Estimation of Streamflow Reductions Resulting from Commercial Afforestation in South Africa

MB Gush, DF Scott, GPW Jewitt, RE Schulze, TG Lumsden, LA Hallowes and AHM Görgens

Department of Water Affairs and Forestry

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Water Research Commission

ESTIMATION OF STREAMFLOW REDUCTIONS RESULTING FROM COMMERCIAL AFFORESTATION IN SOUTH AFRICA

Prepared for the Water Research Commission by

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EXECUTIVE SUMMARY

1. BACKGROUND AND MOTIVATION

The Department of Water Affairs and Forestry (DWAF) has, for some time, needed a comprehensive tool to incorporate the impact of commercial afforestation on water resources into water use authorisation and allocation processes. Before execution of the present project two assessment methods were available:

i. Empirical streamflow reduction curves / equations / tables, developed by Environmentek of the CSIR based on catchment experiments, and
ii. Time series simulation modelling using the *ACRU* model, developed by the School of Bioresources Engineering and Environmental Hydrology of the University of Natal.

Both approaches had their individual strengths and shortcomings. A major shortcoming of the CSIR approach was that of climatic representativeness brought about by the fact that all experimental catchments forming the basis for the curves have a mean annual precipitation (MAP) greater than 1 100 mm whereas 63 % of all afforestation in South Africa has a MAP less than 900 mm. A major shortcoming of the *ACRU* model was that it had not been adequately verified on available experimental data. However, an opportunity existed for these approaches to complement each other in a mutually beneficial way. The *ACRU* model offered a basis for extrapolation of the CSIR approach (specific to the conditions of the research catchments) to a wider range of afforestation situations not covered by the experimental catchments on which the CSIR curves were based. In particular, the lower rainfall range of the forestry estate and the effects of wattle are poorly represented by experimental work.

Consequently, a joint research venture funded by the Water Research Commission (WRC) and DWAF was undertaken based on Terms of Reference (TOR) developed under supervision of Prof. A Görgens (Univ. of Stellenbosch) and supported by the outcome of a workshop attended by 26 scientific and technical/administrative stakeholders. The main objective of this project was to verify the *ACRU* model on available streamflow data from experimental or research afforested catchments and thereafter to apply the model to all regions with economically viable afforestation potential. The goal of the project was to produce regional look-up tables providing quaternary catchment scale streamflow reduction estimates, acceptable to a wide group of stakeholders.

2. PROJECT OBJECTIVES

The specific project objectives were:

- *To develop a range of streamflow reduction tables,*
  - -applicable in all afforested regions of South Africa,
  - -relating to median annual runoff, seasonal runoff and low flows,
  - -through a combination of the CSIR curves and the *ACRU* model.
- *To make an upgraded and verified version of ACRU available,*
  - -for site-specific application in afforested regions,
  - -by verifying the *ACRU* model extensively,
  - -using information from a range of catchment afforestation experiments.

3. METHODOLOGY

The project was undertaken by a team of forest hydrologists and catchment modellers that combined resources from Environmentek of the CSIR and the School for Bioresources Engineering and Environmental Hydrology (BEEH) of the University of Natal. Prof. A Görgens participated as a specialist advisor. A Steering Committee comprising of representatives from DWAF, WRC, the Forestry Industry and the Sugar Industry supervised the scientific progress of the project and advised the Project Team.

Overall, the project comprised the following distinct but overlapping phases, namely;

- experimental catchment selection and data assimilation,
- *ACRU* model verification, and
- extrapolation of results to Quaternary Catchment scale by application of the *ACRU* model, in order to derive tables of national streamflow reductions as a result of afforestation.

In all the model verification runs and model adjustments accurate records of all modifications were logged, and have been included in the full scientific Project Report.

4. VERIFICATION OF THE *ACRU* MODEL

This phase of the project formed the largest and most time-consuming component. It commenced with the selection of suitable afforested catchments for verification of the model's ability to simulate the effects of afforestation on streamflow (Figure I).

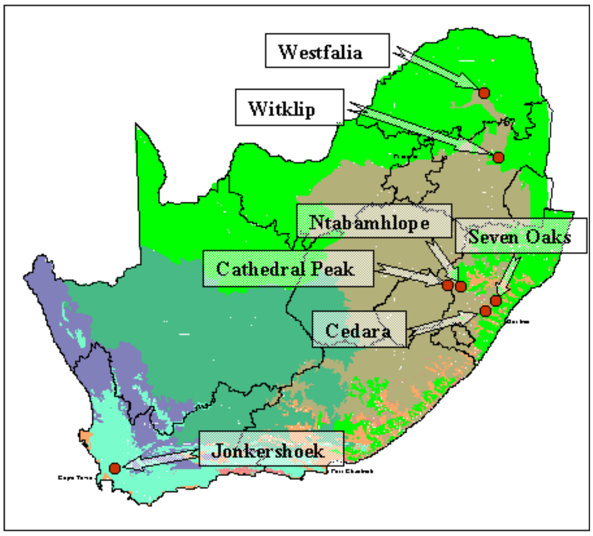

Figure I. Map of South Africa illustrating the locations of the experimental catchments utilised for the verification study.

Site visits to the selected catchments were conducted and necessary data and information were collected. As individual verifications were completed, results were presented and discussed at Technical Team and Steering Committee meetings. These meetings proved valuable in refining simulation techniques and planning the verification procedure to be used. Decisions were also taken on the most effective means of graphically displaying model outputs.

Results from this exercise highlighted specific strengths and weaknesses in the *ACRU* model. In the verification phase, mean annual reductions in streamflow resulting from afforestation were satisfactorily simulated for most long-term research catchments, with greater problems experienced with catchments in the Western Cape. Verifications on shorter duration experiments (Cedara, Ntabamhlope and Seven Oaks catchments) were less successful, and the simulation of specific evaporative processes highlighted some weaknesses. Modelling of low flows (defined as those flows falling below the 75th percentile exceedence level) was less successful than for total flows. A sensitivity analysis of the effects of the quality of model input data revealed that more site specific input data did improve simulation results (as is intuitive). Based on these results, broad confidence limits were calculated in order to assist in the interpretation and application of the national Quaternary Catchment database of streamflow reductions. It was accepted that the incorporation of confidence limits when extrapolating these results to a national scale was imperative.

The Steering Committee subsequently recommended that the *ACRU* model would thereafter be configured and run for all the quaternary catchments (as defined in the well-known WR90 water resources survey of South Africa) that have an estimated mean annual precipitation (MAP) of more than 650 mm (843 QC's in total) (Figure II).

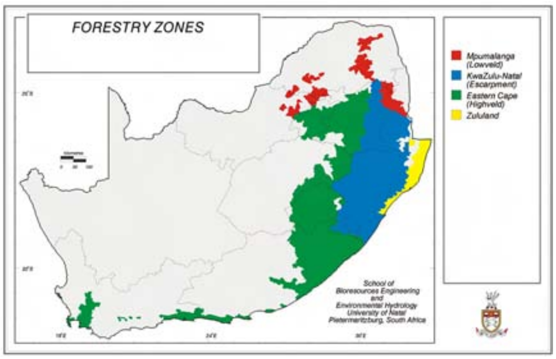

Figure II. A regionalised distribution of all Quaternary Catchments with an MAP of greater than 650 mm.

5. NATIONAL STREAMFLOW REDUCTION TABLES

This phase of the project dealt with the production of a national database of streamflow reductions caused by commercial afforestation at Quaternary Catchment (QC) scale. It was decided that the QC scale was the most practical, as they provided an adequate level of detail without undue complexity, and they are a well accepted spatial unit for the management of water resources in South Africa. Consequently, a potentially large range of diverse catchment properties (baseline vegetation, soils, altitude, rainfall etc.) are represented by single average values for each QC.

Existing QC databases of site-specific information (rainfall and catchment attributes) were utilised. A single quality controlled daily rainfall data set was used to drive the simulation for the period 1950 – 1994, with associated data on temperature and potential evaporation for each QC. A uniform soil texture (Sandy Clay Loam) was selected as being most representative of average soils for these catchments, and simulations using soil depths of 60cm (shallow), 90cm (medium) and 120cm (deep) were run for all QCs.

For each Quaternary Catchment simulations using the *ACRU* model were performed for the dominant Acocks veld type (i.e. that veld type covering the greatest area in the QC). This provided baseline streamflow volumes for each QC against which estimated streamflow reductions resulting from afforestation could be assessed. Model parameters representing Acocks Veld Types were characterized in accordance with guidelines from the National Botanical Institute.

This process was followed by simulations of afforestation with generic tree types representing eucalypts, pine and wattle. While individual trees go through a growth cycle, a large plantation usually has a mosaic of tree ages from seedlings to mature trees. For this study, a normalized single representative age of trees was therefore assumed to mimic the average situation on a typical large forestry estate, catering for planting and felling simultaneously. The ages used were 4 years for Eucalypts, 7 years for Pines and 4 years for Wattles. Simulations were performed to represent 100% forest cover in each case. The water use and streamflow under this forest cover was then compared with those associated with a baseline land cover equivalent to the dominant Acocks Veld Type within a QC. Streamflow reductions were thus assumed to be the difference between streamflow simulated for a QC consisting of the dominanat Acocks Veld Type, and 100% commercial afforestation of the QC. This culminated in the generation of maps and tables representing reductions in streamflow per Quaternary Catchment, and tree genus (Figure III). Reductions in mean and median annual streamflow totals and low flows (driest three months) were calculated in this manner.

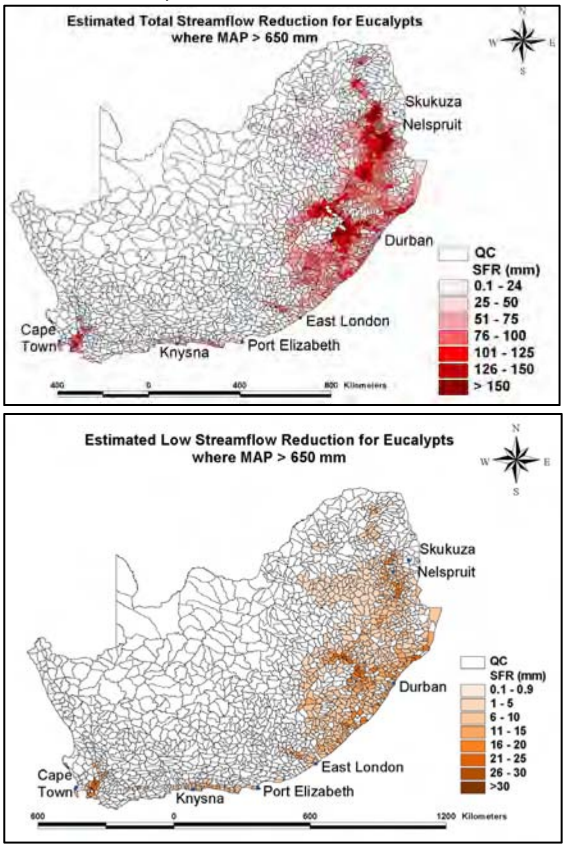

Figure III. Examples of graphical and spatial representations of streamflow reductions (total and low flow reductions for eucalypts).

6. RECOMMENDED USE OF THE SFR TABLES

Analysis of the long-term results for all Quaternary Catchments illustrated that the gross water balance was in order. However, taking into account the fact that the estimated streamflow reductions were based on rather generalised catchment conditions, it is noted that **the actual impact of afforestation in a particular area of a catchment could differ substantially from the figures represented in the tables**. In other words the smaller the scale at which the results are applied, the lower the confidence. The main reasons for this are that rainfall and soils conditions may differ from those assumed for the QC in the model runs. Furthermore, the fact that forestry growth and canopy development in the model were not explicitly adjusted for typical winter rainfall conditions (due to this information being unavailable) leads to lower confidence in the streamflow reduction estimates for the Western Cape. It is also acknowledged that the modelling of low flows under typical South African conditions is extremely site specific and poorly understood at the conceptual level, and as a result, the confidence levels for the impacts on low flows are considerably lower than for the total flow impacts.

To avoid confusion with regard to the influence of soil depth, it is recommended that the SFR values simulated for the medium soil depth case be used to best represent the average South African forestry situation. Therefore, the values are mainly suitable for broad preliminary national or regional planning. **The SFR Table values should be used to improve the SFR estimates in the Water Situation Assessment Model (WSAM).** If used with due consideration of the confidence limit classes, the SFR values can provide a consistent basis for identification of regions where the detail required by forestry licensing procedures may indicate a need for more site-specific study. **It is not recommended that the SFR values for individual QC's be used for water pricing and Catchment Management charges.**

ACRU-simulated baseline streamflow values (Acocks) were compared against WR90 estimates for corresponding QCs, as it is well known that WR90 flow volumes are widely used for water resource planning. It was found that there were a number of QCs where there were clearly some differences in the input data, with either the WR90 estimates significantly greater than the *ACRU* baseline or *vice versa*. However, the WR90 estimates at QC level were simulated with the WRSM90 (Pitman) monthly model using parameter inputs that were only calibrated at the tertiary catchment level. As a result the WR90 QC flows are not the ideal reference to give credibility to the *ACRU* baselines. It was concluded by the Steering Committee that although *ACRU* and WR90 occasionally differed significantly in absolute terms, the estimated streamflow reductions could still be accepted as a best estimate.

7. CONCLUSIONS

This project essentially comprised two simulation phases, namely the verification phase and the extrapolation phase. Although the one was a planned progression from the other, some fundamental differences existed between the two simulation phases, primarily in connection with the level of detail of input data. These differences were unavoidable, but it is, nevertheless, important not to infer too much accuracy in the extrapolation phase that was not present in the verification phase.

The *ACRU* model was verified with acceptable success on the same experimental data sets that were used to produce the CSIR curves. Weaknesses in the model that emerged during the verification phase were difficulties in accounting for the full storage capacity of the soil profile and the year-to-year carry over of water storage or usage. Therefore, amounts of water used in evaporation appeared to be limited by current rainfall.

The QC database of estimated streamflow reductions resulting from commercial afforestation should therefore only be utilised within the boundaries of the confidence limits, which take account of model shortcomings. Therefore, the estimates are not appropriate for detailed on-farm decision-making, but are mainly suitable for broad preliminary national or regional planning. If used with due consideration of the confidence limits of the estimated streamflow reductions, the tables could provide a basis for the identification of regions where forestry licensing may need more detailed study. For water pricing and catchment management charging purposes, a recommendation is to devise three or four impact classes in combination with some regional smoothing between QCs.

8. EXTENT TO WHICH CONTRACT OBJECTIVES HAVE BEEN MET

- *<u>To develop a range of streamflow reduction tables</u>*

This objective was successfully achieved through the Quaternary Catchment scale modelling exercise. The streamflow reduction tables for both median and mean values, are included in the Appendices of this document.

- *To make an upgraded and verified version of ACRU available*

The thorough verification exercise yielded valuable information on the performance of the *ACRU* model in simulating the effects of commercial afforestation on streamflow. Furthermore, estimates of Crop Coefficient, fraction of roots in the A-Horizon of the soil, and interception, were revised for all Acocks veld types. An estimate of evaporation of canopy-intercepted water was included as an individual output together with estimates of soil evaporation and plant transpiration, in order to accurately partition the full evapotranspiration value. These enhancements should serve to improve user-confidence in the model for site-specific applications. The extensive testing of the model revealed strengths, weaknesses and areas requiring further improvement.

9. RECOMMENDATIONS FOR FURTHER RESEARCH

As a result of some of the modelling difficulties experienced in this project the following areas were identified as requiring further research:

a. The conceptual modelling of the dry season low flow component of the hydrological regime requires further investigation, especially in QCs where base flow in rivers is important.
b. The growth dynamics of trees during their entire life cycle needs further investigation, with particular emphasis on the Western Cape forestry growth attributes, in order to properly account for local conditions.
c. The processes associated with deep rooting of trees on certain soils need to be investigated in more detail and the *ACRU* model could be improved to better account for this.
d. Use of the improved, spatially explicit rainfall estimates (presently under finalisation in a WRC project) may improve modelling results in future.
e. Where QCs are known to be highly non-uniform a more realistic sub-division of the relevant QC may improve results.

Finally, the vast majority of research catchments utilised for this project are, or were, located in the higher rainfall regions of the country, while commercial forestry is tending to move towards ever lower and more marginal rainfall regions. This fact highlights the importance of afforested catchment experiments in the drier regions. There are very few such catchments and this is an area where much attention is needed. In this regard, possibilities do exist for further forest-hydrology related research in the relatively dry (MAP < 1000mm) Seven Oaks catchment, which has the advantage of already having well-established WRC-funded instrumentation.

10. CAPACITY BUILDING

New capacity was imparted specifically to the junior researcher since this project formed the basis for post-graduate studies for Mr. Gush (MSc. in Hydrology). Furthermore, valuable links between three research institutions were forged (University of Stellenbosch, School of BEEH at the University of Natal, and the CSIR). This is of significance in the light of recent moves towards multi-institutional research collaboration.

Experience gained from the verification exercise of this project was also of assistance to Ms. Marilyn Royappen of the CSIR, Pietermaritzburg who is from a previously disadvantaged population group. She was able to benefit from the verification exercise as she is utilising some of the same catchments in her current project. Consequently, successful knowledge sharing took place.

11. TECHNOLOGY TRANSFER ACTIONS

During the course of the project Mr. M. Gush delivered project updates as well as a seminar presentation to staff and students of the School of Bioresources Engineering and Environmental Hydrology (UNP) in partial fulfilment of the requirements for his MSc. Hydrology degree. A MSc. dissertation based on this project was written and submitted to the University of Natal.

A paper was submitted and accepted by the SANCIAHS committee and presented by Mr. Gush at the 10th South African National Hydrology Symposium in Pietermaritzburg during September 2001.

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We are grateful for valuable contributions made to this project by members of the Steering Committee:

Mr. H Maaren	Water Research Commission (Chairman)
Dr. SA Mitchell	Water Research Commission
Mr. M Warren	Dept. of Water Affairs and Forestry
Prof. PJT Roberts	Forest Industry
Mr. J Bosch	CSIR
Mr. EJ Schmidt	SASEX
Mrs. A Coleman (nee Roelofsen)	School of BEEH, University of Natal

We wish to acknowledge the role of certain Steering Committee members in representing their larger organisations, specifically Mr. Warren for DWAF, Prof. Roberts for the forest industry and Mr. Schmidt for the sugar industry. Their contributions and involvement were especially important as they represented the organisations likely to be impacted by the findings of this project.

Our thanks are also extended to the Computing Centre for Water Research (CCWR) for access to climatic data and the use of the mainframe for the Quaternary Catchment simulations. Assistance from staff at the School of Bioresources Engineering and Environmental Hydrology (BEEH), University of Natal (Mr. A Pike, Dr. J Smithers, Mr. K Thornycroft and Mr. M Horan), is also gratefully acknowledged.

1. INTRODUCTION

By virtue of their physiology, extent of coverage and location in the catchment areas of South Africa, commercially grown tree species undeniably have an impact on the hydrological resources of this country. Furthermore, this impact is increasing in significance as the area under commercial afforestation expands. In the 12 years between national assessments undertaken in 1986 and 1998, the area under forestry in South Africa increased by 27% to 1.44 x 10^6 ha, which constitutes 1.18% of the land area (Scott *et al.*, 1998). South Africa receives an average annual rainfall of just 475 mm, compared to a global average of 860 mm (Jewitt and Schulze, 1991), and only 20% of the country receives over 800 mm per year (Bosch, 1982). The afforested land occurs predominantly in these high rainfall regions of the country, which are also the all-important sources of many rivers. Plantation forests are characterised by tall, dense, evergreen canopies, and deep root systems, and therefore contrast strongly with the typically short, sometimes seasonally dormant indigenous vegetation with shallower root systems that they typically replace. Thus, there is high potential for negative impacts by forest plantations on catchment water yield (Dye and Bosch, 2000).

Catchments in which some degree of afforestation has occurred, comprise only 14% of the country, yet produce 53% of the mean annual streamflow and 70% of the mean annual low-flows of South African rivers (Scott *et al.*, 1999). The production of timber (i.e. timber plantations) in turn contributes some 8.5% to the total value of agricultural output, whereas the production of timber products (i.e. forest products) contributes some 8.0% to the total value of manufacturing output (Edwards, 2000). At the same time forestry is estimated to have a consumptive water use equivalent to 7.5% of the country's available water resources (Scott *et al*., 1998). Arising from this scenario is the inevitable conflict between the need for forest products and associated industry (Edwards, 2000), against downstream demands for water by the environment, industry, agriculture and urban settlements (Bosch, 1982).

In order to manage this conflict for a limited water resource, the State introduced legislation to regulate the water use of forestry. This is achieved, primarily, through the control of the area that may be planted to trees. Ideally, this system should allow sustainable management and equitable distribution of available water resources amongst all affected parties. This requires an ability to model the hydrological effects of forestry with reasonable accuracy. Consequently, the impact of large-scale afforestation on water resources has led to increasing demands for simulation modelling. Furthermore, commercial forestry was declared a "Stream Flow Reduction Activity" (SFRA) in the National Water Act (NWA, Act No. 36 of 1998). Under the new SFRA Water Use Licensing System (which fully replaced the old Afforestation Permit System) the requirement for afforestation permits (now called "licences") was continued. For licensing, the question of afforestation-related streamflow reduction therefore gains ever more importance as competition for water resources increases. This has placed renewed emphasis on the need to understand, model and manage forest hydrological processes in South Africa.

1.1 Quantification of afforestation-related streamflow reductions: A historical perspective

The expansion of the area under commercial afforestation in the first half of last century led to the initiation of forest hydrological research following the 1935 Empire Forestry Conference in South Africa. This initiative resulted in the establishment of the Jonkershoek Forest Hydrological Research Station in 1935, followed by stations at Cathedral Peak in 1945 and Mokobulaan in 1955 (van der Zel, 1987). Catchment research was also initiated at Westfalia in 1975 and at the Witklip State Forest in 1980, while process-orientated research began in the 1980s (van der Zel, 1995). In 1966, two committees were appointed to investigate afforestation and water supplies. The findings of the first committee, published in 1968, recommended that forestry be allowed to develop freely, except in areas where water resources were already committed and development could be threatened, until natural and economic checks became effective (van der Zel, 1995). The 1970 report of the second committee, found that where expansion of afforestation was endangering established irrigation or other water utilization developments, restrictions should be imposed (Water Matters Committee, 1970). The findings and recommendations of these two committees were incorporated in an amendment of the relevant Forest Act (Act No. 72 of 1968) by adding specific articles on the Control of Afforestation. These required timber growers to apply for permits to establish commercial plantations on new land or sections of land, which, after harvesting, had not been planted to trees for a period exceeding five years (van der Zel, 1995). This legislation introduced what was to become known as the Afforestation Permit System (APS). Initially, the APS was based solely on a simple, yet robust model developed by Nänni (1970), and which became known as the "Nänni Curves" (Figure 1.1).

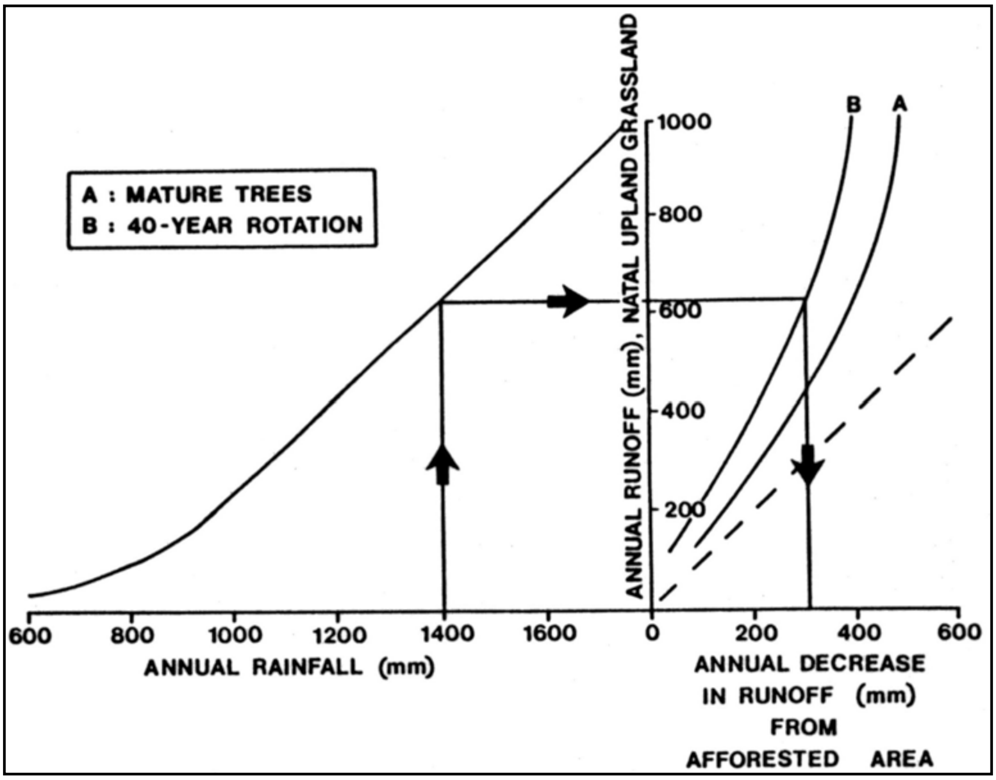


Figure 1.1. The relationship between mean annual rainfall (MAP), mean annual runoff (MAR) and the expected reduction in runoff following afforestation with *Pinus patula* of a grassland catchment (after Nänni, 1970).

The Nänni Curves were subsequently improved upon by the use of additional catchment experimental data from the USA and elsewhere, which gave rise to the "van der Zel Curves" (van der Zel, 1990). The quantification of streamflow reductions due to commercial afforestation in South Africa was further advanced in the 1990s by the development of the following two independent estimation techniques:

- Empirical streamflow reduction curves / equations, developed in the CSIR (Scott and Smith, 1997) and commonly referred to as the CSIR curves (Figure 1.2).
- Time series simulation modelling based on daily soil moisture- and runoff-accounting, achieved with the *ACRU* agrohydrological rainfall-runoff modelling system (Figure 1.3)(Schulze and George, 1987; Jewitt and Schulze, 1993) developed by the Dept. of Agricultural Engineering (now known as the School of Bioresources Engineering and Environmental Hydrology, or BEEH), University of Natal.

It was the recognition of the significance of low-flows when managing water resources, the need to account for differences in climate, tree genus and forest management practices, and the availability of updated catchment afforestation data, that led to the development of the CSIR curves. They were derived from the results of five paired catchment experiments in four different afforestation regions of South Africa, and reflected streamflow reductions physically observed after planting during these long-term experiments. The generalised curves express a percentage reduction, either of mean annual runoff, or of "low-flows", that would be caused by plantations of increasing age. Pines are distinguished from eucalypts, and separate curves are available for “optimal” tree-growing sites as opposed to “sub-optimal”.

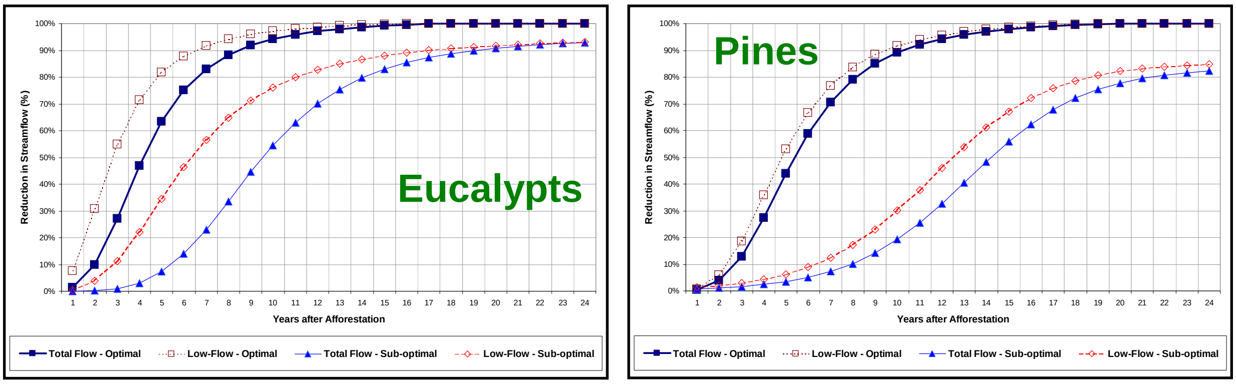


Figure 1.2. Generalised curves for predicting the percentage reduction in total (annual) flows and low flows as a function of age after 100% afforestation with eucalypts and pines respectively (after Scott and Smith, 1997).

A major shortcoming of the CSIR approach was the lack of climatic representativeness, brought about by the small sample of paired catchment experiments studied for its derivation. All the experimental catchments involved have mean annual precipitation (MAP) totals greater than 1100 mm; however less than 30% of all afforested land in South Africa has an MAP of greater that 1000 mm (Scott *et al.*, 2000). A further shortcoming was a lack of clarity regarding the appropriate application of the short and long-lag flow reduction curves. Initially attributed to site suitability for trees, these different curves were later thought to be a function rather of water availability (Scott *et al.*, 1998).

The *ACRU* model is a multi-purpose and multi-level integrated physical conceptual model that can simulate streamflow, total evaporation, and land cover/management and abstraction impacts on water resources at a daily time step (Schulze, 1995). The model requires fundamental input data comprising daily rainfall and other climate data, as well as soils and natural land cover data for the site under investigation. Input to the menu is controlled by a "menubuilder" program where the user enters parameter or catchment related values or uses defaults provided. The model revolves around multi-layer soil water budgeting (Figure 1.3).

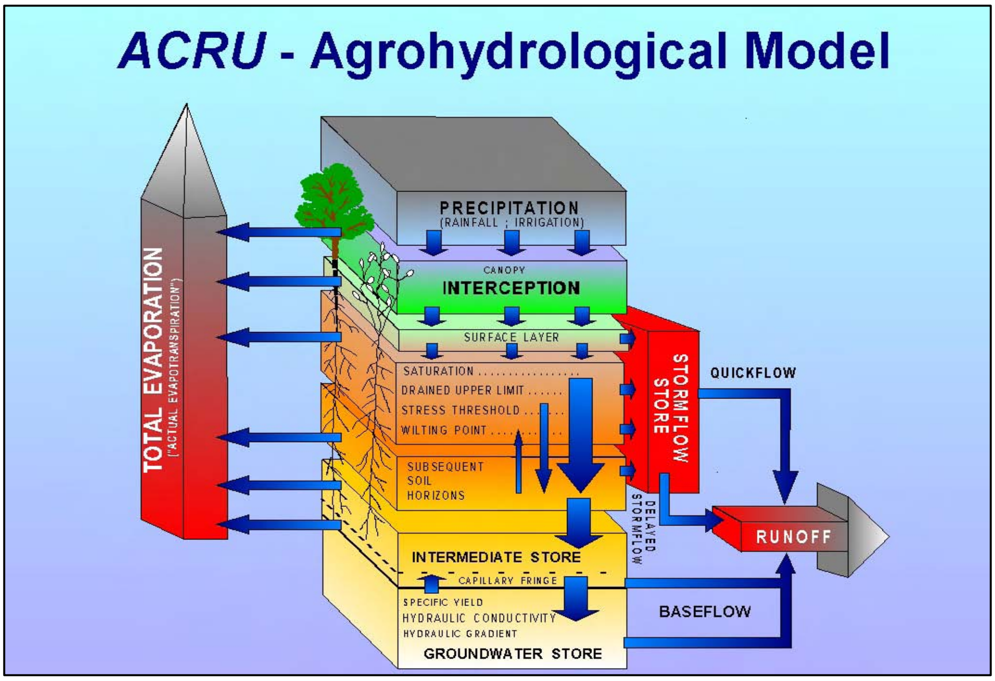


Figure 1.3. A conceptualised illustration of the *ACRU* model.

Streamflow is generated as stormflow and baseflow dependent upon the magnitude of daily rainfall in relation to dynamic soil water budgeting. Spatial variation of rainfall, soils and land cover is facilitated by operating the model in "distributed" mode, in which case the catchment is sub-divided into subcatchments. These subcatchments facilitate simulation of land use changes, or isolation of riparian zones, through the designation of units of similar hydrological response, based largely on land use zones. The DOS-based and menu-driven *ACRU* version 3.25 was used for the project.

Land cover and land use affect hydrological responses through canopy and litter interception, infiltration of rainfall into the soil and the rates of evaporation and transpiration of soil water from the soil. Key variables referred to in this document that are utilised by *ACRU* to account for land cover/use input as well as those influencing rainfall / runoff response are defined in Table 1.1.

Table 1.1 Definitions of key *ACRU* variables

Variable	Definition
ELAIM	Monthly leaf area index (LAI) values
CAY	A monthly consumptive water use (or "crop") coefficient (converted internally in the model to daily values by Fourier Analysis), which reflects the ratio of water use by vegetation under conditions of freely available soil water to the evaporation from a reference potential evaporation (e.g. A-pan or equivalent). Monthly crop factors can be automatically loaded when a particular crop is selected, however these may be over-ridden by more credible Leaf Area Index values (ELAIM) if these are available as input.
VEGINT	An interception loss value, which can change from month to month during a plant's annual growth cycle, to account for the estimated interception of rainfall by the plant's canopy on a rain day.
ROOTA	The fraction of plant roots that are active in extracting soil moisture from the topsoil horizon in a given month, this fraction being linked to root growth patterns during a year and periods of senescence brought on, for example, by a lack of soil moisture or by frost.
COIAM	The coefficient of the initial abstraction, which accounts for vegetation, soil surface and climate influences on stormflow generation. In *ACRU* this coefficient takes cognisance of surface roughness (e.g. after ploughing) and initial infiltration before stormflow commences. Higher values of COIAM under forests, for example, reflect enhanced infiltration while lower values on grassland in summer months are the result of higher rainfall intensities (and consequent lower initial infiltrations) experienced during the thunderstorm season.
E	Monthly A-pan equivalent evaporation
CORPAN	Monthly A-pan adjustment factors (e.g. to account for the presence of an A-pan screen).
FOREST	Option to simulate enhanced canopy evaporation above forests.
DEPAHO	Depth of the A-horizon.
DEPBHO	Depth of the B-horizon.
CONST	Fraction of plant available water at which plant stress sets in.
SMDDEP	Effective soil depth from which stormflow generation takes place.
EFRDEP	Effective soil depth for colonisation by plant roots.
COFRU	Baseflow recession constant.
QFRESP	Stormflow response fraction for the catchment.
CROPNO	Number assigned to represent specific vegetation types (e.g. Acocks 1988 veld type or commercial forest genus), each having unique values of CAY, VEGINT and ROOTA.
CORPPT	Monthly precipitation adjustment factors (e.g. to account for differences in altitude between sub-catchments).

The past few years saw general acceptance of the CSIR curves by the Dept. of Water Affairs and Forestry (DWAF) for use in what was the Afforestation Permit System (APS) and for water resources analysis and planning, while the *ACRU* approach has been receiving increasing support from the timber industry. The **SFRA Water Use Licensing System** fully replaced the Afforestation Permit System (APS), which had been in use since 1972 and which was regulated under the Forestry Act

(Act No. 122 of 1984). As a result of the various shortcomings in the original (1972) system, and especially the lack of local participation in decision-making, an announcement in January 1995 by the then Minister of Water Affairs and Forestry, Prof. Kader Asmal, heralded the phased and progressive development of a new procedure and system, effectively replacing the APS. This new, more comprehensive procedure was developed in consultation with major role-players in the forestry sector of the country, and with other affected parties. The transition was effectively implemented on the 1st October 1999, when Sections 40-42 of Chapter 4 of the National Water Act (NWA) (Act No. 36 of 1998) were implemented (see Government Gazette No. 20513, Notice No. R. 102, 1999). The control and regulation of Stream Flow Reduction Activities is carried out by the Subdirectorate: Stream Flow Reduction Allocations, part of the Directorate: Water Utilisation, which in turn is part of the Chief Directorate: Water Use and Conservation within the Department of Water Affairs and Forestry (Warren, M. (DWAF), Personal communication, Pietermaritzburg, 18 May, 2001).

Under the new National Water Act of 1998 the requirement for afforestation permits (now called "licences") was continued. For licensing, the question of afforestation related streamflow reduction impacts gains ever more importance as competition for water resources increases. Furthermore, the new Act requires formulation of Water Allocation Plans as part of an integrated catchment management strategy, in which afforestation-related streamflow reduction quantification plays a prominent role. These factors indicate a clear need for national standards and techniques for streamflow reduction quantification. The streamflow reduction quantification methodology to be used in the afforestation licensing system needs to exhibit the following attributes:

- Unambiguous (i.e. the same answer every time regardless of the user),
- Transparent (i.e. validatable assumptions),
- Unbiased (i.e. consistently accurate, not precise),
- Dynamic and adaptive (i.e. easily accommodates new scientific understanding, catchment changes and new social aspects), and
- Easy to use.

In principle, the approach used by the CSIR curves met most of the above desired attributes, but the curves represented too limited a range of afforestation situations and required diversification in this regard. The *ACRU* modelling approach offered a basis for extrapolation of the CSIR approach to a wider range of afforestation situations not covered by the experimental catchments, but required further verification. Consequently, the joint research and development venture between the CSIR and *ACRU* research teams ensured that the best forest hydrological insights were available to assist in verifying the model set-up and in using the model to extrapolate to situations where no experimental work has been done.

1.2 Project objectives

Based upon the afore-mentioned rationale this project set about to meet the following objectives, namely:

- *To develop a range of streamflow reduction tables,*
  - -applicable in all afforested regions of South Africa,
  - -relating to mean annual runoff, seasonal runoff and low flows,
  - -through a combination of the CSIR curves and the *ACRU* model.
  - *To make an upgraded and verified version of ACRU available,*
    - -for site-specific application in afforested regions,
    - -by verifying the *ACRU* model extensively,
    - -using information from a range of catchment afforestation experiments

A further objective of this project was to perform on-going modelling-related research tasks as an MSc study, with appropriate modelling support by the School of BEEH, UNP.

The deliverables required from this project were:

i. a set of streamflow reduction tables, at Quaternary Catchment scale, suitable for generalised application in all the commercial afforestation regions of South Africa, and

ii. an upgraded and verified version of the *ACRU* model suitable for site-specific application in all the primary commercial afforestation regions of South Africa.

1.3 Methodology

Overall, the project comprised the following distinct but overlapping phases, namely:

- experimental catchment selection and data assimilation,
- *ACRU* model verification,
- extrapolation of results to a national scale by application of the *ACRU* model, and
- preparation of deliverables.

The above agenda was made more challenging by the acute interest of the water resources management community (specifically the DWAF) and the timber industry in the project deliverables. Furthermore, during the review process prior to the commencement of the project, it was stressed that though synergy between the CSIR and *ACRU* approaches should be the aim, the credibility of the deliverables should not be undermined by a loss of independence and objectivity among the participating researchers from the two institutions. Consequently participants in the project were drawn from both institutions with strategic coordination and delivery focusing by an independent third party (Prof. A Görgens of the Dept. of Civil Eng., Stellenbosch University). Logistically it was decided that it would be most beneficial if the CSIR (Environmentek) and the School of Bioresources Engineering and Environmental Hydrology (BEEH) of the University of Natal performed the bulk of the verification and streamflow reduction simulation modelling in Pietermaritzburg. This had the advantage of easy interaction with the *ACRU* developers as well as complementing the forest hydrology research of the local CSIR Environmentek office. Care was also taken to interact with the forestry industry (through Prof. PJT Roberts), the sugar industry (through Mr. E Schmidt) and the Dept. of Water Affairs and Forestry (through Mr. M Warren) regarding all major assumptions and decisions. All of the above representatives were Steering Committee members.

The first phase of the project consisted of selecting suitable catchment afforestation experiments for the verification exercise. These consisted primarily of the long-term paired catchment experiments located at research stations around the country. Additional shorter-term experiments were also utilised to focus on the verification of specific processes within the model (soil moisture and evapotranspiration trends associated with forests). Site visits were conducted in an effort to improve understanding of catchment characteristics and in order to gather additional data. *ACRU* utilises two possible formats of daily input data, namely SINGLE format files or COMPOSITE format files. Both have very specific requirements for the format of the data (see Smithers and Schulze, 1995). Composite daily data files of fixed format were prepared, which contained daily input data for station name, date, rainfall, maximum temperature (ºC), minimum temperature (ºC), A-pan evaporation equivalent (mm), observed streamflow (mm), and an observed streamflow quality flag wherever possible.

It is important to recognize that aspects affecting the water use of trees are complex and often interact with and are affected by each other. They include climatic variables, total evaporation and leaf area index (LAI), as well as rooting characteristics (including root distribution, depth and colonisation). Most of these also vary over time and under differing plantation management practices. For the verification exercise composite daily data files of fixed format were prepared, which contained daily input data for station name, date, rainfall, maximum temperature (ºC), minimum temperature (ºC), A-pan evaporation equivalent (mm), observed streamflow (mm), and an observed streamflow quality flag wherever possible. Dynamic land use files were used to simulate changes occurring within the catchments over time. Variables incorporated in the dynamic files included depth of the B-horizon (DEPBHO), fraction of plant available water at which plant stress sets in (CONST), coefficients of initial abstraction (COIAM), crop-coefficients (CAY), leaf area indexes (ELAIM), fraction of roots in the A-horizon (ROOTA) and rainfall interception values (VEGINT). All other inputs into the model were entered through use of the *ACRU* Menubuilder.

Model verification followed catchment selection and results were presented and discussed at

Technical Team and Steering Committee meetings during the course of the project. As the verification phase progressed, insights and experience gained were incorporated into the simulations, which also served to improve model performance. Close collaboration between the CSIR and BEEH staff and students characterised this stage of the project. This phase proved to be the most time consuming as input data into the model was assimilated and refined, and as various simulation scenarios were tested and analysed.

Once the verification study had been completed the extrapolation of streamflow reduction simulations to a national Quaternary Catchment scale commenced. This was largely an automated procedure once inputs to the model had been finalised, and was carried out by BEEH staff using independently developed databases. Experience gained from the verification phase was utilised to improve the Quaternary Catchment simulations. Data extraction from these simulations followed, and results were incorporated into the necessary deliverables.

2. VERIFICATION OF OUTPUT FROM THE *ACRU* MODEL

2.1 Verification philosophy

Numerical models are increasingly being used in the public arena, where the outcome of planning decisions depends, at least in part, on the ability of modellers to make predictions about the natural system that would be affected by a new development. In some cases the outcomes justify highly controversial decisions. In future, the assumptions and predictions of models are likely to come under increased scrutiny. The implication of truth is therefore a serious matter, and all too often scientists use the terms verification and validation in ways that are contradictory and misleading Beven (2000). A clear distinction, therefore, needs to be drawn between the definitions of these terms. Essentially, verification is a measure of the *performance* of a model in simulating observed data, while validation is the procedure to ensure that all *components* of the model give an accurate reflection of the model's conceptualisation (Schulze, 1998).

Concern is expressed by Oreskes *et al.* (1994) that the language of verification and validation implies an either-or situation, while in practice, few (if any) models are entirely confirmed by observational data, and few are entirely refuted. In other words, confirmation is a matter of degree and only the relative performance of a model with respect to observational data is legitimate. However, even if the model result is consistent with present and past observational data, there is no guarantee that the model will perform at an equal level when used to predict the future. Beven (2000) suggests that modellers should therefore start to recognise uncertainty at the outset. This may yield many different predictions but such a position would be more easily defendable in an adversarial context by incorporating uncertainty into a risk-based decision making process.

There are clearly inherent risks and concerns when undertaking a modelling exercise and it is important to be aware of these from the outset. However, any verification study is essentially a confidence building exercise and usually yields valuable information on model performance, highlighting strengths and weaknesses. This, in itself, is extremely useful and was one of the objectives of this project. The approach of the verification phase was therefore to learn as much as possible about the ability of the model to simulate the effects of afforestation on streamflow.

2.2 Verification procedure

The objectives of the verification phase of the project were twofold, namely:

i. To conduct a full and proper verification of *ACRU* performance in a known situation by an objective and independent hydrologist, and
ii. To evaluate the adequacy of the model, as it stands, to cope with critical requirements (e.g. the ability to simulate low flows to an acceptable level of accuracy), with the terms adequacy and acceptability needing to be defined.

These objectives necessitated a comparison against long-term afforestation experiments where there was a good record of afforestation effects on streamflow. The verifications sought to demonstrate model robustness through consistency across a range of climate / catchment conditions. Consequently, in terms of catchment selection and data assimilation, the widest possible range of catchment afforestation experiments was selected, along with other suitable afforestation process studies. Detailed descriptions, maps and aerial photographs of most of these long-term paired catchment afforestation experiments are provided by Scott *et al.* (2000). The catchments are located across South Africa in a diverse variety of climatic, pedalogical and phsiographic situations (Figure 2.1). Additional shorter-term experiments were also utilised to focus on the verification of specific processes within the model. Specifically, the simulated trend of soil moisture fluctuations over time under Eucalypts was compared against observed Neutron Probe field data from Ntabamhlope, and simulated evapotranspiration (Et) responses of Eucalypts over time were compared against measured (Bowen ratio) Et data from Seven Oaks in the Natal Midlands. Due to the historical locations of the catchment experiments, the verification sites generally fell in the higher rainfall regions (MAP>1000mm) with the exception of the Ntabamhlope and Seven Oaks sites.

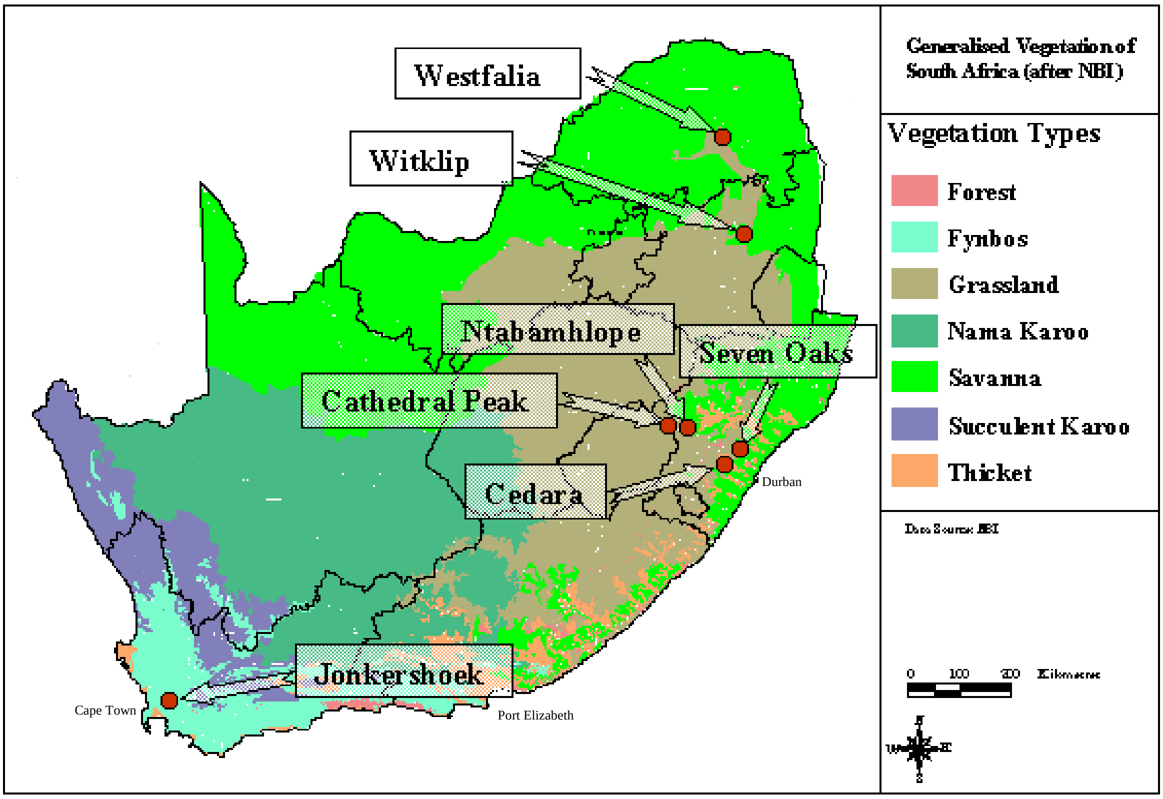


Figure 2.1 **Map of South Africa illustrating the generalised vegetation types / biomes for the country (after Low and Rebelo, 1996). The locations of the experimental catchments referred to in the text are indicated.**

A summary of the catchments selected is given in Table 2.1.

