to increase water level 2. Requests made to the Study Team; (a) Canal alignment; of about 200m from the 2nd river crossing along canal that abstract water from the Chikwakwa stream, (b) 50 m alignment of the canal; that abstract water from the Uzami river, close to the 2nd river crossing. 3. Appreciation; The farmer's group was thankful for all the support and guidance benefited from the Study Team
5. Requested Continuous Record Keepings	1. Recordings of estimated gross irrigation water requirements (GWR) (weekly basis) 2. Recordings of irrigated areas (weekly average) 3. Recordings of water surplus or shortage conditions (weekly basis) 4. Recordings of farming activities and encountered problems (weekly basis) 5. **Table 5** shows the record keeping form written in English version.
6. Others	**1. Request from the Study Team** Requested the IO from Dowa DAO to prepare topographic map of the Titukulane Irrigation Scheme based on the specification and ways suggested by the Study Team, in order to identify an acquittal irrigable areas and present land-use of the scheme.

Layout Map of Proposed Irrigation System for Titukulane Irrigation Scheme (Kas-47)

Layout Map of Rotational Water Supply Plan for Titukulane Irrigation Scheme (Kas-47)



Rotation Area	Date of Water Supply
①	Day 1
②	Day 2
③	Day 3

Table A4-1(11) Training Report on Water Management (Titukulane 2/2)

1. Name of Scheme : Titukulane Irrigation Scheme (Kas-47)
2. Date/Period : July 8, 2008
3. Place of Training : Titukulane Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Member, Total (15)= M(15) + F (0)
   4) AEDC/AEDO : Absent
   5) IO from DAO : AIO (1), Dowa DAO (Mponela)
5. Outlines of Training Workshop :

Item	Descriptions
1. Training Module ▪ Intake Pipe ▪ Canal protection Works ▪ Main Canal Cleaning Works ▪ Water Distribution and Rotation ▪ Water Management Record Keeping	**1. Intake Pipe.** (a) Obstacles deposited in the intake pipe; were removed at the middle of June, (b) Intake water level in front of the intake pipe; was raised by putting the additional 18 sand bags on weir crest (c) Outcome of Raising the Crest; increased water discharges flowing into main canal with a water depth of 6 cm from the top of the intake pipe. **2. Canal Protection Works at the immediate upstream of the No.1 river crossing structures** (a) Scheduled dates for Rehabilitation; were implemented at the end of June 2008, (b) Technical Assistance; technical and input material assistances by Dowa DAO office (c) Material Used; 5-bags of cement; 3-bags from DAO office and 2-bags from FIDP. **3. Main canal cleaning works** a) Prior to the starting dry season cropping upstream portions of the main canal was cleaned with the participation of 15 farmers. **4. Water Distribution and Rotation** (a) Proposed Rotation; was based on the water distribution plan (3-day rotation plan) proposed by the Study Team, (b) Decision for the Proposal; farmer's group had a meeting on July 7, 2008, and the plan was agreed. (c) Water Use; Present water use is only limited at the areas of zone-1 and -2, and not zone-3. **5. Water Management Record Keeping** (a) Data Collection; records on water management for the periods of three month from March 2008 to May 2008 were collected from the Secretary of the Committee.
2. Input/Procured Materials for Training	
3. Outcomes of the Training	
4. Farmer's Group Opinion/ Suggestions	1. Farmers' Plans; are planning to plant the crops of maize, tomatoes, Irish potatoes, mustard, as a dryseason crops. 2. Challenge; Scarcity of Irish potatoes seeds.
5. Continuous Record Keepings	
6. Others	

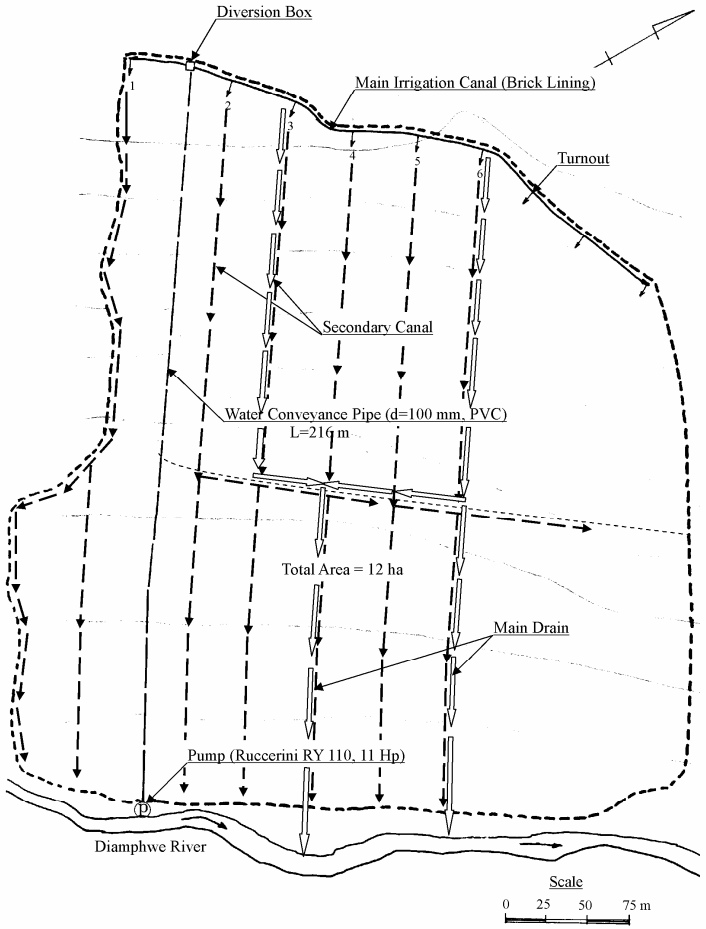
Table A4-1(12) Training Report on Water Management (Chaseta 1/2)