Table 2.1 **Details of catchments selected.**

Catchment	Size	Location	Cover	Altitude	M.A.P	Period
Cathedral Peak IV	0.988 km²	29º00'S, 29º15'E	Grass	2000m	1664 mm	1950-1987
Cathedral Peak II	1.900 km²	29º00'S, 29º15'E	Pine	2100m	1668 mm	1950-1987
Westfalia B	0.326 km²	23º43'S, 30º04'E	Scrub Forest	1250m	1394 mm	1976-1998
Westfalia D	0.396 km²	23º43'S, 30º04'E	Eucalyptus	1150m	1394 mm	1976-1998
Lambrechtsbos A	0.312 km²	33º58'S, 18º57'E	Pine	700m	1272 mm	1969-1991
Lambrechtsbos B	0.655 km²	33º58'S, 18º57'E	Pine	700m	1384 mm	1969-1991
Witklip V	1.073 km²	25º14'S, 30º53'E	Mixed	1150m	1119 mm	1975-1990
Ntabamhlope v7h004	0.300 km²	29º03'S, 29º39'E	Eucalyptus	1500m	902 mm	1990-1995
Cedara u2h018	1.310 km²	29º33'S, 30º14'E	Mixed	1300m	1266 mm	1985-1989
Seven Oaks	0.063 km²	29º11'S, 30º38'E	Eucalyptus	1050m	900 mm	1997-1999

Observed results and relevant input data from these experiments were obtained from the relevant institutions (CSIR and BEEH). The possibility of obtaining data for verification of a low MAP catchment in Australia was investigated but due to difficulties in obtaining the required data in the necessary format, this option was not deemed viable. However the verification performed at Seven Oaks gave some indication of model performance under more marginal rainfall conditions.

Initially, readily available default data values for input into *ACRU* were used for the purposes of the verification exercise. The rationale behind this decision was that these were the databases that would be available for extending the modelling over the remainder of the country at a later stage, and thus the verification modelling needed to use this information base. However, in a subsequent meeting of the Project Scientific / Technical Team it was decided that *ACRU* needed to be tested on the best inputs possible (i.e. using inputs inferred from field visits and other sources of detailed information). This allowed a thorough testing of the modelling system's performance, independent of the rather more general model inputs that would of necessity have to be used for modelling at the Quaternary Catchment scale. In essence this reversal of the earlier position recognised that there was a two stage process to the verification; firstly, a thorough check of *ACRU* performance, and secondly a check of the effect of general input data to the model. Consequently, a sensitivity analysis of the effect of the quality of the input data was performed. Simulations were categorised as default or detailed, referring to the quality of input data (in this respect, largely the site specific nature of the setup information). Affected variables were:

- drivers of reference potential evaporation (e.g. monthly A-Pan equivalents (default), as opposed to daily maximum and minimum temperatures used in the Linacre 1991 equation (detailed) to calculate reference potential evaporation),
- soils data (e.g. *ACRU* soils input variables derived from the ISCW (1993) land type maps (default), as opposed to field trip observations (detailed)), and
- land use data (e.g. automatic *ACRU* baseline Acocks (1988) vegetation estimators (default), as opposed to field trip observations and measurements of LAI or values obtained from Summerton (1995) (detailed)).

Comparative results of this sensitivity analysis are incorporated in Tables 2.19 and 2.20.

The project Steering Committee agreed that skills-based adjustments to certain parameters within the model were permissible with the assistance of BEEH staff. This was with the understanding that these were only to be applied to the pre-afforestation or non-treatment period, and that the reasons for the adjustments were to be recorded. Adjustable *ACRU* parameters included:

- effective soil depth for colonisation by plant roots (EFRDEP),
- effective soil depth from which stormflow generation takes place (SMDDEP),
- the baseflow recession constant (COFRU), and
- the stormflow response fraction for the catchment (QFRESP).

A split-sample approach was agreed upon to be the most effective means of assessing whether the skills-based adjustments were also valid for the post-afforestation treatment period. It was also agreed that a "warm-up" year should precede the simulation in order to set state variables and generate realistic soil moisture contents prior to the actual verification period. Input data for this year consisted simply of a replication of a representative annual times-series of streamflow, rainfall and climatic data taken from later in the existing data set. Feedback from a varied group of experienced participants at Technical Team meetings facilitated the continual improvement of the input data and adjustment of the aforementioned parameters. In this regard it was decided to incorporate hydrological soil depths (i.e. soil depth contributing to runoff) as opposed to pedological soil depths (defined by soil horizons) in the model. Furthermore, emphasis was placed on refining the leaf area index (LAI) values used, so as to utilise results from published literature (e.g. Van Lochem, 1986; Summerton, 1995).

Wherever possible, verifications sought to replicate the paired catchment approach used by Scott and Smith (1997) to generate the CSIR curves, where there was an untreated control catchment and a treated (afforested) catchment. This was achieved by firstly performing verifications on stable, gauged unafforested control catchments wherever possible. This allowed an independent test of how adequately *ACRU* mimicked the natural hydrology of a catchment without any afforestation effect, thereby increasing confidence in the ability of the model to simulate base-line conditions. In cases where it was not possible to use a control catchment to verify the input variables for the simulation of baseline conditions, these were verified using the pre-afforestation period in the treated catchment. The calculation of streamflow reductions resulting from the afforestation of the catchment was performed using a two-step technique. Firstly, the inputs for the simulation of base-line conditions were used to run the model for the entire treated period, thereby simulating streamflow as if no trees had been planted (i.e. mimicking streamflow under base-line conditions). This simulation was then repeated in the same catchment for the same period, changing only the variables pertinent to the planting and maturing of the commercial forest. The progressive divergence of the accumulated streamflow records from these two simulations allowed calculation of streamflow reductions per increasing tree age (see Figure 4.2). The variables that required changing between base-line (Acocks) and afforested simulations were the following:

- Monthly leaf area index (LAI) values (ELAIM), increased sigmoidally for trees before tailing off,

- the fraction of plant roots that are active in extracting soil moisture from the topsoil horizon in a given month (ROOTA), gradually decreased as tree roots colonised the B-horizon,
- an interception loss value, which can change from month to month during a plant's annual growth cycle, to account for the estimated interception of rainfall by the plant's canopy on a rain day (VEGINT), also increased sigmoidally for trees in association with changes in LAI,
- the coefficient of initial abstraction, which accounts for vegetation, soil surface and climate influences on stormflow generation (COIAM), held constant for trees while fluctuating seasonally for Acocks,
- the option to simulate enhanced canopy evaporation above forests (FOREST),
- the hydrological soil depth of the B-horizon (DEPBHO), assumed to increase by 0.25m with mature forests to account for deeper root penetration,
- the fraction of plant available water at which plant stress sets in (CONST) and
- the effective soil depth from which stormflow generation takes place (SMDDEP).

These independent results were then compared against each other, in order to derive the simulated reductions in streamflow resulting from the afforestation. The ability of the model to simulate both total annual flows and low flows were analysed separately: low flows being defined as those falling below the 75^{th} percentile exceedance level.

Graphical illustrations of simulation results were selected from a wider range of graphs representing the verification results in a visual format. These were deemed to best illustrate how well the *ACRU* model performed in each particular study. Although the model generated daily output, monthly totals were calculated and used in the graphs as these were felt to be adequate for the nature of this project. It should be noted that a log scale axis was used in the time series and scatter plot graphs of simulated and observed monthly streamflow totals in order to accentuate the critical low flow component of the simulations. Model performance evaluation criteria included the following for afforested conditions:

- Goodness-of-fit of simulated and observed streamflow series,
- Magnitude of total, seasonal and low-flow reductions,
- Time series pattern of total, seasonal and low-flow reductions,
- Timing of onset of reductions,
- Relative differences in magnitude of total and low-flow reductions,
- Differences in hydrological processes caused by different tree genera,
- Correctness of the slope of the of streamflow reduction versus tree age curve,
- Correctness of the asymptote of the streamflow reduction versus tree age curve,

2.3 Cathedral Peak

This verification was carried out on data from the Cathedral Peak Forestry Research Station (29° 00’ S, 29° 15’ E), which lies on the “Little Berg” plateau in the northern part of the Natal Drakensberg. This station was the main centre for hydrological research in the mountainous summer rainfall region of southern Africa. It was established in 1935 to examine the influences of various management practices on the vegetation and water yield of the local mountain catchments. Precipitation and streamflow have been monitored continuously since the early 1950s. The fifteen research catchments, numbered I to XV, (Figure 2.2) are situated at the head of three isolated Little Berg spurs at an altitude of approximately 1890 m.

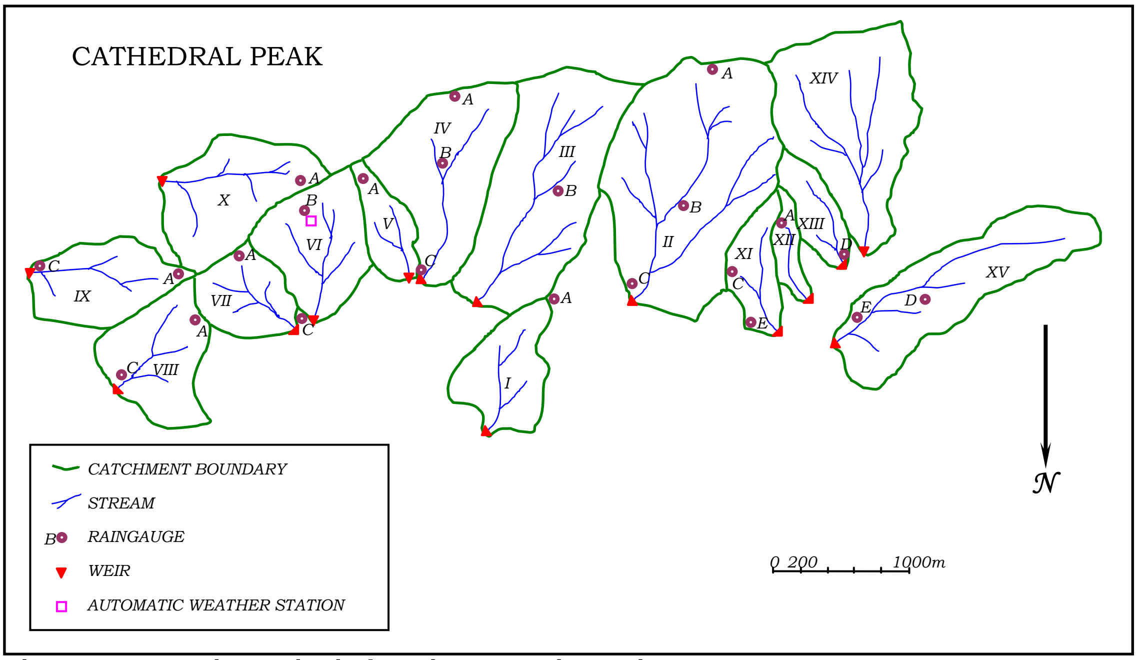


Figure 2.2 The Cathedral Peak Research Catchments.

Each of these catchments received a specific treatment such as afforestation, or protection from fire. Catchments II and III were afforested with *Pinus patula*, catchments IV, V, VI and X received biennial spring burns, catchment I received a biennial spring burn with light summer grazing by livestock, catchments XI to XV received regular burning but only from 1975 onwards, while catchments VII and IX were protected from fire for 5 years and 18 years respectively (Everson, 1985). Catchments **II** and **IV** were selected for this verification study. Catchment II lies at an altitude of between 1844 m and 2454 m and catchment IV lies between 1850 m and 2200 m. Catchment IV was selected as the control catchment, being close to and having the same north-northeast aspect as catchment II, which was the treated catchment (pine) selected for the primary verification. Some characteristics of the two research catchments used at Cathedral Peak are presented in Table 2.2.

Table 2.2 Characteristics of the two research catchments used at Cathedral Peak.

Catchment No.	Weir No.	Rain gauges	Altitude Range	Area (km²)
II	V1m03a	2a, 2br, 2cr	1844 m – 2454 m	1.949
IV	V1m05a	4a, 4br, 4cr	1850 m – 2200 m	0.9882

These catchments were selected by virtue of their contrasting land use and also due to their good length of record, quality of record, and distribution of raingauge / streamflow recorder networks. Although the observed data record from these catchments was of a high quality, some potential simulation problems were identified, primarily the steep altitudinal / precipitation gradient. This necessitated the delineation of sub-catchments and the application of precipitation correction factors (CORPPT).

2.3.1 Cathedral Peak input data

It was decided to use the period from 1950 to 1987 for the Cathedral Peak simulations, as there was reliable streamflow and rainfall data for this period. A "warm-up" year (1949) preceded the simulations and was used to generate realistic soil moisture contents prior to the actual verification period. Input data for this year consisted simply of a replication of a representative annual times-series of streamflow, rainfall and climatic data taken from later in the existing data set.

2.3.1.1 Cathedral Peak land cover

The natural vegetation of Cathedral Peak is Acocks (1988) Highland and Dohne Sourveld (*ACRU* crop no. 2030306). Woody communities in which *Leucosidea sericea* and *Buddleia salvifolia* predominate occur in narrow zones along the streams in some catchments but the hydrological significance of these communities is assumed to be slight (Bosch, 1979). Catchment IV has always been under biennially burnt grassland, but experienced accidental fires in 1955/56 and 1963/64. This catchment was modelled in lumped mode due to the uniform nature of its land cover. Catchment II was also under natural grassland until 1952 when progressive plantings of pine began. For the purpose of modelling the treated catchment II with *ACRU* it was decided to use the distributed mode, and the catchment was delineated into five individual sub-catchments (1 to 5) based upon historical land cover and treatment changes. Sub-catchment characteristics, land use changes and treatment history, for the simulation period, are summarised for catchments II and IV in Table 2.3.

Table 2.3 Catchment characteristics and historical land use changes for catchments II and IV at Cathedral Peak

Characteristics and Land Cover History	Cathedral Peak IV	Cathedral Peak II – Sub-catchments				
	1	1	2	3	4	5
Area (km²)	0.988	0.49	0.25	0.05	0.12	0.99
Mean Elevation (m)	2000	2100	2100	2100	2000	1900
1950 - 1951	Grassland	Grassland	Grassland	Grassland	Grassland	Grassland
1952	Grassland	Grassland	Planted *P. patula*	Grassland	Grassland	Grassland
1955	Grassland	Grassland	*Pinus patula*	Planted *P. patula*	Grassland	Grassland
1963	Grassland	Grassland	*Pinus patula*	*Pinus patula*	Planted *P. patula*	Grassland
1965	Grassland	Grassland	*Pinus patula*	*Pinus patula*	*Pinus patula*	Planted *P. patula*
1966-1987	Grassland	Grassland	*Pinus patula*	*Pinus patula*	*Pinus patula*	*Pinus patula*

Site preparation for the *Pinus patula* stands was pitting and tree growth was simulated using the dynamic file.

2.3.1.2 Cathedral Peak soils information

Soils of Cathedral Peak are highly leached, basalt-derived silty clays (Schulze and George, 1987), and all the catchments are underlain by basaltic lavas, which overlie Clarens Sandstone. Three post-Karoo dolerite dykes run through the research area but they apparently exert no hydrological influence (Nänni, 1956). Soil hydrological characteristics have been described in detail by Schulze (1975), and Granger (1976), with Hutton and Griffin forms being most frequently encountered and associated with the gentler slopes of the catchments (Bosch, 1979). Schulze (1975) found mean soil depth in the catchments to be approximately 0.80 m (A-horizon 0.20 m), however, Everson *et al.* (1998) report a mean soil depth of approximately 0.50 m (A-horizon 0.25 m) in their study of catchment VI. Nevertheless, in the interests of consistency for all the verifications, a 1:50 000 topographical map of the area (2929AA) was obtained and the catchment boundaries were digitised, after which the relevant soil input variables as utilised by the *ACRU Menubuilder* were obtained from the ISCW (1993) soils coverage map. An additional 0.25 m was gradually added to the depth of the B-horizon during periods of afforestation to account for the deeper penetration potential of tree roots. The addition of the 0.25m to the soil horizon immediately after planting trees was deemed unrealistic (the tree roots would not be able to colonise that increased soil depth so soon), hence the decision to phase it in from time of planting until approximate canopy closure (year 4).

2.3.1.3 Cathedral Peak rainfall and streamflow data

Data from four daily rainfall stations (2br, 2cr, 4br, 4cr) located within the two catchments were used to determine an area-weighted daily rainfall record for each catchment. Missing data were patched using the nearest station with good data. This was performed by plotting periods of simultaneous record against one-another and obtaining a best-fit regression from the resultant scatter plot. This equation was then used to patch periods of missing data. Based on these stations catchment II receives a mean annual precipitation of 1510 mm and catchment IV 1387 mm. However, since this figure was based on data from the mid-catchment (2br, 4br) and lower-catchment (2cr, 4cr) gauges, it was necessary to correct this value to take account of the monthly gauges at the top of the catchments (2a, 4a). Consequently, correction factors were applied to the rainfall data for catchments II and IV, based on data from the upper-catchment gauges. This resulted in overall MAP values of 1668 mm for catchment II and 1664 mm for catchment IV. As catchment IV was modelled as a lumped catchment only a single MAP for the catchment was required. Catchment II, however, was modelled in distributed mode and due to the steep altitudinal, and hence, precipitation gradient it was deemed necessary to correct the rainfall for each sub-catchment based on its mean altitude. The rainfall gradient determined for the three gauges in catchment II by Schulze (1975) (2a=1738 mm; 2b=1658 mm; 2c=1508 mm) was used as the guideline for estimating the correction factor (CORPPT). The MAP for catchment II was therefore adjusted for the sub-catchments as follows in Table 2.4.

Table 2.4 Rainfall correction factors applied to sub-catchments within catchment II

Sub-catchment	Mean altitude	Correction Factor (CORPPT)	MAP
1	**2100 m**	**1.15**	**1743 mm**
2	**2100 m**	**1.15**	**1743 mm**
3	**2100 m**	**1.15**	**1743 mm**
4	**2000 m**	**1.10**	**1668 mm**
5	**1900 m**	**1.00**	**1510 mm**

2.3.1.4 Additional climatic data for Cathedral Peak

Daily temperature data were extracted from the CCWR. It was necessary to error check the data for occasions where the minimum temperature equalled or exceeded the maximum temperature on any specific day. This was found to be necessary after initial attempts to run *ACRU* failed because of a routine in the model that used the difference between maximum and minimum temperatures as a divisor. If the values were equal the divisor became zero, which resulted in an error.

Monthly means of daily maximum and minimum temperatures were also obtained from the catchment study by Everson *et al.* (1998). Monthly totals of A-pan equivalent reference potential evaporation data were obtained from Schulze (1997). Monthly means of daily windrun were obtained from Schulze (1975). These data are summarised in Table 2.5.

Table 2.5 Monthly climatic data for Cathedral Peak

Month/ Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T-Max (°C)	26.0	25.6	24.6	22.3	19.9	17.3	17.6	19.7	22.0	23.1	24.0	25.6
T-Min (°C)	13.9	13.7	12.4	9.0	5.5	2.6	2.4	4.5	7.5	9.7	11.4	13.0
A-pan (mm)	156.3	132.3	122.8	111.4	96.9	83.9	96.9	130.7	143.8	145.9	144.9	168.0
Wind (km/day)	130.0	115.0	110.0	125.0	150.0	150.0	165.0	195.0	185.0	190.0	155.0	150.0

2.3.2 Cathedral Peak verification results

2.3.2.1 Cathedral Peak catchment IV

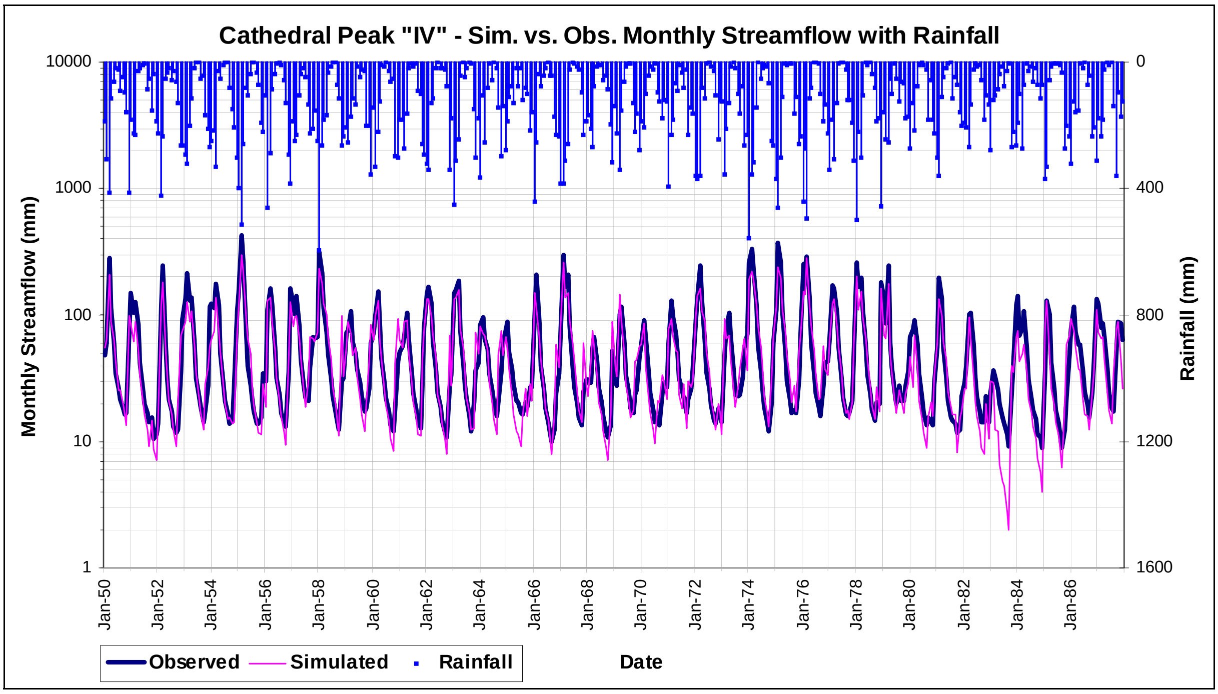


Figure 2.3 **Time series (1950 – 1988) of simulated and observed monthly streamflow totals (mm), as well as monthly rainfall totals (mm) for Cathedral Peak catchment IV.**

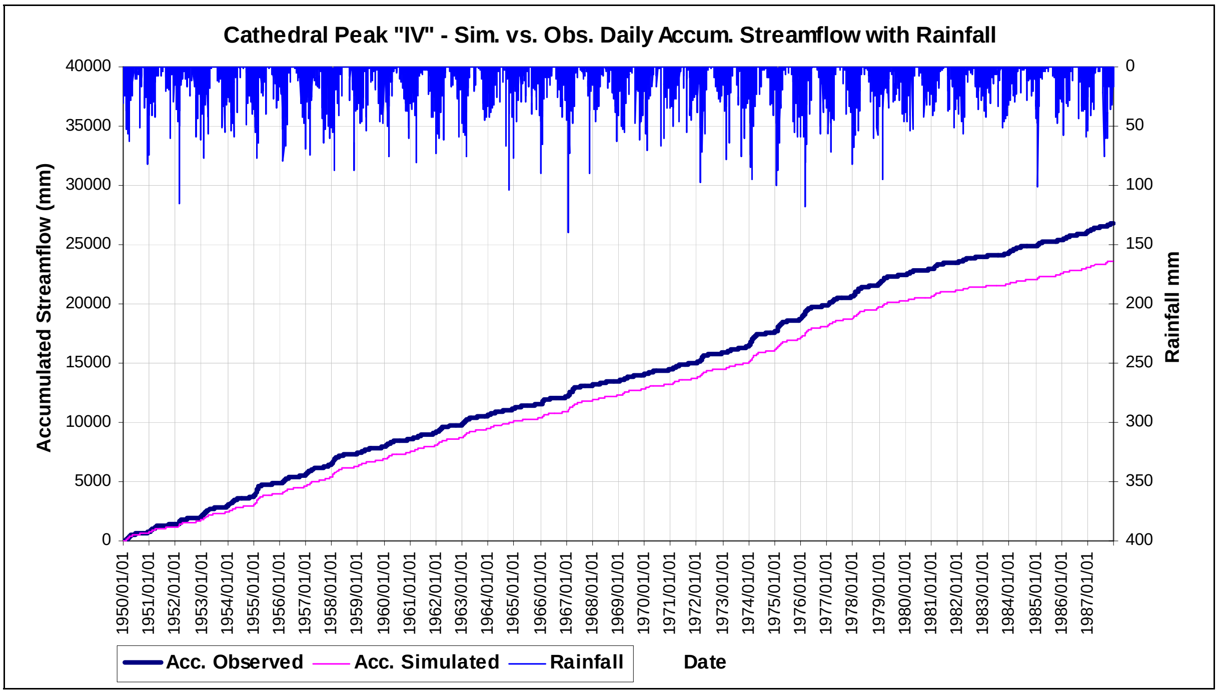


Figure 2.4 **Time series (1950 – 1988) of accumulated streamflow totals (simulated and observed), as well as daily rainfall totals (mm) for Cathedral Peak catchment IV.**

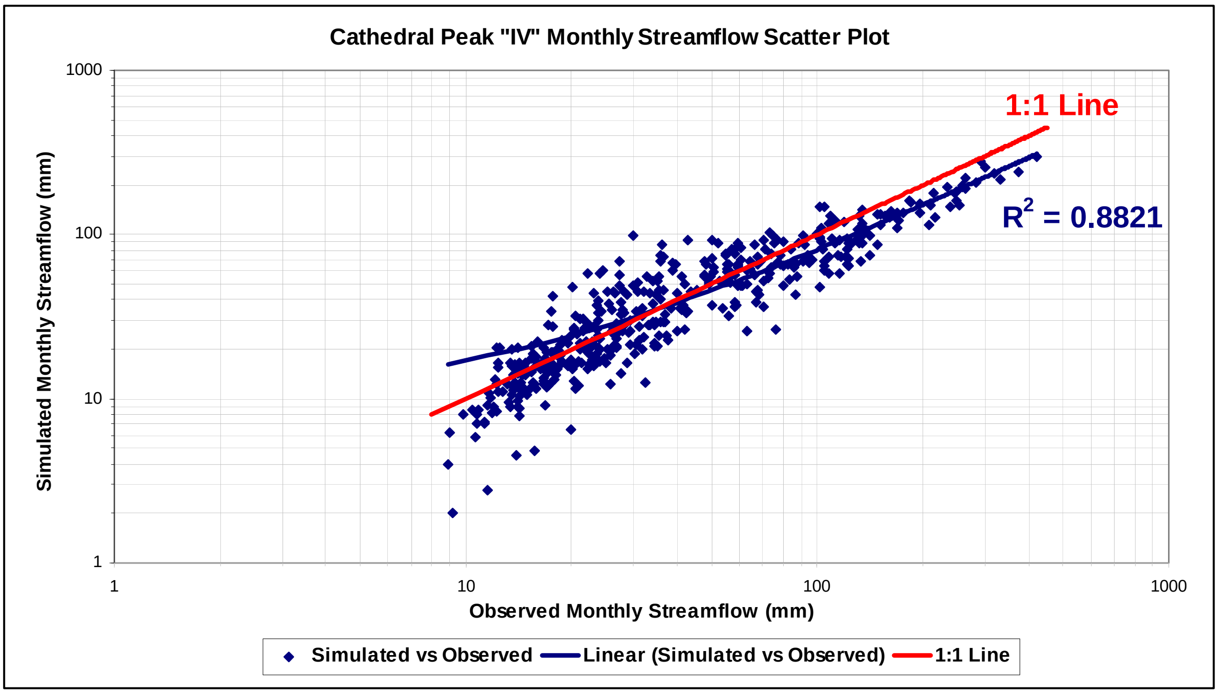


Figure 2.5 **Scatter plot of simulated and observed monthly streamflow totals (mm) for Cathedral Peak catchment IV. A linear trend line, its' R² value and the ideal 1:1 line are illustrated.**

2.3.2.2 Cathedral Peak catchment II

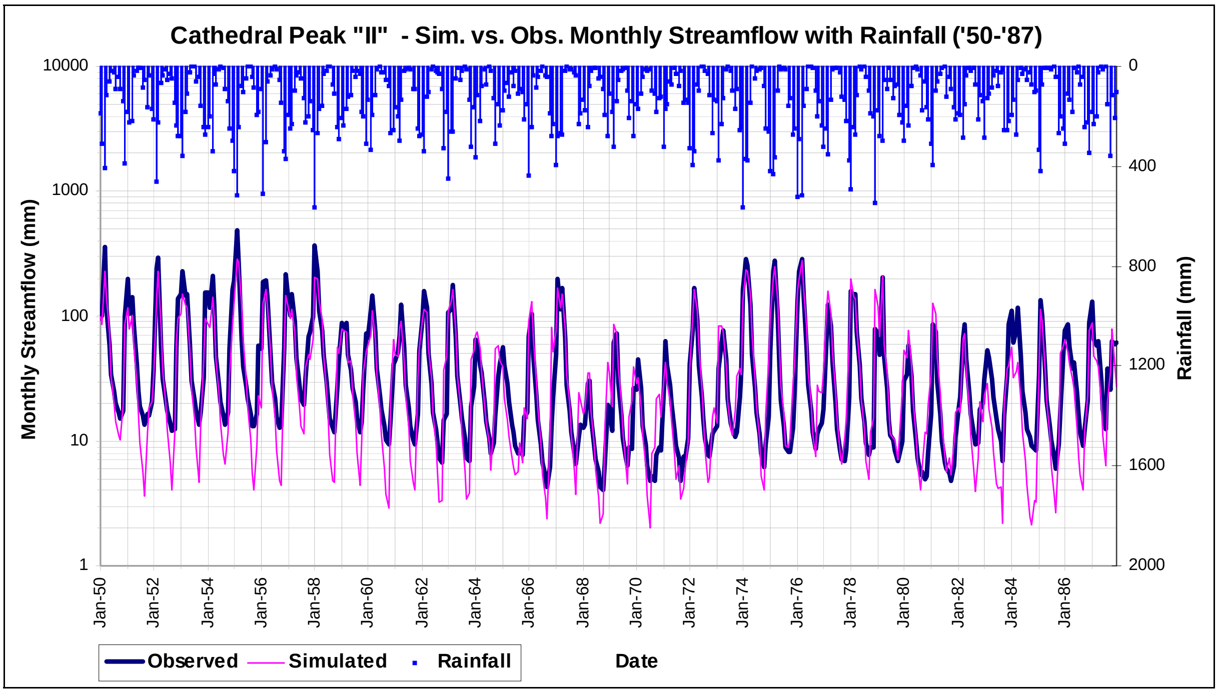


Figure 2.6 **Time series (1950 – 1988) of simulated and observed monthly streamflow totals (mm), as well as monthly rainfall totals (mm) for Cathedral Peak catchment II.**

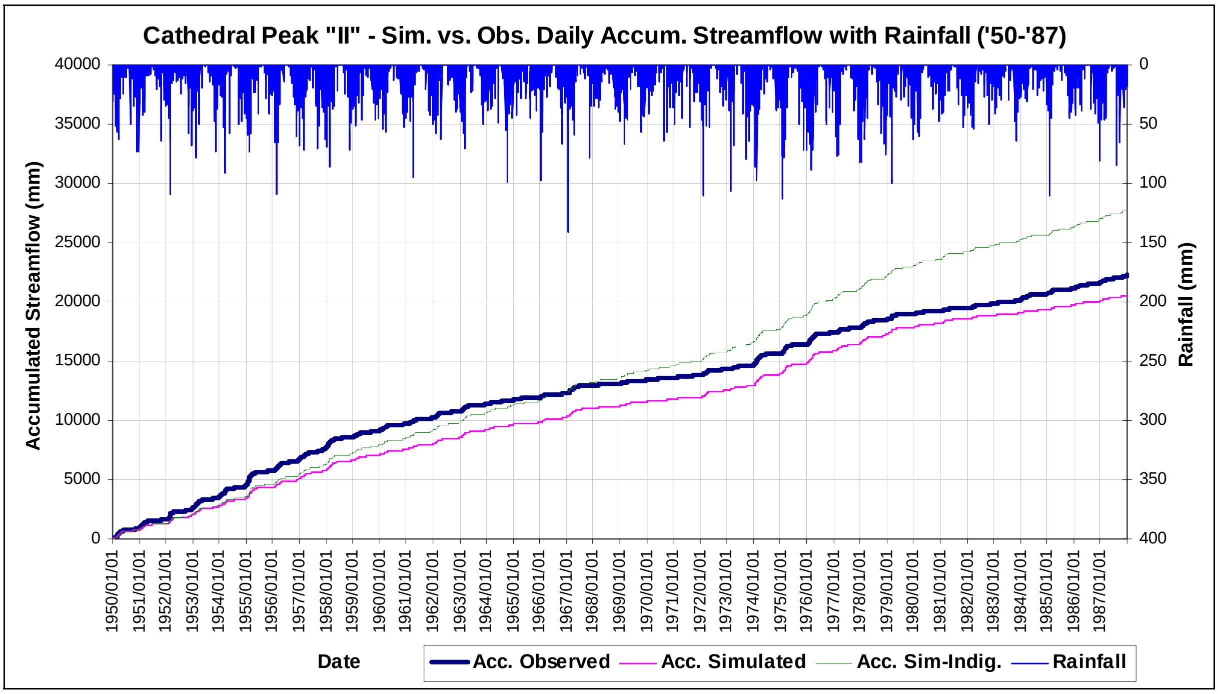


Figure 2.7 **Time series (1950 – 1988) of accumulated streamflow totals (simulated and observed), as well as daily rainfall totals (mm) for Cathedral Peak catchment II. Simulated streamflow under non-treated (un-afforested) conditions is also illustrated.**

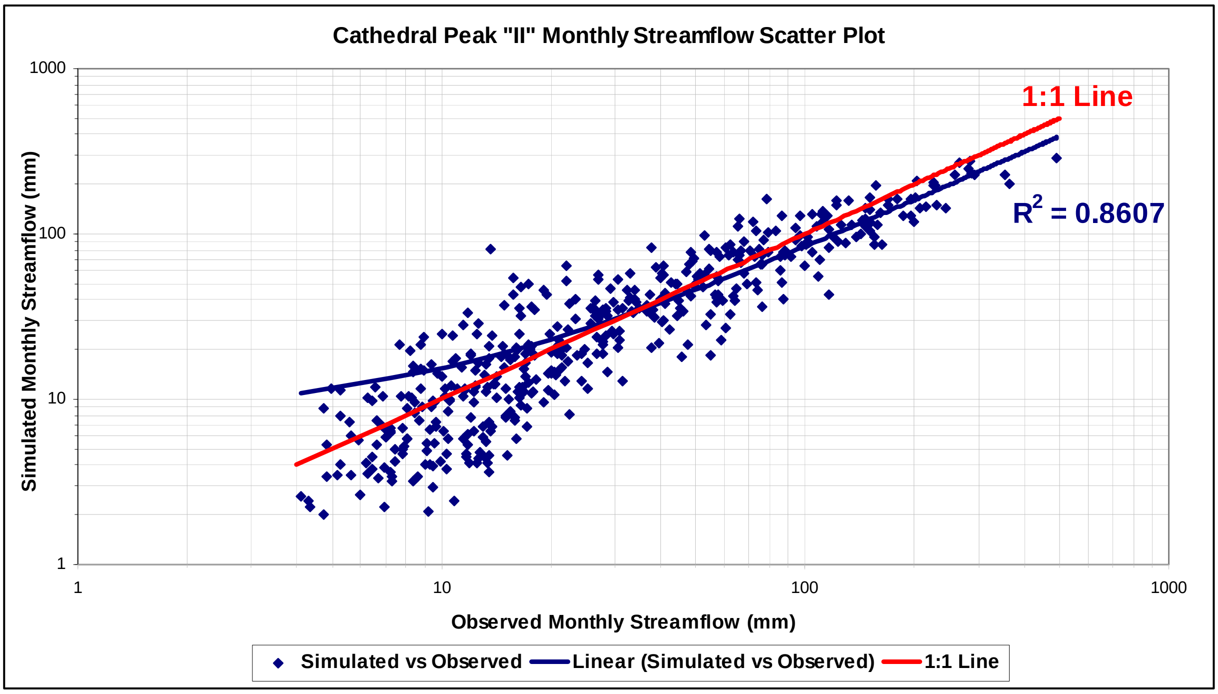


Figure 2.8 **Scatter plot of simulated and observed monthly streamflow totals (mm) for Cathedral Peak catchment II. A linear trend line, its' R² value and the ideal 1:1 line are illustrated.**

2.4 Westfalia

The Westfalia Estate near Tzaneen in the Northern Province has been the site of a paired catchment experiment since 1931. This was initiated by Dr. Hans Merensky to assess the impacts of afforestation on streamflow. However those early experiments were not conducted under controlled conditions and consequently, the Department of Forestry set up a carefully controlled multiple catchment experiment on the Estate in 1974. This consisted of four sub-catchments (A, B, C and D) monitored by four individual weirs (b8m20a, b8m21a, b8m22a and b8m23a) and five rainfall stations (1 to 5) (Figure 2.9).

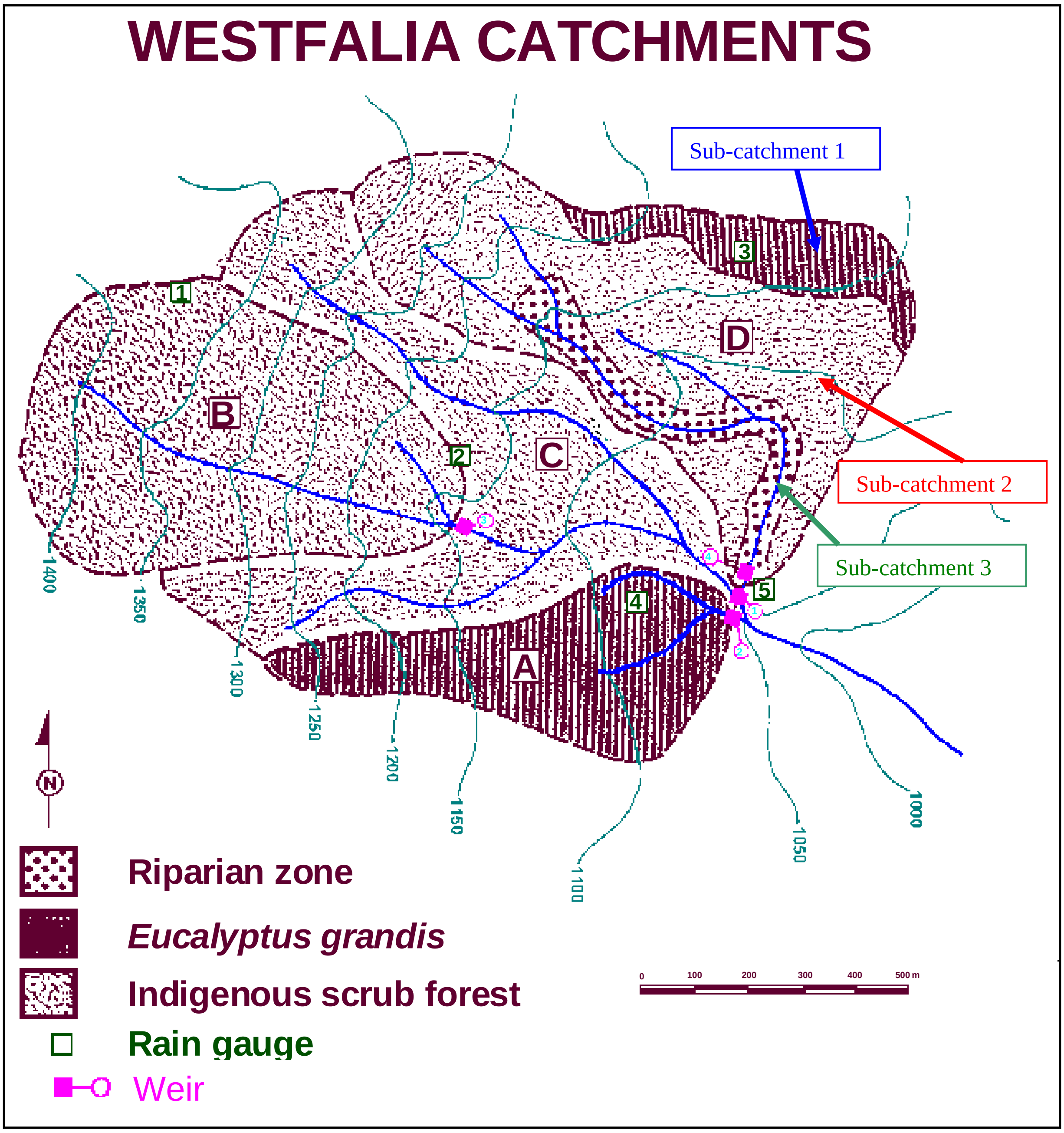


Figure 2.9 The Westfalia research catchments, and sub-catchment delineation of catchment D prior to its large-scale afforestation.

Catchment **B** was selected as the control catchment, while catchment **D** was selected for the primary verification, as it was the one to which afforestation treatments had been applied. Catchments B (23º 43' 00" S; 30º 03' 50" E) and D (23º 42' 50" S; 30º 03' 45" E) lie at an altitude of between 1050 m and 1300 m, with a south-easterly aspect. A 1:50 000 topographical map of the area (2330 CA – Duiwelskloof) was obtained and the catchment boundaries were digitised in order to be able to overlay the outline on spatial soils maps. Some characteristics of the four catchments at Westfalia are presented in Table 2.6.

Table 2.6 Characteristics of the four research catchments at Westfalia.

Catchment No.	Weir No.	Rain gauges	Altitude Range	Area (km²)
A	(2) B8M21a	4	1050 m – 1275 m	0.155
B	(3) B8M22a	1 and 2	1150 m – 1425 m	0.326
C	(1) B8M20a	2	1050 m – 1350 m	0.339
D	(4) B8M23a	1,2,3,4 and 5	1050 m – 1325 m	0.396

Data quality from these catchments was excellent with the exception of a period immediately after a prolonged dry spell in catchment D when some rainfall / streamflow anomalies were identified and flagged. The fact that catchment D produced no streamflow for approximately 4½ years was a likely scenario from an afforested catchment but also presented simulation difficulties. Furthermore, the extremely small size of the catchments increased their sensitivity to small land use / climate changes.

2.4.1 Westfalia input data

It was decided to use the period from 1976 to 1998 for the simulation exercise at Westfalia, as there was reliable streamflow and rainfall data for this period. A “warm-up” year (1975) preceded the simulation. A field trip was subsequently conducted to the site to study catchment characteristics and gather data. Data of the highest quality and detail possible were assimilated and incorporated as input into the model. These data were also rigorously checked (especially rainfall and streamflow data) and patched wherever necessary.

2.4.1.1 Westfalia land cover

The Westfalia catchments were fire-maintained grassland until 1943 after which they were completely protected from fire. As a result they were rapidly colonised by evergreen indigenous scrub forest. This formed a closed canopy of 8 to 15 m in height. Consequently, the indigenous vegetation occurring in the Westfalia area was designated by Acocks (1988) as transitional between North Eastern Mountain Sourveld (evergreen high forest) and Lowveld Sour Bushveld (deciduous woodland). However, field inspection of the current naturally occurring vegetation revealed it to be predominantly indigenous forest. Consequently, Alexandria Forest (*ACRU* crop no. 2080201) was selected to represent the baseline land cover in catchment B and the pre-afforestation vegetation in catchment D. For the purpose of modelling these catchments with *ACRU,* catchment D was delineated into three individual sub-catchments (Figure 2.9) based upon land cover and treatment differences. Sub-catchment characteristics, land cover changes and treatment history, since streamflow gauging was initiated in 1976, were determined from Smith and Bosch (1989) and are summarised for catchments B and D in Table 2.7.

Table 2.7 Catchment characteristics and historical land cover changes for catchments B and D at Westfalia

Characteristics and Land cover History	Westfalia B	Westfalia D – Sub-catchments		
		1	2	3
Area (km²)	0.326	0.07	0.29	0.04
Mean Elevation (m)	1250	1175	1150	1100
1976 - 1977	Indigenous Forest	Indigenous Forest	Indigenous Forest	Indigenous Forest
1978	Indigenous Forest	Planted *E. Grandis*	Indigenous Forest	Indigenous Forest

Characteristics and Land cover History	Westfalia B	Westfalia D – Sub-catchments		
		1	2	3
1979 - 1980	Indigenous Forest	*Eucalyptus grandis*	Indigenous Forest	Indigenous Forest
1981	Indigenous Forest	*Eucalyptus grandis*	Indigenous Forest	Cleared All Veg. (Feb)
1982	Indigenous Forest	*Eucalyptus grandis*	Cleared All Veg. (Dec)	Cleared All Veg. (Dec)
1983	Indigenous Forest	*Eucalyptus grandis*	Planted *E. Grandis* (Mar)	Planted *E. Grandis* (Mar)
1984 - 1994	Indigenous Forest	*Eucalyptus grandis*	*Eucalyptus grandis*	*Eucalyptus grandis*
1995	Indigenous Forest	*Eucalyptus grandis*	*Eucalyptus grandis*	Cleared All Veg.
1996 - 1998	Indigenous Forest	*Eucalyptus grandis*	*Eucalyptus grandis*	Cleared

For the treated period in the simulation of catchment D, dynamic files were used to represent the growth of the planted eucalyptus trees over time. Three variables were included in the dynamic files (ELAIM, VEGINT and ROOTA), which could be simulated on a monthly basis. Changes in VEGINT and ROOTA values according to tree age were obtained from Summerton (1995). The Leaf Area Index (ELAIM) values were based on some readings taken during a field visit using a LiCor 2000 Plant Canopy Analyser, as well as on research into Eucalyptus LAI trends in the Sabie area by Van Lochem (1986). The LAI values contained within the dynamic file are represented in Figure 2.10 and include the effects of thinning and tree age. Site preparation for the *Eucalyptus grandis* stands was pitting. Initial planting density was 1372 stems/ha with thinning down to 650 stems/ha at age 4 and down to 300 stems/ha at age 8. Clear felling did not commence within the simulation period.

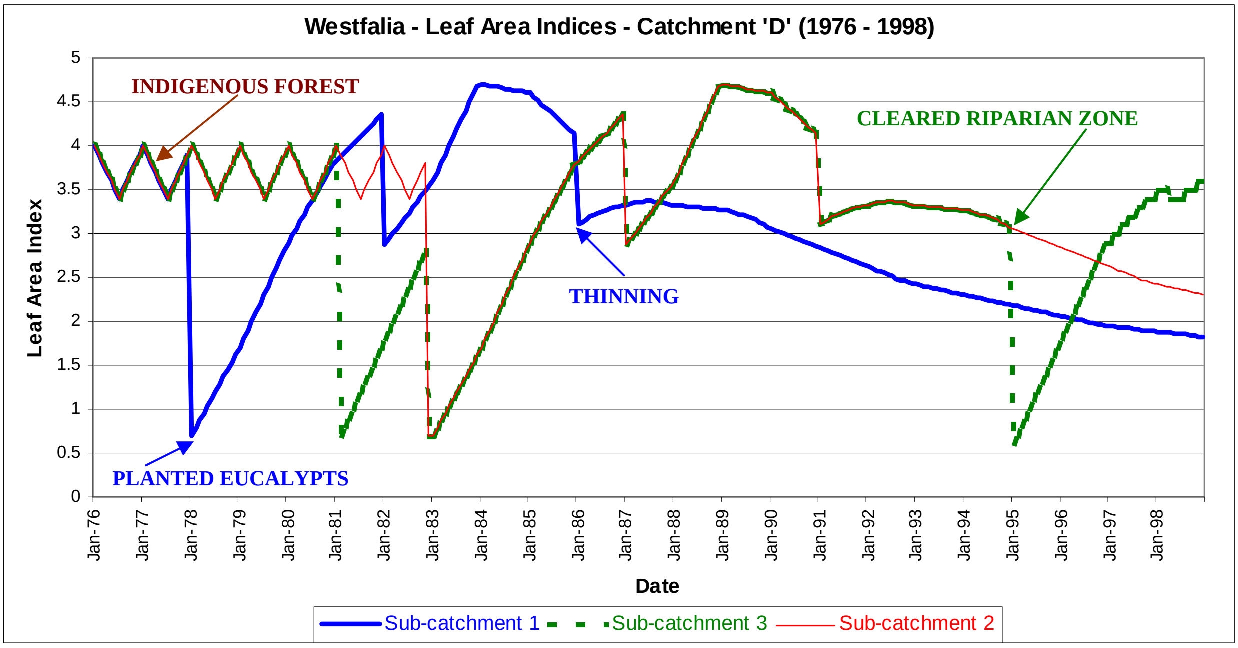


Figure 2.10 Trends in leaf area index (LAI) values for three sub-catchments within catchment D at Westfalia. The values illustrated were contained within the dynamic growth file utilised by *ACRU* to represent growth of the trees over time.

2.4.1.2 Westfalia soils information

The underlying geology of the Westfalia catchments is granite gneiss. The catchment slopes have well drained red soils, while the riparian zones are characterised by hydromorphic marsh soils. Soil depth is very deep (900 – 1200 mm) with an A-horizon of approximately 300 mm and a B-horizon of approximately 800 mm. The dominant soil types are sandy clay loams with clay contents of between 20% and 60%. They are characterised by the Hutton and Farningham series of the Hutton form, while the hydromorphic soils of the riparian zone are of the dry Katspruit and wet Champagne series of the Champagne form (according to the South African binomial soil classification of Mac Vicar *et al.*, 1977). The relevant soil input variables as utilised by the *ACRU* Menubuilder were obtained from the ISCW (1993) soils coverage.