1. Name of Scheme : Chaseta Irrigation Scheme (Li-2)
2. Date/Period : May 27 and 28, 2008
3. Place of Training : Chaseta Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Irrigation Officer (1),
   3) Farmers Committee : Committee Members, Total (10)= M(8) + F(2)
   4) AEDC/AEDO : AEDO and staff (2), Mlomba EPA
   5) IO from DAO : PIO (1) and AIO (1), Lilongwe DAO
5. Outlines of Training Workshop :

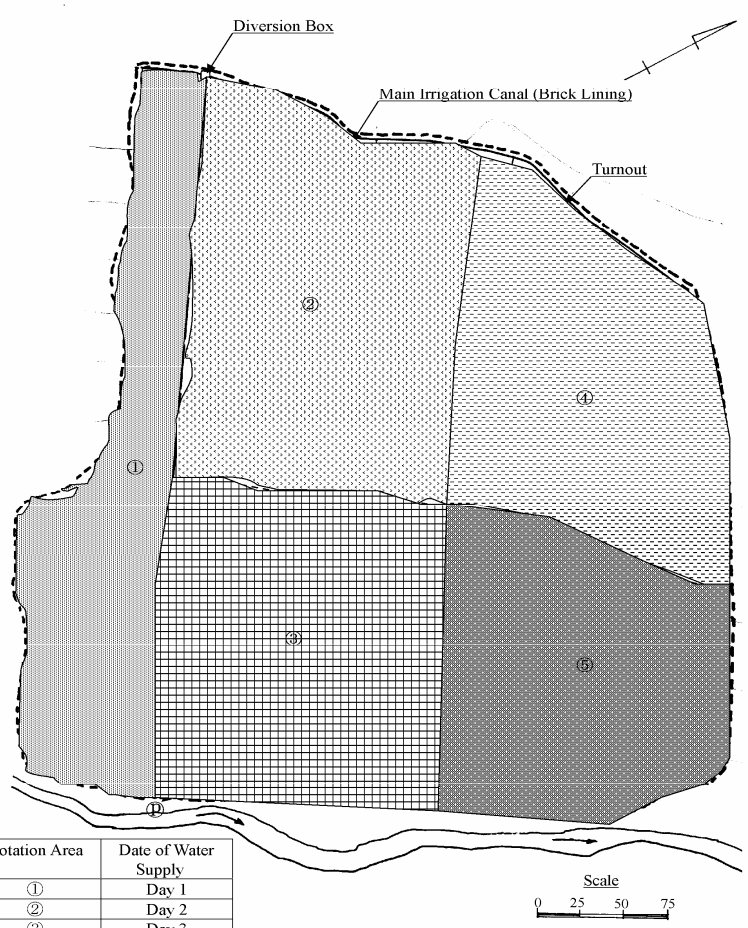
Item	Descriptions
1. Training Module ▪ Pumping System ▪ Pump Tests and Other Structures ▪ Rehabilitation Works ▪ Water management and Distribution Rotation ▪ Water Management Record Keeping ▪ Water Logging Conditions	**1. Pumping System** (a) Characteristic of the Procured Pump; Ruccerini RY 110, 11HP, 3600 rpm, Bore 86 mm (b) Main Canal; proposed length = 330m, lined canal = 201 m, (c) Other Structures; 1-diversion box and 5-turnouts **2. Pump Tests and Other Structures** (a) Pump Operation; test was done on May 15, 2008, (b) Result of Pump Test; it was found out that the pump discharge was 7.0 lit/sec and 12.0 m head. (c) Staff Gauges; were installed beside the Diamphwe River in October 2007 by the Study Team and replaced just near the original site, because one of the staff gauges was damaged. **3. Rehabilitation Works** (a) Secondary Canal; alignments connected to 5-turnouts were delineated on the ground considering the rotational irrigation systems under the participation of farmer's group (b) Canal excavation; was scheduled by the farmers from June 6, 2008. secondary canals branching-off from the lined main canal portions were placed a priority. **4. Water Management and Distribution Rotation** (c) No irrigation in the dry season; due to unfinished work e.g. no secondary canals. Very minimal irrigation was done using water canes. (d) Rotation; 5-day rotation irrigation methods for 5 rotation blocks was proposed to the scheme, and explanation and discussions on the methods were made to the representative of farmer's group (refer to Figure 16). (e) Basis for the Rotation; formulated, on the crop -evapo transpiration (ETc) and readily available soil moisture (RAM). **5. Water Management Record Keeping** (a) Request for the Recording; farmer groups were requested to collect data the from the onset of wet season (2007/08) (b) Progress of Collection; it was found out that the requested record keepings were stopped by the end of Feb 2008. **6. Water Logging Conditions** (a) Solution; to solve the issues of water loggings at farm level, typical improvement methods for surface drainage conditions were explained as the references. (b) Priority; However, it was stated the issue would be placed as second priority in the scheme.

Item	Descriptions
2. Input/Procured Materials for Training	1. Drawings; indicating proposed rotational irrigation systems 2. Iron wire; to strap the PVC pipe with displayed crack
3. Outcomes of the Training	**1 Farmer's group made following work schedule** (a) Excavation of secondary canal ; June 2, 2008 to June 5, 2008 (b) Holding the meeting ; June 6, 2008 **2. Adoption of the Rotation** (a) Willingness; are very much willing to adopt the rotational use of water, (b) Farmers Acceptance; demarcations of 5-day rotation systems were accepted with gladness. **3. Farm Preparations for Dry Season.** (a) All the land preparation works; to be done after all excavation will be done in the week of the 2nd June.
4. Farmer's Group Opinion/ Suggestions and their responses	1. **Expansion of main irrigation canal**; with length of 25 m, of which 16.5 m was lined by the end of February 2008. 2. **Replacement of cracked three PVC pipes**; (100 mm) under the support of the Study Team **3. Responses from the Study Team** (a) Expansion and replacement works; should be done by farmer's group themselves with adequate procurements of materials such as cement, PVC pipes, etc. (b) Exposed PVC pipes; the portions should be laid underground to ensure optimal freshness of PVC pipes by means of deterioration and damages.
5. Requested Continuous Record Keepings	1. Recordings of water level of the Diamphwe River (daily basis) 2. Recordings of water supply condition such as location of irrigation area, irrigated area, GWR, (daily basis) 3. Recordings of pump operation such as actual head (Ha), pump discharge (Q), pump operation hours and consumption of fuels (daily basis) 4. Recordings of water surplus or shortage conditions (weekly basis) 5. Recordings of farming activities and encountered problems (weekly basis) 6. Table 6 shows the record keeping form written in English version.
6. Others	1. **Request from the Study Team**; (a) Canal Beds; requested the farmer's group to raise up main canal invert and side walls at the section of about 20 m to maintain the required head of water level in the main canal. (b) Topographic Maps; requested the IO from Lilongwe DAO to prepare topographic map of the Chaseta Irrigation Scheme based on the specification and ways suggested by the Study Team, in order to identify an acquittal irrigable areas and present land-use of the scheme. 2. **Farmer's group Request**; requested the Study Team to arrange more training on crop management

Layout Map of Proposed Irrigation Systems for Chaseta Irrigation Scheme (Li-2)



Layout Map of Rotational Water Supply Plan for Chaseta Irrigation Scheme (Li-2)



Rotation Area	Date of Water Supply
①	Day 1
②	Day 2
③	Day 3
④	Day 4
⑤	Day 5

Table A3-1 (13) Training Report on Water Management (Chaseta 2/2)

1. Name of Scheme : Chaseta Irrigation Scheme (Li-2)
2. Date/Period : July 11,2008
3. Place of Workshop : Chaseta Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Employed Irrigation Staff (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Members, Total (10) = M (8)+ F (2)
   4) AEDC/AEDO : AEDO(1), Mlomba EPA
   5) IO from DAO : Absent
   6) Others : Village Headman(1)
5. Outlines of Training Workshop :

Item	Descriptions
1) Training Module - Water Distribution Methods - Proposed Drainage System	1. Irrigation; is not yet started, because the farmers are using residual moisture of the soils. 2. Water Distribution Methods; Explanation and discussion on water distribution methods were made once again to the farmers' representatives. 3. Canal Excavation; five secondary canals were excavated by the farmers. However; these secondary canals are only within the areas, where the main canal has been constructed with length of 201 m. 4. Proposed drainage system; was drawn as shown in Figure 15. This was derived after looking at the existing drains within the scheme and the topographic slope of the area. However, it is subject to change as not all when the land will be put fully under cultivation.
2) Input/Procured Materials	
3) Outcomes of the Training	1. Farmers made the following schedule a) To finish land preparation and planting by the end of July, 2008 b) To finish leveling and making drains after all the planting activities are done. (Within July)
4) Farmer's Group Opinion/ Suggestions	1. Farmers' Suggestions; suggested that what if the canal running parallel to the main aligned canal be a raised type of canal, since the area to be fed or irrigated by it is higher than the excavated canal. 2. Farmers' Request; requested the presence of the Study Team when water is applied into the established field. 3. Demonstration; a clear demonstration of furrow and ridge layout and field ditches to the farmers, despite that the majority have already planted using their own ideas.
5) Issues requested to Farmer's Group by Study Team	1. Discipline; to be disciplined in the agreed procedure of rotational irrigation if it is to succeed. 2. Zones; Maintain the zones as per suggested and agreed within themselves
6) Others	1. Request; farmers requested the Study Team for clarification on land preparation (ridge making), with regard to irrigation pattern.