2.4.1.3 Westfalia rainfall and streamflow data

Data from five daily rainfall stations located within the catchments were used to determine an area-weighted daily rainfall record for catchments B and D. The Theissen Polygon technique was applied to weight the contributions of the individual rain gauges to the average for the catchment. Based on this technique catchment B received a mean annual precipitation of 1394.4 mm and catchment D 1394.0 mm between 1976 and 1998.

2.4.1.4 Additional climatic data for Westfalia

Temperature data were extracted from the CCWR using a number of stations located in the vicinity of Westfalia. The nearest station to the actual catchment was Tzaneen (A0679106) and this was used as the primary source of maximum and minimum temperatures. There were, however, gaps in the record from this particular station and consequently, the records were patched using alternative stations, namely Tzaneen (A0679260), Letaba (A0679562), Letaba (A0682141) and Koedoesrivier. Correlation between the Tzaneen station and the patching stations were established and correction factors were subsequently applied to the patching stations. Account was also taken of the altitudinal difference between Tzaneen (724 m ASL) and Westfalia (1050 m – 1400 m ASL) and this was accounted for in the *ACRU Menubuilder* using the variables ILRF (lapse rate control flag), TELEV (altitude of the base temperature station) and LRREG (adiabatic lapse rate region). Once the record was completely patched it was necessary to error check the data for occasions where the minimum temperature equalled or exceeded the maximum temperature on any specific day.

Monthly means of daily maximum and minimum temperatures were also extracted from the Agrohydrological and Climatological Atlas (Schulze, 1997), while average monthly totals of A-pan equivalent evaporation data were obtained from the BEEH gridded coverage's. Monthly means of daily windrun were calculated from data obtained from a weather station within the Westfalia Estate. These data are summarised in Table 2.8.

Table 2.8 Monthly climatic data for Westfalia.

Month/ Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T-Max (°C)	28.0	27.0	27.0	25.0	23.0	22.0	21.0	23.0	25.0	27.0	28.0	29.0
T-Min (°C)	19.0	18.0	17.0	13.0	9.0	7.0	7.0	9.0	11.0	13.0	15.0	17.0
A-pan (mm)	189.7	169.9	169.4	146.6	135.3	112.4	121.3	157.3	181.9	210.9	207.9	197.8
Wind (km/day)	110.1	129.1	162.8	109.2	98.9	96.2	119.1	140.9	148.8	109.2	91.6	113.5

2.4.2 Westfalia verification results

2.4.2.1 Westfalia catchment B

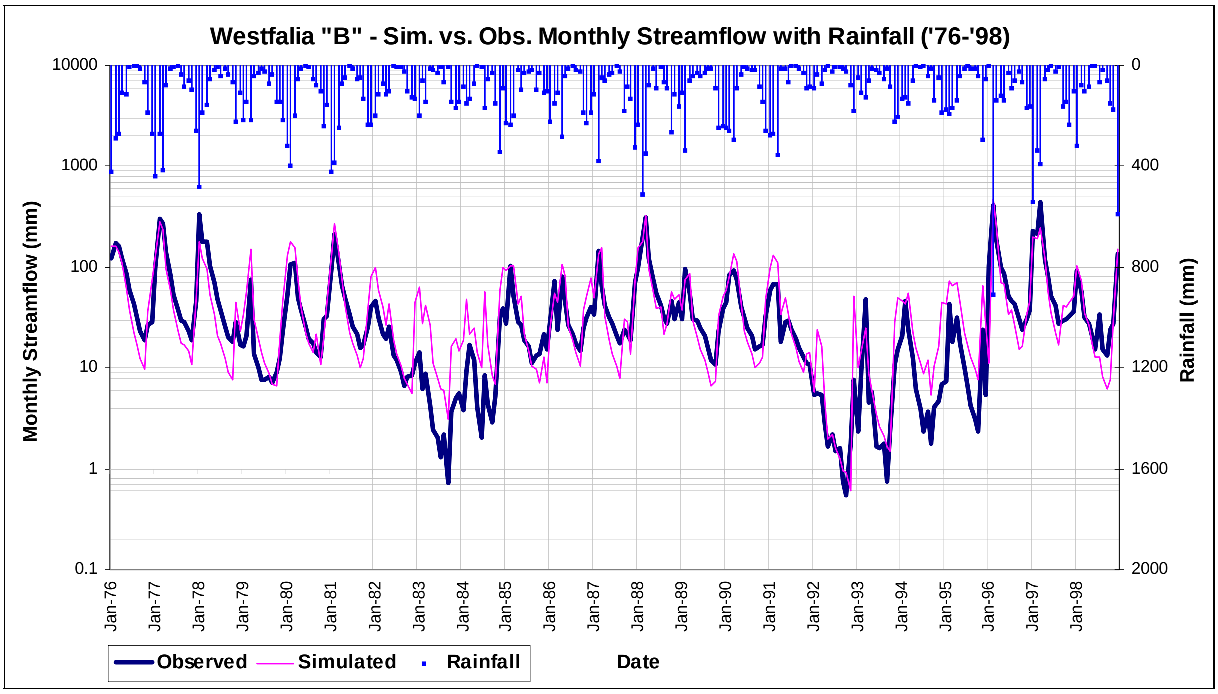


Figure 2.11 **Time series (1976 – 1998) of simulated and observed monthly streamflow totals (mm), as well as monthly rainfall totals (mm) for Westfalia catchment B.**

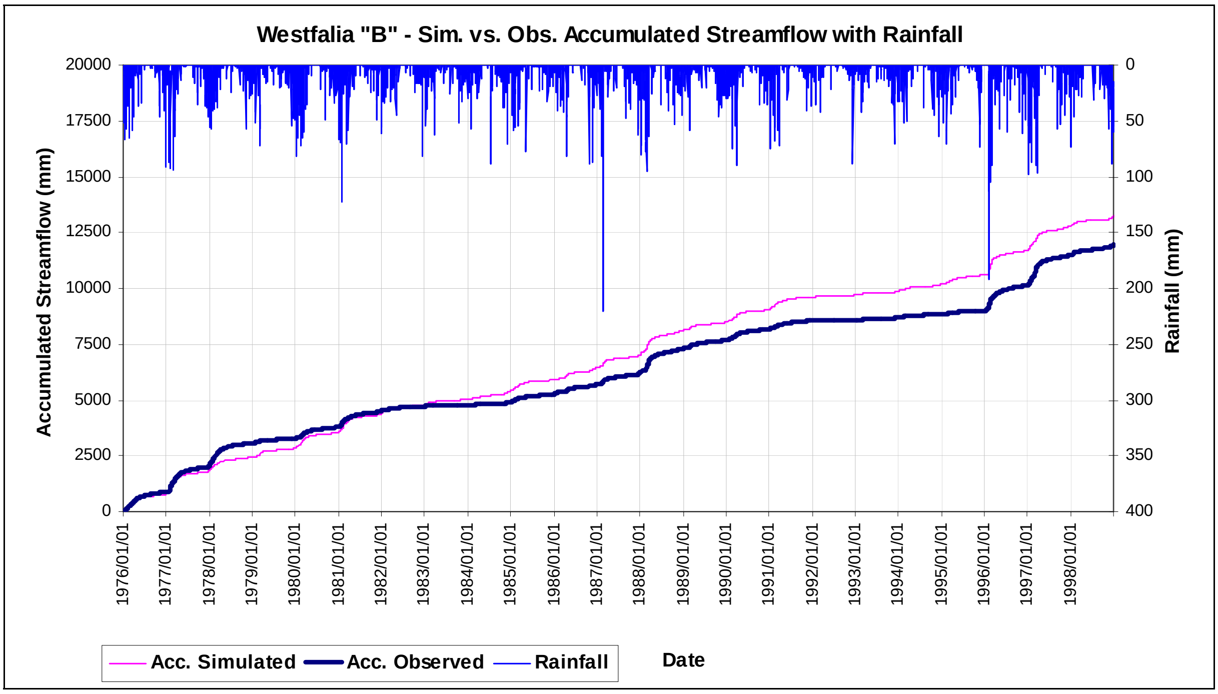


Figure 2.12 **Time series (1976 – 1998) of accumulated streamflow totals (simulated and observed), as well as daily rainfall totals (mm) for Westfalia catchment B.**

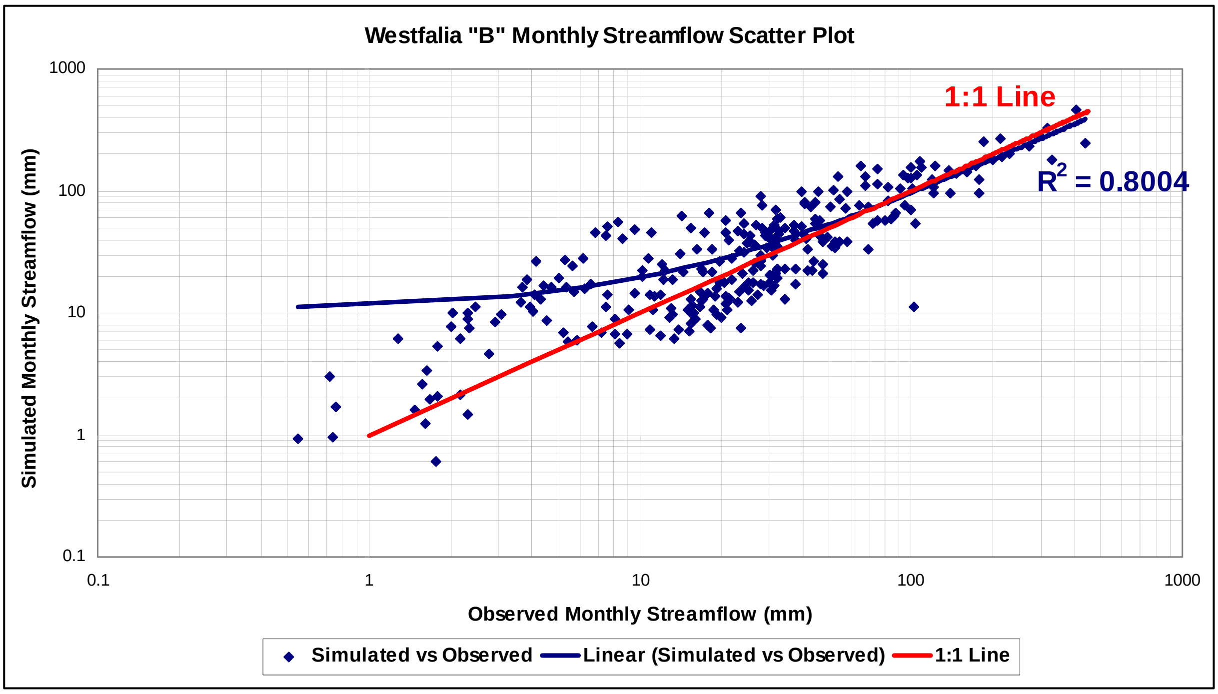


Figure 2.13 **Scatter plot of simulated and observed monthly streamflow totals (mm) for Westfalia catchment B. A linear trend line, its' R² value and the ideal 1:1 line are illustrated.**

2.4.2.2 Westfalia catchment D

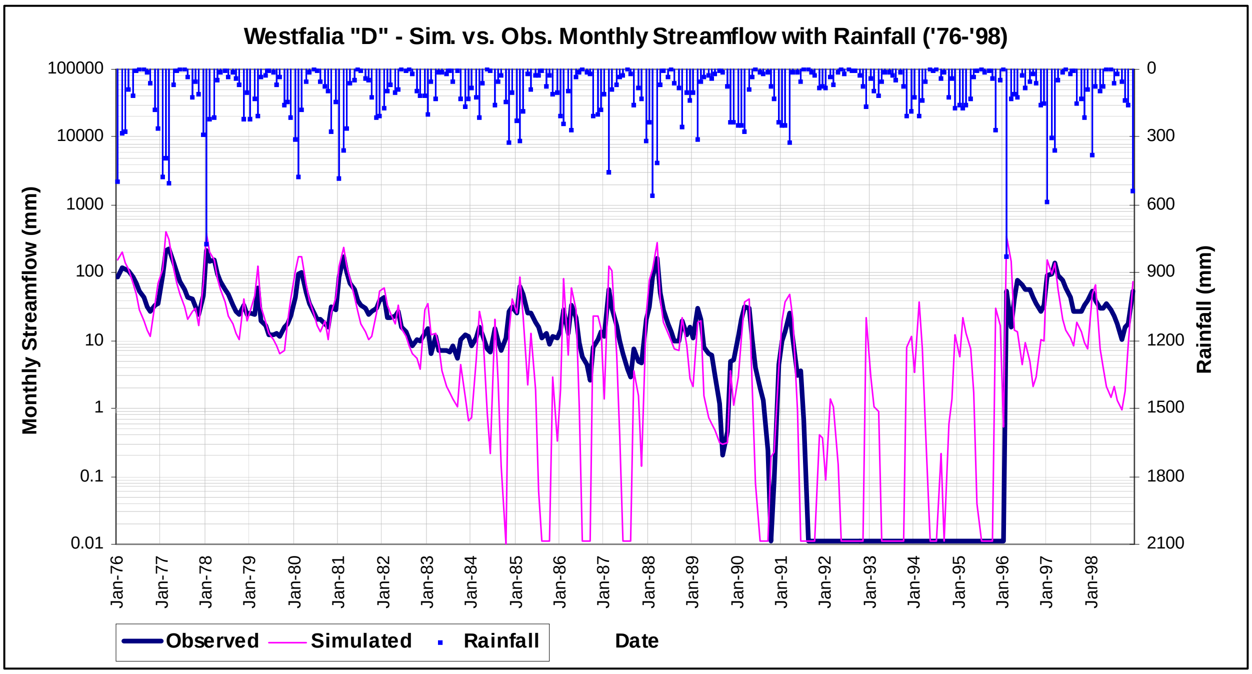


Figure 2.14 **Time series (1976 – 1998) of simulated and observed monthly streamflow totals (mm), as well as monthly rainfall totals (mm) for Westfalia catchment D. Note the period between August 1991 and January 1996 when all observed streamflow ceased from the catchment.**

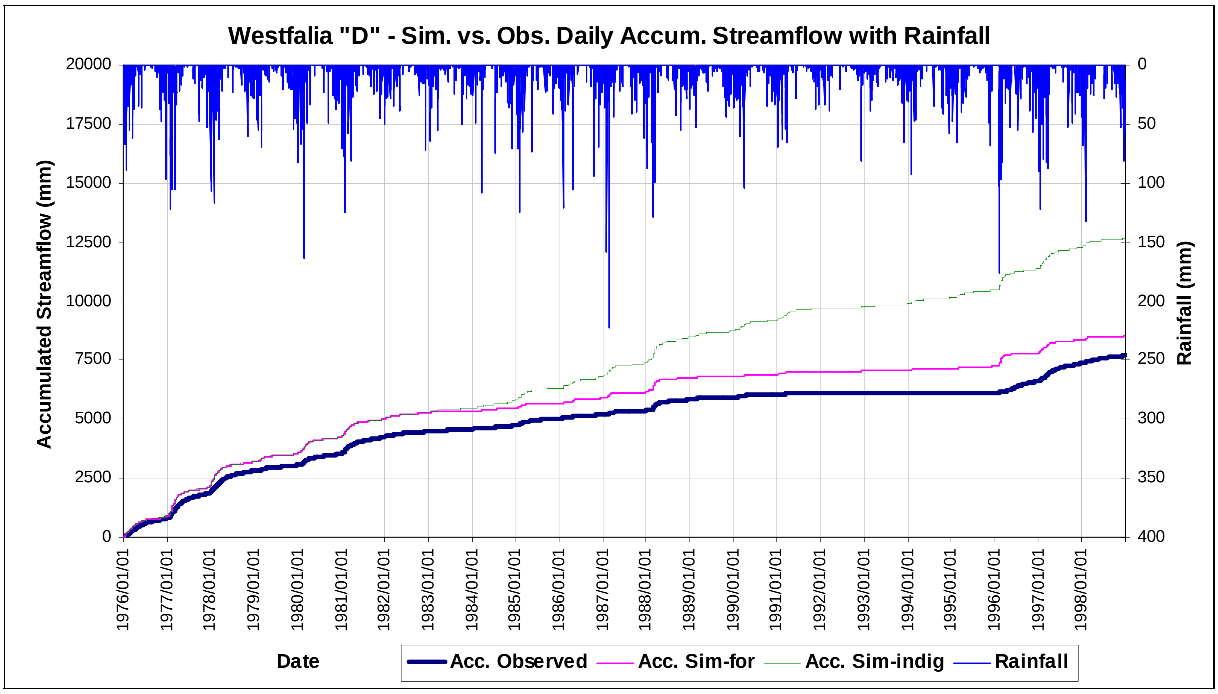


Figure 2.15 Time series (1976 – 1998) of accumulated streamflow totals (simulated and observed), as well as daily rainfall totals (mm) for Westfalia catchment D. Simulated streamflow under non-treated (un-afforested) conditions is also illustrated.

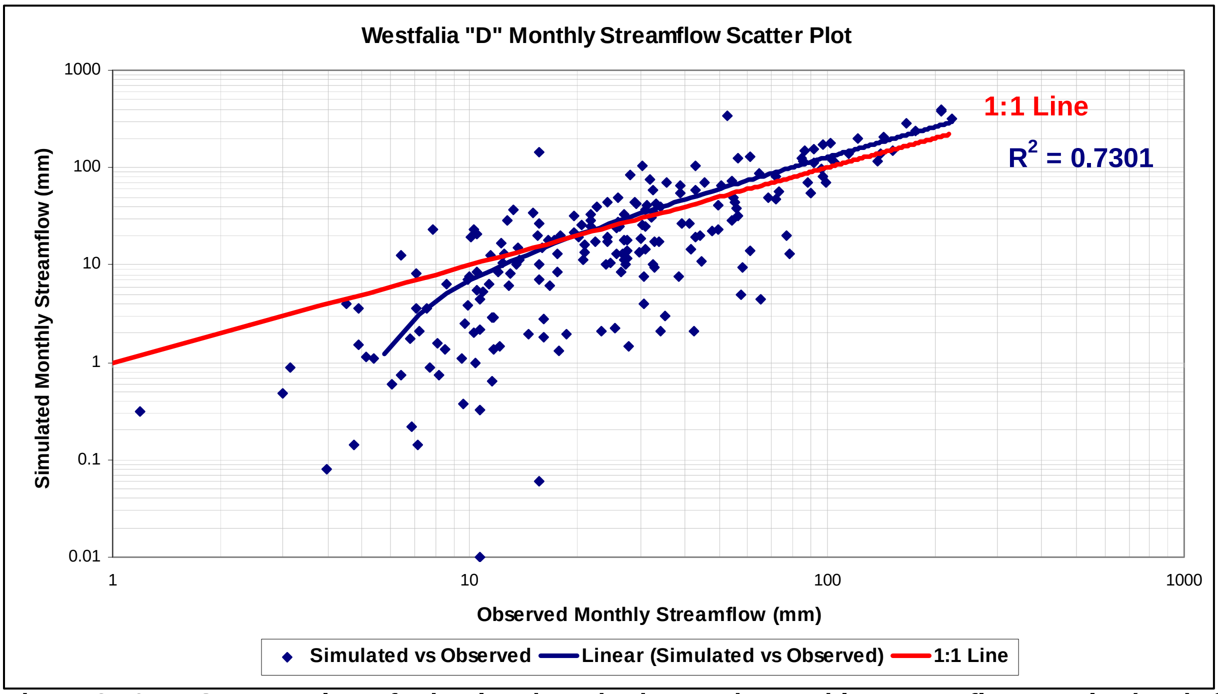


Figure 2.16 Scatter plot of simulated and observed monthly streamflow totals (mm) for Westfalia catchment D. A linear trend line, its' R² value and the ideal 1:1 line are illustrated.

2.5 Jonkershoek

The experimental catchments of Jonkershoek are situated in the temperate, winter rainfall region of the south-western Cape. **Lambrechtsbos A** (33º 57' 40” S; 18º 56' 50” E) and **Lambrechtsbos B** (33º 57' 40” S; 18º 57' 00” E) which lie within the Jonkershoek valley (Figure 2.17), were the two catchments selected for verification studies.

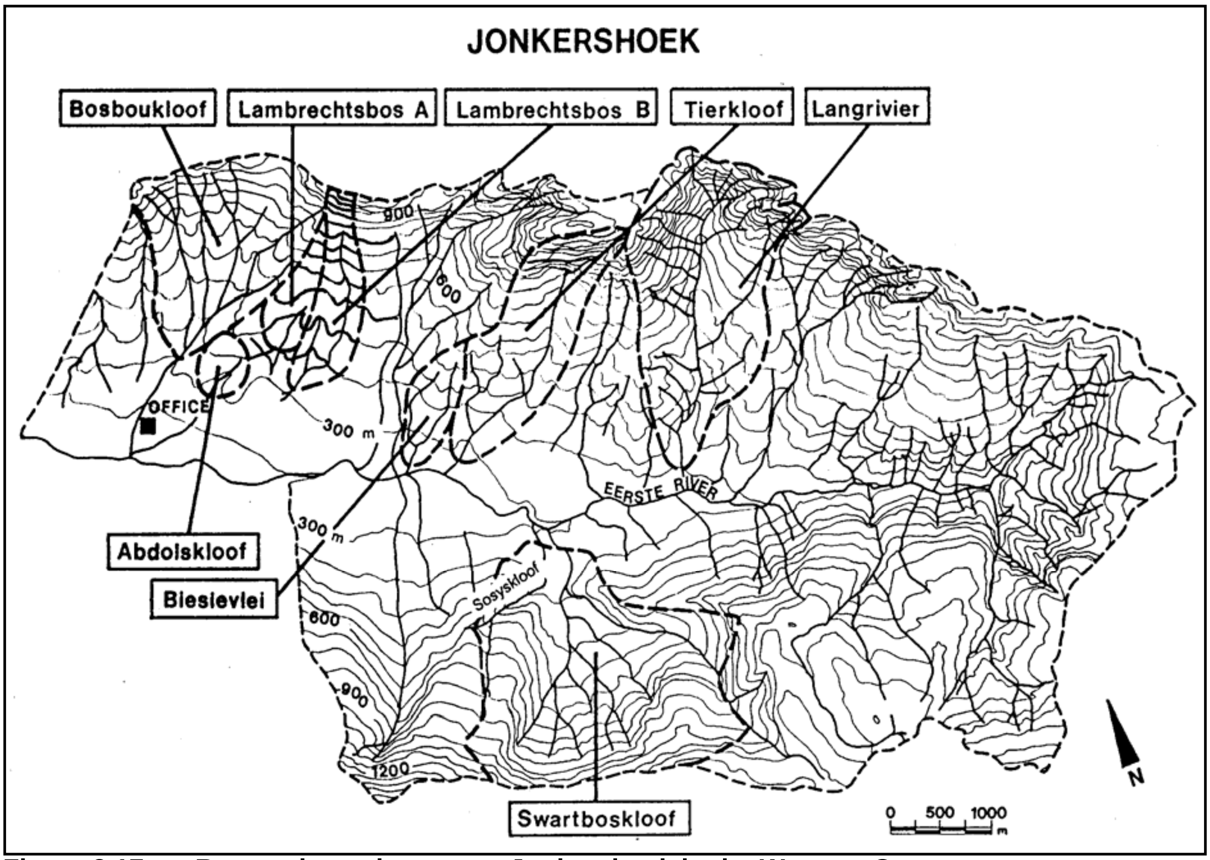


Figure 2.17 Research catchments at Jonkershoek in the Western Cape

These catchments were deemed most suitable due to their high percentage of forestry and good, long streamflow records (including a significant pre-afforestation streamflow period). A further advantage was the distribution of forestry within these catchments across a full altitudinal range. A 1:50 000 topographical map of the area (3318DD) was obtained and the catchment boundaries were digitised in order to overlay the outline on spatial soils maps. Some characteristics of the Lambrechtsbos A and B catchments are presented in Table 2.9.

Table 2.9 Characteristics of the two research catchments used at Jonkershoek.

Catchment	Weir No.	Rain gauges	Altitude Range	Area (km²)
Lambrechtsbos A	G2M09a	15a, 10b	300 m – 800 m	0.312
Lambrechtsbos B	G2M10a	15a, 10b	250 m – 1100 m	0.655

Simulation problems associated with these catchments are their small size, steep altitudinal / precipitation gradients, and little knowledge of their underlying geology. In this regard it was suspected that some water from Lambrechtsbos B might exit from Lambrechtsbos A, although this is unconfirmed. Some rainfall / streamflow anomalies also exist in that there have been occasions when runoff has exceeded rainfall for a given period.

2.5.1 Jonkershoek input data

It was decided to use the period from 1969 to 1991 for both Lambrechtsbos A and B simulations, as there were reliable streamflow and rainfall data for this period as well as daily A-pan values. A "warm-up" year (1968) preceded the simulation.

2.5.1.1 Jonkershoek land cover

The natural vegetation of the Jonkershoek area was classified by Acocks (1988) as Macchia (*ACRU* crop no. 2020101), and this was selected to represent the baseline land cover prior to the 94% afforestation with pine of Lambrechtsbos A in 1972. 74% of Lambrechtsbos B was planted to pine in 1963. Site preparation for the *Pinus radiata* stands was intensive preparation. Both these catchments were modelled in distributed mode and the un-afforested portions of the catchments were primarily the riparian areas. A field trip to the catchments revealed that these zones were heavily forested with indigenous riverine forest, and these zones were therefore modelled as Alexandria Forest (*ACRU* crop no. 2080201). A dynamic file was used for Lambrechtsbos A to simulate the transition from natural fynbos cover (or Macchia, i.e. the characteristic sclerophyllous scrub vegetation of the western Cape region, similar to the scrub of other Mediterranean type regions), to pine plantations as well as the growth of the planted pine trees over time. Variables included in this file were depth of the B-horizon (DEPBHO), fraction of plant available water at which plant stress sets in (CONST), coefficients of initial abstraction (COIAM), effective soil depth from which stormflow generation takes place (SMDDEP), leaf area indexes (ELAIM), fraction of roots in the A-horizon (ROOTA) and rainfall interception values (VEGINT). Respective sub-catchment details and land cover history are listed in Table 2.10.

Table 2.10 Sub-catchment characteristics and historical land cover changes for Lambrechtsbos A and Lambrechtsbos B at Jonkershoek.

Characteristics and Land cover History	**Lambrechtsbos A – Sub-catchments**		**Lambrechtsbos B – Sub-catchments**	
	1	**2**	**1**	**2**
Area (km²)	0.29	0.02	0.485	0.17
Mean Elevation (m)	700	700	700	700
1969 - 1971	Fynbos	Riverine Forest	*Pinus radiata*	Riverine Forest
1972 - 1991	*Pinus radiata*	Riverine Forest	*Pinus radiata*	Riverine Forest

2.5.1.2 Jonkershoek soils information

The relevant soil input variables as utilised by the *ACRU Menubuilder* were obtained from the ISCW (1993) soils coverage. Soils of the area are classified as sandy loams and tend to be shallow and stony.

2.5.1.3 Jonkershoek rainfall and streamflow data

Data from one daily rainfall station (15a) and one monthly rainfall station (10b) located in Lambrechtsbos B were used to determine a daily rainfall record for the catchments. The monthly gauge (10b) was the more representative of the two in that it was situated approximately in the centre of the catchments, while the daily gauge (15a) was situated at the base of the catchments. As a daily rainfall record was required as input into the model it was necessary to apply a correction factor to the daily data from gauge 15a based on monthly data from gauge 10b. This was achieved by comparing average monthly rainfall totals for the two gauges against each other and deriving an appropriate monthly correction factor (CORPPT), which was applied to the daily rainfall data from gauge 15a. The correction factors differed for the two catchments, being greater for Lambrechtsbos B to account for its higher mean altitude. Rainfall data were also checked against data from two additional gauges (11a and 13a) for anomalies and missing values. Based on this technique the approximate mean annual precipitation for Lambrechtsbos A is 1272 mm and for Lambrechtsbos B is 1384 mm. Streamflow data for the two catchments (Lambrechtsbos A =

G2M09a; Lambrechtsbos B = G2M10a) were plotted against each other to check for outliers (Figure 2.18).

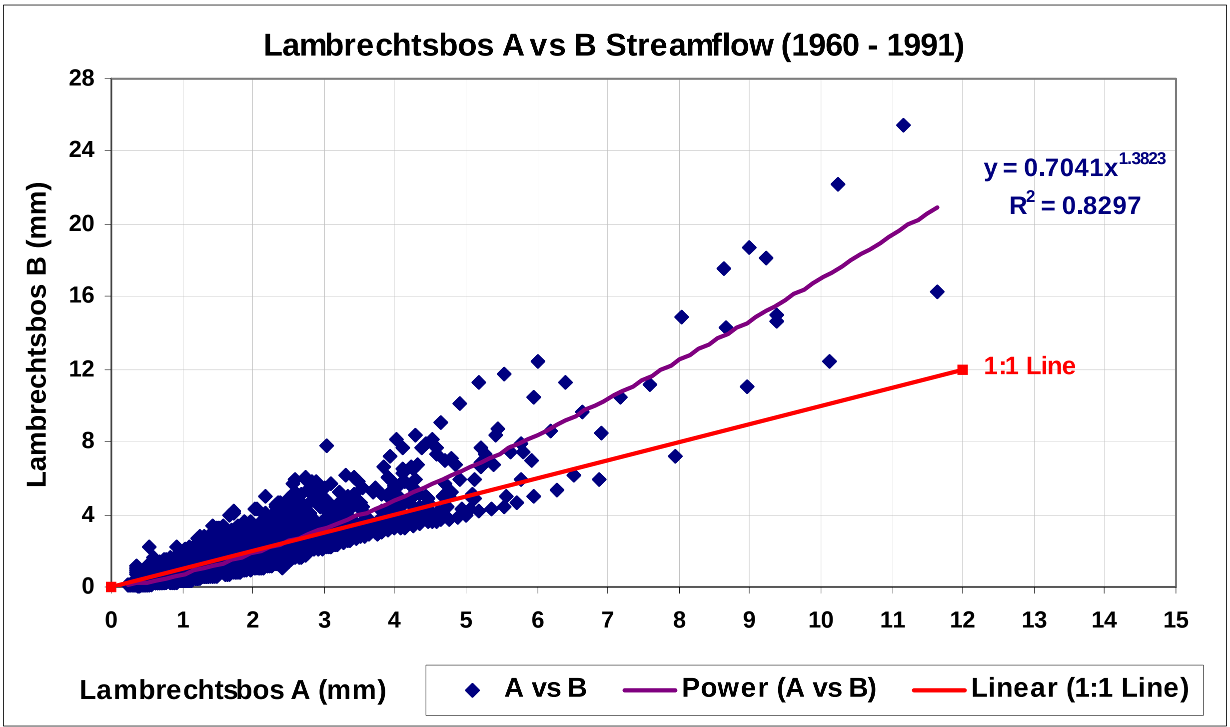


Figure 2.18 Scatter plot and trend-line of daily runoff data (1960 – 1991) for Lambrechtsbos B (G2M10a) against Lambrechtsbos A (G2M09a).

Analysis of Figure 2.18 shows the good correlation between daily runoff totals (mm, i.e. adjusted for catchment size) for a 32-year period from the two gauges. No distinct outliers are evident which is encouraging in terms of data quality. Low flows appear to be of a similar magnitude from both catchments, with the larger flood events producing exponentially greater runoff from the larger and higher catchment (Lambechtsbos B) relative to the smaller Lambrechtsbos A, which is intuitive.

2.5.1.4 Additional climatic data for Jonkershoek

Daily A-pan and S-tank data for the Jonkershoek valley were used to derive reference potential evaporation for the simulations. Daily S-tank data was available for the "Manor House" station from 1969 to 1979, and daily A-pan data was available for the "Swartboskloof" station from 1975 to1991. It was therefore necessary to utilise both records to generate data for the entire simulation period (1969-1991), and the period of overlap (1975-1979) was used to establish a relationship between the S-tank and the A-pan data. The procedure followed was first to convert the "Manor House" S-tank data to an A-pan equivalent using smoothed mean monthly A-pan **:** S-tank ratios for specific zones in southern Africa derived by Louw (1966). The resultant "Manor House" A-pan equivalent values were then plotted against corresponding "Swartboskloof" A-pan values to derive a relationship between the two data sets. This accounted for the difference in locality between the data sets. All the "Manor House" A-pan equivalent values were adjusted accordingly, and a complete A-pan record was established for the simulation period. Weekend accumulations in the data (resulting from the pan not being read over a weekend) were disaggregated and missing data were substituted with an average daily value for that month calculated from the existing A-pan data set. A monthly adjustment factor (CORPAN) was applied within the model to the pan evaporation data to correct for screening.

Temperature data were extracted from the CCWR using a station located in the vicinity of the catchments, namely Jonkershoek (Bos) (0021778W) and this was used as the primary source of daily maximum and minimum temperatures. Monthly means of daily maximum and minimum temperatures were also extracted from the Agrohydrological and Climatological Atlas (Schulze, 1997), while average monthly totals of A-pan equivalent evaporation data were obtained from the BEEH gridded coverage's. These data are summarised in Table 2.11.

Table 2.11 Monthly climatic data for Jonkershoek

Month/ Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T-Max (°C)	23.0	21.0	19.0	17.0	15.0	13.0	13.0	15.0	16.0	17.0	19.0	20.0
T-Min (°C)	9.0	11.0	11.0	10.0	7.0	7.0	5.0	5.0	7.0	8.0	9.0	10.0
A-pan (mm)	212.7	172.5	165.2	84.6	66.8	58.6	67.2	75.5	88.7	116.0	154.6	213.0

2.5.2 Jonkershoek verification results

2.5.2.1 Lambrechtsbos catchment A

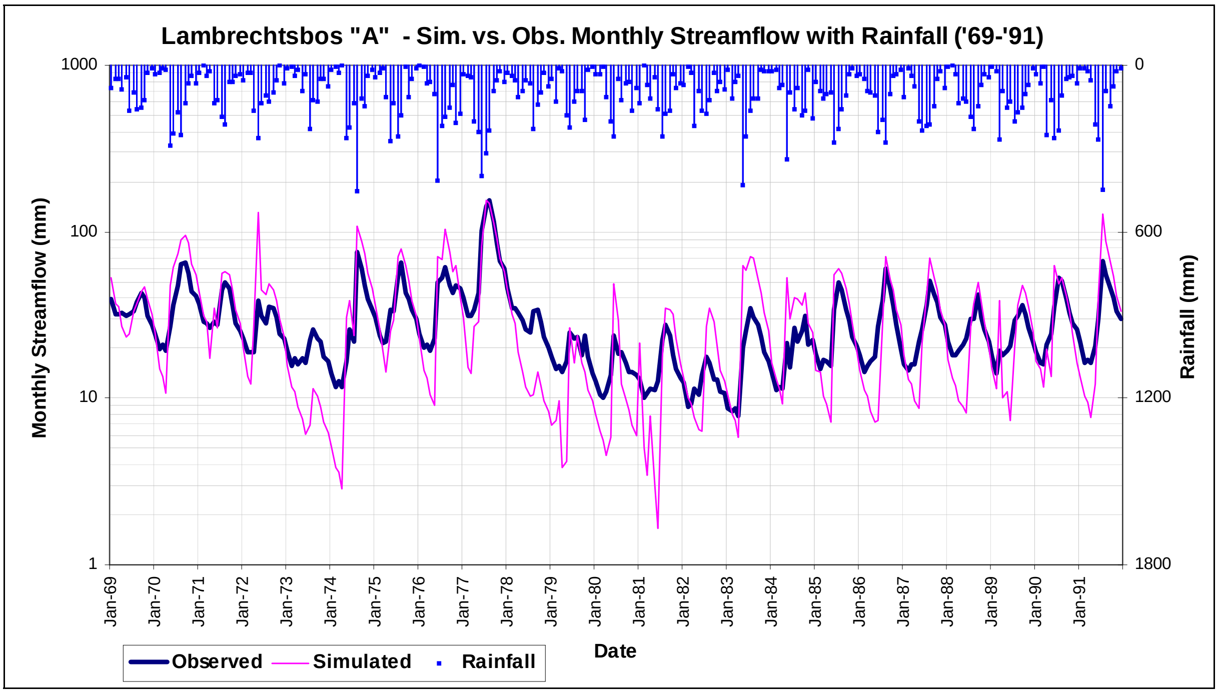


Figure 2.19 Time series (1969 – 1991) of simulated and observed monthly streamflow totals (mm), as well as monthly rainfall totals (mm) for Lambrechtsbos catchment A.

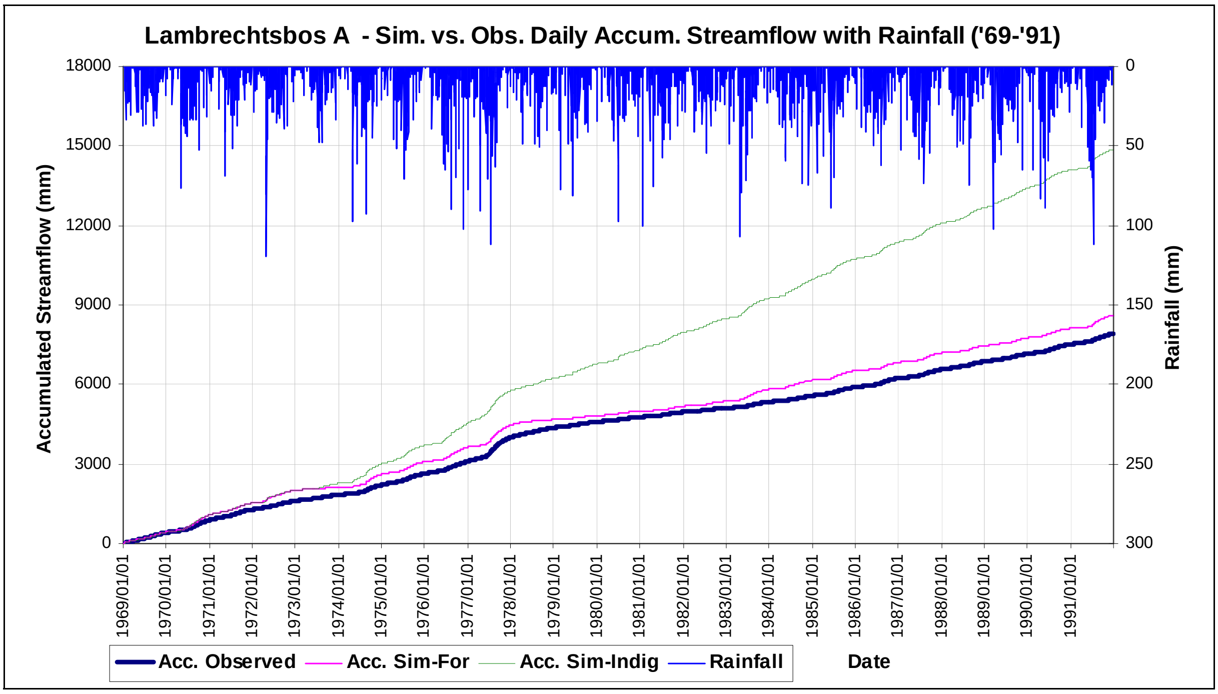


Figure 2.20 Time series (1969 – 1991) of accumulated streamflow totals (simulated and observed), as well as daily rainfall totals (mm) for Lambrechtsbos catchment A. Simulated streamflow under non-treated (un-afforested) conditions is also illustrated.

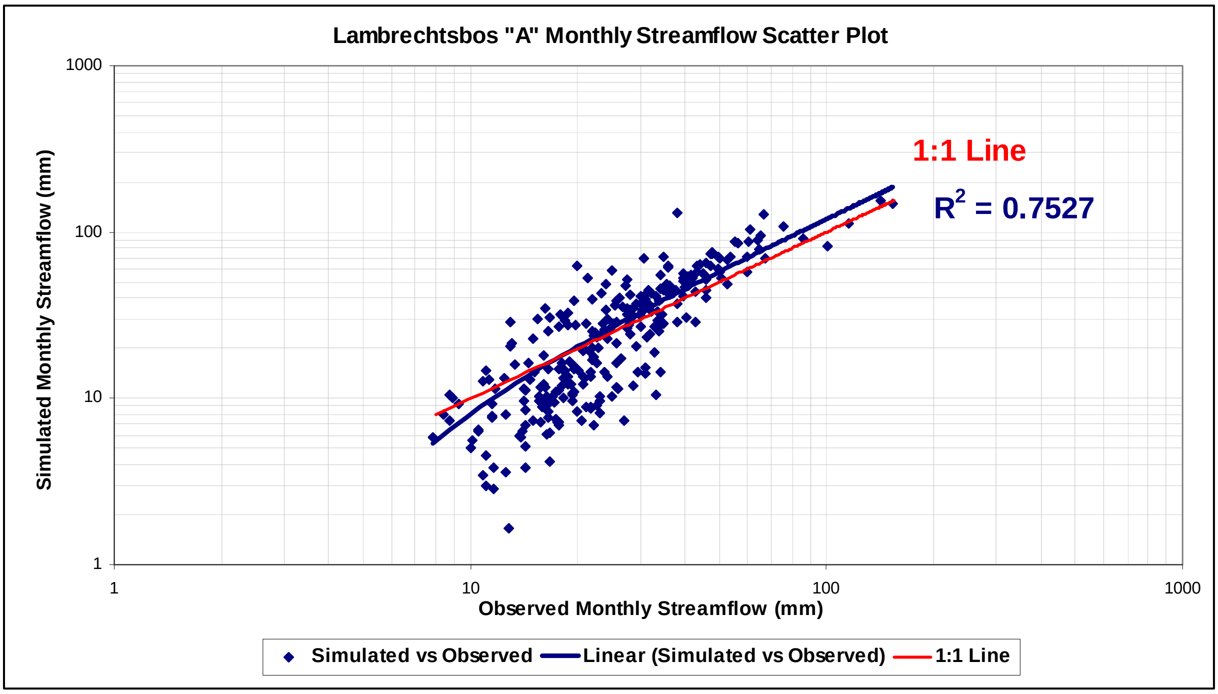


Figure 2.21 Scatter plot of simulated and observed monthly streamflow totals (mm) for Lambrechtsbos catchment A. A linear trend line, its' R² value and the ideal 1:1 line are illustrated.

2.5.2.2 Lambrechtsbos catchment B

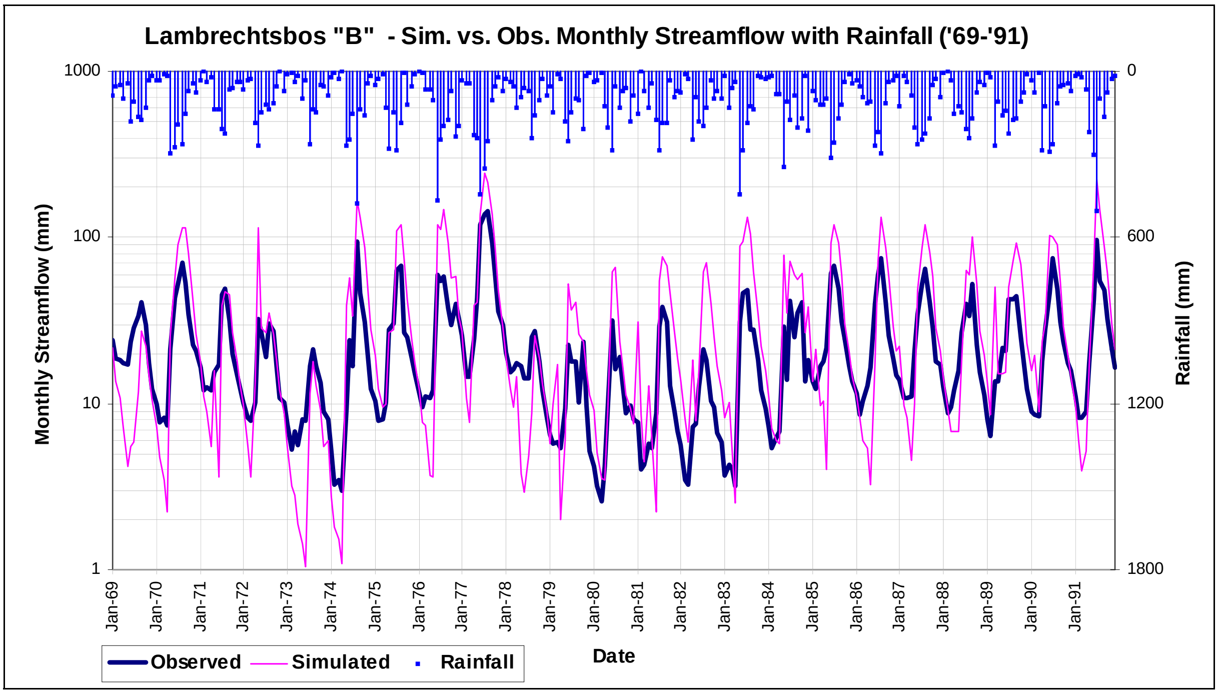


Figure 2.22 Time series (1969 – 1991) of simulated and observed monthly streamflow totals (mm), as well as monthly rainfall totals (mm) for Lambrechtsbos catchment B.

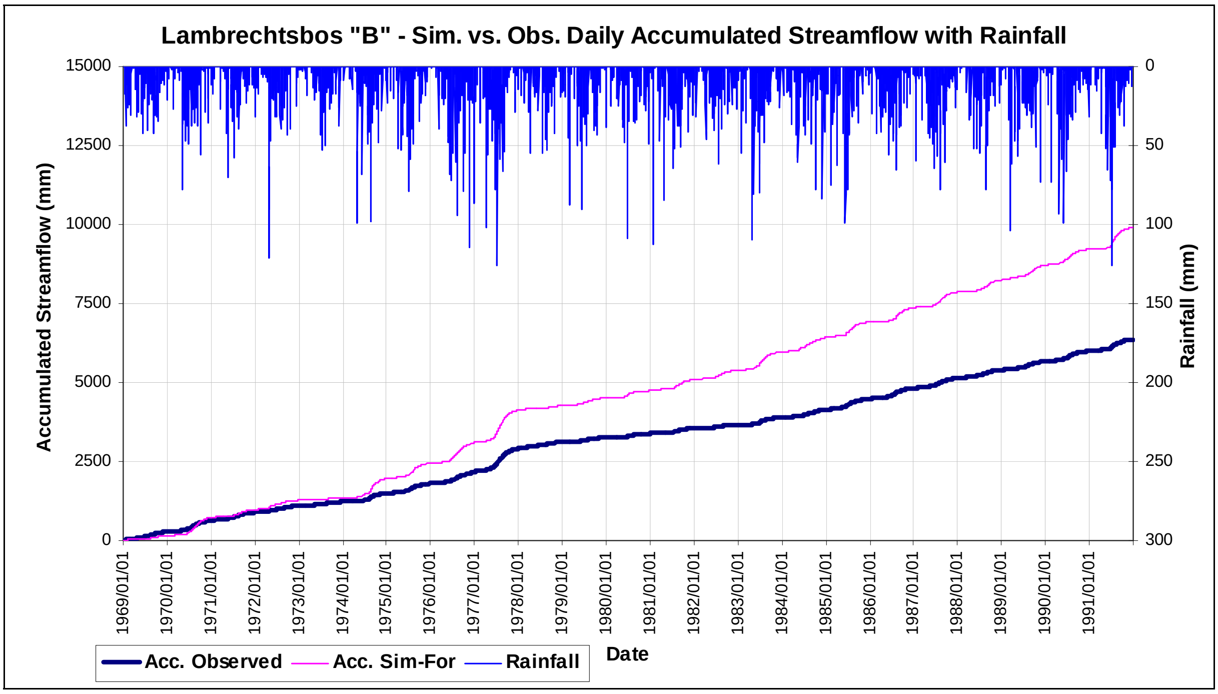


Figure 2.23 Time series (1969 – 1991) of accumulated streamflow totals (simulated and observed), as well as daily rainfall totals (mm) for Lambrechtsbos catchment B.