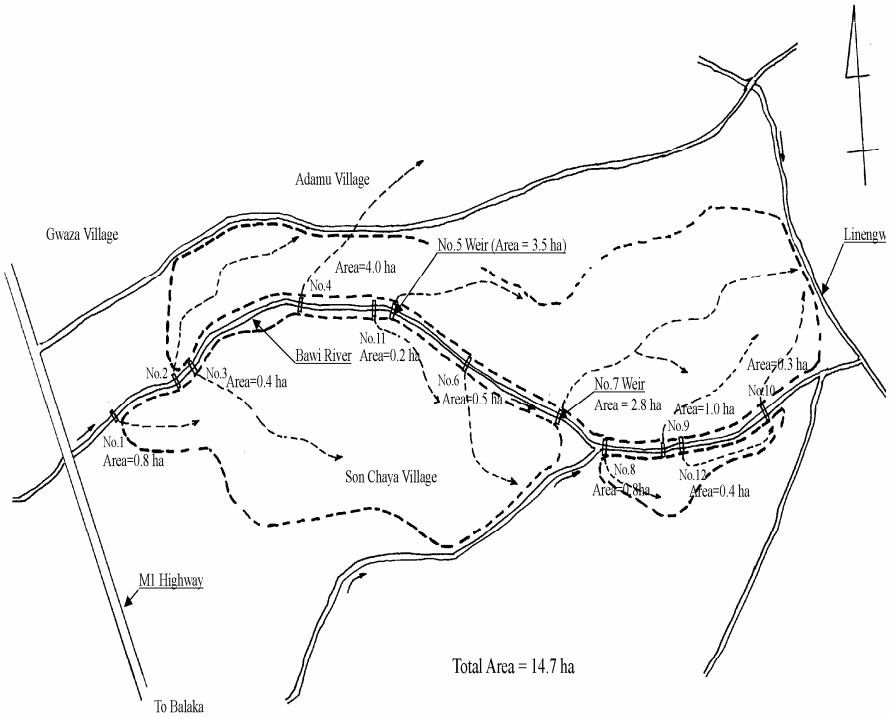
Table A4-1(14) Training Report on Water Management (Bawi 1/2)

1. Name of Scheme : Bawi Irrigation Scheme (Li-21)
2. Date/Period : May 29 and 30, 2008
3. Place of Training : Bawi Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Irrigation Officer (1)
   3) Farmers Committee : Committee Member, Total (11) = M (6) + F (5)
   4) AEDC/AEDO : Absent
   5) IO from DAO : SAIO (1) and AIO (1), Ntcheu DAO
5. Outlines of Training Workshop :

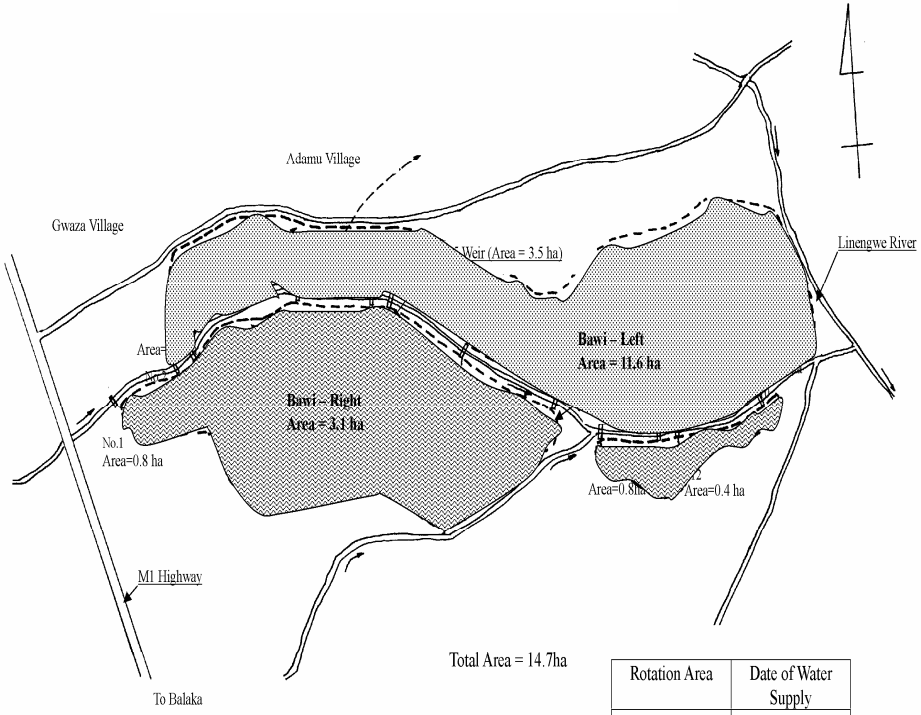
Item	Descriptions
1. Training Module ▪ Rehabilitation works ▪ Maintenance works ▪ Cropping ▪ Water management and Distribution Rotation ▪ Water Management Record keeping	**1. Rehabilitation Works** (a) No. 5 and No.7 diversion weirs; stone Masonry type (b) Dimensions of the Weirs; No 5 (Length 15.0, Height 1.5m) and No 7(Length 12.7, Height 18.m) (c) Water Piping; from the No.7weir body and foundation was observed at the left side portions of the weir, and the discharges are gradually increasing little by little. **2. Maintenance Works** (d) Intake canal; connected with No.5 diversion weir was flashed by the flood, (e) Action Taken; flashing and clearing which occurred during the wet season and the canal alignment was shifted to the left side and eroded portion was protected by gabion structure. **3. Cropping** (a) 2007/08 wet season cropping, most of the land under the No.5 and No.7 weirs were cultivated under the rain-fed conditions, (b) Use of Irrigation Facilities; minimum use of the rehabilitated irrigation facilities for irrigation activities. However supplemental irrigations water supplies for crops. (c) Other Irrigation Water Use; periodical water supply for fish farming (three ponds for No.5 area and four ponds for No.7) were/are made through the main canals rehabilitated. (d) Present cultivation areas; 1.0 ha under No.5 diversion weir and 1.5 ha under No.7 weir sites. **4. Water Management and Distribution Rotation** (a) Present System of Rotation; for example water supply hours by crops are 6-8 hr for maize and tomato, 2-6 hr for cabbage, 24 hr for sugarcane and banana using drainage water. (b) Water Supply; beneficial areas under the No.7 weir, of which original areas are 2.8 ha increased compared to before, because of the stabilized water supply through the rehabilitated diversion weir. (c) Proposed Rotation System; Bawi Irrigation System has 12 sub-schemes, 3-day rotational water distribution has been made; 3-day for right bank sub-schemes and 3-day for left bank sub-schemes. (d) Lessons for Rotation; based on the present water distribution ways, the Study Team explained to the farmers group on the proposed rotation plan for the whole Bawi Irrigation Scheme (refer to Figure 18). (e) Comments on the Rotation Plan; the plan was accepted by the farmers. (f) Water for Fish Pond; fish farming in No.5 and No.7 are receiving the diverted water from the Mphoko river