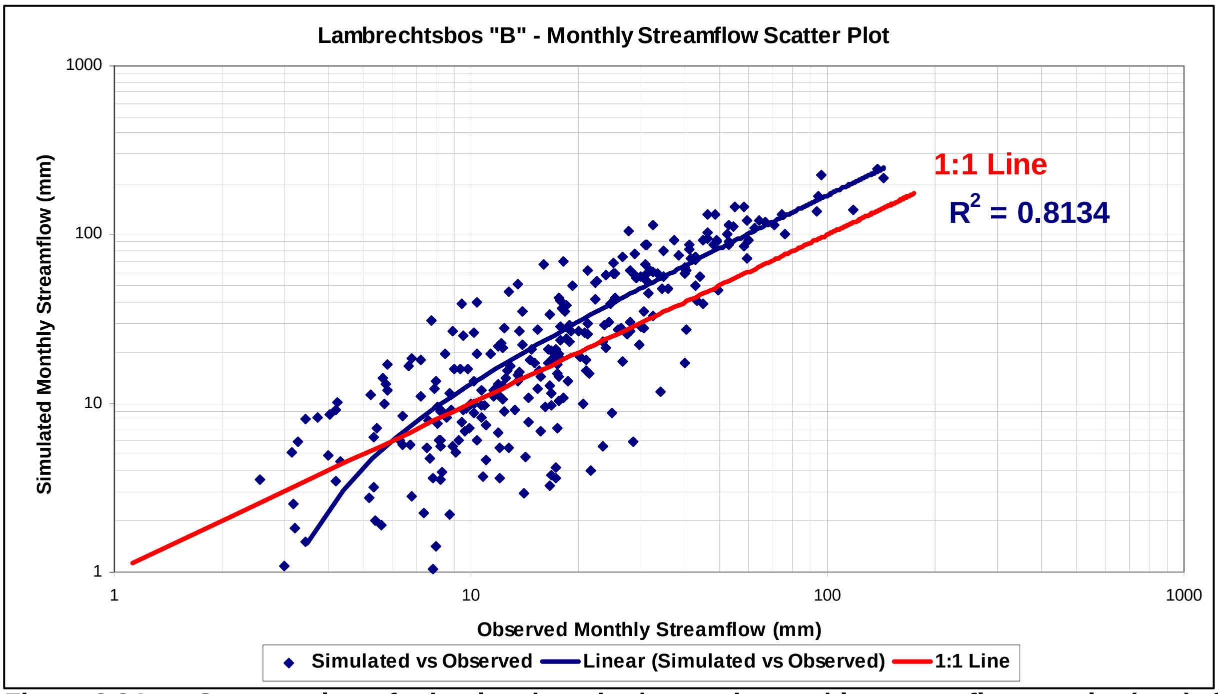


Figure 2.24 **Scatter plot of simulated and observed monthly streamflow totals (mm) for Lambrechtsbos catchment B. A linear trend line, its' R² value and the ideal 1:1 line are illustrated.**

2.6 Witklip

Catchment **V** (25º 14' S; 30º 53' E) on the Witklip State Forest (Figure 2.25) lies at an altitude of between 1060 m and 1320 m, has a north-westerly aspect, and was the catchment selected for the verification study.

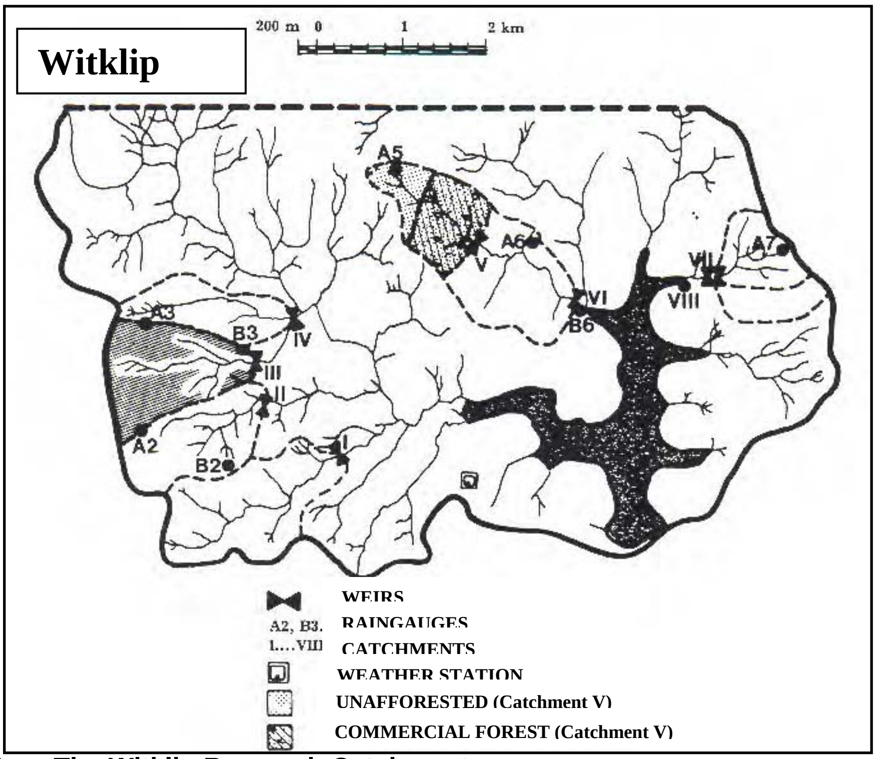


Figure 2.25 **The Witklip Research Catchments**

A 1:50 000 topographical map of the area (2530 BB – Sabie) was obtained and the boundary of Witklip catchment V was digitised in order to be able to overlay the outline on spatial soils maps.

2.6.1 Witklip input data

It was decided to use the period from 1975 to 1990 for the simulations, as there was reliable streamflow and rainfall data for this period. A "warm-up" year (1974) preceded the simulation. A field trip was also conducted to this site to study catchment characteristics and gather data. Interviews with forestry staff at Witklip were conducted in order to build up a database of historical land use and management changes (Table 2.12) that had taken place during the period of simulation.

2.6.1.1 Witklip land cover

The natural vegetation of the Witklip region is classified by Acocks (1988), as North Eastern Mountain Sourveld (evergreen high forest). This vegetation still characterises the upper reaches of catchment V (0.517 km²) in the form of grassland with isolated patches of indigenous scrub forest occurring in the fire-protected riparian zones. The rest of the catchment is under commercially grown eucalypts (0.095 km²) and pines (0.468 km²). The eucalypts are located predominantly in the middle reaches of the catchment in a narrow band below the areas of open grassland, where they serve as windbreaks and fire belts. For the purposes of modelling this catchment with *ACRU* it was delineated into nine individual sub-catchments (1 to 9) necessitated by differences in land cover and the staggered felling and re-planting dates. Dynamic files were used to simulate the growth of the planted trees over time. Sub-catchment characteristics, land cover changes and treatment history, since streamflow gauging was initiated in 1975, are summarised in Table 2.12.

Table 2.12 Sub-catchment characteristics and land cover history

Feature	Sub-catchment No.								
	1	2	3	4	5	6	7	8	9
Area (km²)	0.517	0.024	0.047	0.024	0.097	0.023	0.179	0.139	0.030
Elevation	1250	1180	1180	1180	1100	1100	1100	1100	1100
1975-1979	Grassland	Mature eucalypts	Mature eucalypts	Mature eucalypts	Mature pines	Mature pines	Mature pines	Mature pines	Mature pines
1980	Grassland	Mature eucalypts	Mature eucalypts	Mature eucalypts	Felled & replanted	Mature pines	Mature pines	Mature pines	Mature pines
1981	Grassland	Felled & replanted	Mature eucalypts	Mature eucalypts	Pines	Mature pines	Mature pines	Mature pines	Mature pines
1982	Grassland	Eucalypts	Mature eucalypts	Mature eucalypts	Pines	Felled & replanted	Felled & replanted	Mature pines	Mature pines
1983	Grassland	Eucalypts	Mature eucalypts	Felled & replanted	Pines	Pines	Pines	Felled & replanted	Felled & replanted
1984	Grassland	Eucalypts	Felled & replanted	Eucalypts	Pines	Pines	Pines	Pines	Pines
1985-1990	Grassland	Eucalypts	Eucalypts	Eucalypts	Pines	Pines	Pines	Pines	Pines

Site preparation for the eucalyptus and pine stands is classified as intermediate. Clearfelling and replanting of the pine plantations took place over a three-year period between June 1980 and April 1983. The eucalyptus fire belts were clearfelled and replanted between June 1981 and June 1984.

2.6.1.2 Witklip soils information

The soils of Witklip are described as sandy clays and soils characteristics for input into *ACRU* were obtained from the ISCW (1993) land type maps using the *Autosoils* technique derived by Pike and Schulze (1995).

2.6.1.3 Witklip rainfall and streamflow data

Daily streamflow data were obtained from station X2M38a situated at the outlet of catchment V. There was a complete record with no missing values. Daily rainfall data were obtained from station A6, which is situated slightly below the catchment outlet. Sixteen years of data provided a MAP of 1100 mm. There were 194 days (3.3%) of missing data within this period. Rainfall values derived from the nearby Witklip (Bos) station (0555673W) were extracted from the CCWR and were used to patch the missing data.

2.6.1.4 Additional climatic data for Witklip

Limited daily maximum and minimum temperature data were available from the actual Witklip weather station (available data existed from 1975 to 1979). Consequently, temperature data for a number of stations located in Nelspruit were extracted from the CCWR, namely Nelspruit Freidenheim (0555866A), Nelspruit Res. (0555837A) and Nelspruit Brondal (0555621A). Using these stations, a data record was established for Nelspruit, after which a correlation was derived between the existing Witklip data and the Nelspruit data. The Nelspruit data was adjusted accordingly for the remaining period and used to complete the temperature record. Once the record was completely patched it was error checked.

Monthly means of daily maximum and minimum temperatures were also extracted from the Agrohydrological and Climatological Atlas (Schulze, 1997) for comparative purposes. Average monthly totals of A-pan equivalent evaporation data were obtained from the BEEH gridded coverage's. These data are summarised in Table 2.13.

Table 2.13 Monthly climatic data for Witklip

Month/ Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T-Max (°C)	28.0	27.9	26.8	25.5	24.6	22.6	22.8	24.7	27.2	27.0	27.1	27.8
T-Min (°C)	14.3	14.4	13.6	10.6	8.5	5.5	5.4	6.5	8.9	11.3	12.3	13.7
A-pan (mm)	184.5	169.5	166.6	138.7	126.6	104.3	113.8	144.1	167.0	191.9	178.8	189.3

2.6.2 Witklip verification results

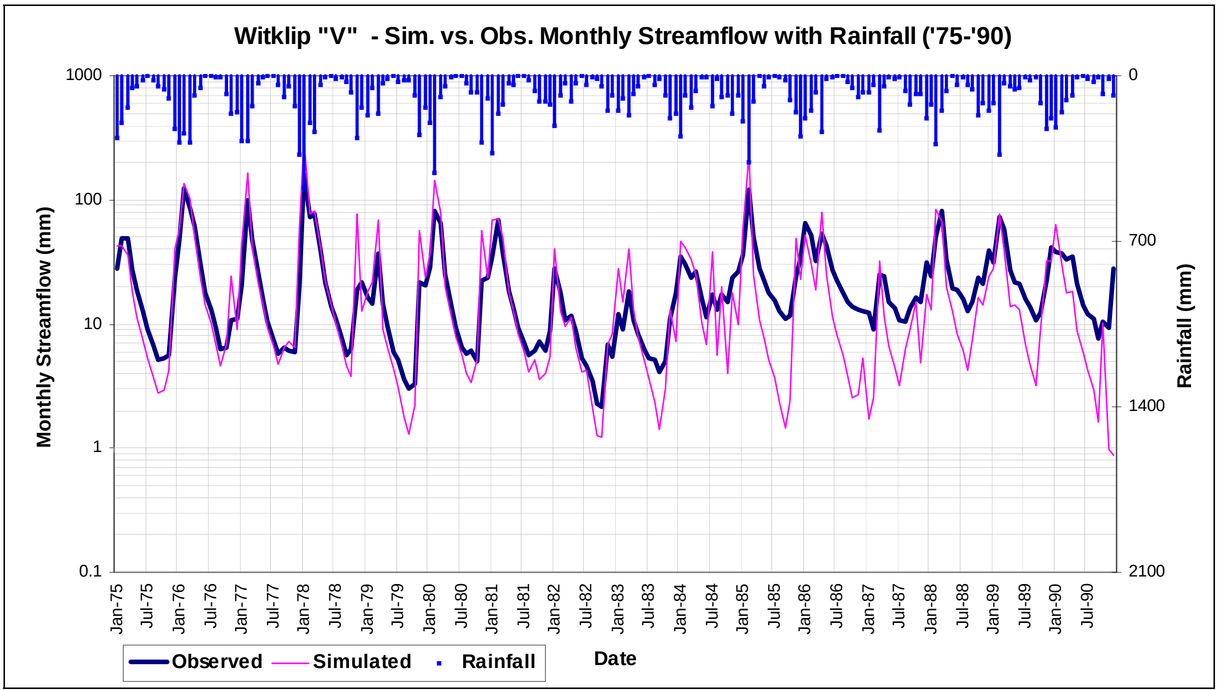


Figure 2.26 Time series (1975 – 1990) of simulated and observed monthly streamflow totals (mm), as well as monthly rainfall totals (mm) for Witklip catchment V.

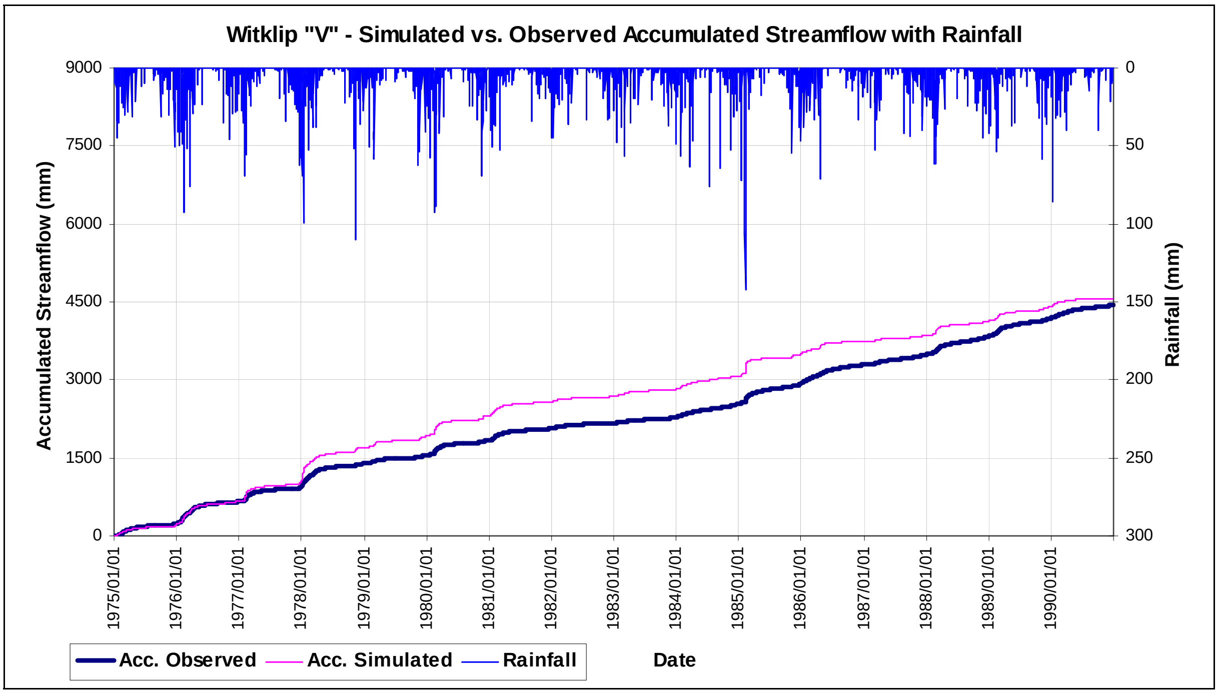


Figure 2.27 Time series (1975 – 1990) of accumulated streamflow totals (simulated and observed), as well as daily rainfall totals (mm) for Witklip catchment V.

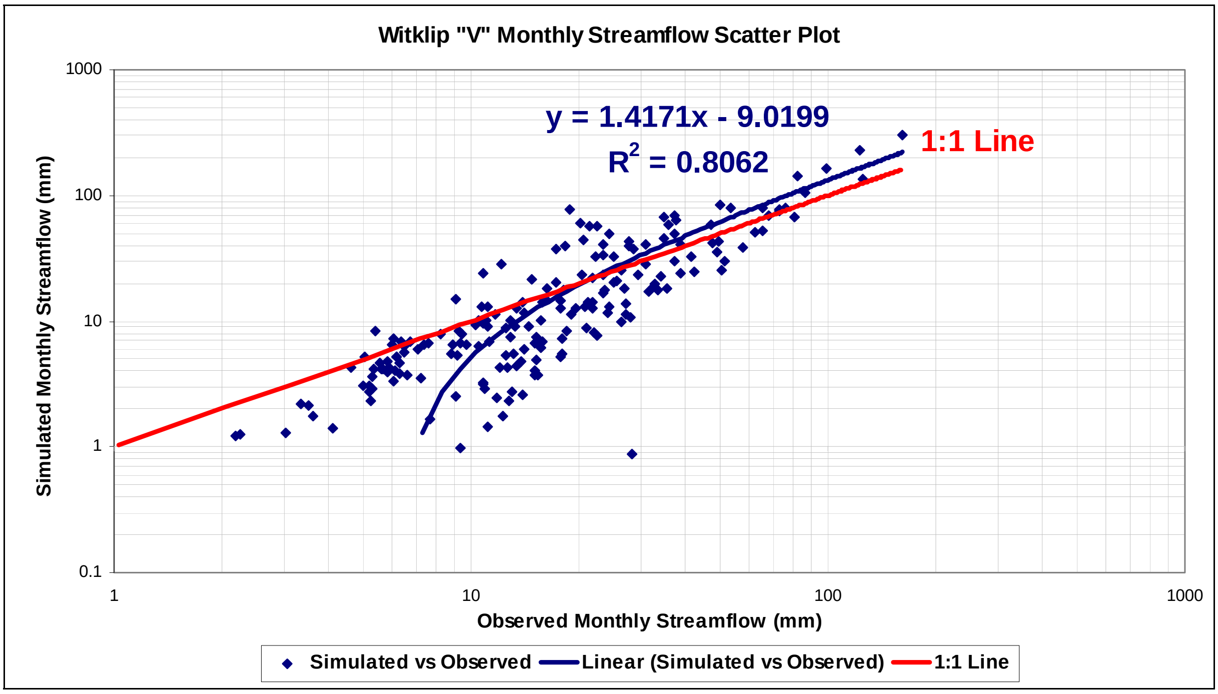


Figure 2.28 Scatter plot of simulated and observed monthly streamflow totals (mm) for Witklip catchment V. A linear trend line, its' R^2 value and the ideal 1:1 line are illustrated.

2.7 Ntabamhlope

Catchment **MV7H004** (29º 03' S; 29º 39' E) in the De Hoek area near Estcourt is one of numerous sub-catchments making up the greater Ntabamhlope research area (Figure 2.29). This was the first catchment on which the verification phase of the project was conducted. There were initial misgivings about the suitability of this catchment for the first verification study, however, a combination of other factors was considered compelling enough to warrant starting with this catchment. It was decided that verification of this catchment would provide a useful introductory exercise and that BEEH staff and student assistance would facilitate setting up and running the *ACRU* model. It was, therefore, used primarily to refine the verification procedure through generation of increased confidence in the application of the model and by streamlining the data acquisition process. Verification of this catchment also afforded an opportunity to refine and enhance the graphical display of results. Although the hydrological infrastructure for research at this locality was in existence as early as 1962, these rural catchments were first instrumented and monitored by the former Department of Agricultural Engineering of the University of Natal in 1974 (Smithers and Schulze, 1994b). Research in this location has continued, to a greater or lesser degree, to the present day.

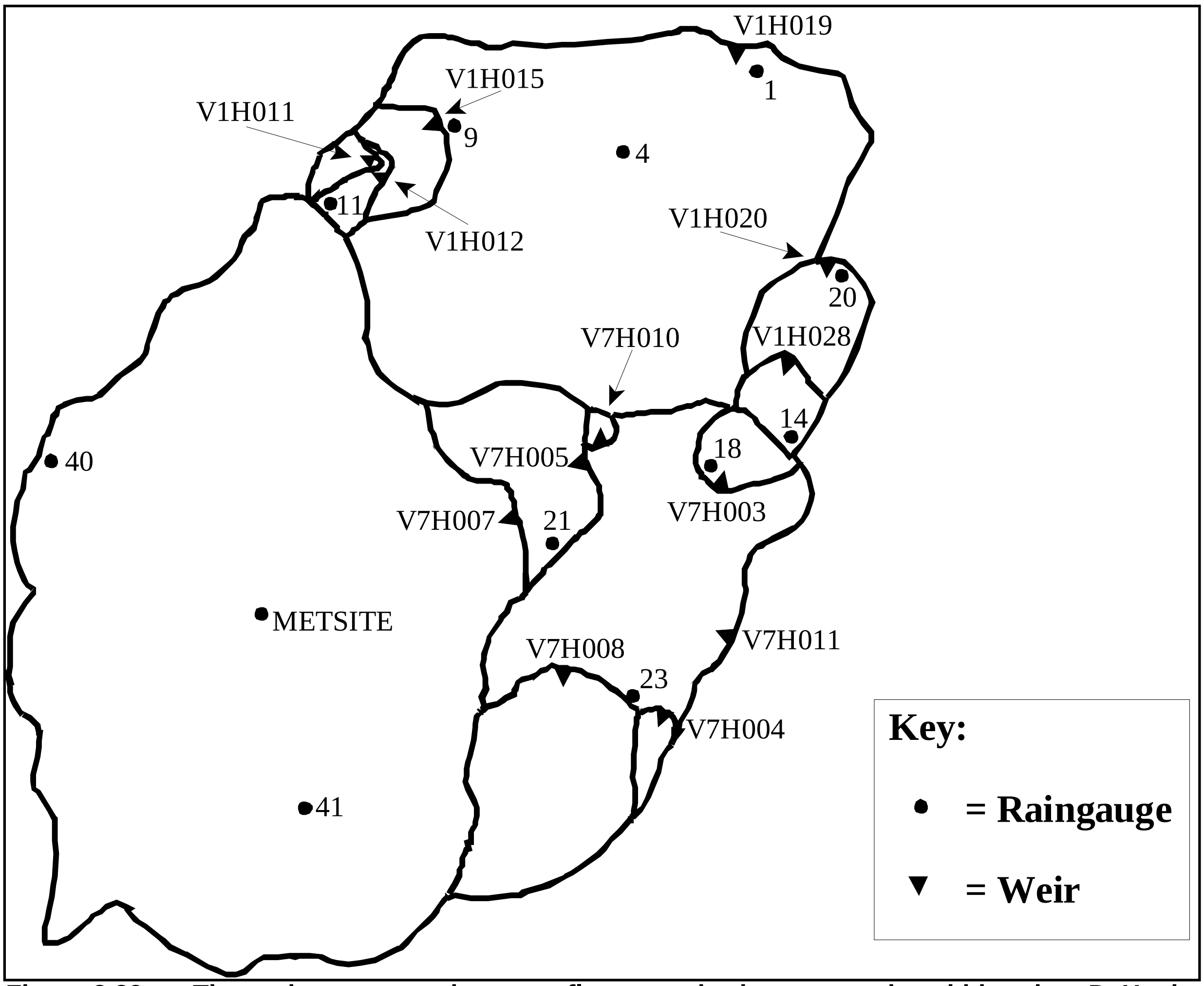


Figure 2.29 The raingauge and streamflow monitoring network within the DeHoek / Ntabamhlope research catchments.

Catchment MV7H004 is 0.30 km² in area, has a north by north-easterly aspect and ranges in altitude from 1450 m to 1541 m. It was selected for the verification study for a number of reasons:

- It had 97% *Eucalyptus* forest and 3% grass cover,
- Observed pre- and post-afforestation streamflow data were available for the verification exercise,
- Observed soil moisture measurements were available for the afforested catchment
- Comprehensive rainfall and weather data for the catchment were available,
- It was a uniform catchment with little spatial variability,
- It had been intensively monitored by BEEH, and
- It was easily accessible.

There were, however, also a number of drawbacks to using this catchment:

- The period of utilisable streamflow data was limited,
- The quality of data was at times dubious as the equipment suffered vandalism,
- The presence of a dam upstream complicated the hydrology of the catchment, and
- The small size of the catchment made simulation by *ACRU* more difficult.

2.7.1 Ntabamhlope input data

A field trip was conducted to the catchment, where photographs were taken, sampling of soil depth at various locations was performed, and other pertinent catchment details were noted (e.g. sub-catchment configuration, size and land use, and dimensions of the earth-wall dam within the catchment). All relevant data were entered into the model for the verification process, while observed soil moisture data were used to verify the temporal soil moisture fluctuations within the model. *ACRU* was set up and run from 1990 to 1996, during which the catchment was afforested.

2.7.1.1 Ntabamhlope land cover

The natural grassland occurring in this catchment is classified as False Grassveld (Acocks, 1988). Monthly crop factor values were obtained from Midgley *et al*., (1994), while monthly values for leaf area index, canopy interception loss (mm/rainday) and the fraction of active root system in the A-horizon for grass were obtained from the *ACRU* utilities file. The catchment underwent complete site-preparation (ploughing and ripping) before the planting of two commercial Eucalypt species commenced towards the end of 1989. For simulation purposes the catchment was divided up into two sub-catchments based on land use. The individual sub-catchment areas were 0.29 km² (1) and 0.01 km² (2) in extent. These sub-catchments were digitised into electronic format using Arc-Info. For the simulation, 97% of the catchment was under two species of commercial forests, namely *Eucalyptus nitens* and *Eucalyptus macarthurii*, with the remaining 3% falling under riparian grassland. The afforested area was allocated the land use type of eucalyptus forest (100%). A dynamic file was created and utilised in this simulation in order to account for the growth of the forest over time and changing monthly values of crop factor (CAY), leaf area index (ELAIM), canopy interception loss (VEGINT) and fraction of active root system in the A-horizon (ROOTA) were entered into the dynamic file for each year of the simulation. These values were derived from Summerton (1995).

An earth-wall dam exists in sub-catchment 2, and is situated approximately 60 m upstream of the weir. It has a surface area of 0.24 ha and a capacity of 1136 m³, with a 2 m high wall 40 m in length. Seepage through the wall was calculated to be approximately 0.7 m³/day (usually 1/1500 X capacity). There is also a 50-m² impervious area of sandstone adjunct to the streambed in sub-catchment 1.

2.7.1.2 Ntabamhlope soils information

The soils in this catchment are of the Hutton form (Balmoral series), typified by silty clays and clay loams. They consist of an orthic A and structure-less red apedal B-horizon with a high clay content (40-50%) and high infiltration rate. The subsoil permeability is rapid and plant available water is between .130 and .160 (m/m).

2.7.1.3 Ntabamhlope rainfall and streamflow data

The rain falls mainly in the summer months from October to April, with the mid-winter months being particularly dry. Until the beginning of 1996, when large-scale vandalism severely depleted the instrumentation at Ntabamhlope, the hydrological network consisted of nine streamflow weirs and nine rainfall-recording stations. Weir V7H004 and raingauge MC23 are of relevance to this study as they lie within catchment V7H004. Rainfall data between 1990 and 1996 were extracted from the CCWR. An electronic tipping-bucket raingauge (MC23) measured rainfall for this period at weir MV7H004, and rainfall data from this station was, therefore, used. Brief periods of missing data were patched using the nearby meteorological station rainfall records and an altitudinal correction factor of -3.0 mm/day was applied to that data to account for the difference in altitude. The next nearest station to this catchment in terms of location and altitude was found to be Highmoor (Bos) (29º 19' S; 29º 37' E).

Observed streamflow data ($m^3.day^{-1}$) were available from the CCWR for the afforested period between 01/01/1990 and 30/04/1996, and these were used for the verification. There were 34 days of missing data (1.5%) within this period and these were flagged.

2.7.1.4 Additional climatic data for Ntabamhlope

Temperature data between 1990 and 1996 were extracted from the CCWR using data from the meteorological station situated in the greater Ntabamhlope catchment. A Fortran program was written to extract maximum and minimum daily values from the raw logger data. Occasional missing or suspect daily values needed to be patched and the next nearest station to this catchment with comprehensive temperature data was Estcourt (29º 01' (Lat) and 29º 52' (Long)). An altitudinal correction factor was applied to the data from this station (Max -0.7ºC and Min -2.9ºC) due to the higher altitude of the simulated catchment. These correction values were obtained by comparing temperature data from Estcourt with a corresponding period of temperature data from the Ntabamhlope met-site (1991-1995) and an average difference for maximum and minimum temperatures between these two stations was calculated. It was decided to use this temperature data to drive the Linacre (1991) model to calculate reference potential evaporation, as reliable daily A-pan values were not available for this period. However, monthly A-pan data were extracted from the gridded BEEH coverage's in order to perform sensitivity tests on reference potential evaporation drivers (daily temperatures vs. monthly A-pan values). The area also experiences very windy conditions during August and September. Monthly means of daily windrun data were obtained from Smithers and Schulze, (1994b). These data are summarized in Table 2.14.

Table 2.14 Monthly climatic data for Ntabamhlope

Month/ Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A-pan (mm)	192.3	162.2	149.9	122.7	101.4	91.6	101.3	136.0	159.6	168.3	171.5	196.0
Wind (km/day)	125	110.5	107	104	109	111	122	141	172.5	172	169	158

2.7.2 Ntabamhlope verification results

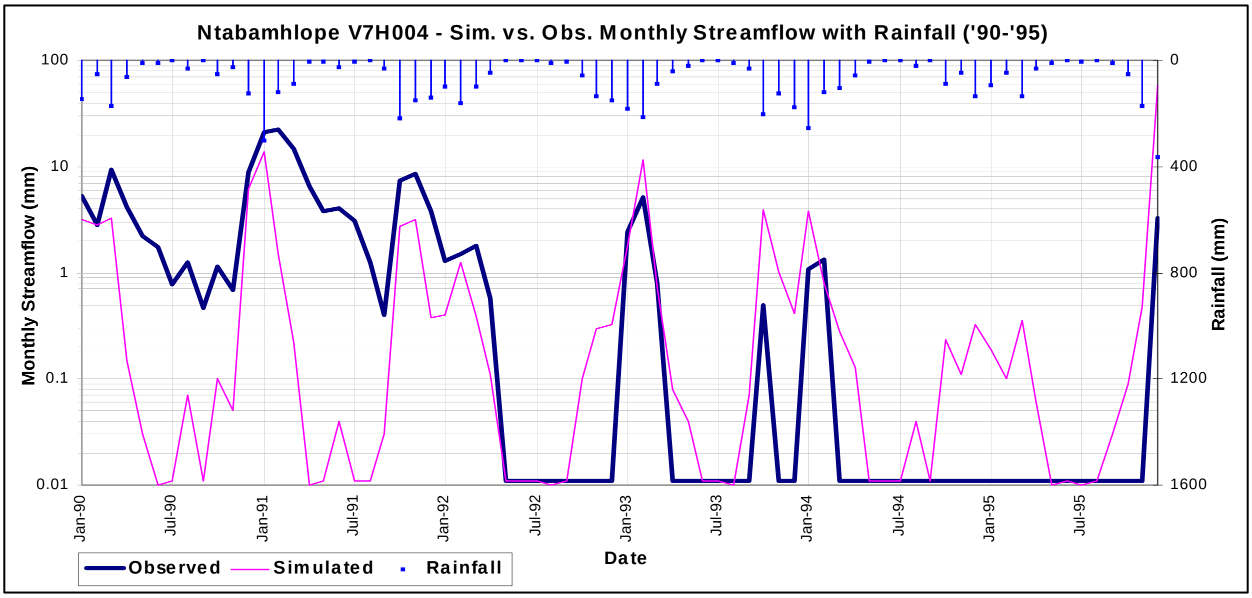


Figure 2.30 Time series (1990 – 1995) of simulated and observed monthly streamflow totals (mm), as well as monthly rainfall totals (mm) for Ntabamhlope catchment V7H004. Note the periods during which all observed streamflow ceased from the catchment.

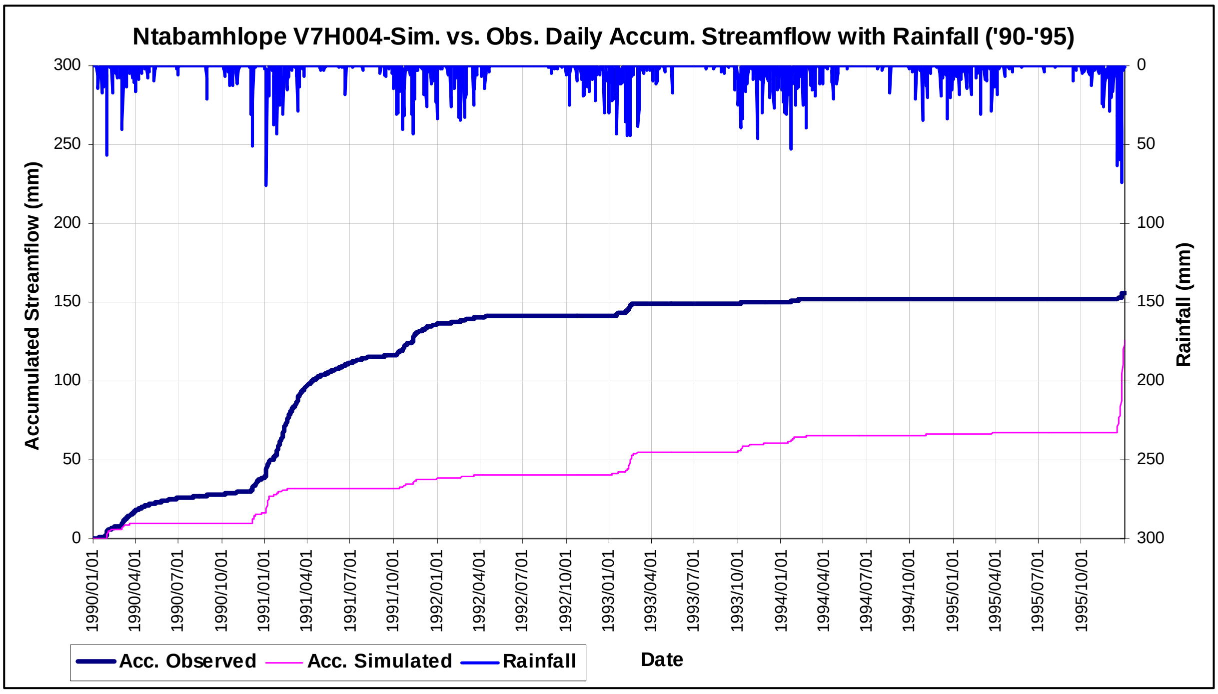


Figure 2.31 **Time series (1990 – 1995) of accumulated streamflow totals (simulated and observed), as well as daily rainfall totals (mm) for Ntabamhlope catchment V7H004.**

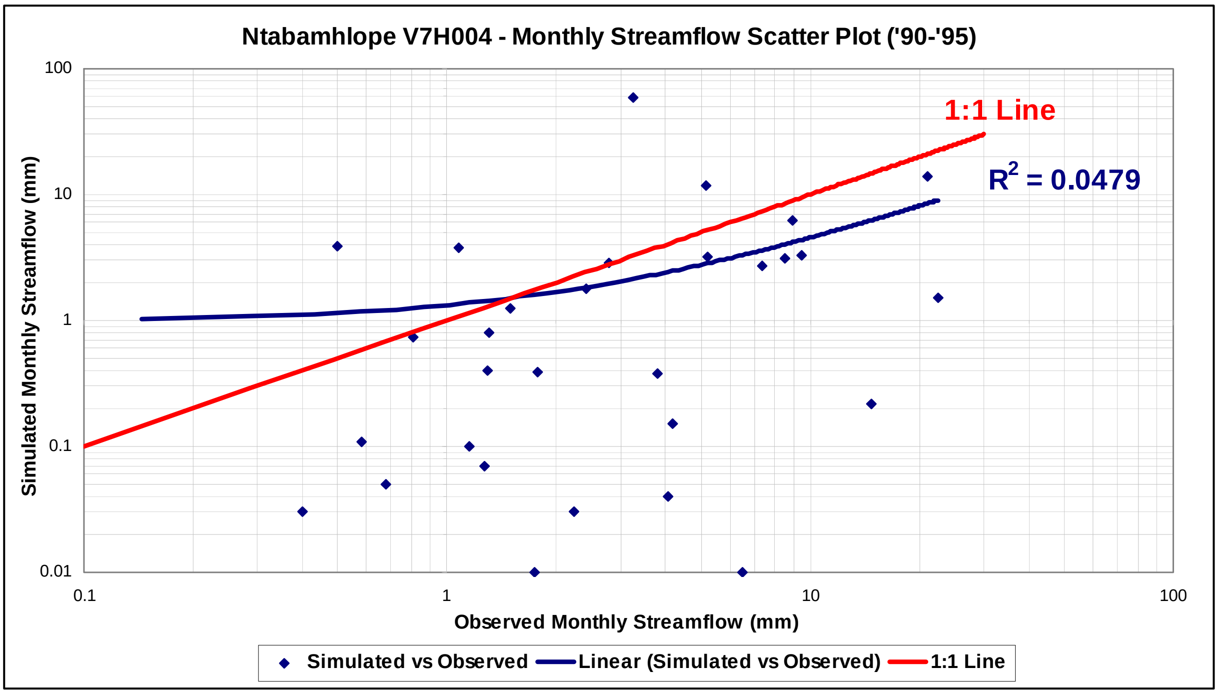


Figure 2.32 **Scatter plot of simulated and observed monthly streamflow totals (mm) for Ntabamhlope catchment V7H004. A linear trend line, its' R² value and the ideal 1:1 line are illustrated.**

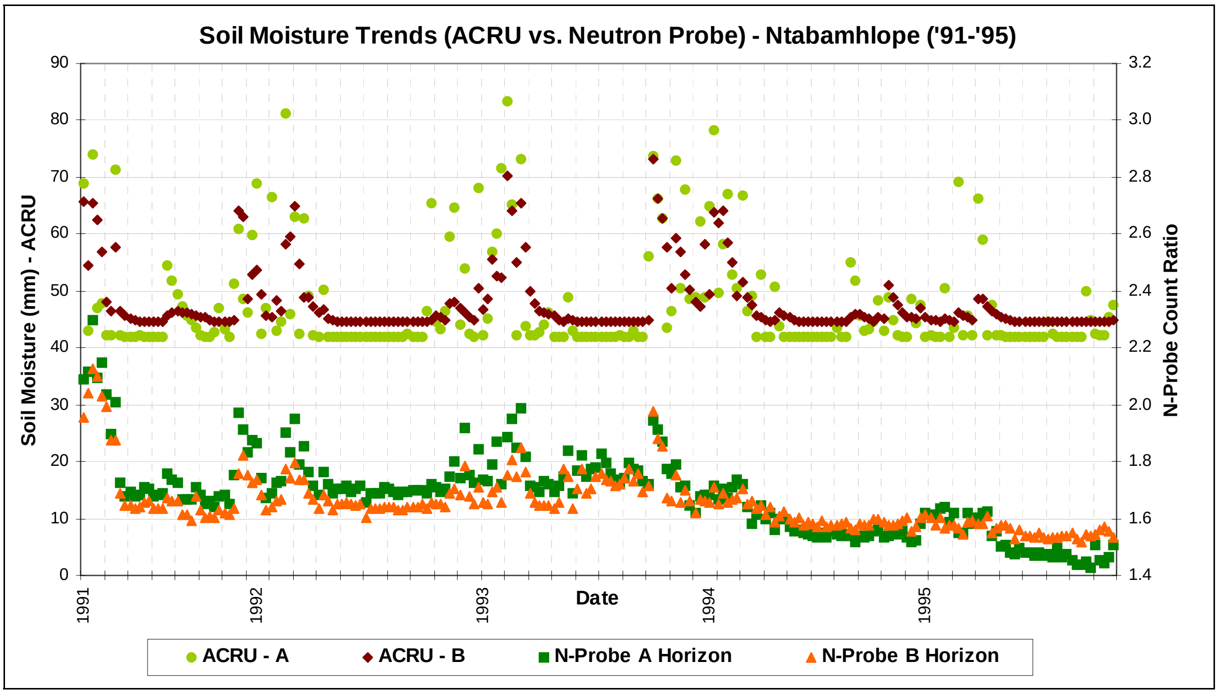


Figure 2.33 A comparison of observed (neutron probe soil moisture gauge) and *ACRU* simulated A- and B-horizon soil moisture trends within Ntabamhlope catchment V7H004, between 1991 and 1995. Note that these soil moisture trends are not directly comparable in terms of millimeters of water per soil horizon, because no reliable calibration relationship was available for the Neutron Probe, hence only the trends in soil moisture reduction with increasing tree age are compared.

2.8 Cedara

Cedara U2H018 (29º 33' S; 30º 14' E) is one of the research catchments situated at Cedara Agricultural College, north of Pietermaritzburg in the Natal midlands (Figure 2.34). Instrumentation and monitoring of these catchments by the former Department of Agricultural Engineering of the University of Natal commenced in 1976. They were selected as being representative in land use, soils and physiography of large parts of the Natal Midlands, one of the most intensively farmed regions in South Africa under plantations, crops and veld (Smithers and Schulze, 1994a).

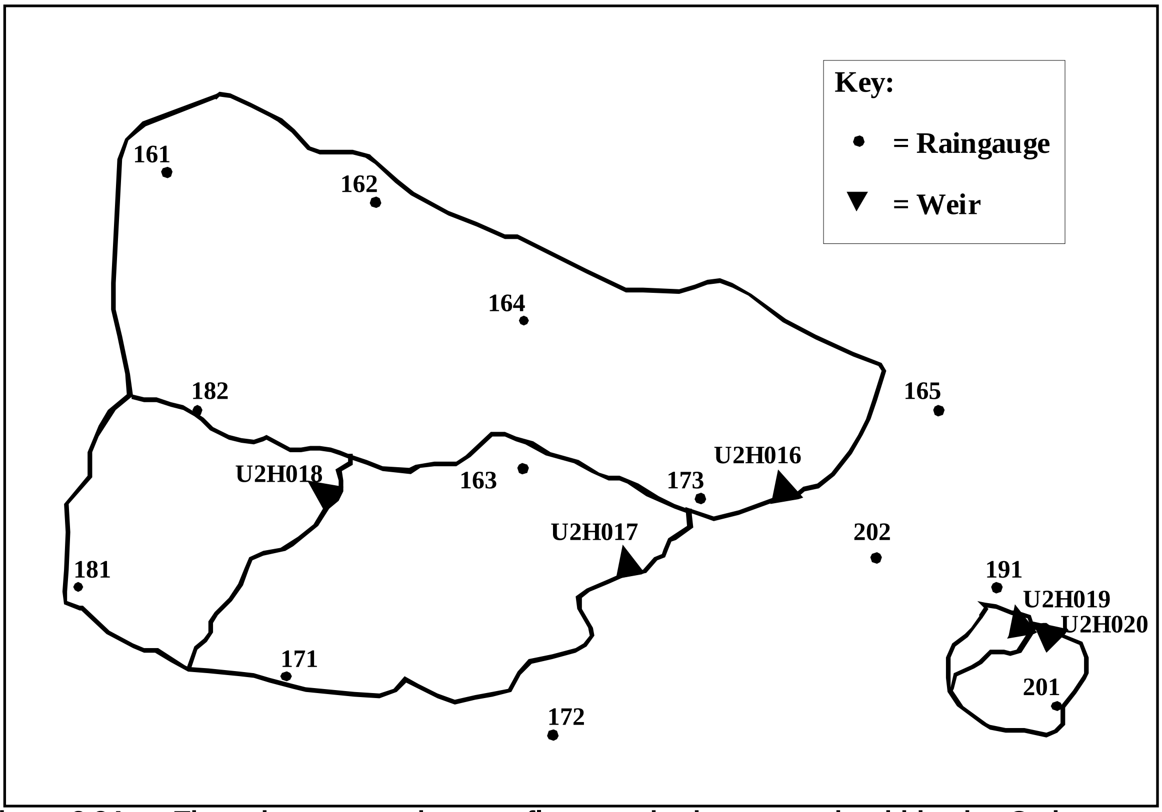


Figure 2.34 The raingauge and streamflow monitoring network within the Cedara research catchments.

Catchment U2H018 is the most heavily afforested catchment at Cedara with approximately 77% under trees (mainly *Pinus patula* and *Pinus radiata*). The remaining area is scrub and veld. Some characteristics of this catchment selected for the verification study are presented in Table 2.15.

Table 2.15 Characteristics of the research catchment used at Cedara.

Catchment	Weir No.	Rain gauges	Altitude Range	Area (km²)
Cedara 18	U2H018	MC181, MC182, MC171	1200 m – 1450 m	1.31

2.8.1 Cedara input data

Input data for the Cedara verification were drawn predominantly from a previous *ACRU* simulation performed by BEEH. A relatively short period from 1985 to 1989 was utilised for this simulation, preceded by a “warm-up” year (1984). This was necessitated by the poor quality of streamflow data available for this catchment. Within the five-year period there were 377 days of dubious or missing data, which is equivalent to approximately 20.6% of the record. Conclusive deductions of model performance based on this verification are problematic as a result.

2.8.1.1 Cedara land cover

Smithers and Schulze (1994a) found that virtually all land use changes that took place in this catchment were related to afforestation and deforestation practices, and that these were much in equilibrium. Consequently, this simulation was performed in lumped mode and an “operational” catchment scenario was accepted, i.e. even stand age distributions were assumed. Therefore, no dynamic file was used to simulate the growth of the trees and a representative average tree age was used as a result. Furthermore, 77% of this catchment was planted to a mixture of commercial tree species (mainly *Pinus patula* and *P. radiata*), with 15 % under scrub forest and the remaining 8% under grassland.

2.8.1.2 Cedara soils information

The relevant soil input variables as utilised by the *ACRU Menubuilder* were obtained from a previous study of the Cedara catchments by Smithers and Schulze (1994a).

2.8.1.3 Cedara rainfall and streamflow data

Data from three daily rainfall stations (MC181, MC182 and MC171) located in close proximity to the catchment were used to determine an area-weighted daily rainfall record for the catchment. Based on these stations the catchment receives a mean annual precipitation of approximately 1044 mm. Daily streamflow data were obtained from station U2H018 situated at the outlet of the catchment. There were 974 days (20.5%) missing data within this 13-year period.

2.8.1.4 Additional climatic data for Cedara

Daily maximum and minimum temperature data were extracted from the CCWR. Monthly A-pan data extracted from the gridded BEEH coverage's are summarised in Table 2.16.

Table 2.16 Monthly climatic data for Cedara

Month/ Variable	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
A-pan (mm)	174.4	151.4	145.1	120.3	102.6	90.9	100.1	129.2	146.6	154.7	157.6	179.5

2.8.2 Cedara verification results

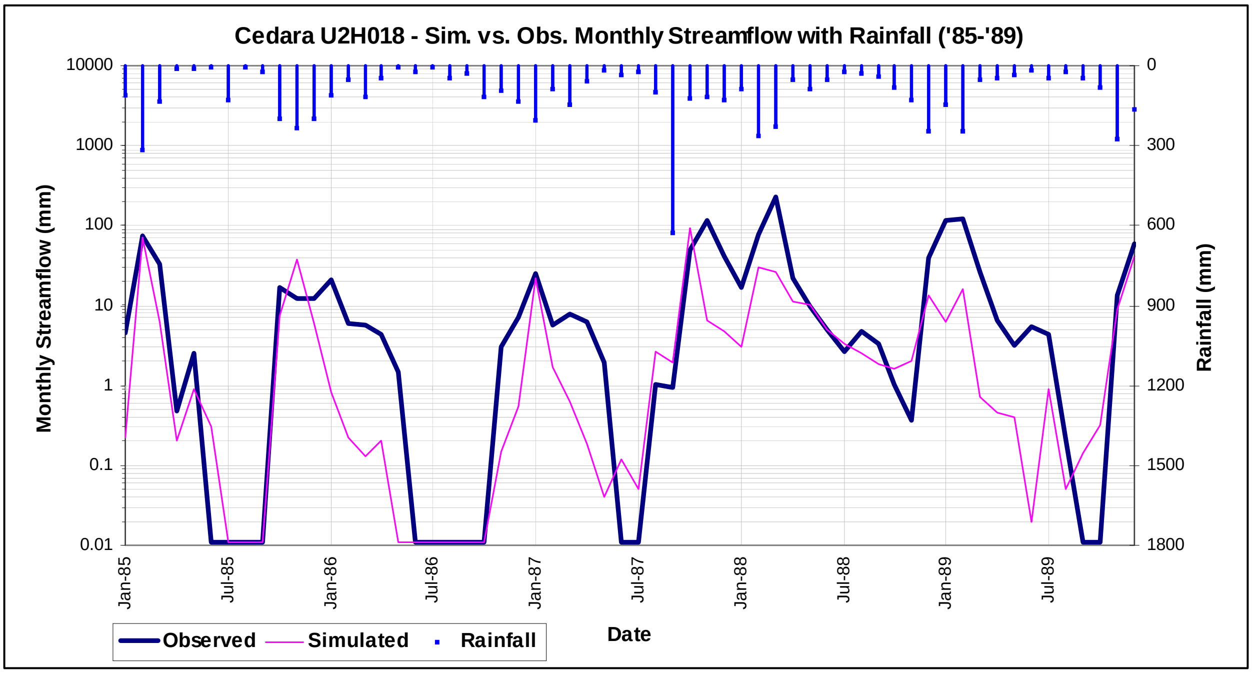


Figure 2.35 Time series (1985 – 1989) of simulated and observed monthly streamflow totals (mm), as well as monthly rainfall totals (mm) for Cedara catchment U2H018. Note the periods during which all observed streamflow ceased from the catchment.

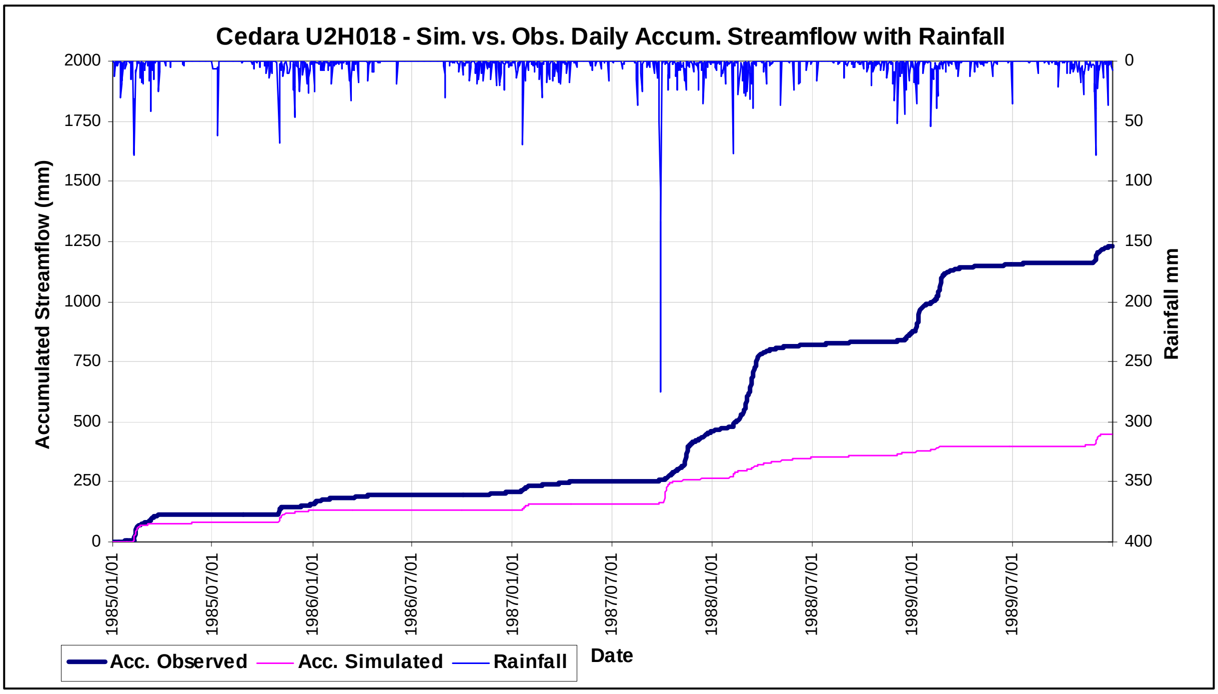


Figure 2.36 **Time series (1985 – 1989) of accumulated streamflow totals (simulated and observed), as well as daily rainfall totals (mm) for Cedara catchment U2H018.**

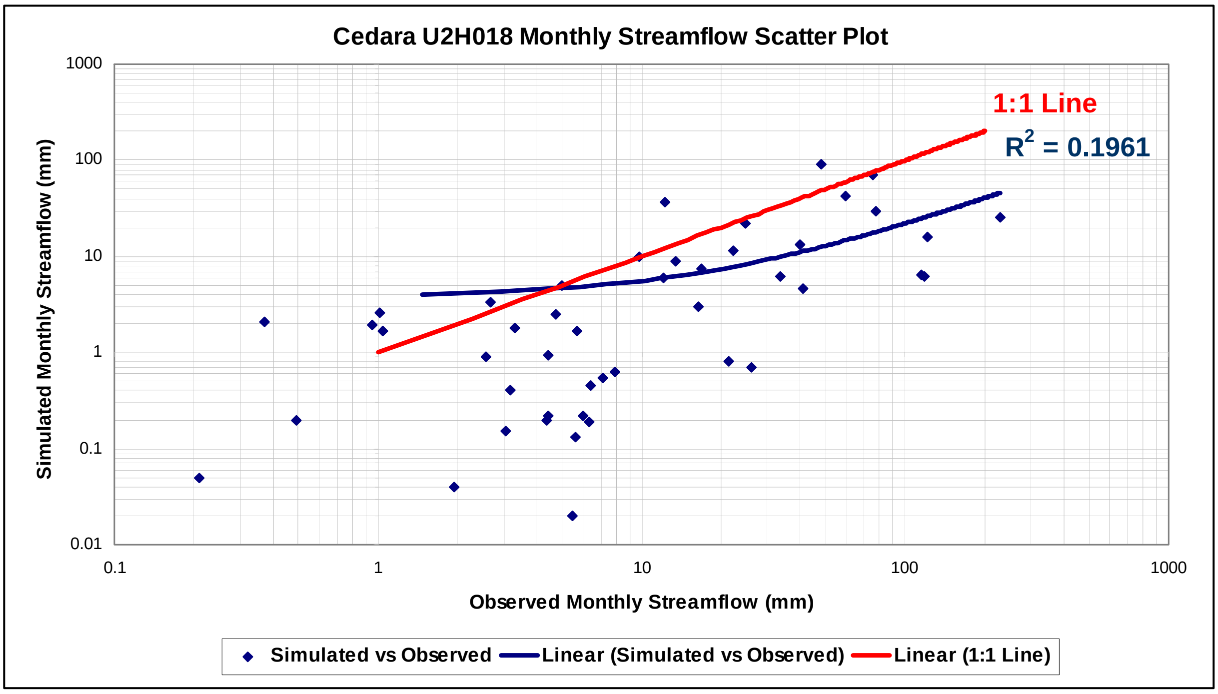


Figure 2.37 **Scatter plot of simulated and observed monthly streamflow totals (mm) for Cedara catchment U2H018. A linear trend line, its' R^2 value and the ideal 1:1 line are illustrated.**

2.9 Seven Oaks

Comparative evaporation studies conducted by the CSIR on the Mistley-Canema Estate (Mondi Forests) in the Seven Oaks district approximately 70 km from Pietermaritzburg provided an ideal site to test the internal evapotranspiration routine within the *ACRU* model. The verification study was performed against actual evaporation measured using the Bowen ratio technique in compartment B29 (29º 11' S, 30º 38' E) at Seven Oaks (Burger *et al.*, 1999), which was planted to eucalypts. Characteristics of this location are presented in Table 2.17.

Table 2.17 Characteristics of the Seven Oaks verification study site

Compartment	Rain gauges	Altitude Range	Area (km²)
B29	Mistley, 2STRMS2	1000 m – 1100 m	0.063

2.9.1 Seven Oaks input data

2.9.1.1 Seven Oaks land cover

This compartment was completely planted to *Eucalyptus dunii* and *E. macarthurii* during June 1996. Intensive site preparation was assumed, which determined the input values of ELAIM, ROOTA and VEGINT (Summerton, 1995), for the dynamic file.

2.9.1.2 Seven Oaks soils information

The soil characteristics at Seven Oaks were determined by means of a GIS compartment boundary overlay on the ISCW (1993) land type maps using the *Autosoils* technique derived by Pike and Schulze (1995). The texture of the soil is loamy sand of the Hutton type.

2.9.1.3 Seven Oaks rainfall and streamflow data

Two raingauges were used to determine the rainfall data for the simulation. The majority of the data was derived from the Mistley raingauge based at the Mondi Forest offices on the estate, with subsequent data obtained from the CSIR's electronic tipping-bucket raingauge (2STRMS2) installed later at a nearby experiment. No streamflow data were required as this simulation was merely used to verify the evapotranspiration estimations in *ACRU* .

2.9.1.4 Additional climatic data for Seven Oaks

Average monthly totals of A-pan equivalent evaporation data as well as monthly means of daily maximum and minimum temperatures were extracted from the Agrohydrological and Climatological Atlas (Schulze, 1997). These data are summarised in Table 2.18.

Table 2.18 Monthly climatic data for Seven Oaks

Month/ Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T-Max (°C)	21	20	19	18	17	15	13	17	21	22	23	22
T-Min (°C)	13	14	13	11	8	6	6	8	10	12	14	13
A-pan (mm)	190	170	150	125	105	95	105	125	145	150	160	180

2.9.2 Seven Oaks verification results

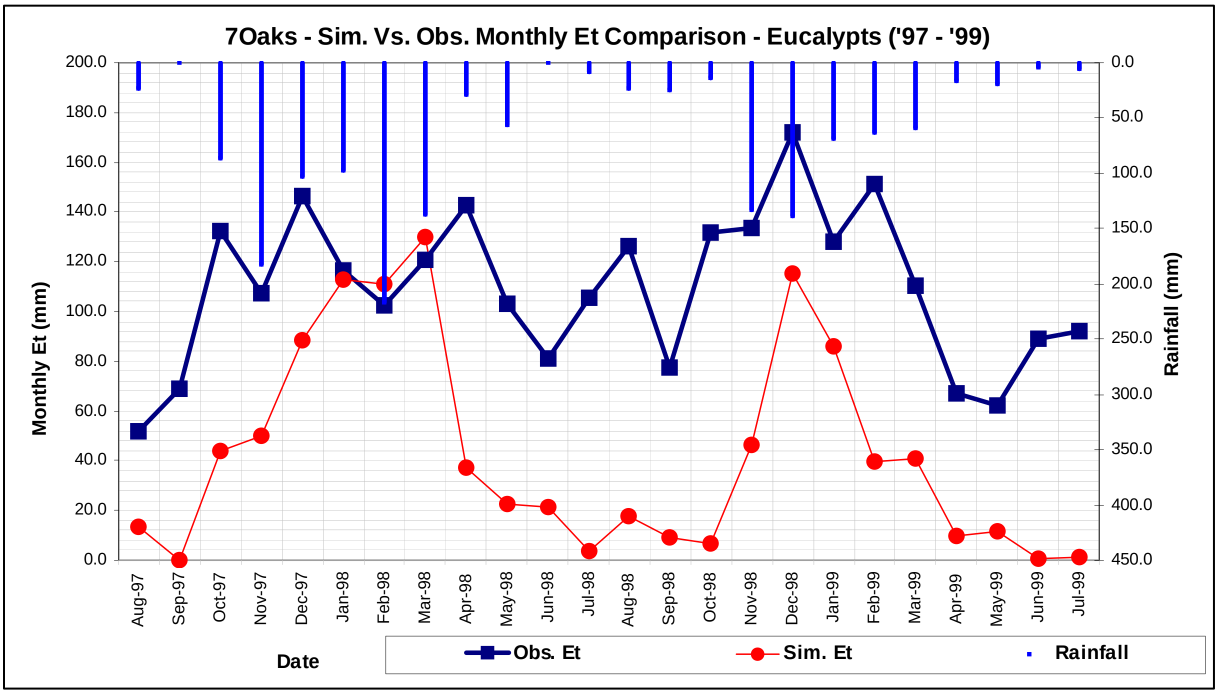


Figure 2.38 **A comparison of monthly totals of observed (Burger *et al.*, 1999) and *ACRU* simulated evapotranspiration trends of eucalypts within the Seven Oaks catchment, between August 1997 and July 1999. Monthly rainfall totals are included.**

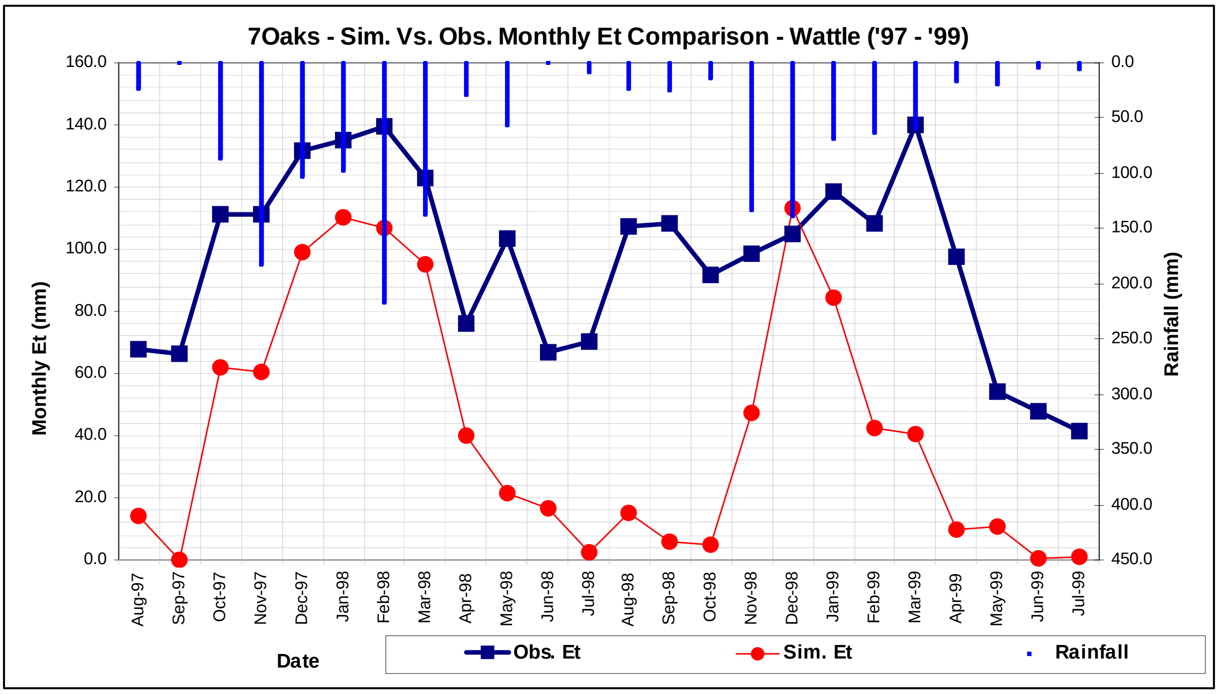


Figure 2.39 **A comparison of monthly totals of observed (Bowen ratio) and *ACRU* simulated evapotranspiration trends of wattle within the Seven Oaks catchment, between August 1997 and July 1999. Monthly rainfall totals are included.**

2.10 Analysis and discussion of the verification study

Oreskes *et al.* (1994) refer to a two-step calibration/verification technique in which the available dependent data set is divided into two parts. In the first step, the independent parameters of the model are adjusted to reproduce part of the data. Then in the second step the model is run and the results are compared with the second part of the data. In this scheme, the first step is labelled "calibration," and the second step is labelled "verification." The fact that this project focused on research catchments where verifications were possible on stable, naturally vegetated control catchments as well as on treated (afforested) catchments, improved confidence in the pre-treatment period of the afforested catchment verification.

Two methods of analysing the verification phase were possible. Firstly the purely visual method which contained a degree of subjectivity, but which afforded a clearer idea of temporal trends in the data, and secondly the statistical method which lent itself to a more objective assessment and the allocation of specific limits of acceptability. The results were presented at Steering Committee meetings as they became available, which generated considerable discussion as potential reasons for various trends in the data were proposed. Following these discussions, suggestions from members of the committee as to how to improve the simulations were given and these were subsequently tested.

Based on the visual results given above, as well as on statistical analyses of the data, various general conclusions may be drawn about model performance. The majority of the simulations generated a coefficient of determination (R^2) of above 0.75, which could be considered reasonable bearing in mind the very small size of the catchments. The treated catchment of Westfalia D was slightly below this R^2 value, but the result is still encouraging considering that the catchment dried up completely for a number of years. The Ntabamhlope and Cedara simulations, however, were less acceptable but this could be attributed to poor and missing data for these catchments.

In terms of streamflow volumes generated by the simulations, two-thirds of the simulations generated greater streamflow than had been observed. This applied to both total flows and low flows, although regular undersimulation of the lowest flows was often evident. The exceptions to this were the Cathedral Peak and Cedara simulations, which underestimated all streamflow. In cases where streamflow was overestimated this was due largely to the significant oversimulation of wet season flows. Furthermore, in catchments where observed streamflow dried up completely (specifically Westfalia D and Ntabamhlope), *ACRU* simulations still continued to generate streamflow. This highlights a potential weakness in the model to reduce runoff to zero. Further evidence of this is seen when comparing soil moisture estimations at Ntabamhlope (see Figure 2.33) where simulated soil moisture levels were reduced to a threshold value while observed soil moisture trends continued to decline as the trees matured.

The quantification of simulated streamflow reductions due to afforestation was possible for certain verifications (i.e. there was a control catchment and / or a pre-treatment calibration period prior to afforestation of the catchment). Streamflow reductions following treatment (afforestation) of the catchment were calculated by initially simulating streamflow under baseline conditions (Acocks veld type) and then comparing these against simulated streamflow under afforestation, to determine reductions in total flow and low flow for each year since planting. These *ACRU*-generated reductions were then compared against reductions in streamflow as calculated by Scott *et al.* (2000) for the corresponding catchment afforestation experiment. Certain distinct simulation trends emerged. It was evident that *ACRU*-simulated streamflow reductions commenced earlier and to a greater degree than those calculated by Scott *et al.* (2000). This gave rise to overly severe reductions in streamflow as a result of afforestation initially. However, later in the rotation reduction trends appeared to become more realistic with a characteristic tailing off of streamflow reductions for mature trees. Examples of the two streamflow reduction estimation techniques (for total and low flows, as percentages and actual values) are illustrated below in Figures 2.40 to 2.51. Varying individual rainfall totals caused large annual variations in streamflow reductions. These annual precipitation totals are included in the figures as labels.

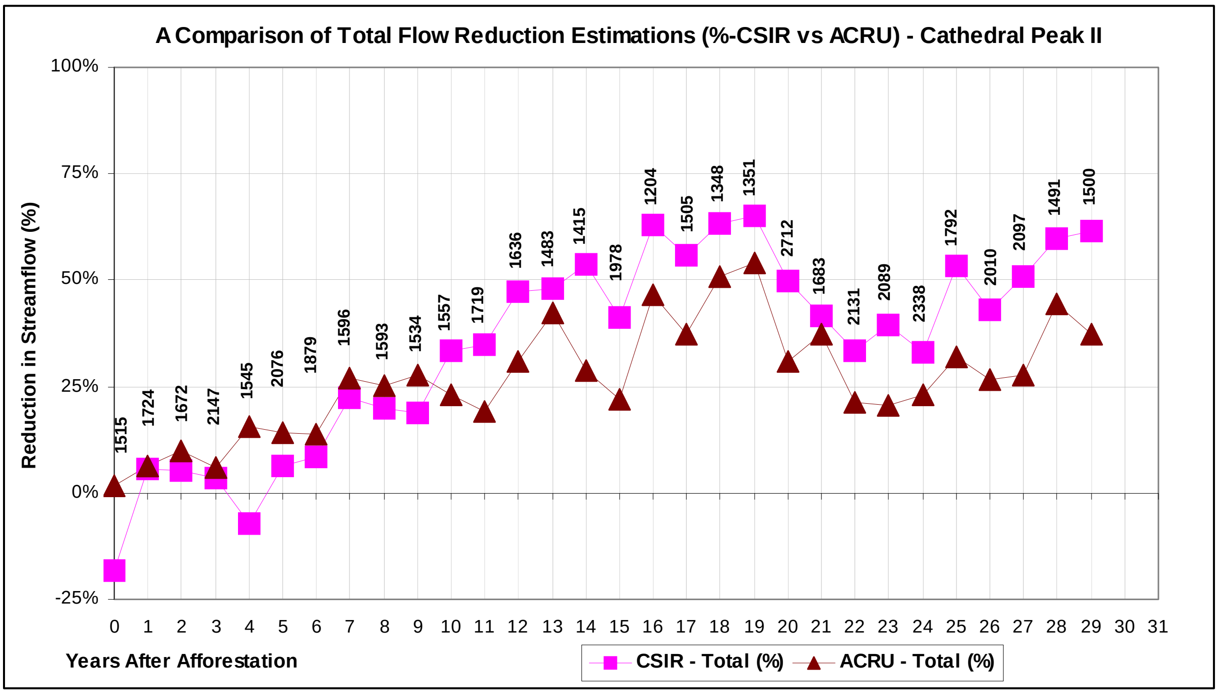


Figure 2.40 **A comparison of *ACRU*-simulated total streamflow reductions (%) against those calculated by Scott *et al.* (2000) for the afforested Cathedral Peak catchment II. Annual precipitation totals are included as labels.**

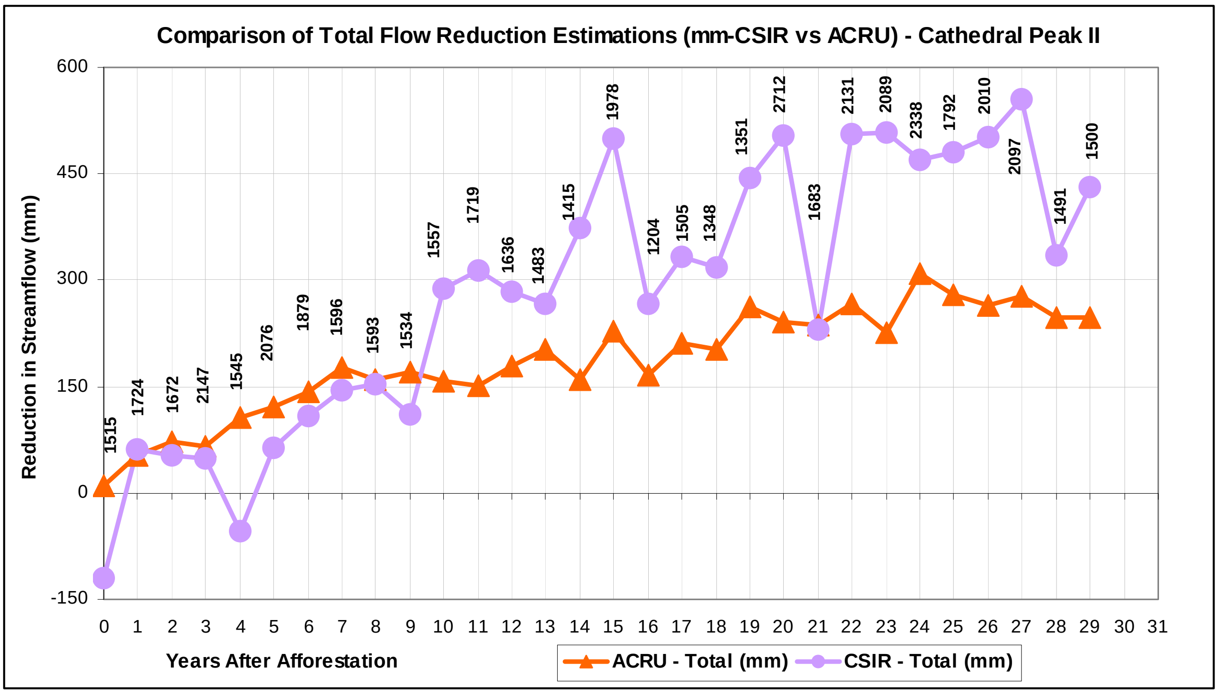


Figure 2.41 **A comparison of *ACRU*-simulated total streamflow reductions (mm) against those calculated by Scott *et al.* (2000) for the afforested Cathedral Peak catchment II. Annual precipitation totals are included as labels.**

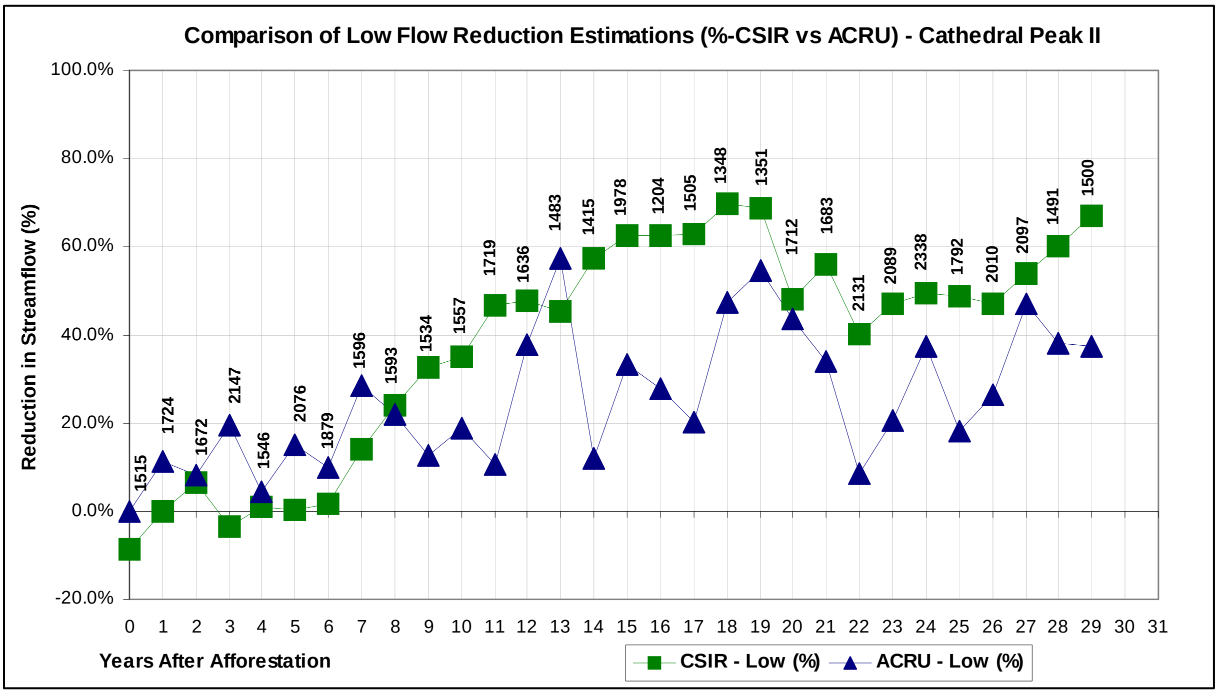
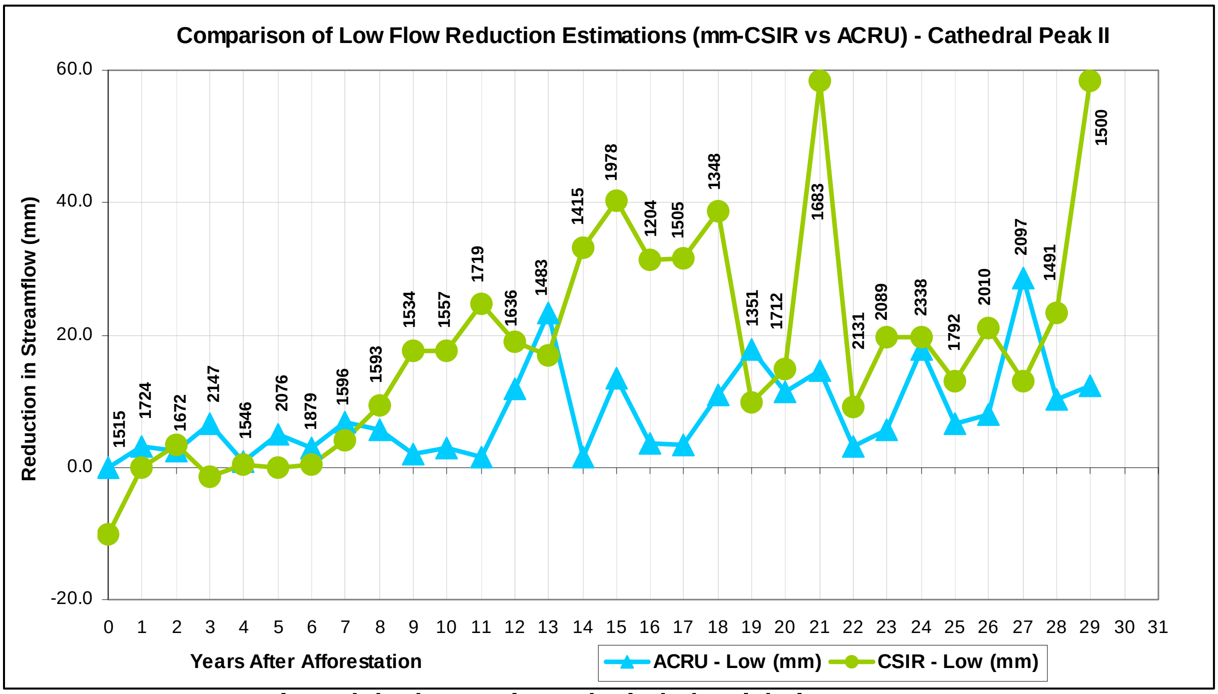


Figure 2.42 A comparison of ***ACRU***-simulated low flow reductions (%) against those calculated by Scott ***et al.*** (2000) for the afforested Cathedral Peak catchment II.



Annual precipitation totals are included as labels.

Figure 2.43 A comparison of ***ACRU***-simulated low flow reductions (mm) against those calculated by Scott ***et al.*** (2000) for the afforested Cathedral Peak catchment II. Annual precipitation totals are included as labels.

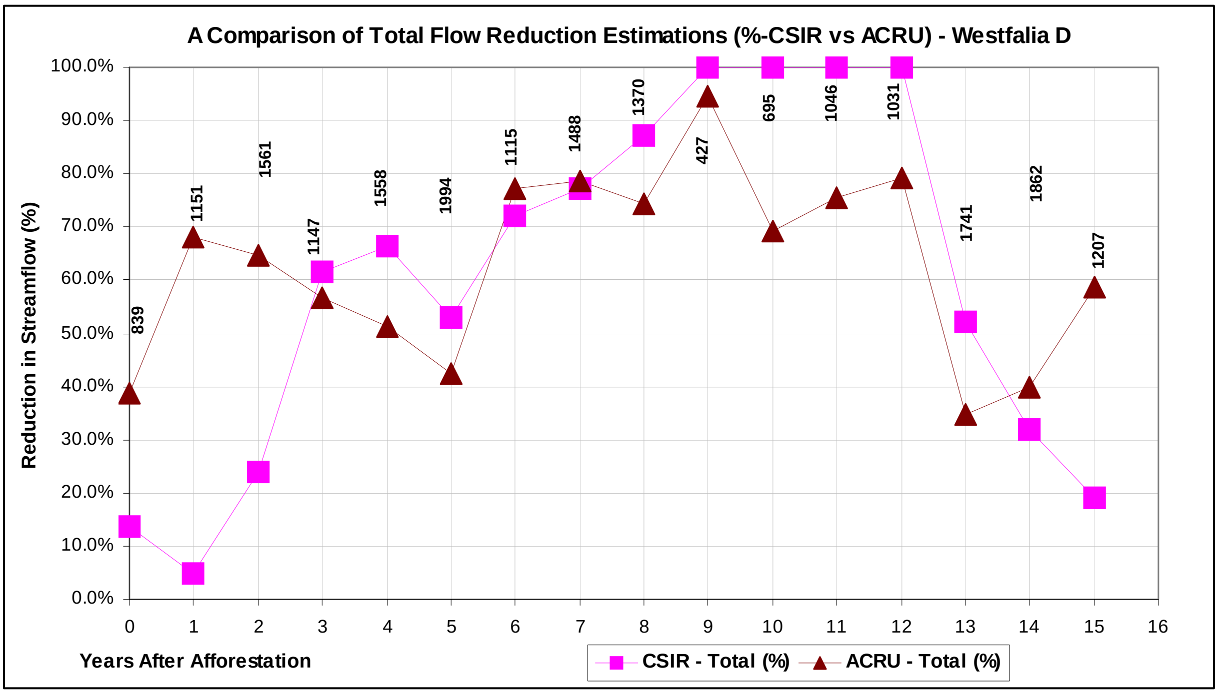


Figure 2.44 **A comparison of *ACRU*-simulated total streamflow reductions (%) against those calculated by Scott *et al.* (2000) for the afforested Westfalia catchment D. Annual precipitation totals are included as labels.**

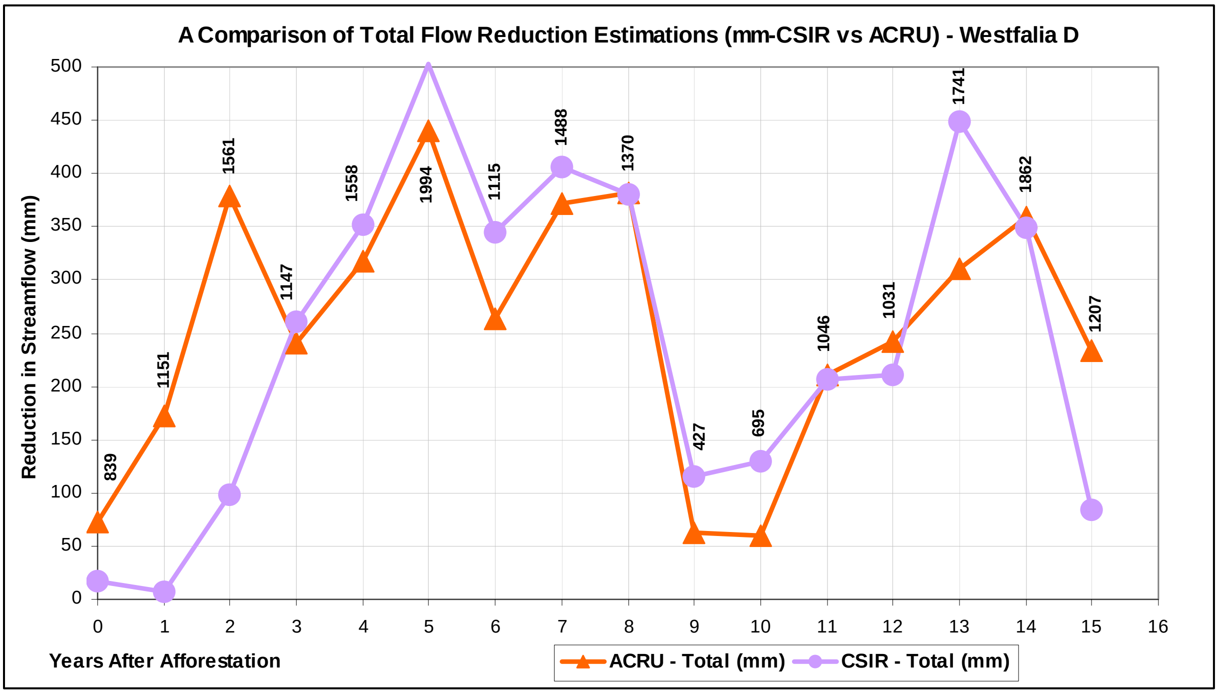


Figure 2.45 **A comparison of *ACRU*-simulated total streamflow reductions (mm) against those calculated by Scott *et al.* (2000) for the afforested Westfalia catchment D. Annual precipitation totals are included as labels.**

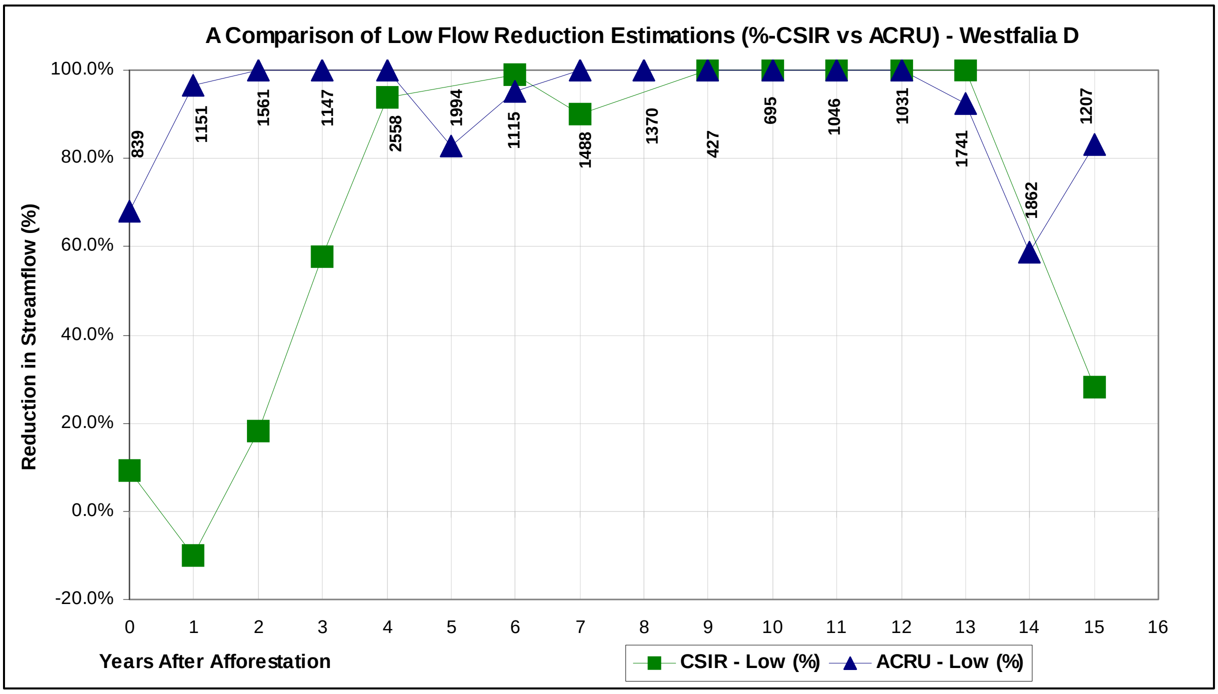


Figure 2.46 A comparison of ***ACRU***-simulated low flow reductions (%) against those calculated by Scott ***et al.*** (2000) for the afforested Westfalia catchment D. Annual precipitation totals are included as labels.

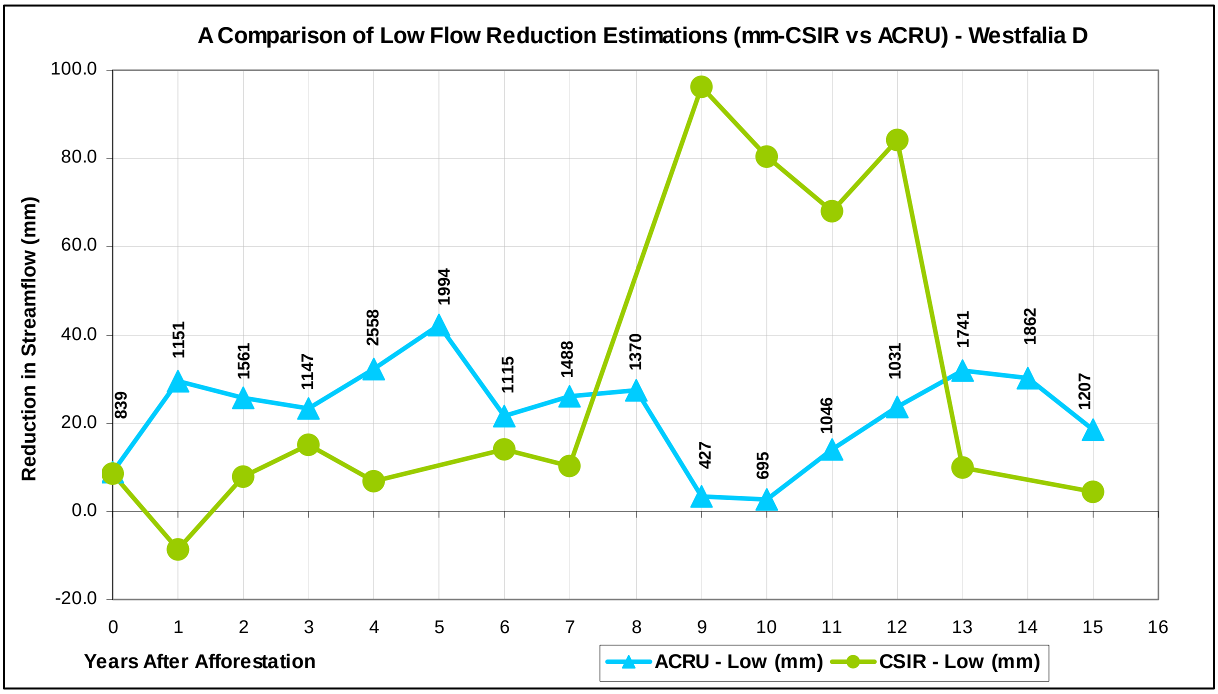


Figure 2.47 A comparison of ***ACRU***-simulated low flow reductions (mm) against those calculated by Scott ***et al.*** (2000) for the afforested Westfalia catchment D. Annual precipitation totals are included as labels.

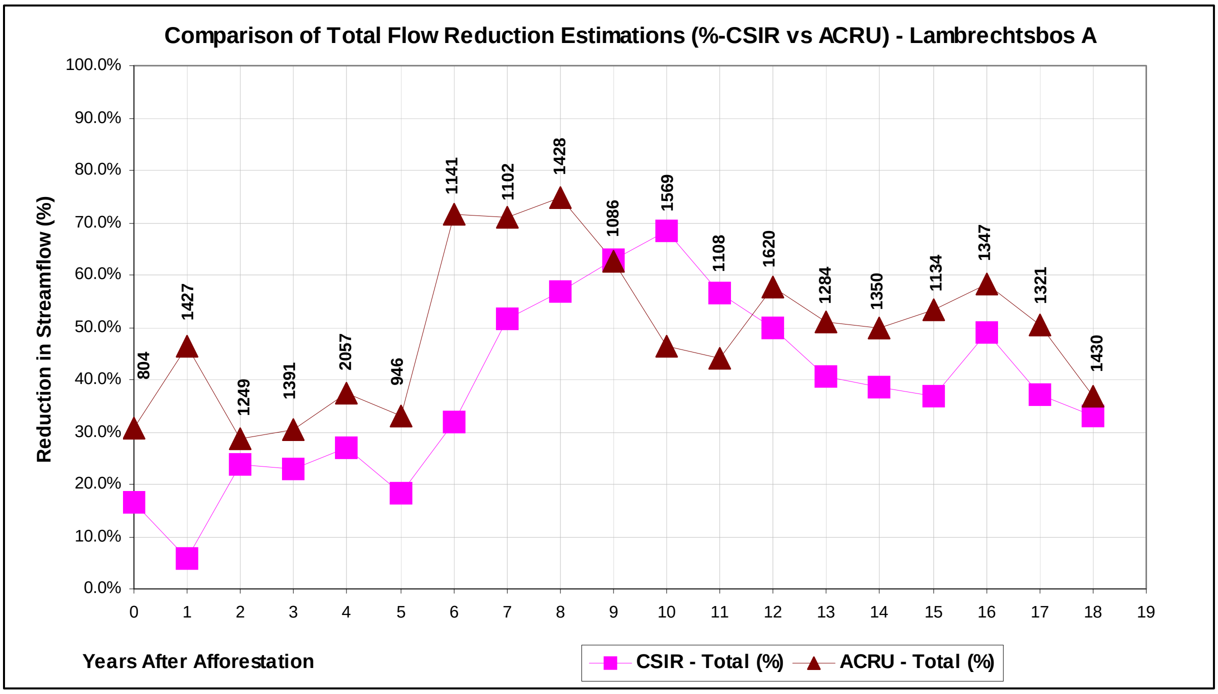


Figure 2.48 A comparison of ***ACRU*-simulated total streamflow reductions (%) against those calculated by Scott *et al.* (2000) for the afforested Lambrechtsbos catchment A. Annual precipitation totals are included as labels.**

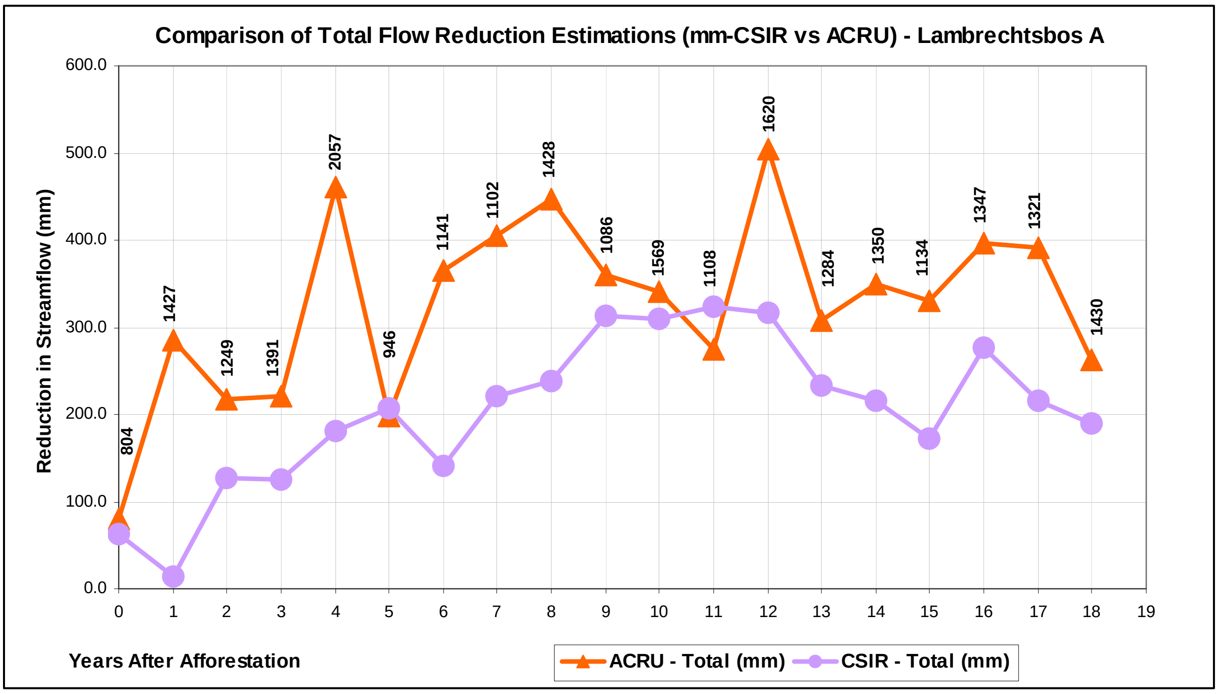


Figure 2.49 A comparison of ***ACRU*-simulated total streamflow reductions (mm) against those calculated by Scott *et al.* (2000) for the afforested Lambrechtsbos catchment A. Annual precipitation totals are included as labels.**

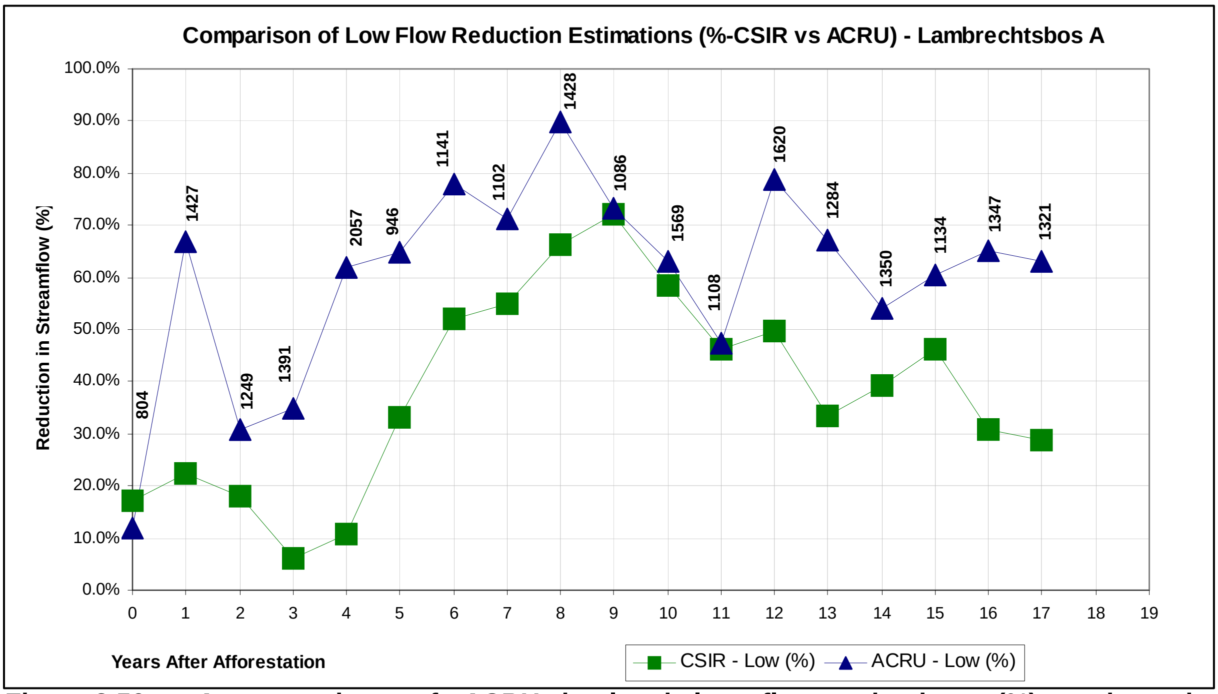


Figure 2.50 **A comparison of *ACRU*-simulated low flow reductions (%) against those calculated by Scott *et al.* (2000) for the afforested Lambrechtsbos catchment A. Annual precipitation totals are included as labels.**

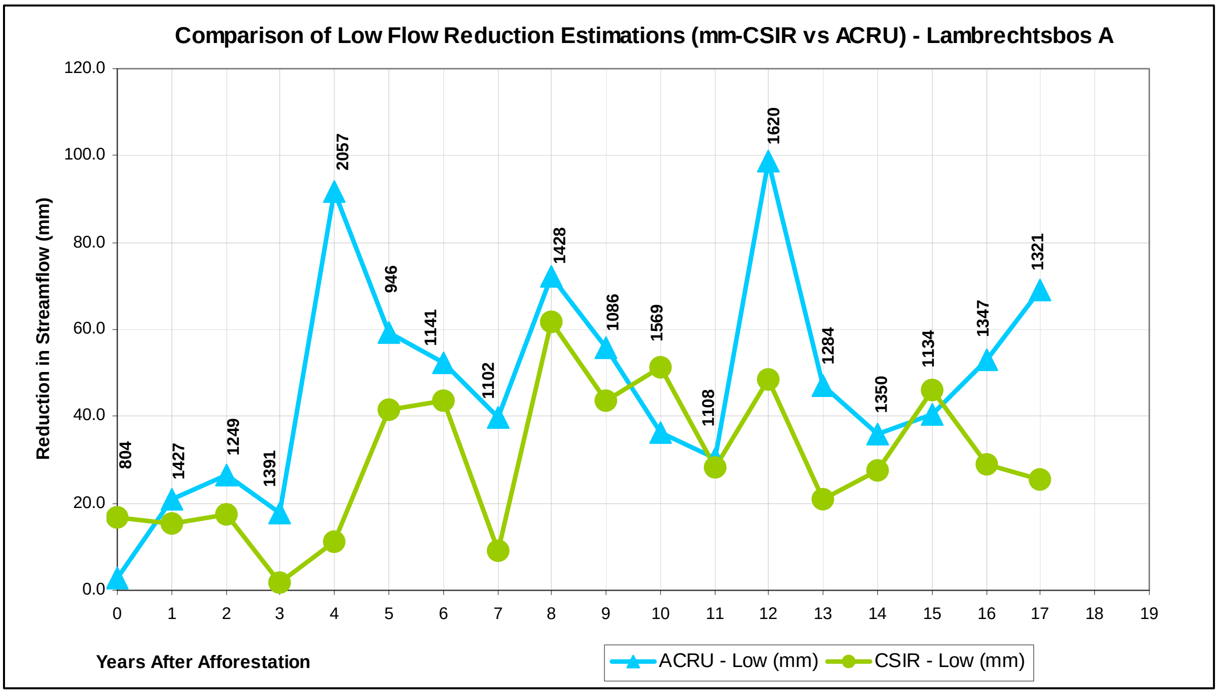


Figure 2.51 **A comparison of *ACRU*-simulated low flow reductions (mm) against those calculated by Scott *et al.* (2000) for the afforested Lambrechtsbos catchment A. Annual precipitation totals are included as labels.**

2.11 Confidence limits

An important principle of the chosen methodology for generating the national streamflow reduction tables in the second phase of this project, was not to infer accuracy in extrapolation that was not present in the verifications. It was not possible to generate confidence limits about the outputs of the *ACRU* simulations for all the Quaternary Catchments in South Africa that contain or have the potential to contain forestry. However, from a detailed analysis of the verification results, a semi-quantitative and qualitative description of differences and expected confidence limits of the modelling was developed to serve as a qualifier of the output of this project.