Item	Descriptions
	without rotation. **5. Water Management Record Keeping** (a) Data Collection; data that was requested to be collected since the beginning of the wet season was collected. (b) Progress of Record Keeping; it was found out that the requested record keeping works were stopped by the end of January 2008.
2. Input/Procured Materials for Training	1. Drawings; indicating proposed rotational irrigation system
3. Outcomes of the Training	(a) Importance of Water Distribution; farmers understood the importance of rotational irrigation method, especially during the scarce water sources in the winter season (b) Meeting; farmer's group will hold the meeting with all beneficiaries to understand and discuss on the rotation water supply practices and also record keepings. (c) Maintenance; farmers will do their part to maintain the areas at the intake points.
4. Farmer's Group Opinion/ Suggestions	1. Farmers requested the following trainings (b) crop management (c) irrigated crop production through field trip (study tour)
5. Requested Continuous Record Keepings	1. Recordings of estimated gross irrigation water requirements (GWR) (weekly basis) 2. Irrigated Area (weekly basis) 3. Recordings of water surplus or shortage conditions (weekly basis) 4. Recordings of farming activities and encountered problems (weekly basis) 5. Table 7 shows the record keeping form written in English version.
6. Others	**1. Study Team requested Ntcheu DAO Irrigation Officer and Farmer Groups the following.** (a) To prepare topographic map; of the Bawi Irrigation Scheme based on the specification and ways suggested by the Study Team, in order to identify an acquittal irrigable areas and present land-use of the scheme. (b) Countermeasures; to be taken for protection of water piping at left side of No.7 diversion weir (c) Refilling of new canal; New canal branching off from the No.7 main canal ought to be refilled and a new one should be provided to avoid non-effective utilization of diverted water to be discussed with the related members. 2. Teachings; there is need to teach farmers on more practical water management issues 3. Record keepings; are poor and must be encouraged.

Layout Map of Existing and Proposed Irrigation Scheme for Bawi Irrigation Scheme (Li-21)



Layout Map of Rotational Water Supply Plan for Bawi Irrigation Scheme (Li-21)



Rotation Area	Date of Water Supply
Bawi - Left	Day 1 - 3
Bawi - Right	Day 4 - 6

Table A4-1(15) Training Report on Water Management (Bawi 2/2)

1. Name of Scheme : Bawi Irrigation Scheme (Li-21)
2. Date/Period : July 12, 2008
3. Place of Training : Bawi Irrigation Scheme
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Members, Total (1) = M (1) + F (0)
   4) AEDC/AEDO : Absent
   5) IO from DAO: IO (1) and SAIO (1), Ntcheu DAO
5. Outlines of Training Workshop :