2.11.1 Establishing a confidence rating

The aim of this section of the study was to produce a reliable, objective, and defensible set of confidence limits / guidelines that could be traced to the only firm measurement of forestry effects that are available, *viz*. the gauged catchment experiments.

The confidence in predictions arises from two sources:
First, the degree to which experimental situations have been successfully replicated in the simulation modelling, i.e. successful verification of the model, leading to confidence that the model is able to predict streamflow with reasonable accuracy and for the right reasons. Secondly, the availability of observational data against which the realism of simulations can be gauged: the greater the extent to which simulations are performed away from experimental circumstances, the greater is the uncertainty in the results.

The verification studies provide a sound quantitative basis for evaluating the *ACRU* modelling system's performance in accurately monitored experimental catchments. Assessment was made of model performance on both total flows and the low flow components separately (Tables 2.19 and 2.20, respectively). The pattern of performance in the dry seasons and in dry spells (multi-year droughts) is of particular interest as these are the situations where streamflow reductions are considered to be most critical. In this respect, the qualitative performance of the simulation modelling is also important.

The model was run on both "best available information (detailed)" and "default" input data set modes for the experimental catchments. The verification assessment therefore has two components, namely, the accuracy of the verification exercises generally, and the similarity between the simulations resulting from "detailed" and "default" sets of input variables. If the simulations with detailed inputs are good, but those generated with default inputs are very different, it reduces the confidence that can be placed in the final product, which is generated from default type inputs. These aspects are summarised in Table 2.21, for total and low flow simulations respectively.

The availability of observational data against which the realism of simulations can be gauged is not a function of the modelling system, but of the availability of experimental evidence. Reservations or a lack of confidence on this account are particularly applicable to the drier forestry areas and the wattle genus, neither of which situations are verifiable. The combination of these uncertainties (i.e. wattle in drier regions) further reduces confidence.

However, the verification studies *per se* do not allow a measure of the success of the modelling exercise in replicating the observed streamflow reductions over time. Instead, this is a measurement derived from the difference between simulations with *ACRU* for two different land covers on the one catchment with the same block of climatic data. Here it is possible to compare the estimated streamflow reductions derived by regression analysis of each experiment to *ACRU*-derived flow reduction curves. There are two *ACRU* curves available; those derived using the detailed inputs (best information) and default inputs. Hence, two comparisons are possible for each study where a control catchment baseline could be generated with *ACRU*, and these comparisons are summarised in Table 2.21. It is thought that the performance of the *ACRU* modelling system in this area is the more important stage, as this is the working product of the whole project. The comparisons are both qualitative and quantitative. The results from the verification inform this stage – indicating which aspects of the simulations can be treated with higher confidence.

2.11.2 Working with monthly streamflow totals.

The *ACRU* modelling system operates on a daily timestep. It effectively distributes water on a daily basis, given rainfall, evaporation demand and available water on every individual day. In considering model performance in this exercise monthly totals of daily flows were utilized. This provides a large opportunity for the averaging of differences and the smoothing of the output response to the hydrological driving variables. Modelling differences in the short term, for example the response in streamflow to individual rain events, is therefore not tested by using monthly totals of streamflow. However, for a general and broad scale assessment of the effects of afforestation on total and seasonal flows (not stormflows) summing to the level of a month is appropriate. The important point to remember with respect to accuracy is that monthly totals are much easier to simulate accurately than are shorter time-steps of flow, and annual totals in turn are easier still. Summing over the whole of a forestry rotation of many years affords even greater opportunity for the cancelling of differences (i.e. over and under-simulations), and this is further enhanced by the movement from individual catchment scale to Quaternary Catchment scale.

2.11.3 The influence of verification efforts on confidence.

This project has put extensive effort into an appropriate setting up of *ACRU* to reasonably simulate the observed streamflows in the research catchments. To some extent the adjusting of certain non-physically based parameters in the model during the process of verification, without changing the structure of the model, can be seen as a form of calibration. The outcome of this is that the final simulations create a good impression of the modelling system's ability to match measured flows. At the same time, though, this process undermines confidence in the model as a physical process model in which most variables are measurable physical properties of the system being modelled, and hence extrapolation, following calibration of parameters that have little or no physical relevance, is a greater risk.

Qualitative and quantitative results are summarized for total and low flows in Tables 2.19 and 2.20 below. Distinction is made in each of the tables between the use of detailed (site specific) and default (readily available) input information. A selection of these results is also depicted graphically in Figures 2.52 and 2.53. In analysing these results it should be borne in mind that observed data (against which the simulated results are compared) are never entirely without fault, no matter how carefully monitored, and that the severity of error may vary in time and space. The accuracy with which rainfall over a catchment on a given day is represented is also an uncertainty, and a daily model does not account for rainfall intensity which has a significant influence on runoff patterns. Furthermore, small catchments (such as those used in this study) may have extraneous influences such as subterranean geological structures. Ideally simulations using the *ACRU* model should be done on catchments of 5-50km^2 due to the structure of the model coding. All these issues have less of an influence in larger catchments.

Table 2.19 A comparison of statistical and graphical verification results for TOTAL FLOWS at monthly time-steps. Results obtained using detailed and default input variables are tabulated.

	Goodness of Fit: Simulated *vs*. Observed Total flow - Detailed Inputs					Goodness of Fit: Simulated *vs* Observed Total flow - Default Inputs				
Catchment / Experiment	**Correlation (Monthly Data R²)**	**Bias (Monthly Data Coef. efficiency)**	**Ave. simulation difference mm/mth / (%)**	**Monthly mean flow (mm)**	**Mean Absolute difference on Monthly totals**	**Correlation (Monthly Data R²)**	**Bias (Monthly Data Coef. efficiency)**	**Average simulation difference mm/mth / (%)**	**Mean Absolute difference on Monthly totals**	**Differences between detailed and default simulations**
Cathedral Peak IV (control)	0.8820	0.7151	-6.9813 (-11.8767)	58.8	15.7 (28.1%)	0.8564	0.6886	9.0500 (15.3960)	19.7 (58.6%)	Overall difference is slightly greater, but changes to oversimulation; bias is low so cancellation of differences covers larger absolute differences.
Cathedral Peak II (pines)	0.8607	0.7742	-3.7009 (-7.5847)	48.8	13.9 (38%)	0.7520	0.5355	7.5525 (15.4784)	21.9 (82%)	Moderate differences become large differences; undersimulation changes to oversimulation so actual differences are very large between runs.
Westfalia B (control)	0.8004	0.7716	4.6273 (10.6558)	43	17.8 (83.1%)	0.7864	0.7624	5.59 (12.9%)	19.4 (86.4)	Little change; differences are moderate to large but get no bigger; oversimulation.
Westfalia D (eucalypts)	0.7300	0.6805	3.0254 (10.8003)	28.0	16.6 (66.4%)	0.7081	0.6411	5.74 (20.5%)	18.5 (73.8%)	As for Westfalia B, the differences change little with default inputs; oversimulation.
Lambrechtsbos-A (pines)	0.7527	0.7148	2.5549 (8.9094)	28.7	10.0 (38.1%)	0.6250	0.6056	1.71 (5.96%)	12.8 (47.9%)	Moderate differences with low bias and large cancellation element, remains similar.
Lambrechtsbos-B (pines)	0.8135	0.5623	12.8162 (55.5544)	23.1	15.0 (62.7%)	0.6769	-0.0818	36.9 (159%)	37.0 (199.5%)	Moderate oversimulation becomes very large & more biased.
Witklip V – (pines, eucalypts, grass)	0.7660	0.6997	-4.4789 (-19.3285)	23.2	12.3 (60.4%)	0.8027	0.6312	8.94 (38.5%)	13.4 (55.4%)	Moderate undersimulation becomes a large oversimulation, hence a very large shiftt.
Ntabamhlope – (eucalypts)	0.0479	-0.1076	0.4142 (-19.1584)	2.2	2.4 (143% **)	0.0659	0.0019	0.26 (12%)	2.47 (160% **)	Very large differences with large bias get marginally smaller with default inputs.
Cedara – (pines, scrub, grass)	0.1962	-4.2976	-13.0322 (-63.4400)	20.5	15.5 (84 **)	0.3594	-1.9803	-8.32 (-40%)	13.8 (110% **)	Large differences with large bias get marginally smaller with default inputs
Seven Oaks – (eucalyptus Evapo-transpiration measurement)	0.3261	-2.4690	-66.3968 (-60.8535)	ET = 109.1	67.3 (65%)	0.3634	-12.9260	-84.27 (-77%)	84.3 (79.3%)	Very large differences with large bias get marginally smaller with default inputs

- * Mean includes many zero values;
- ** Gross underestimate; this is a mean value for only those months when there was flow in the treated catchment (i.e. non-zero flow months).

Table 2.20 A comparison of statistical and graphical verification results for LOW FLOWS at monthly time-steps. Results obtained using detailed and default input variables are tabulated.

	Goodness of Fit: Simulated *vs* Observed Low flows – Detailed Inputs					Goodness of Fit: Simulated *vs* Observed Low flows - Default Inputs				
Catchment / Experiment	**Correlation (Monthly Data R²)**	**Bias (Monthly Data Coef. efficiency)**	**Ave. simulation difference mm/mth / (%)**	**Monthly mean flow (mm)**	**Mean Absolute difference on Monthly totals**	**Correlation (Monthly Data R²)**	**Bias (Monthly Data Coef. efficiency)**	**Ave. simulation difference mm/mth / (%)**	**Mean Absolute difference on Monthly totals**	**Differences between detailed and default simulations**
Cathedral Peak IV (control)	0.3420	0.2990	-0.7075 (-4.81%)	14.7	3.4 (23.9%)	0.2437	-0.5255	6.7261 (45.7%)	6.8 (45.5%)	Differences are doubled in size
Cathedral Peak II (pines)	0.1572	0.1526	0.2341 (2.82%)	8.3	3.91 (46%)	0.2330	-1.4509	19.5892 (236%)	11.3 (138%)	Differences are close to 3X as great using defaults
Westfalia B (control)	0.3462	-0.2896	9.0753 (190%)	4.77	9.4 (191.8%)	0.3291	-0.2487	9.4503 (198%)	9.6 (189.0%)	Differences, already large, are no worse with default inputs.
Westfalia D (eucalypts)	0.0199	-0.1992	2.9956 (1346%)	0.22 *	3.4 (89.8%) **	0.0236	-0.2347	4.1258 (1854%)	4.5 (168.6%) **	Differences are doubled
Lambrechtsbos-A (pines)	0.0868	-0.0768	-2.7530 (-20.2%)	13.6	6.0 (43.2%)	0.0350	-0.0870	-2.7145 (-19%)	6.8 (48.0)	Almost no difference, little loss of simulation accuracy
Lambrechtsbos-B (pines)	0.1317	0.0271	2.2359 (33.7)	6.6	4.1 (60.1%)	0.0786	-0.9805	18.3933 (276%)	18.5 (293.8%)	Very large increase in simulation differences (X 4+)
Witklip V – (pines, eucalypts, grass)	0.1484	-2.3718	-3.5 (-57%)	6.1	3.6 (61.0%)	0.2836	-0.0874	2.1102 (34%)	2.7 (43.6%)	Differences are smaller with default inputs, by a third.
Ntabamhlope – (eucalypts)	N/a	N/a	0.1224 (N/a)	0	Flow simulated in 25 out of 37 zero flow months	N/a	N/a	0.1605	flow simulated in 30 out of 37 zero flow months	All observed low flows are 0, hence oversimulations by a large margin
Cedara – (pines, scrub, grass)	0.7002	0.9531	0.1647 (425%)	0.04 *	0.19 (266%**)	0.6712	0.9888	0.6507 (1682%)	0.65 (897%**)	Low flows are much more poorly simulated; greater over-simulation.
Seven Oaks – (eucalyptus Evapo-transpiration measurement)	N/a	N/a	N/a			N/a	N/a	N/a		N/a

- * Mean includes many zero values;
- ** Gross underestimate; this is a mean value for only those months when there was flow in the treated catchment (i.e. non-zero flow months).

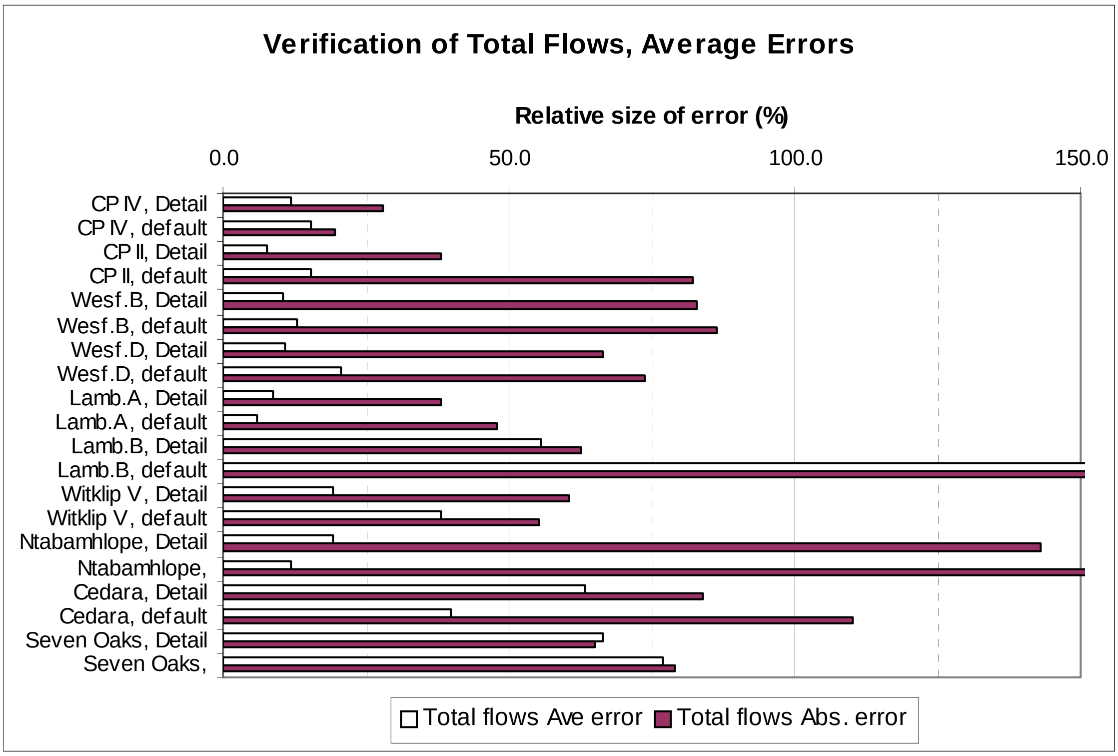


Figure 2.52 Average differences in estimating the total flows during verification exercises in numerous afforestation experiments.

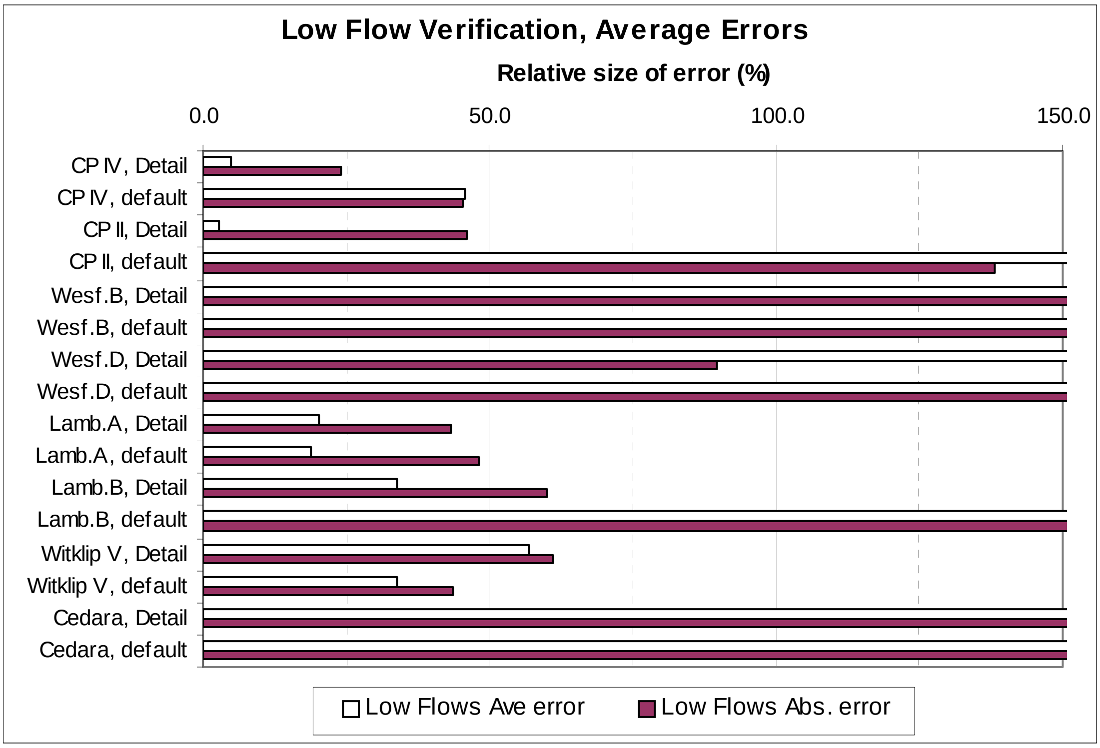


Figure 2.53 Average differences in estimating the low flows during verification exercises in various afforestation experiments.

2.11.4 Confidence limits on the verification simulations

2.11.4.1 Ntabamhlope: Verification against measured soil water

Four years of soil water measurement were available from a young eucalypt plantation at Ntabamhlope, and a separate effort was made to simulate this component of the water balance of the plantation site (Figure 2.33). The most important aspect of the simulation was that the observed data showed a progressive desiccation of the soil profile over the four years of record. However, the *ACRU* simulations show complete desiccation of the soil profile in each dry season, so that there is no greater drying out of the soil water stores in successive years. This indicates a potential inability within *ACRU* to account for the full storage capacity of soils. This weakness is evident in the frequent under-simulations of low flow from the experimental catchments, for example Cathedral Peak II, Westfalia D, Lambrechtsbos-A, Witklip and Cedara (Figures 2.6, 2.14, 2.19, 2.26 and 2.35).

2.11.4.2 Cathedral Peak IV: Detailed input simulations of control catchment

Cathedral Peak IV is a simple basin, with a stable cover of dense grassland, with a high rainfall with low variability (mean ≈ median rainfall). Overall, this is one of the best simulations of any catchment. Summed over a thirty-year period there is a general under-simulation by 11%. The monthly volumes were fairly well simulated, with little bias.

However, low flows are poorly simulated (very low R^2 and bias is fairly high). This may possibly be attributed to little year by year variation in low flows, however, a general under-simulation, and an inability to sustain good flows through the dry season are evident. During drought years (early 1980's) low flow under-simulations continue for many months in a row. This points toward inadequate storage provision in the model. From April 1982 – January 1985 there is consistent under-simulation. Recession curves are poorly simulated for most years during this period. A possible contributing factor is the fact that the influence of the regular bi-annual burning regime was not accounted for in the modelling exercise.

Default inputs greatly increase simulated low flows, causing 45% over-simulation generally (9 mm/month). Total flows are also over-simulated, but to a lesser degree, though there is a substantial bias.

2.11.4.3 Simulation of Low Flows in Cathedral Peak IV

In the above Cathedral Peak IV simulation, the lowest quarter of simulated monthly flows are one quarter to one tenth of the size of the observed sequence of monthly flows (Figure 2.54). The differences in simulating monthly flows are typically consistent, i.e. there is a bias, which ranges for periods of two to 15 consecutive months. This bias is greater during drier spells; for example, during the eight years of record in the 1980s the average sequence of under-simulation using the detailed input menu was 9.2 consecutive months (Figure 2.55). Over this eight year period the simple sum of differences amounted to 22% under-simulation of observed flows. This pattern is significant when it comes to working out probabilities and distributions using *ACRU* simulated data. Simulations are only reasonable during average years and when totalled over a whole year. But the distributions generated from monthly totals, and even more so from daily flows, will be seriously misleading, especially as regards the low flow component.

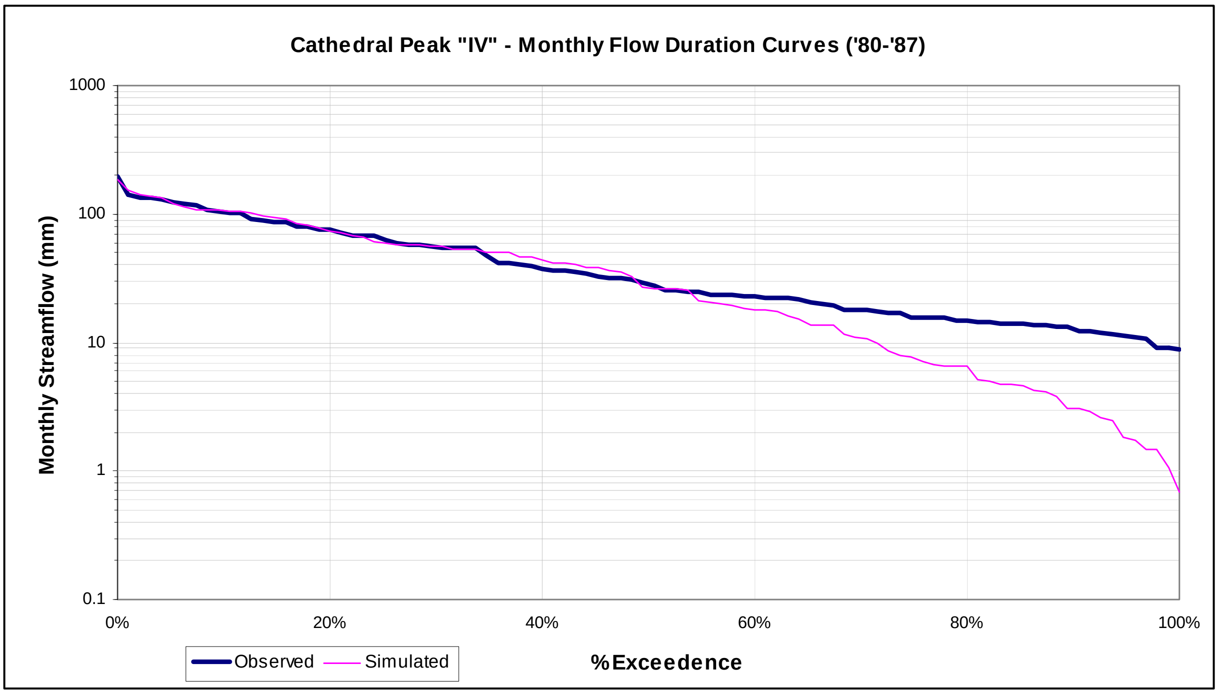


Figure 2.54 **Showing the undersimulation of the lower half of all monthly flow totals between 1980 and 1987 at Cathedral Peak IV, the control catchment under seasonal grassland.**

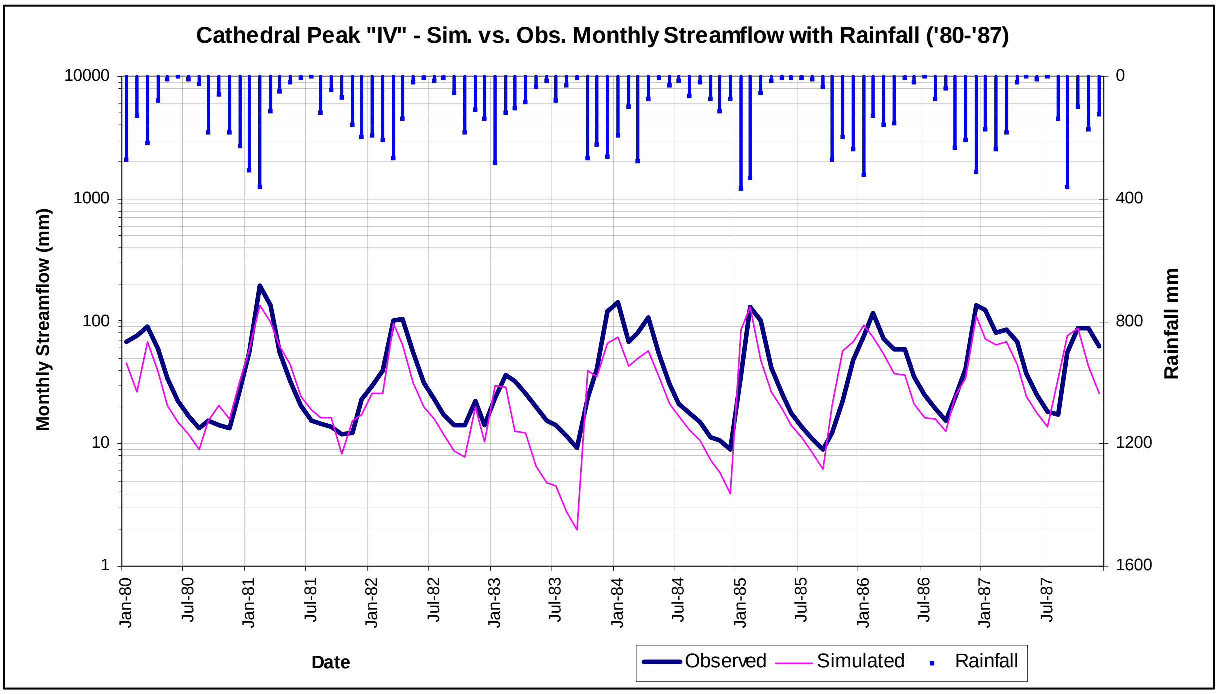


Figure 2.55 **A segment of the simulation for Cathedral Peak IV showing greater under-simulation during the drought period in the early 1980's, and the long periods of consistent under-simulation during the annual recession and dry seasons in particular.**

Another example of low flow simulations is the control catchment Westfalia B. Here the lower monthly flows in each year were generally under-simulated in most years for 4 to 6, but up to 15 consecutive months. However, during two drought spells 1982 – 1985 (Figure 2.56 below) and 1991 – 1995, *ACRU* could not simulate the progressive desiccation of the catchment, and low flows were consistently over-simulated for 42 out of 44 and 43 out of 49 consecutive months, for the two droughts respectively. In both cases the simple summed difference amounted to over 110% of the observed flow during these intervals. This again illustrates the large risk of using statistical summaries derived from *ACRU* simulated flows summed over periods of a year or less, for long-term planning.

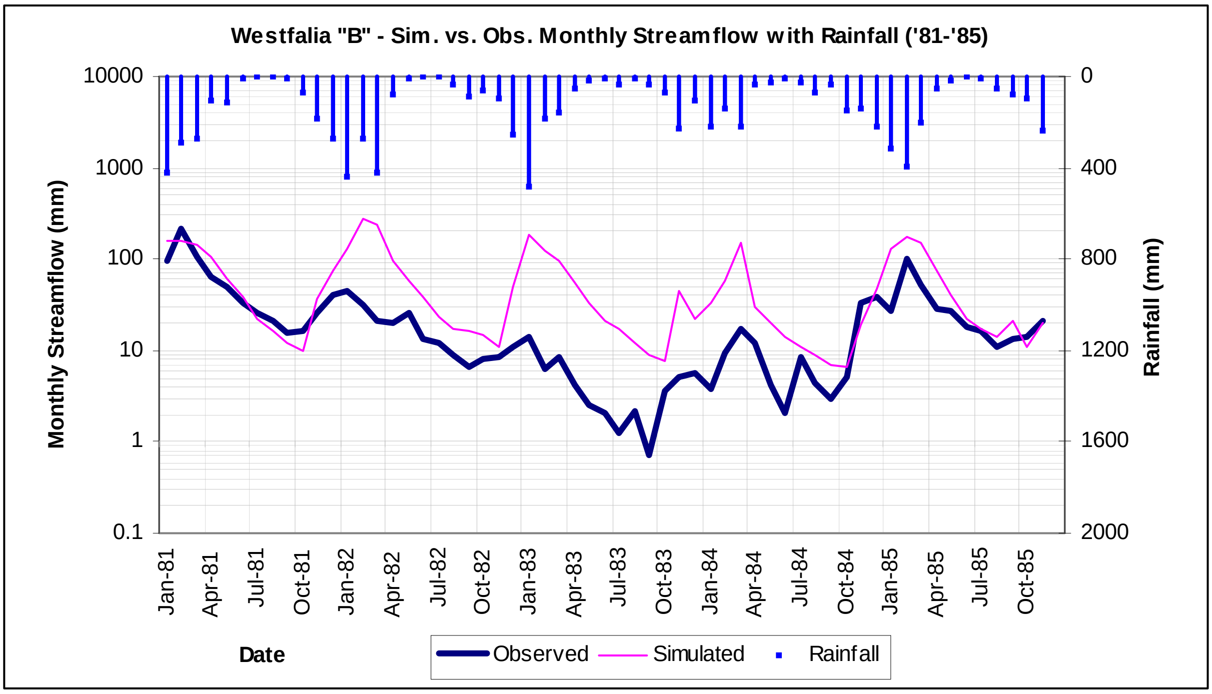


Figure 2.56 **A sample section of the verification simulation using detailed information for Westfalia B, the control catchment, during a drought period when the flows were consistently over-simulated by *ACRU*.**

2.11.4.4 Seven Oaks: Verification against measured actual evaporation.

The Seven Oaks experiment conducted by CSIR researchers is one of the few detailed measurements of actual evaporation in a plantation setting. The verification simulation of evaporation under a young eucalypt crop at this site was performed with detailed input information including site-specific data on weather and tree characteristics. However, the evaporation is under-simulated by more than half, or 66 mm per month (Table 2.19). Using default inputs for that region of the KwaZulu-Natal midlands, the under-simulations are even greater, evaporation not even reaching one third of that which was measured by the Bowen ratio method. An accurate estimation of evaporation by the model is therefore not evident in this exercise. It is possible, therefore, that where *ACRU* has simulated streamflow under a eucalypt plantation, such as at Westfalia, the streamflow, a net output dependent on simulations of many other processes, is being reasonably simulated for the wrong reasons; i.e. the component processes may not be accurately simulated but the overall answer is approximately correct. The specific problem may be that *ACRU* is not accounting for the large storage capacity of the soil profile and the year-to-year carry over of water storage or usage. Therefore, amounts of water used in evaporation are limited by current rainfall.

There is a better understanding of evaporation from eucalypts than for any other timber type in SA, therefore one would expect to have more confidence in the simulation of evaporation from eucalypts than when simulating pine and wattle. Much more work of this sort needs to be performed to verify the land use hydrology models. Evaporation measurements from wattle data and sugar cane are available from the same Seven Oaks experiment, and these ought to be used to assist in model development. At the same time, additional detailed evaporation measurements need to be taken from other cover types, particularly pine which occupies the largest plantation area, so that the modelling of evaporation from different land covers can be improved.

2.11.5 Confidence limits on reproducing the measured flow reductions.

The second, and more important, part of developing confidence limits derives from a comparison of flow reductions as measured from a regression analysis of the catchment experiments with the flow reductions as simulated by *ACRU*. Unfortunately there were only three direct comparisons possible: Cathedral Peak II, Westfalia D and Lambrechtsbos-A. Table 2.21 shows, for total and low flows separately, the averaged deviations between measured and simulated flow reductions over the maturing and mature phases of the plantations. The first simulation in each catchment was performed using the best available input information (the so-called detailed inputs simulation), while the second was performed using the default input information that would be used in a general simulation of the Quaternary Catchment of which the research catchment is a part (the so-called default inputs simulation). The contrast between these two simulations gives an indication of the nature of the difference that is likely to result from the application of default inputs over the rest of the country during the Quaternary Catchment simulations.

Table 2.21 A summary table showing the averaged differences between regression-estimated (CSIR; Scott *et al.* 2000) and *ACRU*-simulated flow reductions in three catchment experiments. The differences (in % and mm reductions) are shown, together with the actual observed mean annual and low flow reductions over the indicated plantation age interval. Both the summed differences, which incorporate cancellation of differences of different signs, and absolute differences (sign ignored) are shown. The sign of the differences indicates an under (negative) or over (positive) simulation by *ACRU*.

Simulation	Trees and Period averaged (tree ages in yrs)	Total flows (annual)					Low Flows (driest 25% of monthly flows)				
		Diff. (in % reduction)	Abs.Diff. (in % reduction)	CSIR mean reduction (mm/a)	Diff. (mm reduction)	Abs.Diff. (mm reduction)	Diff. (in % reduction)	Abs.Diff. (in % reduction)	CSIR mean reduction (mm/a)	Diff. (mm reduction)	Abs.Diff. (mm reduction)
Cathedral Peak 2, Detail inputs	Pines, 6 to 29	-11.36	13.89	339	-127.8	143.6	-17.10	21.05	21.8	-12.5	15.7
Cathedral Peak 2, default inputs		-19.77	22.17		-161.1	187.9	-24.37	27.67		-6.5	14.9
Wesfalia D, Detail inputs	Eucalypts 4 to 15	-6.76	15.15	291	-23.1	53.2	26.45	28.21	39.0	-7.1	36.8
Wesfalia D, default inputs		-8.54	16.12		11.8	61.9	22.56	25.26		-8.6	37.4
Lamb. A, Detail inputs	Pines 6 to 18	9.20	14.17	241	111.3	119.4	18.94	18.94	36.7	15.3	18.2
Lamb. A, default inputs		-15.54	17.59		-105.1	105.1	-5.55	16.91		-20.6	20.9

2.11.5.1 Simulated Flow Reductions at Cathedral Peak II

Total flow reductions are underestimated by 11% (127 mm/yr) using detailed inputs and by almost 20% (161 mm) when using default input variables (Table 2.21; Figure 2.57). The pattern of deviations illustrated in Figure 2.59 reflects a tendency for *ACRU* to over-simulate the water use increment during the first few years of a timber rotation. In this instance the over-simulation is followed by a consistent under-simulation of flow reductions from the maturing and mature pine plantation. The absolute differences associated with these total flow simulations are larger but fairly close to the overall difference, indicating that the underestimates are fairly consistent and that relatively little cancelling of differences has occurred when summing the differences.

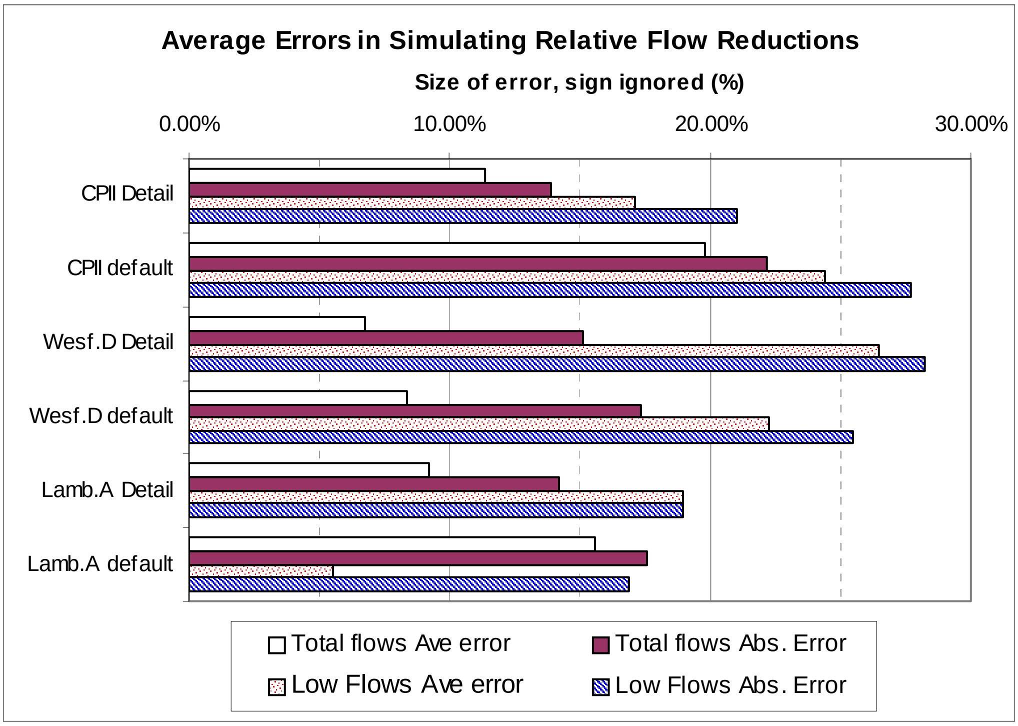


Figure 2.57 **Differences in estimating the percentage flow reductions caused by forestry in three research catchments.**

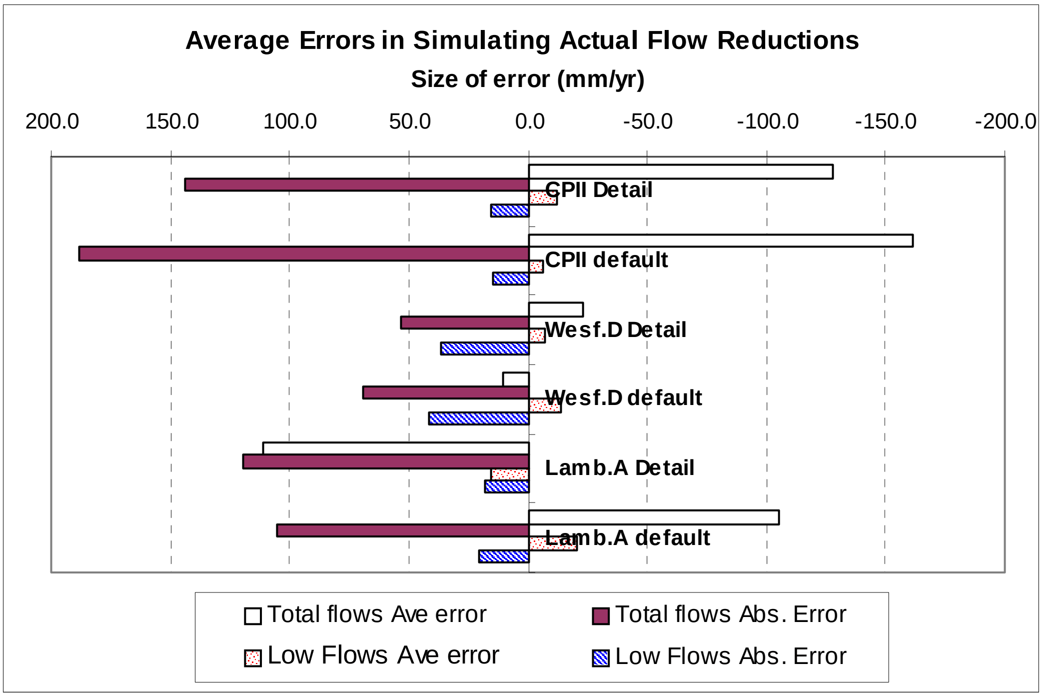


Figure 2.58 **Average differences in estimating actual flow reductions (mm) caused by forestry in three research catchments.**

The low flow reduction curves have larger deviations from the CSIR estimated flow reductions than is the case with total flows, the underestimates being 17% (12.5 mm) and 24% (6.5 mm) for detailed and default runs respectively (Table 2.21; Figure 2.57). The pattern of deviations is similar to that for total flows. The difference between detailed and default input simulations is relatively small in this instance. Greater cancelling of the overall differences occurs with the low flows, especially in the case of the default inputs, indicating that there is less consistent under-simulation of these when using the default inputs.

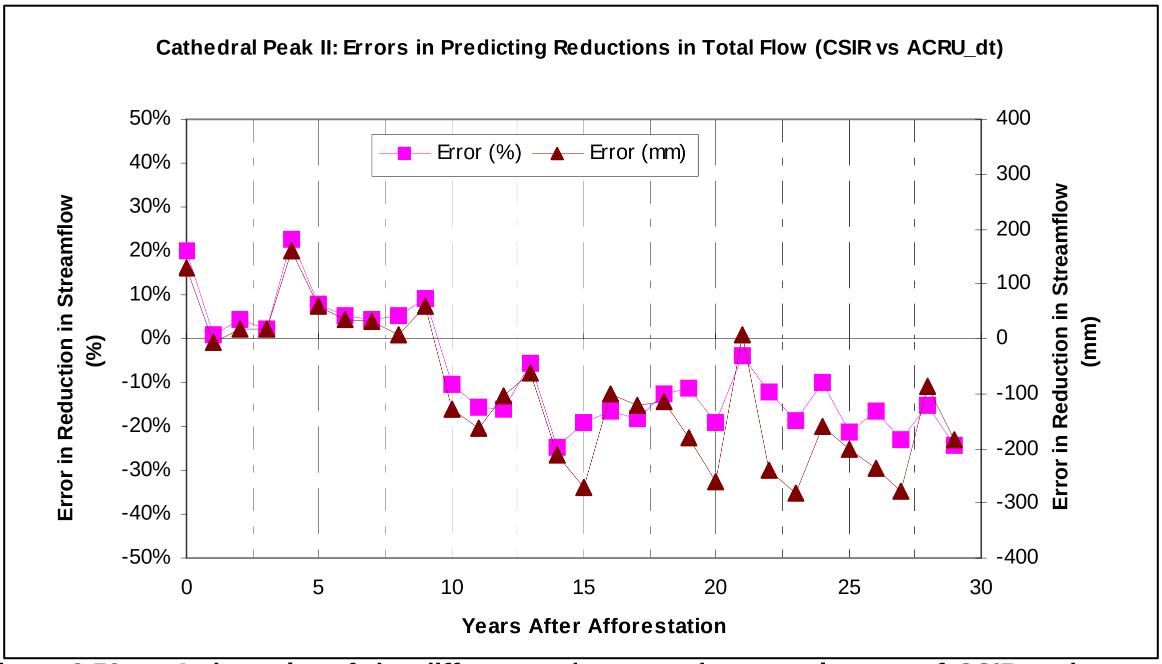


Figure 2.59 **A time plot of the differences between the annual sums of CSIR estimates of total flow reduction and those derived from *ACRU* simulations (detailed inputs) for Cathedral Peak II after afforestation with *Pinus patula*. Negative differences indicate an under-estimate of reductions.**

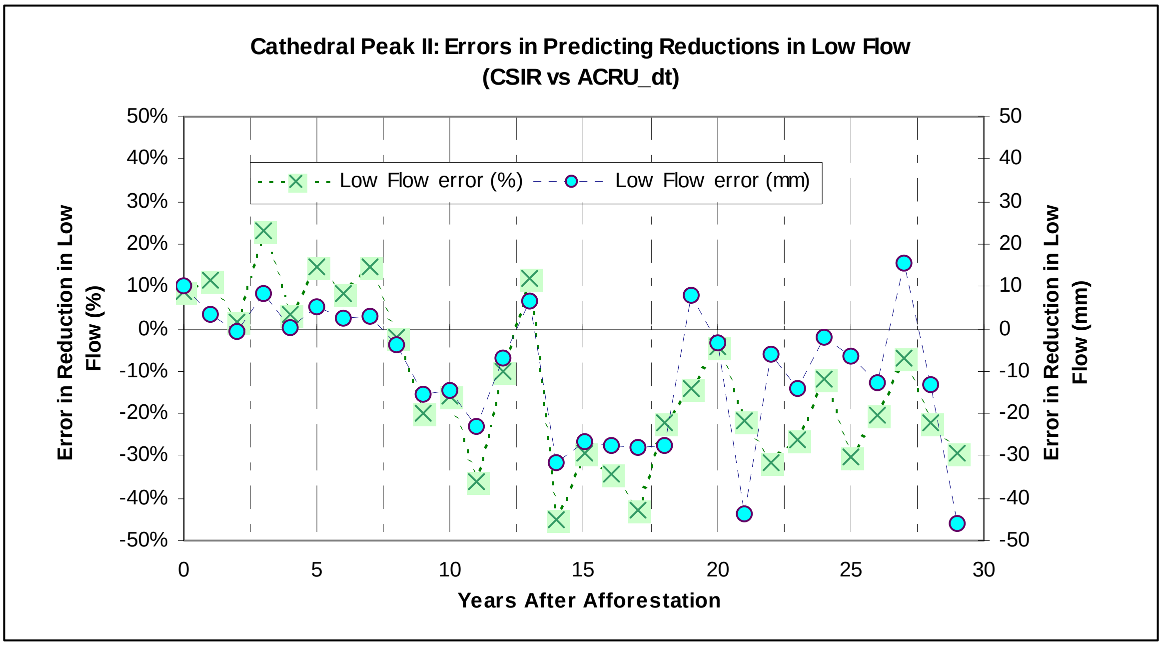


Figure 2.60 **A time plot of the differences between the sums of CSIR estimates of low flow reduction and those derived from *ACRU* simulations (detailed inputs) for Cathedral Peak II after afforestation with *Pinus patula*. Negative differences indicate an under-estimate of reductions**.

2.11.5.2 Simulated flow reductions at Westfalia D

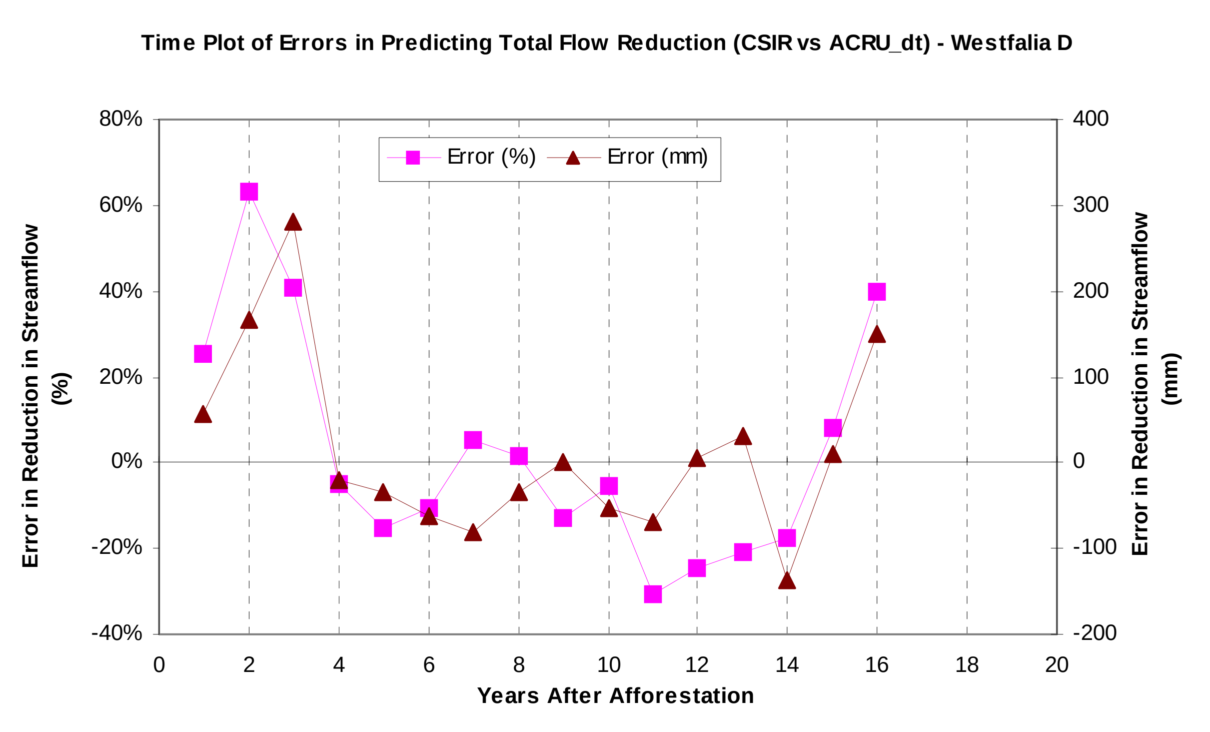


Figure 2.61 A time plot of the differences between the annual sums of CSIR estimates of flow reduction and those derived from *ACRU* simulations (detailed inputs) for Westfalia D after afforestation with *Eucalyptus grandis*. Negative differences indicate an under-estimate of reductions.

Over a whole rotation, percentage reductions in total flow under the eucalypts at Westfalia are reasonably simulated by both the detailed and default input simulations. Again the effects of forestry are under-simulated, but to a lesser extent than at Cathedral Peak, partly because of compensatory over-simulation of the early and late stages. The simulation difference in each year is fairly large with a large degree of cancellation of differences resulting in a smaller overall difference.

The low flows are less successfully simulated: a fact that is not surprising as Westfalia catchment D remained dry over a number of years despite some fairly high rainfalls. Proportional simulation differences (%) in these zero flow years could not be calculated, so the figures in Table 2.20 are gross underestimates, being applicable to the dry seasons non-zero flow only. Even so, reductions in low flows are oversimulated by around 25% over the whole experiment, though this includes much cancellation of simulation differences. In terms of absolute differences, the overall differences are closer to 100%.

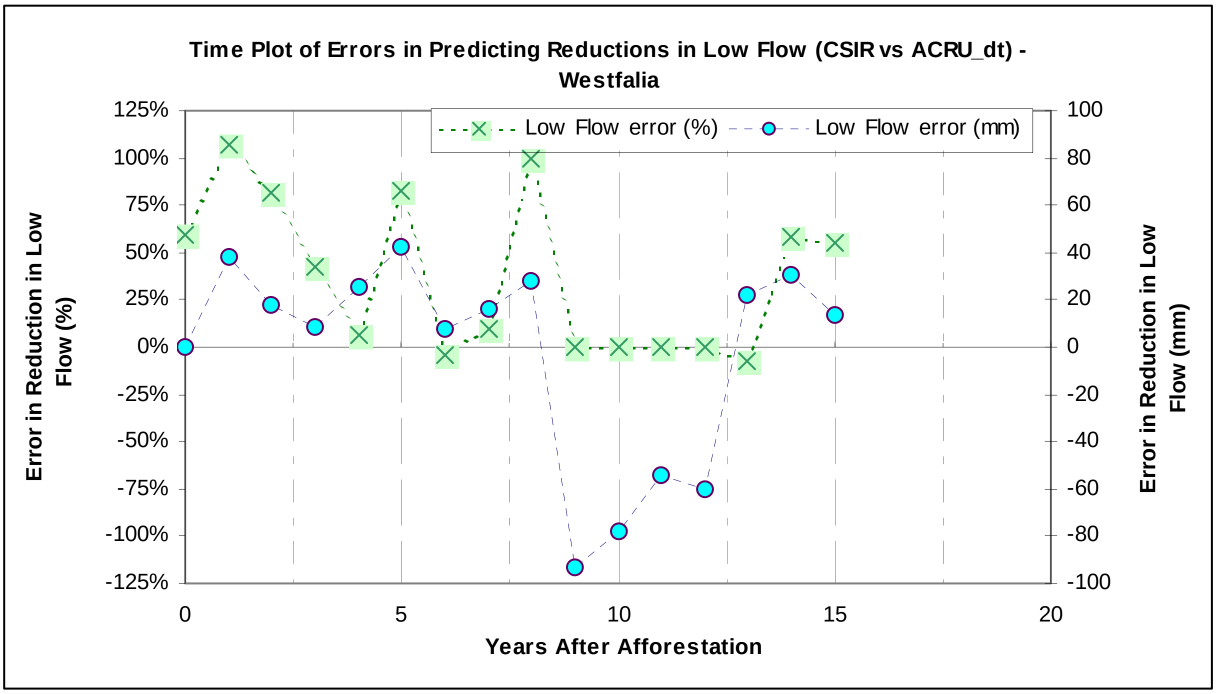


Figure 2.62 A time plot of the differences between the annual sums of CSIR estimates of low flow reduction and those derived from *ACRU* simulations (detailed inputs)for Westfalia D after afforestation with *Eucalyptus grandis*. Negative differences indicate an under estimate of reductions.

2.11.5.3 Simulated flow reductions at Lambrechtsbos-A

Differences in estimating reductions in total flow in the winter rainfall region were around an overall 10% over-simulation when using the detailed inputs, but around 15% under-simulation when using default inputs. There was little cancellation of differences in either case, the under or over simulations being consistent throughout the thirteen year period of averaging. The differences in actual depth of runoff were substantial over the mature phase of the simulation, the average difference amounting to almost 50% of the total flow reduction of 241 mm. Of more of concern is the fact that the differences from the detailed and default simulations were in opposite directions, so the difference in depth of flow between these simulations was over 80% of the average flow reduction.

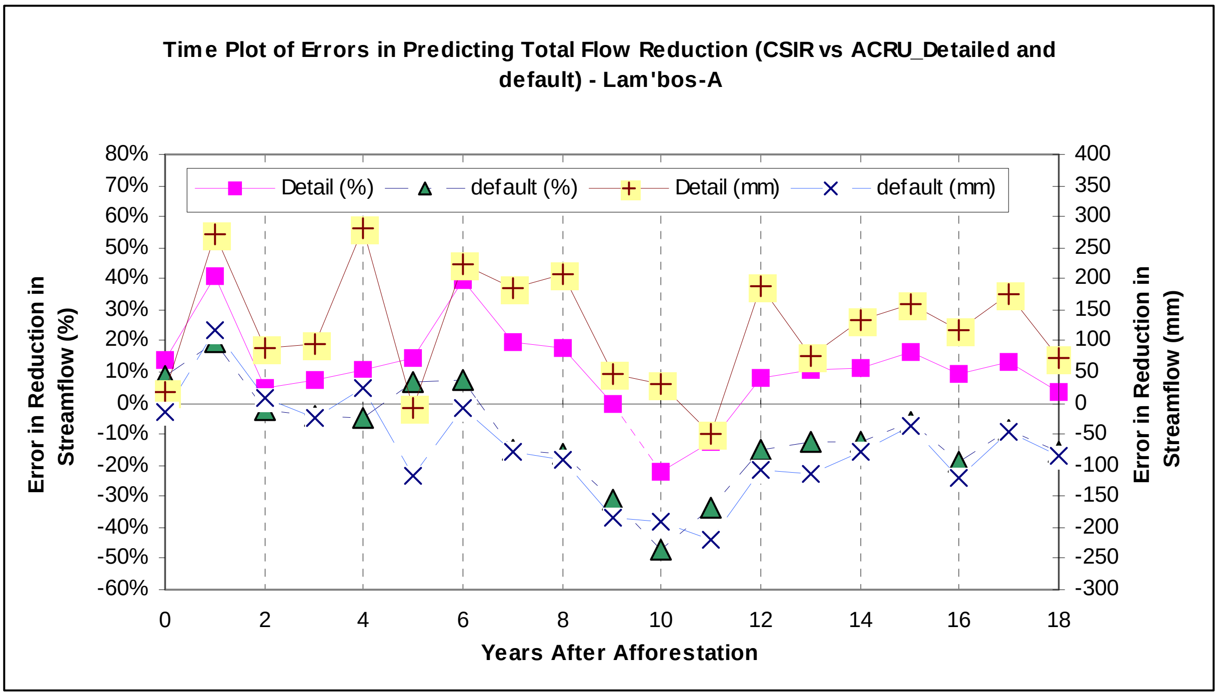


Figure 2.63 A time plot of the differences between the CSIR estimates of total flow reduction and those derived from *ACRU* simulations (both detailed and default inputs) for Lambrechtsbos-A catchment in Jonkershoek after afforestation with *Pinus radiata*. Negative differences indicate an under estimate of reductions.

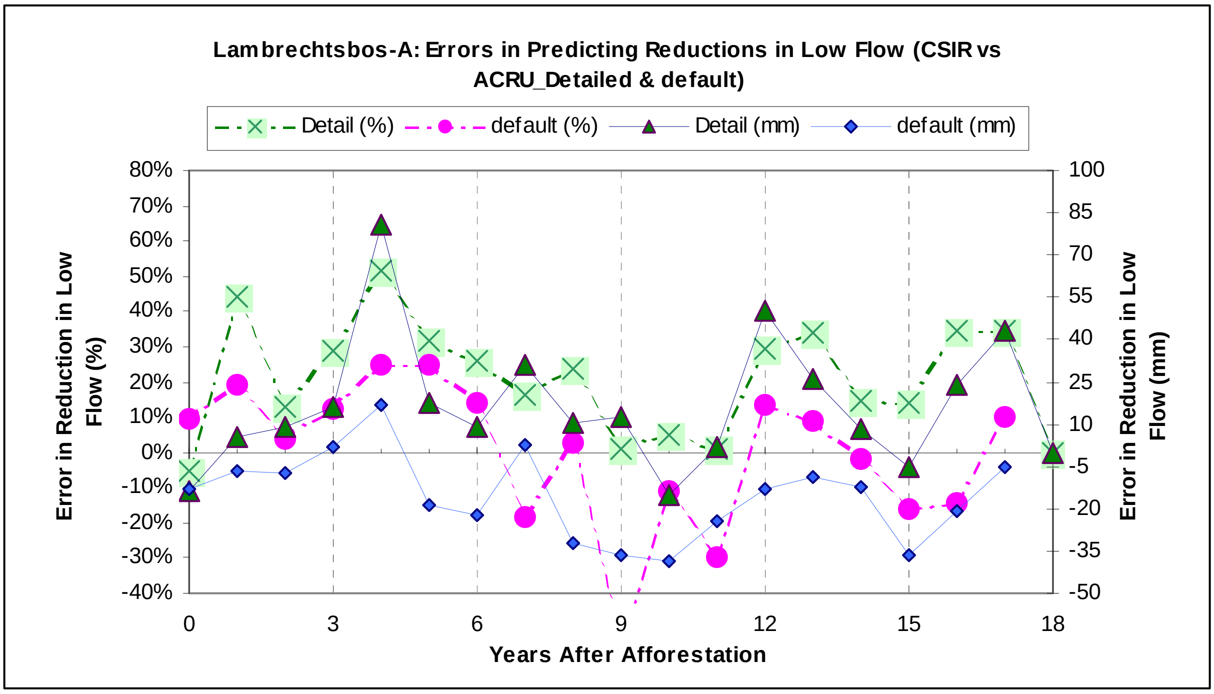


Figure 2.64 A time plot of the differences between the CSIR estimates of low flow reduction and those derived from *ACRU* simulations (detailed and default inputs) for Lambrechtsbos-A catchment in Jonkershoek after afforestation with *Pinus radiata*. Positive differences indicate an over estimate of reductions.

The estimated reductions in low flows have greater differences in the case of the detailed inputs, the low flow reductions having been consistently over-simulated throughout the mature phase of the plantation. There is consequently no cancellation of differences because of this consistent bias. In the case of the default inputs, the overall difference for low flow reductions is similar to that for the total flow reductions, but in this simulation there is large cancellation of differences over the course of the rotation (-5% overall but a mean absolute difference of 17% per year). As in the case of the total flows, the simulation performed with detailed inputs over-estimates low flow reductions and the simulation using default inputs under-estimates flow reductions. The difference between these simulations is around 100% of actual low flows on a year-by-year comparison.

2.11.6 Summary on confidence limits.

Verification Exercises. The size of differences using detailed inputs is better for **total flow** (monthly totals summed by year) than for low flows. Over a whole rotation the summed difference is as low as 6% (Cathedral Peak, Westfalia) but as high as 60% in other cases (Cedara, Jonkershoek, Witklip). Month by month differences (i.e. absolute differences) were large (20-80%) for the detailed input studies. Total flows are better simulated because of the greater opportunity for cancellation of differences over the course of the year, e.g. at Jonkershoek, only the annual total flow is reasonably well simulated, the seasonal patterns being systematically missed.

By and large, differences in simulating total flows were roughly doubled when default inputs were used. In the best cases this involved just additional variability, but in others the differences were in the vicinity of 100% (i.e. of the same size as the variable being measured). Switching to default inputs caused much greater differences in the simulation of low flows (3 – 4 times greater than when using detailed inputs), except where simulations were already poor (>50% differences) and then default inputs did not necessarily make differences any greater, and differences were possibly less biased.

The relative differences in simulating low flows are large, though these differences, because of the small volume of low flows, are readily lost in the annual total. At Cathedral Peak and Lambrechtsbos-A the low flows were under-simulated because these catchments have well-sustained baseflow. At Westfalia, the drought periods were over-simulated because *ACRU* does not fully accommodate the storage capacity of these humid catchments, and hence their capacity to absorb rainfall following extended drying.

The best low flow simulations were for the detailed input case at Cathedral Peak (less than 5% difference overall) but absolute differences were 23% - 46% in the detailed simulations, and more than double this size when default inputs were used. At Westfalia not even cancellation of differences could reduce the size of differences that were greater than 190% in all cases. Simulations of low flow in Lambrechtsbos-A were reasonably good (40 – 50% absolute differences) though with a distinct bias, but any confidence gained from this case is undermined by the much greater differences (60 – 300%) of opposite sign and equally biased in the adjacent, larger and perhaps more representative Lambrechtsbos-B catchment.

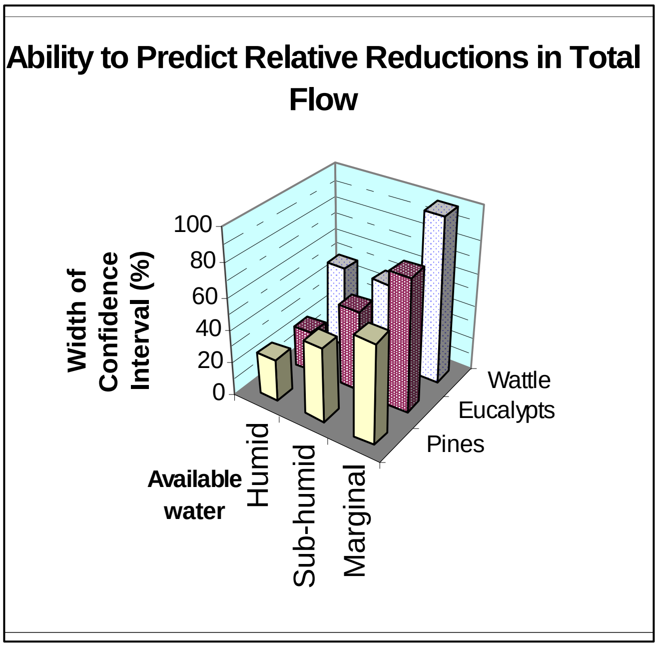
The two verifications of interim hydrological processes, namely soil water storage and evaporation from eucalypts, were weak. In particular the simulation of eucalypt evaporation was an under-estimate by more than a half, indicating that component processes are not simulated correctly, though the integrated result may appear reasonable.

In summary, over a long enough period the total streamflow can be reasonably simulated (5-20% accuracy), because of the averaging of differences. However, the statistics derived from the summing of flows over periods of days to seasons should be treated with great caution because of consistent bias in differences of a seasonal nature.

Success in simulating flow reductions. With detailed input data relative (percentage) total flow reductions could be simulated moderately accurately, with differences over the whole rotation of between 7 – 12%. Differences in year-to-year estimates of flow reduction were greater (13 – 16%). Using default inputs, reductions in total flows were simulated less well but still under 20% difference on percentage flow reduction. Flow reductions in the summer rainfall area were under-estimated and those in a single winter-rainfall catchment were over-estimated. Differences in predicting the actual reductions in streamflow (mm of reduction rather than %) were rather large (> 100 mm) at Cathedral Peak II (CP II) and Lambrechtsbos-A (Lb-A), though at Westfalia D (Wsf D) the absolute reductions over the whole rotation had a smaller difference, partly because of lower water availability. When using default inputs, the differences in actual reductions were larger, but not markedly so.

2.11.7 Generalised confidence limits on ACRU-generated estimates of flow reductions.

Generalised confidence limits have been generated, based on the above material on verification success and, more particularly, the differences in predicting observed streamflow reductions in three measured experiments. To accommodate uncertainty involved in extrapolating to conditions that have not been measured experimentally, a simple grid was designed of tree genera against water availability. The poor simulations are typically in the sub-humid zone (Ntabamhlope, Cedara), and involve pines and eucalypts. The better prediction success has been with pines and eucalypts in humid conditions (Cathedral Peak and Westfalia). In the marginal water availability zones and when the crop is wattle, uncertainty increases. The confidence limits can only provide a rough guideline and, given the paucity of hard data, are clearly only approximate. We have started from differences contained in Table 2.21, and have increased the limits with increasing uncertainty in an intuitive way, and to account for the increased accuracy afforded by the protracted verification efforts that were possible in the case of the three experimental catchments used Table 2.21. These confidence limits are illustrated in Figures 2.65 and 2.66, and are recorded in Table 2.22.



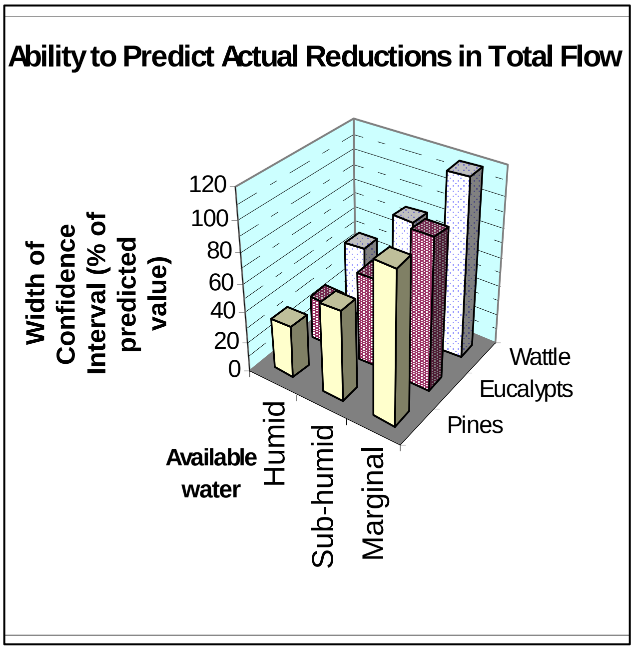


Figure 2.65 Approximate confidence limits on predictions of relative (left) and actual (right) total flow reductions by genus and water availability regime for the new SFR factors for forestry, derived from *ACRU* modelling.

When estimating the relative reductions in the low flows (%), the *ACRU* simulations produced either consistent over-estimates (Wsf D and Lb-A) or under-estimates of low flow reductions (CP II) in the range of 17 to 28%. In two cases default inputs produced lower average differences (over the whole rotation) because greater variability allowed for cancelling of differences. When estimating actual reductions in low flow (mm), differences in estimation were again similar with both detailed and default inputs, but month by month differences remain large, being in the vicinity of 50 - 100% of the size of the monthly low flow. In the case of Lambrechtsbos A though, the flow reductions were over-estimated when using detailed inputs, and underestimated (but by a lesser extent) when using default inputs, the shift being equivalent to two-thirds the size of the mean monthly flow.

The water availability categories are rather intuitive rather than absolute. The water availability factor takes account of the rainfall and the unsaturated water storage capacity (plant available water) on the site. It is known that the experimental research sites have large water reservoirs, based on deeply weathered saprolites, and that these water reservoirs play an important role in the observed streamflow response of the basins, naturally and after afforestation. However, the precise water storage capacity has not been determined explicitly for these basins. The following breakdown for the water availability categories is based on preliminary calculations of unsaturated soil water storage (Scott and Lesch, 1997) and on a general knowledge of the conditions in the research catchments.

- **Humid**: average annual water availability of 1500 mm or more; comprising at least 1050 mm of rainfall (MAP) and unsaturated soil water store of 450 mm or more.
- **Sub-humid**: average annual water availability of 1200 mm to 1500 mm, comprising a minimum MAP of at least 850 mm and associated soil water storage to make up the balance.
- **Marginal**: a water availability of less than 1200 mm, or a MAP of less than 850 mm.

Table 2.22: Approximate and preliminary confidence limits for the *ACRU*-generated predictions of flow reductions resulting from afforestation, to be applied to the figures in the national tables as a percentage of the predicted flow reduction.

Pecentage Reductions in flow (Confidence bands)						
Genus	Humid		Sub-humid		Marginal	
	Total flow	Low flow	Total flow	Low flow	Total flow	Low flow
Pines	25	45	45	60	60	100
Eucalypts	25	50	50	65	80	120
Wattle	50	60	50	90	100	150
Actual Reductions in flow (Confidence bands)						
Genus	Humid		Sub-humid		Marginal	
	Total flow	Low flow	Total flow	Low flow	Total flow	Low flow
Pines	40	60	60	75	100	140
Eucalypts	40	65	60	80	100	160
Wattle	60	100	80	120	120	200

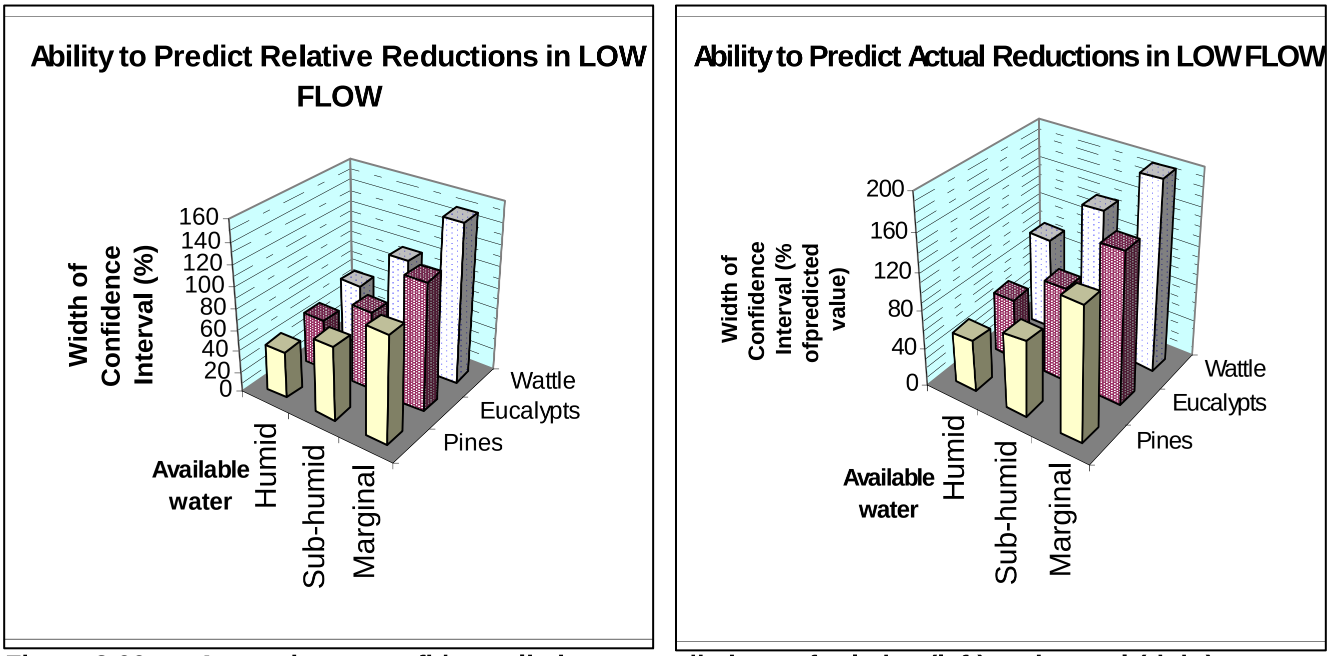


Figure 2.66 Approximate confidence limits on predictions of relative (left) and actual (right) low flow reductions for the new SFR factors for forestry, derived from *ACRU* modelling.

3. NATIONAL STREAMFLOW REDUCTION TABLES

This aspect of the project revolved around applying the lessons learnt in the verification phase of the project in order to model flow reductions on a national scale for all Quaternary Catchments (QCs) deemed to have forestry potential in South Africa. The use of QCs constituted the most practical scale, as they provided an adequate level of detail without undue complexity given that existing QC databases (rainfall and catchment characteristics) could be utilised. In addition, previous work had prepared the basic QC input data, obviating the need for much data preparation.

The following driver variables of the final streamflow reduction tables were decided upon:

- the Acocks veld type (pre-afforestation baseline vegetation),
- three tree genera (eucalyptus, pine and wattle), and
- three soil depths.

Consequently, for each of the 843 QCs selected, 12 simulations were performed, *viz*. 3 soil depths under Acocks (1988) land cover, ***plus*** 3 soil depths under 3 commercial tree genera.

In regard to soils information it was agreed that for the purposes of modelling forestry impacts countrywide, one soil texture and three soil depths should be utilised. The soil texture chosen was a sandy clay loam, which was deemed a representative texture of soils within South African forestry areas. The soil depths decided upon were to be 0.6 m, 0.9 m and 1.2 m for the Acocks coverage, and these same 3 depths for the forestry simulations. It was agreed that this would be advantageous in terms of uniformity and comparison of results across the country. The decision was prompted by difficulties in obtaining the originally proposed 30/50/80 depth percentiles for each Quaternary Catchment. This was problematic, for example, in cases where a Quaternary Catchment only contained two land types with the same soil depth. The end-user would then simply be able to select one of three soil depths for each Quaternary. This was also the method that was used for the similar sugarcane study conducted by the School of Bioresources Engineering and Environmental Hydrology (BEEH). Only those Quaternary Catchments with an MAP of above 650 mm were selected (843 in total), with the remainder considered too dry for forestry.

3.1 The Quaternary Catchment database

The Department of Water Affairs and Forestry (DWAF) has delineated southern Africa into 22 so-called Primary catchments which were then subdivided into Secondary, Tertiary and finally into interconnected Quaternary Catchments, of which 1946 were identified. The Quaternary Catchment is the smallest operational catchment unit identified by DWAF for country wide general planning purposes (Midgley *et al.*, 1994).

Meier (1997) established initial information for each Quaternary Catchment in southern Africa, namely:

- the daily rainfall station file number for the selected rainfall driver station;
- 12 values of monthly means of daily maximum temperature;
- 12 values of monthly means of daily minimum temperature;
- 12 values of monthly totals of A-pan equivalent reference potential evaporation;
- catchment attributes (e.g. area, mean altitude, mean annual precipitation, centroid latitude and longitude);
- soils attributes (e.g. horizon thicknesses, soil water content at the lower limit, drained upper limit and porosities of the top- and sub-soil horizons (A and B horizons), as well as saturated drainage redistribution rates from the A to B horizons and from the B horizon into the intermediate groundwater zone); and
- land cover attributes required by the *ACRU* model (e.g. monthly values of crop coefficient, vegetation interception losses per rain day, rooting distributions of the A horizon, etc.).

The most important input variable required by the *ACRU* model is daily rainfall. A so-called driver rainfall station was assigned with a continuous and quality checked 44-year daily rainfall record (1950 – 1993) to each Quaternary Catchment (Meier and Schulze, 1995). As rainfall-runoff models are particularly sensitive to rainfall input, data from over 9000 daily rainfall stations were considered in the process of selecting driver rainfall stations for the respective Quaternary Catchments (Meier, 1997).

For this phase of the project, Quaternary Catchments with an MAP of greater than 650 mm were selected (843 in total). In catchments with an MAP below 650 mm commercial afforestation was deemed economically unviable and they were consequently excluded. These selected Quaternary Catchments were then assigned to one of four forestry climatic zones. These zones corresponded with the four climatic zones identified by Summerton (1995), namely Mpumalanga, KwaZulu-Natal, Eastern Cape and Zululand. This was necessary as the *ACRU* variables for Leaf Area Index (ELAIM), rainfall interception (VEGINT) and fraction of roots in the A horizon (ROOTA) were taken from Summerton (1995) who had classified these variables according to the four climatic zones. Zones were delineated according to climatic homogeneity and not necessarily according to provincial boundaries. Consequently, Quaternary Catchments in the Highveld, Eastern Free State, Lesotho and in the Western and Southern Cape, for example, were assigned to the Eastern Cape zone, that zone being deemed most similar climatically. The constraint was the fact that there were only four sets of input data (tree/root growth data i.e. leaf area index, roots in the A-horizon and rainfall interception values) to use for the four data sets (Mpumalanga, KwaZulu-Natal, Eastern Cape and Zululand). In other words, every QC (with an MAP >650mm) had to be assigned to one of those four data sets. Unfortunately Summerton's work did not cover the Western Cape province specifically, therefore QCs in that region needed to be assigned to the closest region (climatically), which was deemed to be the Eastern Cape. This was the case for QCs on the Highveld and Eastern Free State as well, (i.e. we decided that those fairly marginal QCs would be better off grouped together with the Eastern Cape QCs which at least had a drier/colder climate than Mpumalanga, KwaZulu-Natal or Zululand). This was not the ideal solution, but was deemed to be the best option given the data available. Obviously a future need would be to clarify root / forest growth and interception input values for the Western Cape. Notwithstanding this, the other input data (rainfall, temperature and evaporation) were highly site-specific and would have reflected the local conditions accurately and these would have had significant inpact on the stream flow reduction estimations (i.e. they would have acounted for regionalisation). The delineation of these four zones is shown in Figure 3.1.

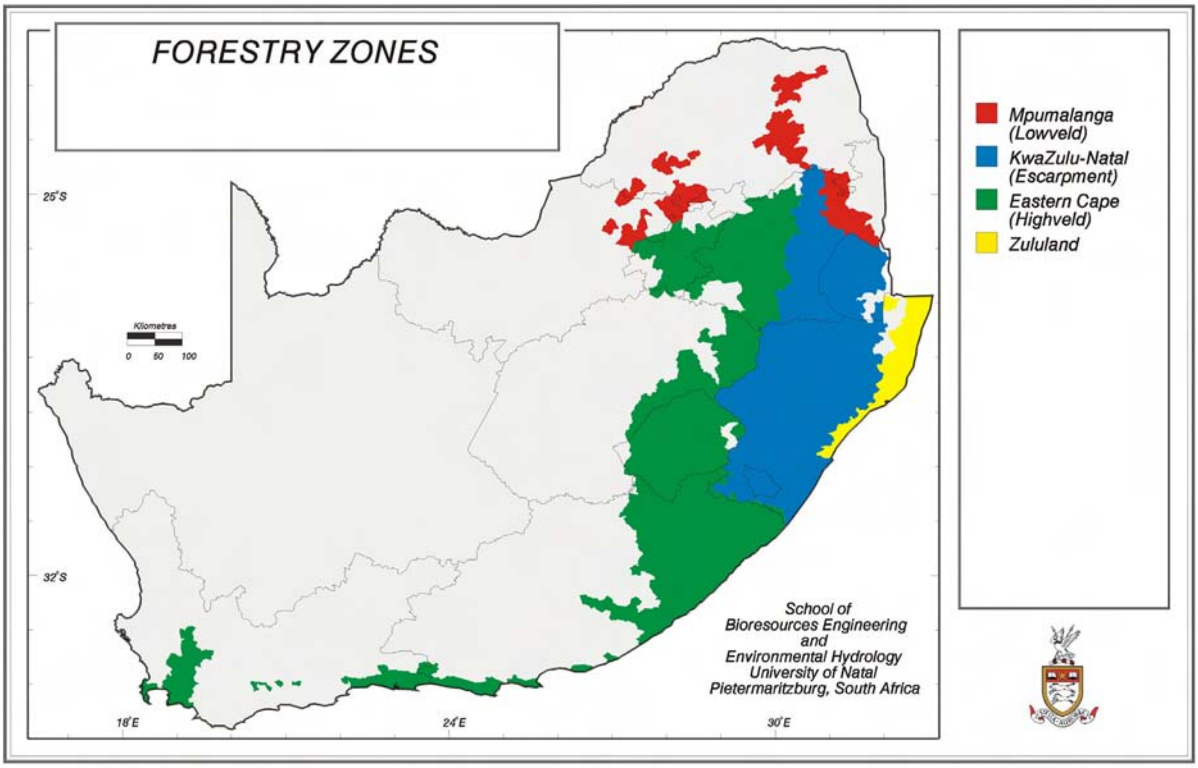


Figure 3.1 The distribution of the four forestry climatic zones for Quaternary Catchments with an MAP of greater than 650 mm.

Inputs required by the *ACRU* model needed to be written into the model's input menu prior to the simulation of any Quaternary Catchment. Instead of storing the information pertaining to each catchment in individual *ACRU* input menus, the information required was stored in a database. An interface was developed whereby information could be selected from an *ACRU* Input Database and automatically read into the model's input menu for the model to run. Selected output from the model runs could be displayed in the form of maps or time series.

Various inputs, *viz*. information on soils, land use and climate for each catchment being simulated were required by the model for simulations and these were entered into the model's input menu. The *ACRU* input menu is a formatted ASCII file in which the various hydrological variables required by *ACRU* are entered prior to simulation. These inputs were stored in a spreadsheet, thereby allowing flexible modification and manipulation of the *ACRU* input information in a familiar format. Each row in the spreadsheet referred to a catchment and each column to an *ACRU* input. The column names followed the parameter names used in the *ACRU* input menu, however, the columns did not need to be in the same order as they occur in the input menu. The first column was the name of the Quaternary Catchment, e.g. U10A.

3.2 The establishment of representative tree ages

The initial motivation for performing this analysis was to determine the representative age of each tree genus that was equivalent to the average streamflow reduction over a typical rotation. This was necessary because it was assumed that in a typical QC there would be a normalised stand-age distribution (i.e. constant planting and felling with approximately equal areas under each age). Consequently, as it was decided that *ACRU* simulations in this phase would only be carried out for a single age, a representative streamflow reduction that was about equal to the average over the whole rotation was required. In order to determine this representative tree age for each genus, *ACRU* simulations were performed for each tree age in a typical rotation (as well as for the dominant Acocks veld type in each Quaternary Catchment) to generate a streamflow reduction curve with increasing tree age. To do this a database was established in a spreadsheet for each of the three tree genera that contained all the inputs required to carry out the *ACRU* simulations. This database was then used to set up the *ACRU* input menu prior to simulation. In an effort to include both wet and dry years in the analysis simulations were run for the period 1950 - 1993 for each tree age. The mean and median (50th percentile) values of streamflow were extracted in each instance. Once the simulations had been carried out, the resultant streamflow reduction curves (using mean and median annual runoff values) were plotted, allowing the average reduction for the whole rotation to be determined for each genus. The representative age was isolated by reading off the tree age that gave a streamflow reduction approximately equivalent to the average reduction over the whole rotation. This process was repeated for each of the three tree genera in a representative Quaternary Catchment from each of the four climatic zones to assess the influence of location and tree genus on the streamflow reduction (SFR) curve. This process was repeated to determine the representative tree age for both long and short rotations for pines and eucalypts (eucalypts = 10 yrs and 25 yrs; pines = 18 yrs and 30 yrs).

The shape of these initial streamflow reduction curves was, however, contrary to what has emerged from experimental evidence. Figure 3.2 illustrates this using an example of simulated mean and median reductions in streamflow for increasing age eucalypts on medium soils in Quaternary Catchment B42B in Mpumalanga. The marked increase in SFR for tree age 0 to 1 was dissimilar to what has been proven from historical catchment afforestation experiments, which indicate a more gradual reduction in streamflow initially. This was a concern that first had to be addressed before the representative age could be finalized. Consequently, efforts were made to obtain a more scientifically verifiable shape to the SFR curve, specifically to improve the transition from Acocks (tree age 0) to commercial forest (tree age 1).

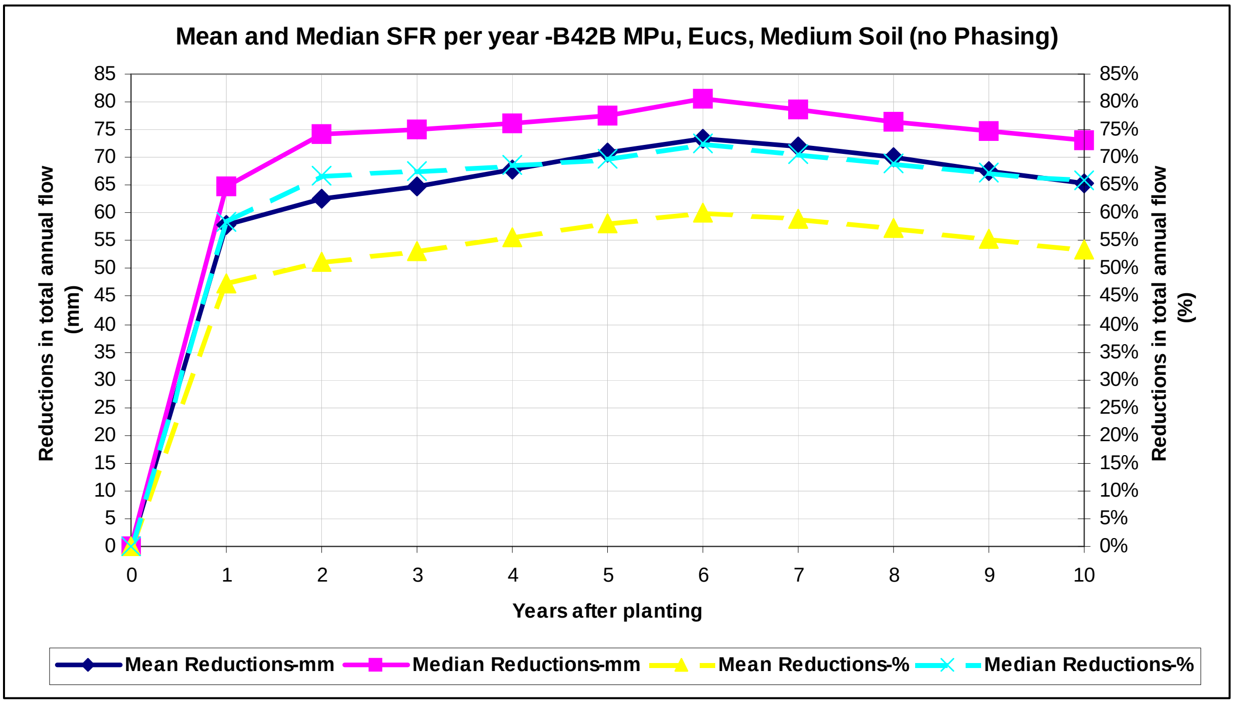


Figure 3.2 **Initial mean and median streamflow reductions (mm and %) for increasing age eucalypts on medium soils before phasing the variables describing the transition from Acocks to trees.**

In order to introduce a more gradual transition from Acocks to trees, a procedure was introduced which systematically changed the inputs used for the Acocks simulations to those used for the forestry simulations, until tree age 4 which was when canopy closure was assumed to have been achieved. Variables that were dynamically changed in this phased manner are represented in Table 3.1 and were:

- the option of enhanced canopy evaporation (FOREST) which is 0 under Acocks and becomes 1 when trees have canopy closure from age 4;
- the effective rooting depth (EFRDEP) which was set to correspond with the depth of the A+B horizons (i.e. 0.6m, 0.9m and 1.2m for the three soil depth's under trees aged 4 yrs and older), was phased from the corresponding values of 0.5m, 0.75m and 0.95m for Acocks;
- the fraction of plant available water of a soil horizon at which evaporation is assumed to drop below the maximum evaporation during drying of the soil (CONST) was phased from 0.4 under Acocks to 0.1 under eucalypts aged 4 yrs and older, and to 0.9 under pines and wattles aged 7 and 4 yrs and older respectively;
- the effective soil depth from which stormflow generation takes place (SMDDEP) was phased from 0.3 under Acocks to 0.35 under trees aged 4 yrs and older; and
- the coefficient of initial abstraction (COIAM) was phased from actual values under Acocks to 0.35 under trees aged 4 yrs and older.

Table 3.1 **An example of phased values assigned to selected variables to represent the transition from Acocks baseline vegetation to forestry (eucalypts on medium depth soils).**

TREE AGE	FOREST	EFRDEP	CONST	SMDDEP	COIAM											
	All year	All year	All year	All year	J	F	M	A	M	J	J	A	S	O	N	D
0 Acocks	0	0.75	0.40	0.30	0.15	0.15	0.15	0.2	0.25	0.25	0.25	0.25	0.25	0.2	0.2	0.15
1	0	0.79	0.36	0.31	0.20	0.20	0.20	0.24	0.28	0.28	0.28	0.28	0.28	0.24	0.24	0.20
2	0	0.83	0.27	0.33	0.25	0.25	0.25	0.28	0.30	0.30	0.30	0.30	0.30	0.28	0.28	0.25
3	0	0.86	0.19	0.34	0.30	0.30	0.30	0.31	0.33	0.33	0.33	0.33	0.33	0.31	0.31	0.30
4	1	0.90	0.10	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35

The revised streamflow reduction curve is illustrated below (Figure 3.3) .

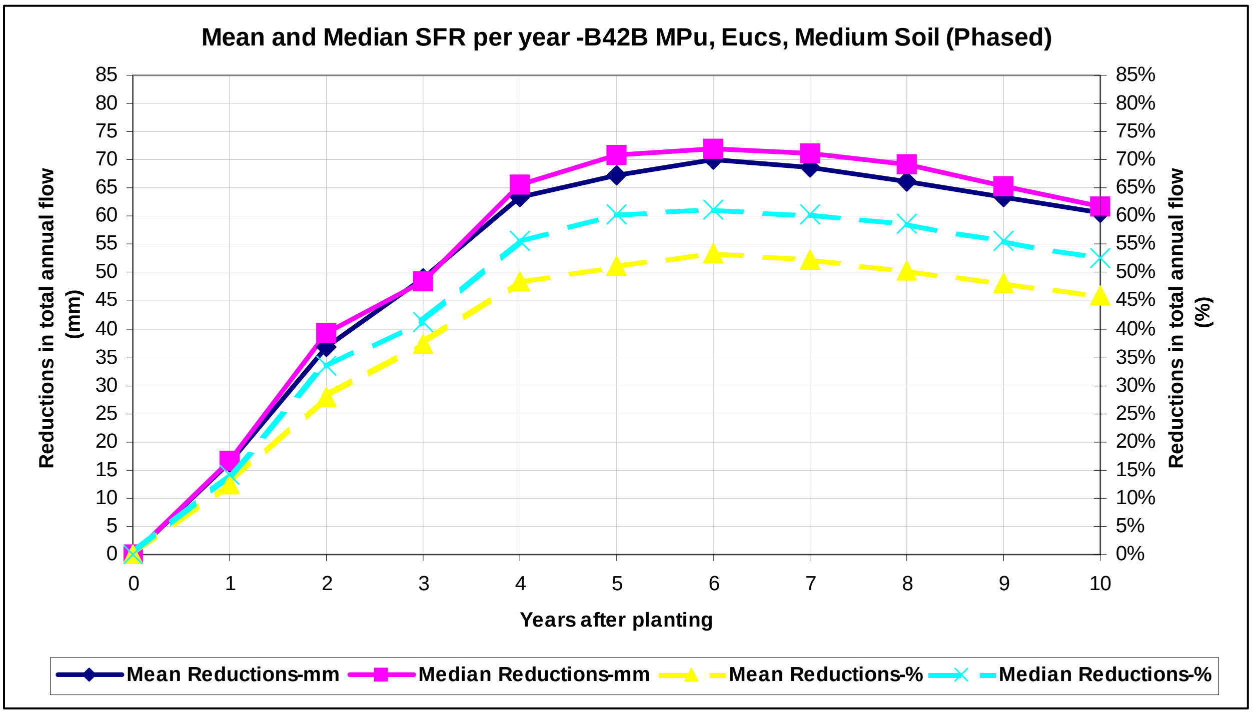


Figure 3.3 **Improved mean and median streamflow reductions (mm and %) for increasing age eucalypts on medium soils after phasing of the variables describing the transition from Acocks to trees.**

With the shape of the SFR curve having been revised it was possible to finalise the representative age (and hence the relevant hydrological variables) to be used for each genus and rotation length, using the mean SFR value as explained above. It was subsequently found that for both pines and eucalypts the rotation length (short vs. long) did not have a marked effect on the mean SFR and hence the representative age. This was so because the tail of the SFR curve in the longer rotation tended to flatten out along the mean SFR value of the short rotation curve. It was therefore proposed that only one representative age be used in simulations for each genus, regardless of rotation length, namely year 4 (eucalypts), year 7 (pines) and year 4 (wattle). These ages represented both the mean and median water use within a catchment with a normalised age distribution.

3.3 Simulation procedure

The modal Acocks veld type (i.e. that veld type representing the greatest area in the catchment) was identified for each of the 843 Quaternary Catchments. Values for the water use coefficient (CAY), vegetation interception loss (VEGINT) and fraction of roots in the A-horizon (ROOTA) were assigned to each Quaternary Catchment according to its Acocks veld type. The values of leaf area index (LAI), VEGINT and ROOTA for the three tree genera for each of the four zones were taken from Summerton (1995) and are shown in Table 3.2.

Table 3.2 The values of leaf area index (ELAIM), vegetation interception loss per rainday (VEGINT) and fraction of roots in the A-horizon (ROOTA) used for the three tree genera within each climate zone (after Summerton, 1995).

Variable	ELAIM			VEGINT			ROOTA		
Zone / Genus	Eucalypt	Wattle	Pine	Eucalypt	Wattle	Pine	Eucalypt	Wattle	Pine
Mpumalanga	3.5	2.5	3.5	2.2	1.9	3.4	0.71	0.79	0.68
KwaZulu-Natal	4.2	2.8	3.8	2.0	1.8	3.3	0.76	0.84	0.68
Eastern Cape	2.7	3.0	3.1	1.8	1.7	3.2	0.81	0.89	0.68
Zululand	4.4	2.8	3.8	2.6	1.8	3.3	0.66	0.84	0.68

This pre-populated database included information pertaining to the individual Quaternary Catchments, the Acocks veld types and the three tree genera being simulated for this study. All relevant *ACRU* input variables were added to the database, and assigned unique names. Each row in the database contained the *ACRU* input information relevant to a particular catchment selected for simulation, and the information was extracted by matching the catchment selected with the catchment name recorded in the first column of the database. An *ACRU* input menu was automatically created for each catchment by extracting the information from the database so that the individual menus contained information pertinent to each particular catchment (e.g. climate, soils, land cover), and the file containing the daily rainfall information for the simulation period (1950 - 1993) was prepared for use in the simulation. Once the *ACRU* simulations had been performed the output variables that were required (e.g. streamflow, rainfall or total evapotranspiration) were extracted and imported into ARC/INFO GIS or a spreadsheet for display purposes. Various statistical values were computed for each of the desired output variables, namely:

- mean;
- coefficient of variation CV (%);
- minimum value;
- maximum value;
- 10th percentile value;
- 20th percentile value;
- 50th percentile value (median);
- 80th percentile value; and
- 90th percentile value.

Of these, only the mean and median values of monthly output as well as annual totals were selected for analysis.

3.4 Analysis and discussion

Results of the Quaternary Catchment simulations were plotted for each tree genus and soil depth, and graphs were generated which illustrated streamflow reductions in relative terms, i.e. percentages and absolute terms, i.e. mm. Reductions were calculated for both total flows as well as low flows (driest three months of the year). Both mean and median runoff data were plotted to assess the difference between them, however median values were selected for the final streamflow reduction calculations. This was because median values were deemed to be most characteristic of long-term fluctuations in streamflow as they minimised the influence of extreme events. For the calculation of low flows, the 12 median flows for each month were ranked and smallest three were selected (i.e. representing the three months of lowest flow).

The final tables represented reductions in streamflow for all Quaternary Catchments across South Africa following complete afforestation with one of three primary commercial forestry tree genera. There were columns allocated to general information (area in hectares, Mean Annual Precipitation and *ACRU*-simulated Acocks baseline streamflow) followed by 18 streamflow reduction scenarios. The column headings of the tables are explained in Table 3.3.