Item	Descriptions
1. Training Module ▪ Assessment of Piping Water ▪ Assessment Results ▪ Solution	1. Assessment of Piping water; No.7 diversion weir was surveyed in the aspects of water piping from weir body and its foundation, which have been observed previously. 2. Assessment Results; As a result, it was found out that water piping from the weir body was same situation as before. 3. Solution; rehabilitation done on July 2, 2008 by the suggestion of the Study Team.
2. Input/Procured Materials for Training	
3. Outcomes of the Training	
4. Farmer's Group Opinion/ Suggestions	
5. Continuous Record Keepings	
6. Others	1. Farmers' Concerns; express their concern on poor coordination in the scheme because of the speculation that Malawi government and JICA Study Team want to seize the land from the farmer. 2. Farmers Opinion towards the Speculation; want to solve these issues through intervention by government and JICA Study Team. 3. Farmers Fear; it is considered that these problems might occurred by driving in a stake to carry out topographic surveys in No.5 and No7 areas. 4. Topographic Surveys; under the situations, the topographic surveys in the area were suspended for the meantime. 5. Solution to the Problem; to sort out problems mentioned above, joint meeting involving farmers, committee members, EPA officer of AEDC and AEDO, DAO irrigation officers, etc. is scheduled to be held on July 16, 2008 at Bawi Irrigation Scheme site.

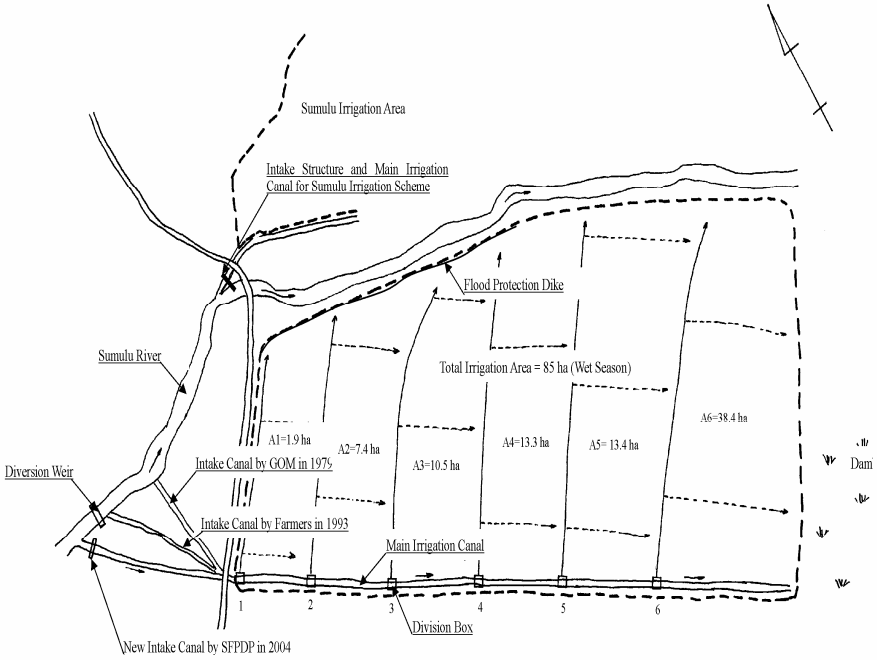
Table A4-1(16) Training Report on Water Management (Chibwana 1/2)

1. Name of Scheme : Chibwana Irrigation Scheme (Ma-1)
2. Date/Period : June 3 - June 5, 2008
3. Place of Training : Chibwana Irrigation Scheme Site
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Irrigation Officer (1)
   3) Farmers Committee : Committee Members,Total(10) =M(5) + F(5)
   4) AEDC/AEDO : Absent
   5) IO from DAO : Irrigation Officer (1), Machinga DAO
   6) Others : Village headman (1)
5. Outlines of Training Workshop :

Item	Descriptions
1. Training Module ▪ Rehabilitated Structures ▪ Dry Season Cropping ▪ Water Management and Rotation ▪ Maintenance Works ▪ Water Management Record keeping ▪ Water logging Conditions	**1) Rehabilitated Structures** (a) Diversion weir; rehabilitated by gabion, (b) Intake structure; repaired with damaged sluice gate, (c) Main canal; total length of 1,350 m, six division boxes and secondary canals **2) Dry Season Cropping** (a) Land Preparation; is not yet into action, because farmers are still harvesting rice until the end of July. (b) Scheduled Date for Dry season cropping; farmers replied that the dry season cropping will starts from the beginning of August. (c) Water Level Condition; current water level of the Sumulu river is not enough to divert water to the main canal, even though diversion weir was rehabilitated by putting gabion to raise water level. (d) Total Area Considered for Irrigation; only 30 ha. This is due to the current situations of the defective and damaged protection band partially provided along the Sumulu river as there has been natural flow of water in the middle of the whole scheme from the No.1 block to the No.6 block. **3) Water Management and Rotation** (a) Proposed Rotation; 5-day rotational irrigation methods for five rotation blocks were proposed to the scheme, (b) Training; explanation and discussion on the methods were made to the representative of the farmer's group (refer to Figure19). (c) Farmers' Comments on Rotation; the idea was not fully accepted, because of the current flooding problems at the middle of the scheme and also poor condition of the present secondary canals. (d) Study Teams' Views on Comments; modification of the rotational irrigation water supply plan will be needed, considering that the six secondary canals will supply water to a distance of about 200 m, after that the secondary canals will be joined by the natural flow with flood water flowing into area from the damaged protection band. **4) Maintenance Works** (a) Excavation of the secondary canals; especially NO.3 and No.5 canals was scheduled by the farmers as soon as possible after harvesting the summer season rice, before August. (b) Dry Season Crops; maize, tomato, beans, etc.. **5) Water Management Record Keeping** a) Collection Methods; instructions were given to the farmers groups.

Item	Descriptions
	b) Output; it was found out that the papers for the record keepings were kept by the old Secretary of the Committee. But, current Secretary was assuring the Study Team of the existing records being kept c) New format of the record keepings; written in local dialogue of "Chichewa" was provided to the Committee member to start records from June 2008. d) Zumulu River Water Level; the Study Team was requested to provide an additional staff gauges at the diversion weir site in the water source, because water does not flow into the main canal during the harvesting months. **6) Water Logging Conditions** (a) Solution; to solve the issues of water loggings at farm level, typical improvement methods for surface drainage conditions were explained as the references. (a) Priority; However, it was stated the issue would be placed as second priority in the scheme.
2. Input/Procured Materials for Training	1) Drawings; indicating proposed rotational irrigation systems
3. Outcomes of the Training	1. Willingness of the farmer's group to follow the Rotation; are very much willing to follow the suggested rotational irrigation systems as long as the secondary canal excavation will be done. 2. Work Schedule ; after finishing harvesting works of the wet season crops, excavation of secondary canals, clearing of grass and silt from the canals will start before land preparations in August.
4. Farmer's Group Opinion/ Suggestions	1. Request; Provision of protection band along the Sumulu river, to solve the problems of the flood water in the scheme.
5. Requested Continuous Record Keepings	1. Recordings of discharge records such as main canal water depth, diverted discharge, GWR (weekly basis) 2. Recordings of location of irrigation area and irrigated area (weekly basis) 3. Recordings of water surplus or shortage conditions (weekly basis) 4. Recordings of farming activities and encountered problems (weekly basis) 5. Table 8 shows the record keeping form written in English version.
6. Others	1. Farmers Request; a. to provide a staff gauges to observe water level at the diversion weir site b. to prepare a "Chichewa" format for record keepings c. to visit again, after formulation of a new plan of the rotational irrigation systems in line with the present situation at the scheme d. To provide sacks of sand-bags to increase the water level at the diversion weir site.

Layout Map of Existing and Proposed Irrigation Systems for Chibwana Irrigation Scheme (Ma-1)



Layout Map of Rotational Water Supply for Chibwana Irrigation Scheme (Ma-1)

Rotation Area	Date of Water Supply
①	Day 1
②	Day 2
③	Day 3
④	Day 4
⑤	Day 5 - 6

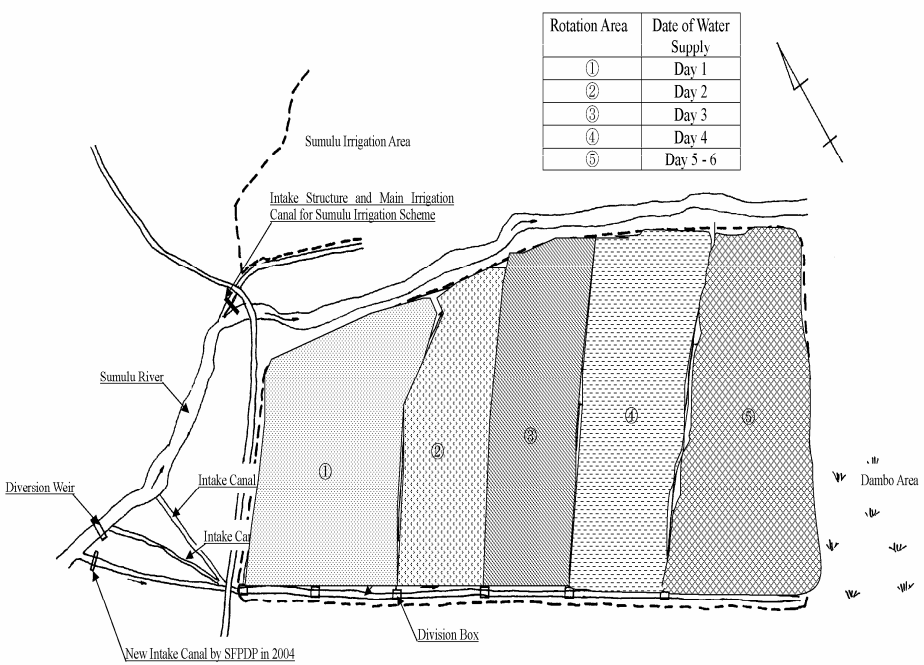


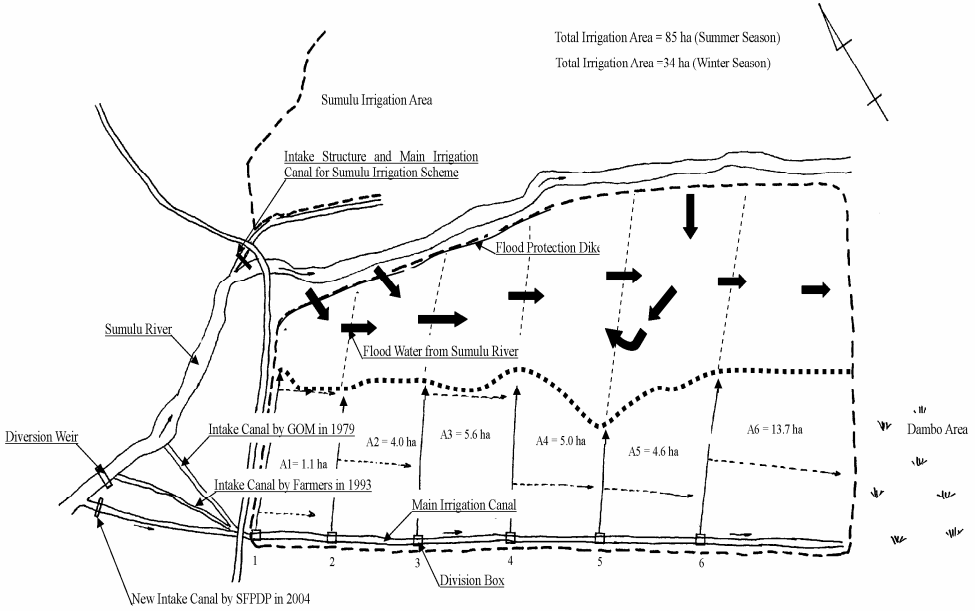
Table A4-1(17) Training Report on Water Management (Chibwana 2/2)

1. Name of Scheme : Chibwana Irrigation Scheme (Ma-1)
2. Date/Period : July 2, 2008
3. Place of Training : Chibwana Irrigation Scheme Site.
4. Attendants to Training Workshop :
   1) JICA Study Team : Water Management Expert (1) and Local (1)
   2) DoI Staff : Absent
   3) Farmers Committee : Committee Members, Total (3) = M (3) + F (0)
   4) AEDO/AEDC : AEDC (1) and AEDO (1), Nsanama EPA
   5) IO from DAO : Absent
5. Outlines of Training Workshop :

Item	Descriptions
1. Training Module ▪ Irrigation Structures ▪ Work Schedule before Dry season cropping ▪ Water Management and Water Distribution Rotation ▪ Water Management Record Keeping.	**1. Irrigation Structures** (a) Replacement of the Intake gate, was replaced on June 27-28, 2008. (b) Recommended rehabilitation works; No.3 and No5 secondary canal should be cleaned and excavated before the start of the winter season cropping. **2. Work Schedule before Dry Season Cropping (July 25, 2008).** a. Provision of sand-bag in front of the diversion weir to raise up the water level in the Sumulu river b. Cleaning of main canal and excavation of No.3 and No.5 secondary canals c. Procurement; of key to lock the gate handle **3. Water Management and Water Distribution Rotation** (a) Irrigation Water Supply; dry season cropping; is yet to start (b) Rotation; Revised 5-day rotation irrigation plan for 5 rotation blocks was presented to the Committee members (refer to Figure 22). (c) The Plan; 34ha out of 85ha (total area) will be irrigated during the dry season The balance (52 ha) will be remained as non-cultivation areas, due to insufficient water supply. **4. Water Management Record Keeping** a) Collection of Old Records; instructed records related to the water management were collected from the Committee members. b) Output; recording had been stopped in February 2008. As per the survey, the records were stopped being recorded in February, 2008. c) New set of Forms; The Secretary was given the Chichewa version for record keeping and was encouraged to record as much as possible. d) Water level at the Source; it was requested that water level in main canal and the Zumulu river be recorded.
2. Input/Procured Materials	1. Revised Drawings indicating proposed rotational irrigation systems.
3. Outcomes of the Training	1. Land Preparation; farmers started land preparation as of July 1. 2. Farmers made the following schedule: a) Secondary canal cleaning; July 3, 2008

Item	Descriptions
	b) Electing representatives for each zone; i.e. according to the rotational system of irrigation. On July 3, 2008 c) Sand Bag for Diversion Weir Use; collection of sacks from each farmer which will be used for sandbags at the diversion weir site to increase water level on July 3, 2008 d) To finish land preparation; for planting winter season crops of maize and tomatoes by July 25, 2008
4. Farmer's Group Opinion/ Suggestions	None
5. Continuous Record Keepings	None
6. Others	None

Layout Map of Existing and Proposed Irrigation Systems for Winter Season Cropping in Chibwana Irrigation Scheme (Ma-1) (under the Present Situation)



Layout Map of Rotational Water Supply Plan for Winter Season Cropping in Chibwana Irrigation Scheme (ma-1) (under the Present situation)

Rotation Area	Date of Water Supply
①	Day 1
②	Day 2
③	Day 3
④	Day 4
⑤	Day 5 - 6