Table 3.3 Explanation of the abbreviation codes used to describe the columns represented in the final streamflow reduction tables.

Abbreviation	Interpretation
AREA	Quaternary Catchment area (ha)
MAP	Quaternary Catchment Mean Annual Precipitation (mm)
ASTF	Acocks baseline vegetation on shallow soils – Median Annual Total Flow (mm)
AMTF	Acocks baseline vegetation on medium soils – Median Annual Total Flow (mm)
ADTF	Acocks baseline vegetation on deep soils – Median Annual Total Flow (mm)
ASLF	Acocks baseline vegetation on shallow soils – Annual Low Flow (driest three months - mm)
AMLF	Acocks baseline vegetation on medium soils – Annual Low Flow (driest three months - mm)
ADLF	Acocks baseline vegetation on deep soils – Annual Low Flow (driest three months - mm)
ESTFR	Eucalypts on shallow soils – Median Annual Total Flow Reductions (mm)
EMTFR	Eucalypts on medium soils - Median Annual Total Flow Reductions (mm)
EDTFR	Eucalypts on deep soils – Median Annual Total Flow Reductions (mm)
ESLFR	Eucalypts on shallow soils – Annual Low Flow Reductions (driest three months - mm)
EMLFR	Eucalypts on medium soils – Annual Low Flow Reductions (driest three months - mm)
EDLFR	Eucalypts on deep soils – Annual Low Flow Reductions (driest three months - mm)
PSTFR	Pines on shallow soils – Median Annual Total Flow Reductions (mm)
PMTFR	Pines on medium soils - Median Annual Total Flow Reductions (mm)
PDTFR	Pines on deep soils – Median Annual Total Flow Reductions (mm)
PSLFR	Pines on shallow soils – Annual Low Flow Reductions (driest three months - mm)
PMLFR	Pines on medium soils – Annual Low Flow Reductions (driest three months - mm)
PDLFR	Pines on deep soils – Annual Low Flow Reductions (driest three months - mm)
WSTFR	Wattle on shallow soils – Median Annual Total Flow Reductions (mm)
WMTFR	Wattle on medium soils - Median Annual Total Flow Reductions (mm)
WDTFR	Wattle on deep soils – Median Annual Total Flow Reductions (mm)
WSLFR	Wattle on shallow soils – Annual Low Flow Reductions (driest three months - mm)
WMLFR	Wattle on medium soils – Annual Low Flow Reductions (driest three months - mm)
WDLFR	Wattle on deep soils – Annual Low Flow Reductions (driest three months - mm)

Modelled results were compared against local and international measurements of streamflow reductions resulting from afforestation, and analysis of these results revealed a number of concerns that the project team first had to address, namely:

- In the initial simulation runs there were inconsistencies in the approach used to estimate the *ACRU* parameters for Acocks veld types. Consequently, estimates of Crop Coefficient (CAY), fraction of roots in the A-Horizon (ROOTA), and interception (VEGINT), were revised for all Acocks veld types. Based on a national analysis of climatic drivers of plant growth such as the length of growing season, moisture-dependent growing season, heat units and frost period, the result was a consistent methodology for the estimation of these parameters for Acocks veld types. This approach with relevant results was presented to members of the National Botanical Institute - all of whom accepted the method.
- The choice of model output variables regarding evapotranspiration did not include an estimate of evaporation of canopy-intercepted water. Consequently, the simulated daily value needed to be included as an individual output together with estimates of soil evaporation and plant transpiration, in order to accurately partition the full evapotranspiration value. This facilitated comparison against measured evapotranspiration data from Seven Oaks (Burger *et al.*, 1999) as the measured data consisted of summed transpiration and canopy-intercepted evaporation data, but excluded soil evaporation. This involved a minor change to the model code but did not affect total water balance.
- In some cases, a net gain in streamflow was found for the shallow soils scenario, however, observations of runoff from catchments with shallow soil, as well as soil moisture and evapotranspiration measurements from such sites suggest that there will still be streamflow reductions from shallow soil sites. Investigations of the model configuration for shallow soils revealed an inconsistency in the Effective Rooting Depth parameter (EFRDEP) whereby Acocks vegetation on shallow soils had access to proportionally greater soil moisture storage than on medium and deep soils. This effectively caused the Acocks vegetation to occasionally reduce soil moisture (and

consequently streamflow) by more than the trees were able to, resulting in gains in streamflow following afforestation. Once the value of EFRDEP had been adjusted consistently for increasing soil depth very few QCs showed an increase in streamflow following afforestation.

- Indications were that the Quaternary Catchment streamflow reductions might initially have been underestimated and hence further assessment and testing of the evaporative processes within the model commenced. A problem with the estimate of soil water evaporation from Acocks' land cover was identified. It was suggested that a "surface cover" routine included in *ACRU*, (but not in the version of the model used for this project) be invoked. In essence, the routine suppresses soil evaporation through an estimate of the amount of protection provided by a soil surface cover i.e. dead matter or mulch on the surface. This problem was discovered by comparing soil evaporation under Acocks against soil evaporation under trees for some selected Quaternary Catchments. It was found that there was an unrealistically large component of soil evaporation under Acocks even for a very woody Acocks veldtype such as coastal forest. This was deemed unrealistic and the cause was the fact that the canopy cover routine had not been invoked in the version of the model used for the simulations. Invoking this routine had no impact on evapotranspiration from forests, as soil evaporation was suppressed in any event once their LAI values went above 3 (due to the 100% cover). However, as the Acocks used crop coefficients (CAY), which were converted to LAI values for evapotranspiration calculations, and as these converted LAI practically never went above 3 the soil evaporation suppression didn't occur.
- Following observations from the initial simulations that streamflow reductions under pine were generally higher than those for Eucalypts, it was discovered that the variable CONST which represents the fraction of plant available water at which plant stress sets in was set at 0.1 for all tree types in the national runs. In the verification runs (and in all other *ACRU* studies of this nature) this value was set at 0.1 for Eucalypts and 0.9 for pines. This problem was rectified and subsequent model runs indicated that the streamflow reductions for eucalypts were higher than those for pine. Consequently, the initial national runs needed to be repeated. The project steering committee was satisfied that modifications to both the model code and model input were made for valid scientific reasons, which were supported by detailed analyses of the hydrological processes represented in the model.
- Finally, there were strong indications that the handling of soil water storage/capacity within the model required revision. However, this was not something that could be addressed by this project and instead forms part of a longer-term strategy to improve the model.

Consequently, the national simulation runs needed to be repeated. The project steering committee was satisfied that modifications to both the model code and model input were made for valid scientific reasons, which were supported by detailed analyses of the hydrological processes represented in the model. These revised results were analysed and graphically represented in order to facilitate interpretation of the values. Tables 3.4 and 3.5 represent some selected statistical outputs extracted from the final streamflow reduction tables.

Comparisons were also undertaken to investigate how *ACRU* estimates of streamflow reductions compared against those calculated using the generalised CSIR Curves of Scott and Smith (1997). In this case only comparisons of relative (%) reductions were possible as actual (mm) values were not available for the CSIR Curves. The "Optimum" CSIR Curves values were selected as it was felt that these were best suited for comparison against the *ACRU*-simulated values on medium depth soils (0.9m), considered above average for forestry soils. These comparisons are represented in Table 3.6.

Table 3.4 Selected statistical output (general information and streamflow reductions in mm) for all Quaternary Catchments with afforestation potential.

All QCs	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
Max	258736.0	1812.8	1190.8	1178.5	1166.9	69.7	68.3	67.2	201.2	231.5	250.6	23.8	27.3	28.1	152.5	199.7	215.2	11.7	17.5	20.2	133.0	179.5	192.4	21.7	23.7	25.0
Min	5531.0	647.0	17.4	13.8	12.5	0.6	0.0	0.0	11.3	13.6	12.5	0.6	0.0	0.0	5.7	10.8	11.8	-1.1	0.0	0.0	-3.1	10.3	12.3	0.0	0.0	0.0
Average	35399.9	840.2	138.5	123.7	113.0	10.0	8.0	6.5	64.8	73.6	72.1	6.0	6.1	5.4	46.9	57.3	59.2	2.6	3.6	3.6	45.1	56.5	59.0	4.4	4.7	4.4

Table 3.5 Selected statistical output (general information and streamflow reductions in %) for all Quaternary Catchments with afforestation potential.

All QCs	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
Max	258736.0	1812.8	1190.8	1178.5	1166.9	69.7	68.3	67.2	93.9%	98.9%	100.0%	100.0%	100.0%	100.0%	84.1%	97.1%	97.1%	82.4%	100.0%	100.0%	89.0%	97.1%	98.4%	100.0%	100.0%	100.0%
Min	5531.0	647.0	17.4	13.8	12.5	0.6	0.0	0.0	7.9%	9.6%	11.4%	26.5%	39.0%	39.4%	3.3%	5.7%	9.0%	-41.7%	0.0%	7.5%	-1.9%	8.3%	9.4%	0.0%	19.0%	28.4%
Average	35399.9	840.2	138.5	123.7	113.0	10.0	8.0	6.5	56.2%	70.2%	74.0%	65.5%	88.1%	94.5%	41.4%	56.9%	63.5%	28.1%	58.6%	75.7%	41.0%	57.4%	64.2%	46.0%	70.7%	83.4%

Table 3.6 Comparison of SFR estimates (%) derived using the generalised CSIR Curves (for 4yr old eucalypts 7yr old pines and 4yr old wattles on optimum sites), against those derived using the *ACRU* model (using median and mean SFR values for 4yr old Eucs 7yr old pines and 4yr old wattles on medium depth soils). The CSIR pine Curve was used for the wattle calculations, as recommended by Scott and Smith (1997). The differences between the CSIR Curves and *ACRU* estimates are given for each scenario.

SFR Estimator	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
CSIR Curves	46.8%	46.8%	46.8%	71.6%	71.6%	71.6%	70.6%	70.6%	70.6%	76.8%	76.8%	76.8%	27.4%	27.4%	27.4%	35.9%	35.9%	35.9%
ACRU (medians)	56.2%	70.2%	74.0%	65.5%	88.1%	94.5%	41.4%	56.9%	63.5%	28.1%	58.6%	75.7%	41.0%	57.4%	64.2%	46.0%	70.7%	83.4%
Difference	9.4 %	23.4 %	27.2 %	-6.1 %	16.5 %	22.9 %	-29.2 %	-13.7 %	-7.1 %	-48.7 %	-18.2 %	-1.1 %	13.6 %	30.0 %	36.8 %	10.1 %	34.8 %	47.5 %
CSIR Curves	46.8%	46.8%	46.8%	71.6%	71.6%	71.6%	70.6%	70.6%	70.6%	76.8%	76.8%	76.8%	27.4%	27.4%	27.4%	35.9%	35.9%	35.9%
ACRU (means)	44.3%	55.8%	60.5%	48.0%	63.8%	71.8%	32.9%	44.3%	50.1%	22.3%	38.6%	47.9%	31.6%	43.3%	49.4%	32.9%	46.4%	54.4%
Difference	-2.5 %	9.0 %	13.7 %	-23.6 %	-7.8 %	0.2 %	-37.7 %	-26.3 %	-20.5 %	-54.5 %	-38.2 %	-28.9 %	4.2 %	15.9 %	22.0 %	-3.0 %	10.5 %	18.5 %

Of interest in Table 3.4 is the fact that, in general, for all soil depths greatest total flow reductions are caused by eucalypts followed by those of pines and then those of wattles in that order. Also, in eucalypts the greatest reductions (total and low flows) occur on medium depth soils while for the other two genera these occur on deep soils. Highest baseline (Acocks) streamflow (total and low flows) occurs on shallow soils followed by that on medium then on deep soils.

In relative terms (i.e. % from Table 3.5), greatest flow reductions (total and low) are caused, on average, by eucalypts followed by wattles and then pines in that order, for all soil depths. For all three genera streamflow reductions (total and low) are greatest on deep soils followed by those on medium and then on shallow soils. The order of genera resulting in greatest reductions is therefore dependent upon whether one uses actual mm reductions or % reductions. This is also true for the effect of soil depth. For example, on medium soils using absolute (mm) values the order of streamflow reductions is eucalypts followed by pines and then wattles, while using relative (%) values the order is eucalypts followed by wattles and then pines. In terms of soil depth for eucalypts using absolute (mm) values the order of streamflow reductions is medium then deep and then shallow, while using relative (%) values the order is deep then medium and then shallow.

From Table 3.6 it is evident that in most instances *ACRU*-simulated streamflow reductions (%) were greater than those calculated using the CSIR Curves, with the exception of reductions by pines (total and low flows on all three soil depths). Differences between the two estimation methods ranged from minimal (0.2%) to significant (54.5%) with the average difference being 22% (using median values) and 18.7% (using mean values).

Selected graphical representations of these results are also given below. Figures 3.4 to 3.6 illustrate median annual total flow reductions for eucalypts, pines and wattle on medium depth soils, while Figures 3.7 to 3.9 illustrate median annual low flow reductions for eucalypts, pines and wattle on medium depth soils. The data are colour-coded to indicate which climatic zone (*cf.* Figure 3.1) each Quaternary Catchment represents (i.e. red = Mpumalanga (including the Lowveld and Northern Province), blue = KwaZulu-Natal (including the escarpment), yellow = Zululand, and green = North Eastern Cape (including the Highveld, Eastern Free State, Lesotho, Western and Southern Cape)).

Two cases of *increases* in median annual total or low flows following afforestation occurred. The first was a single QC in Zululand (U50A) that showed an increase in median annual runoff following afforestation with wattle on shallow soil (Figure 3.10). The second case was for pines on shallow soils, in which 30 QCs exhibited increases in median annual low flows following afforestation (Figure 3.11).

Simulated streamflow reductions were also plotted spatially by means of GIS coverages in order to check for anomalies (e.g. significant differences in streamflow reduction between quaternary catchments with similar climatic and physiographic characteristics). Examples of these spatial representations of streamflow reductions are illustrated in Figures 3.12 and 3.13 (median annual total flow and low flow reductions in mm assuming 100% afforestation with eucalypts on medium depth soils), Figures 3.14 and 3.15 (median annual total flow and low flow reductions in mm assuming 100% afforestation with pines on medium depth soils) and Figures 3.16 and 3.17 (median annual total flow and low flow reductions in mm assuming 100% afforestation with wattles on medium depth soils).

Figures 3.18 to 3.20 compare *ACRU*-simulated median annual runoff (MdAR) under baseline (Acocks) conditions against streamflow reductions (in mm and %) for the three genera (eucs, pine and wattle) on medium soil depths. Observed SA catchment experiment results (as calculated by the regression equations of Scott *et al.*, 2000, and scaled up to represent 100% afforestation in the catchment) are plotted for comparative purposes.

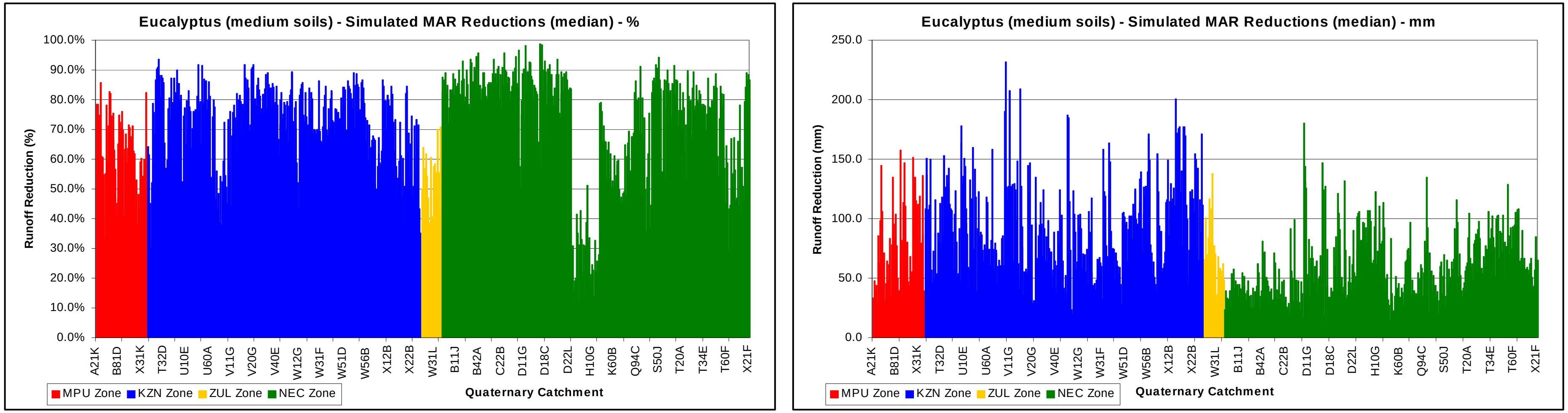


Figure 3.4 **Quaternary Catchment median annual total flow reductions in percentages (left) and mm (right) assuming 100% afforestation with eucalypts on medium depth soils.**

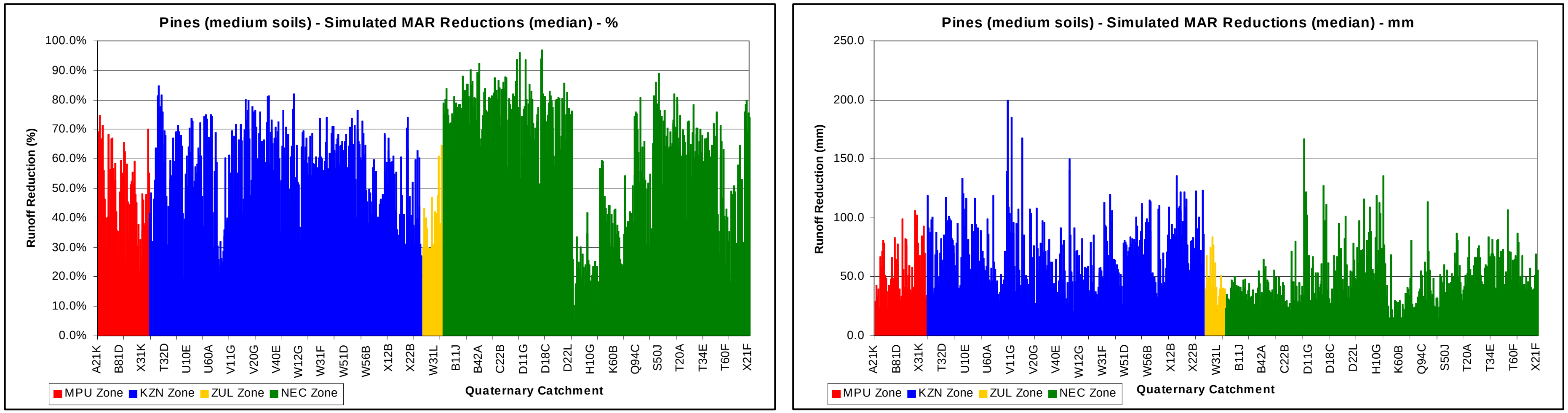


Figure 3.5 **Quaternary Catchment median annual total flow reductions in percentages (left) and mm (right) assuming 100% afforestation with pines on medium depth soils.**

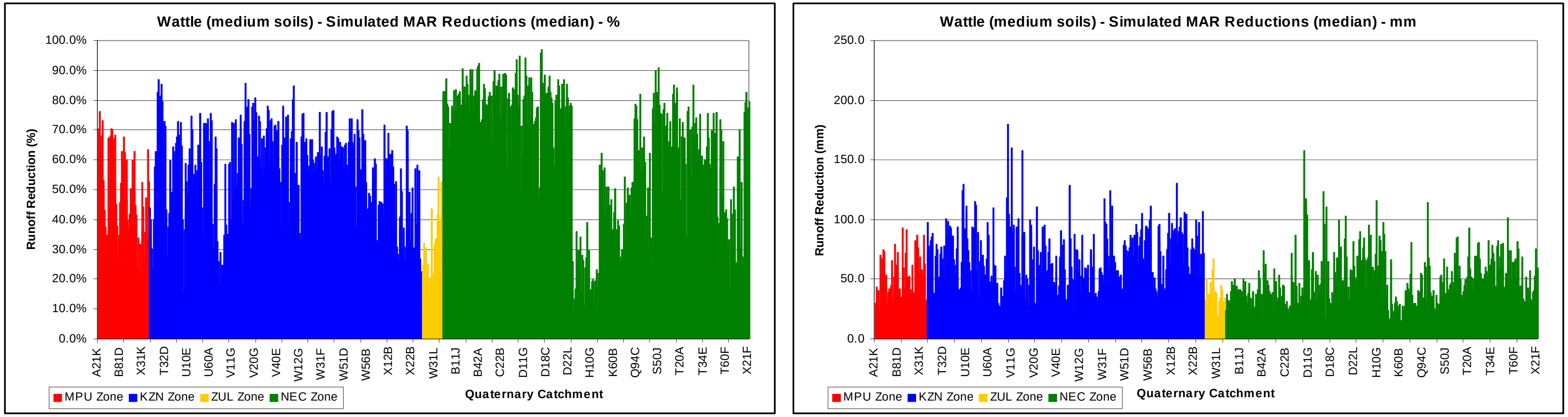


Figure 3.6 Quaternary Catchment median annual total flow reductions in percentages (left) and mm (right) assuming 100% afforestation with wattle on medium depth soils.

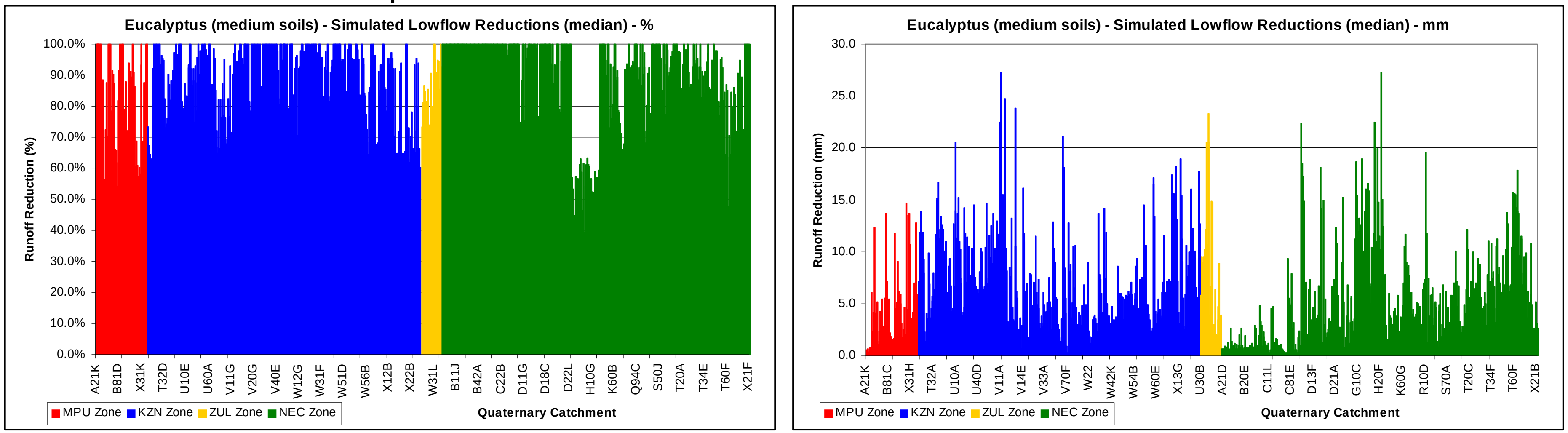


Figure 3.7 Quaternary Catchment median annual low flow reductions in percentages (left) and mm (right) assuming 100% afforestation with eucalypts on medium depth soils.

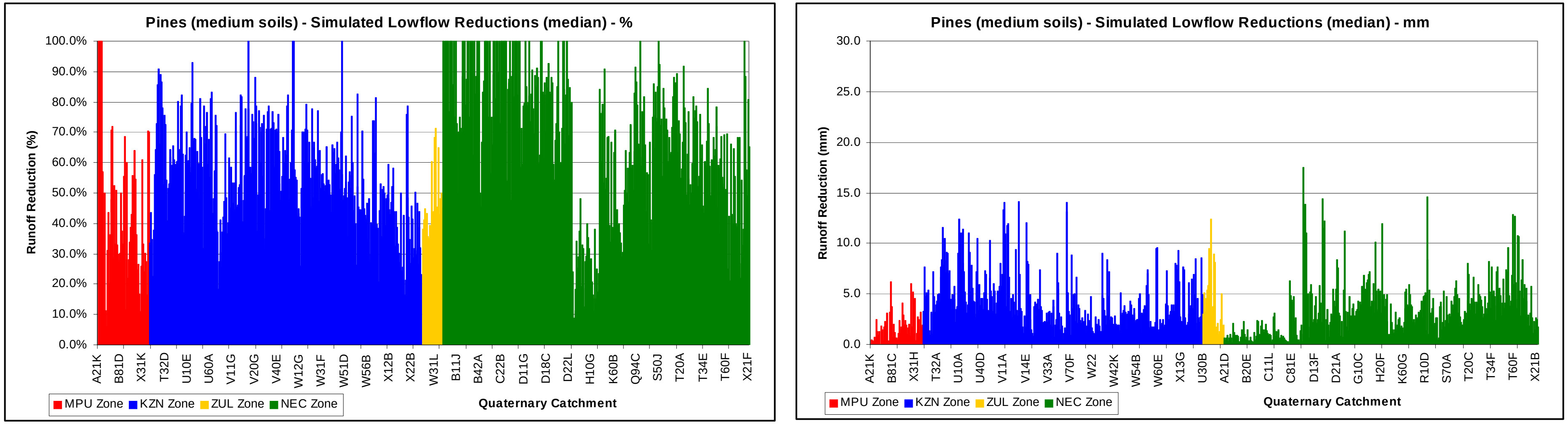


Figure 3.8 **Quaternary Catchment median annual low flow reductions in percentages (left) and mm (right) assuming 100% afforestation with pines on medium depth soils.**

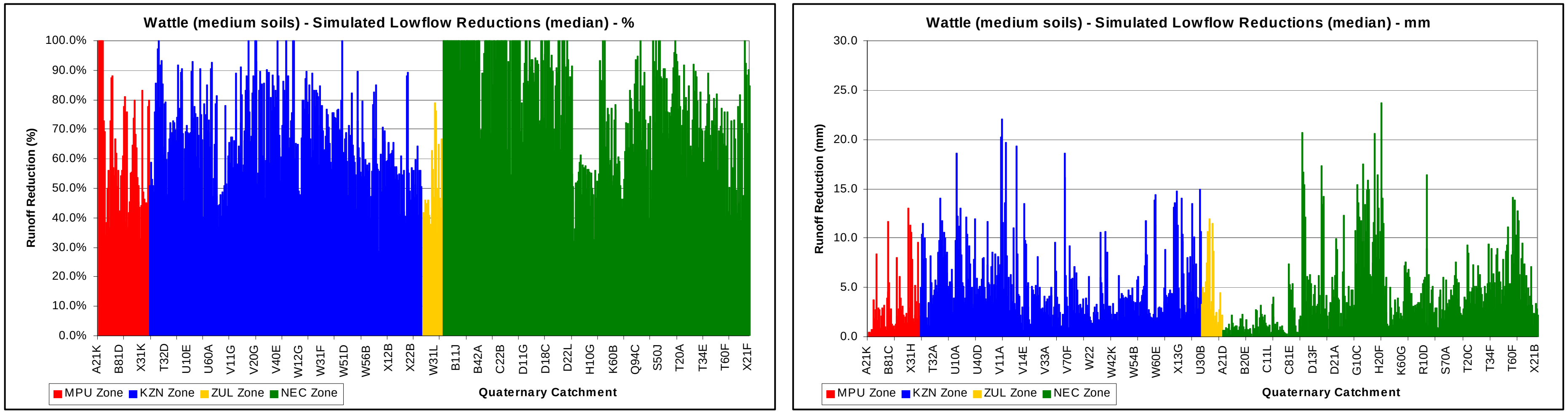


Figure 3.9 **Quaternary Catchment median annual low flow reductions in percentages (left) and mm (right) assuming 100% afforestation with wattle on medium depth soils.**

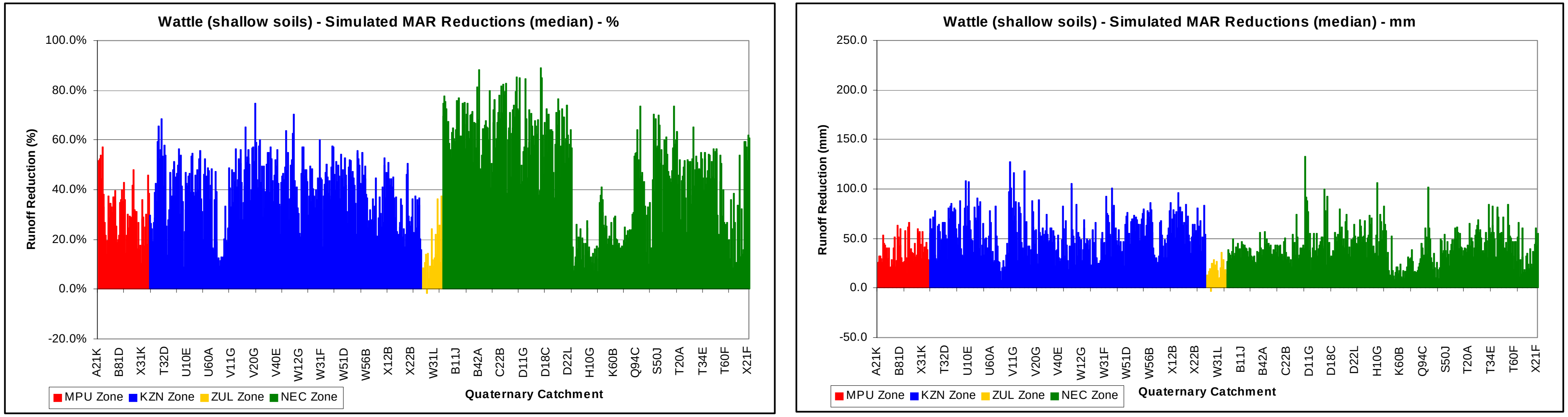


Figure 3.10 **Quaternary Catchment median annual total flow reductions in percentages (left) and mm (right) assuming 100% afforestation with wattle on shallow depth soils. Negative values indicate increases in low flows.**

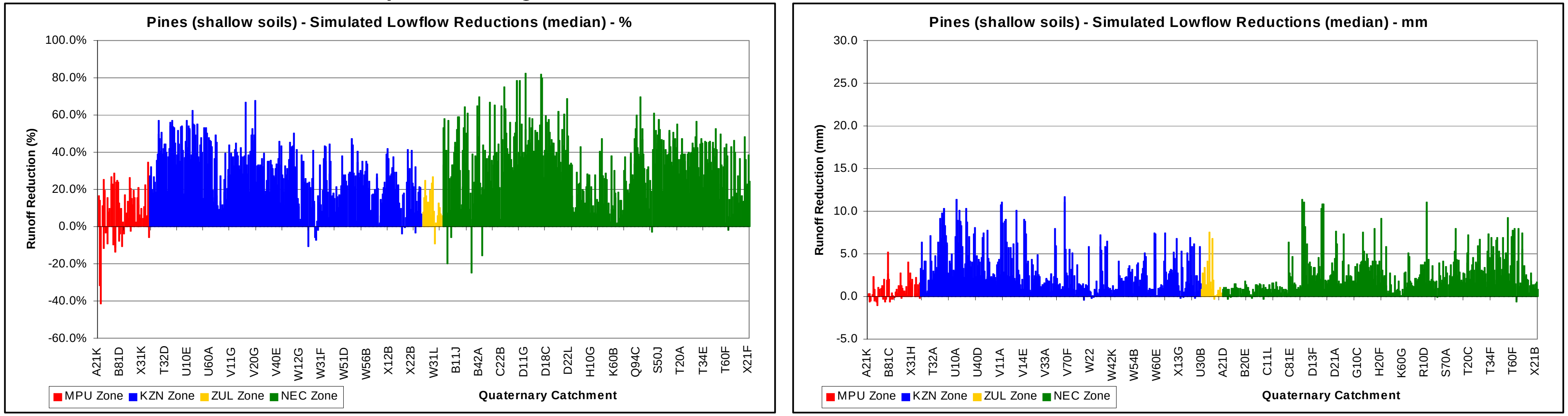


Figure 3.11 **Quaternary Catchment median annual low flow reductions in percentages (left) and mm (right) assuming 100% afforestation with pines on shallow depth soils. The negative values indicate increases in streamflow.**

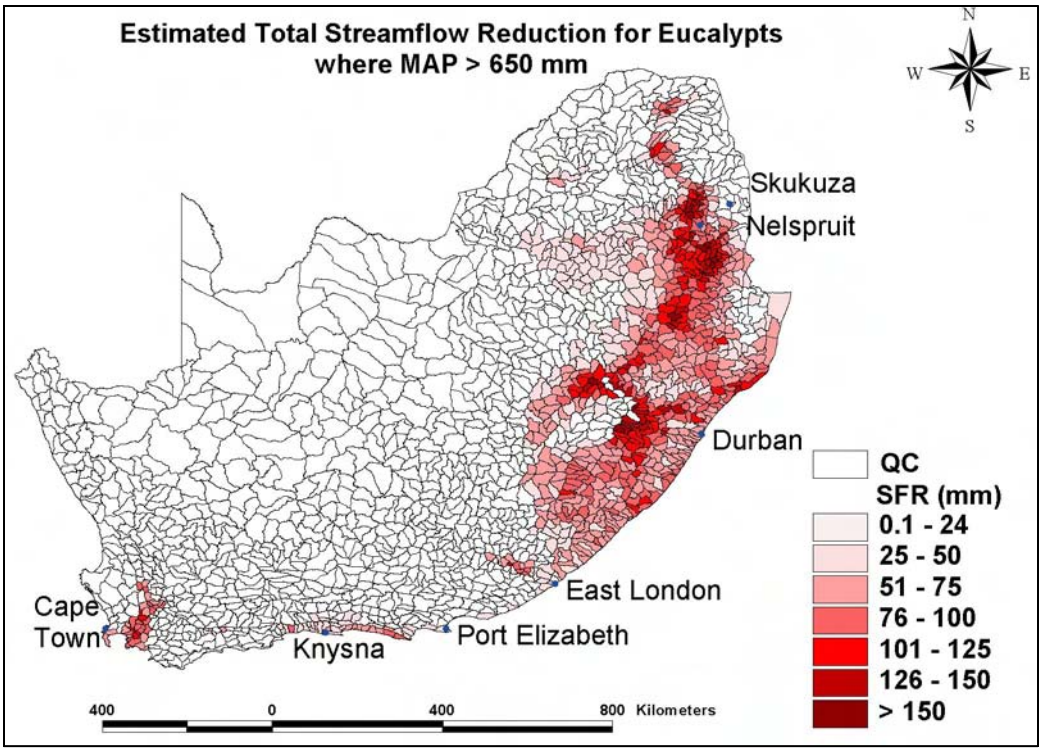


Figure 3.12 **Spatially distributed quaternary catchment median annual total flow reductions in mm assuming 100% afforestation with eucalypts on medium depth soils.**

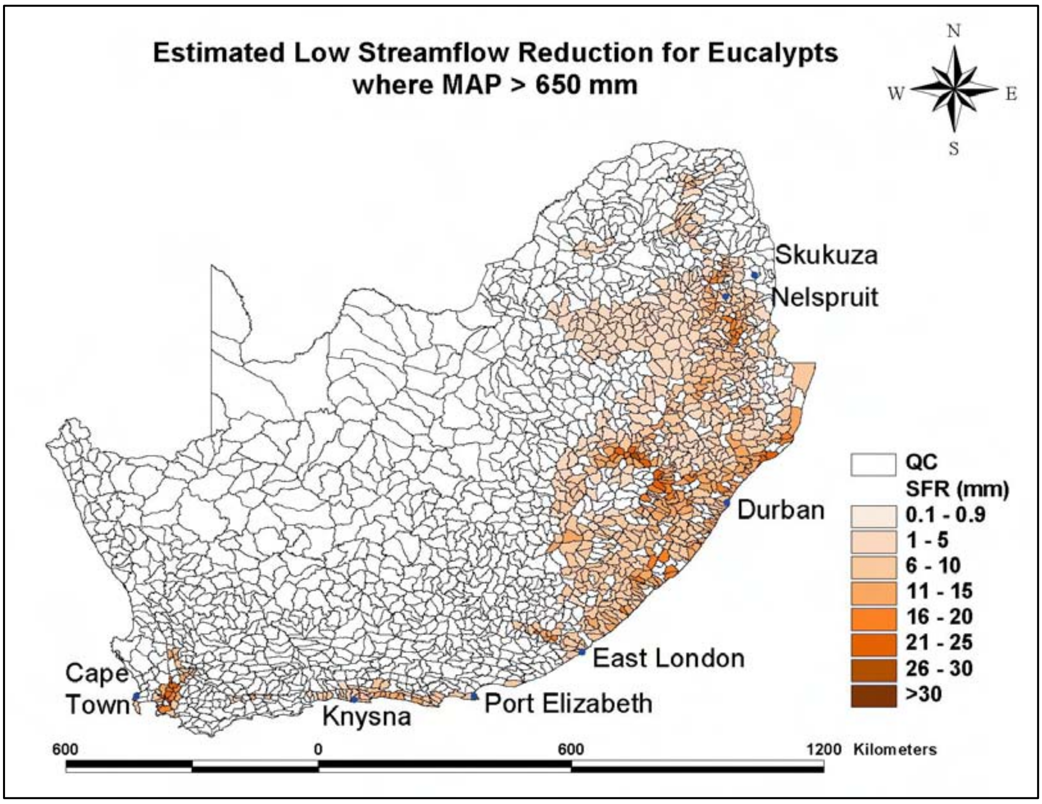


Figure 3.13 **Spatially distributed quaternary catchment median annual low flow reductions in mm assuming 100% afforestation with eucalypts on medium depth soils.**

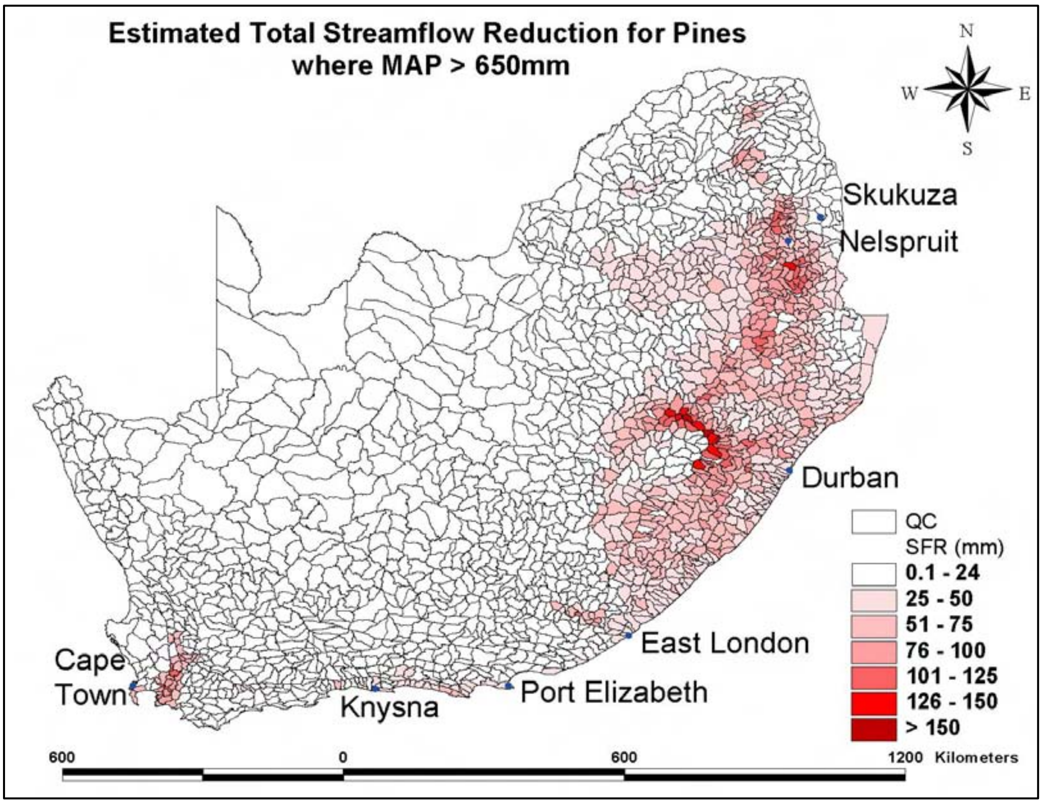


Figure 3.14 **Spatially distributed quaternary catchment median annual total flow reductions in mm assuming 100% afforestation with pines on medium depth soils.**

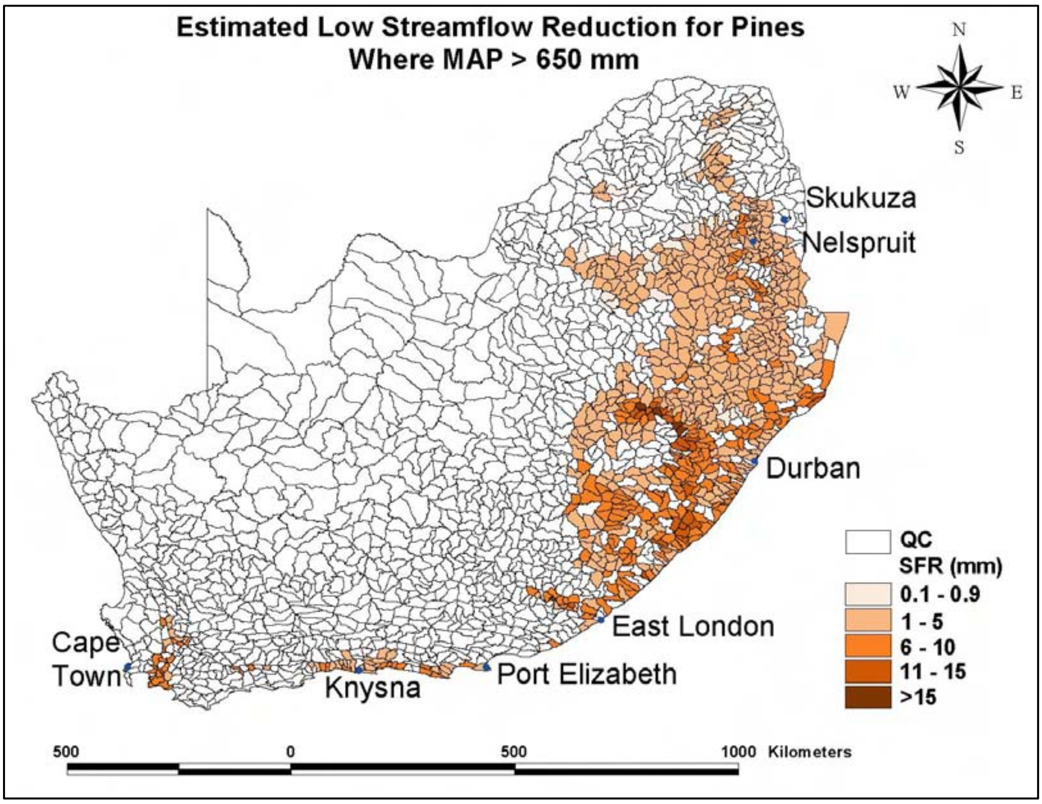


Figure 3.15 **Spatially distributed quaternary catchment median annual low flow reductions in mm assuming 100% afforestation with pines on medium depth soils.**

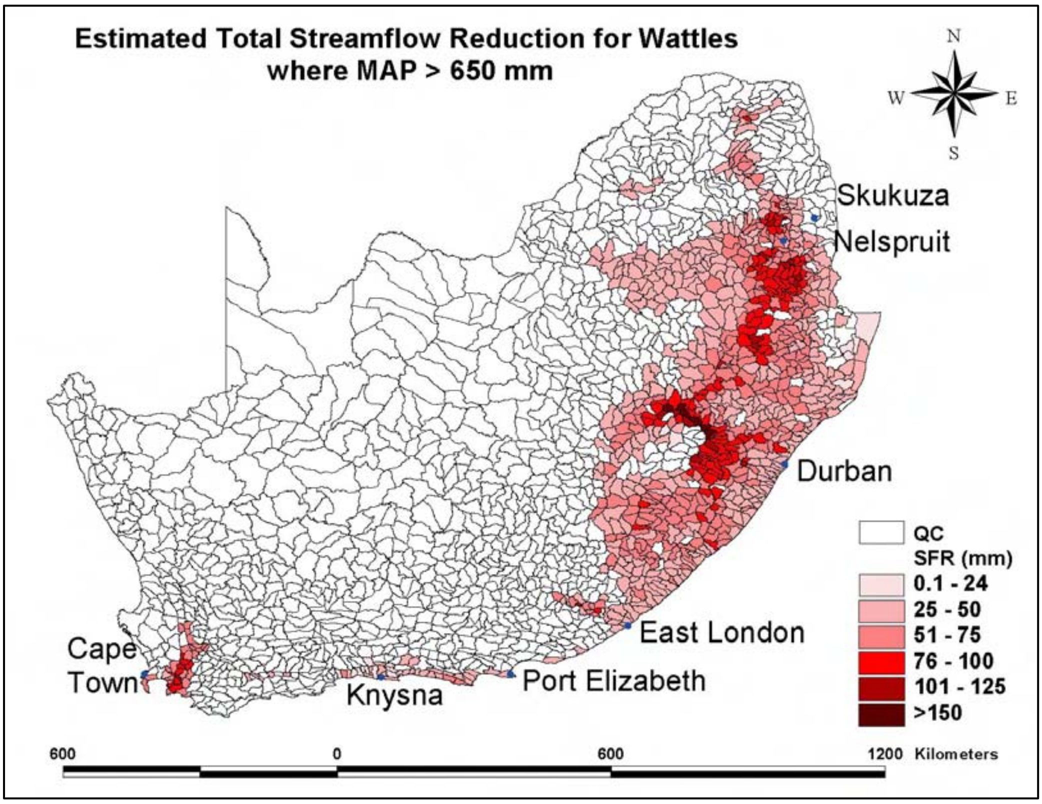


Figure 3.16 **Spatially distributed quaternary catchment median annual total flow reductions in mm assuming 100% afforestation with wattles on medium depth soils.**

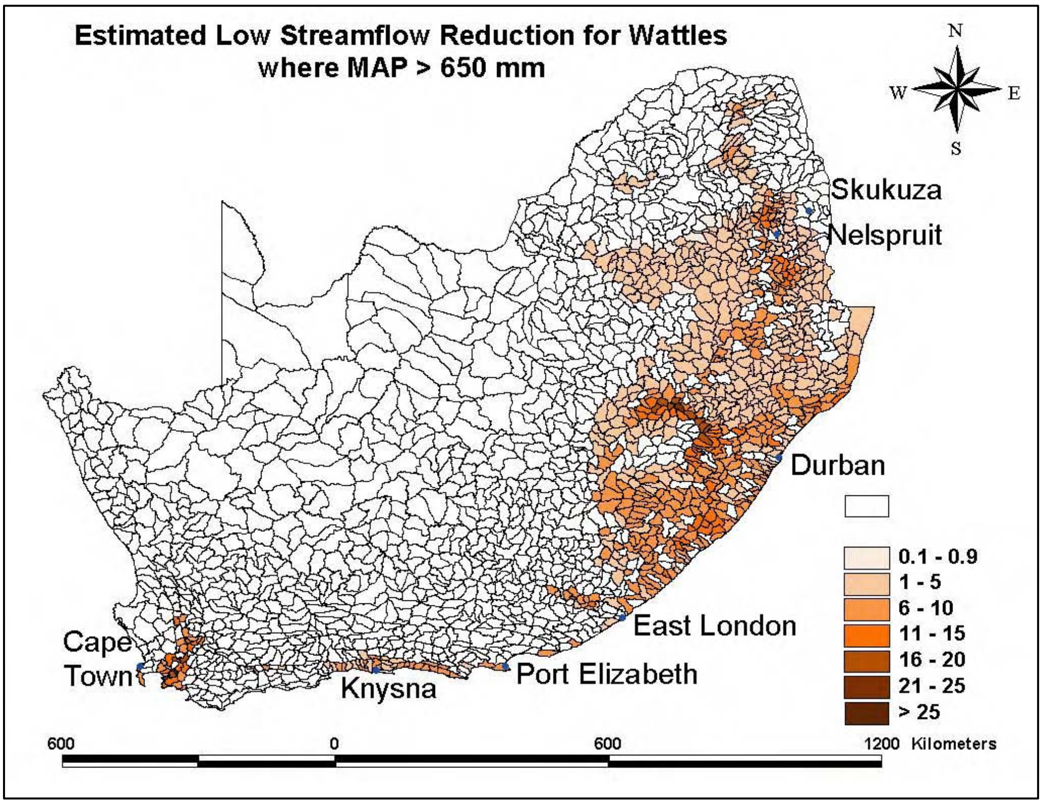
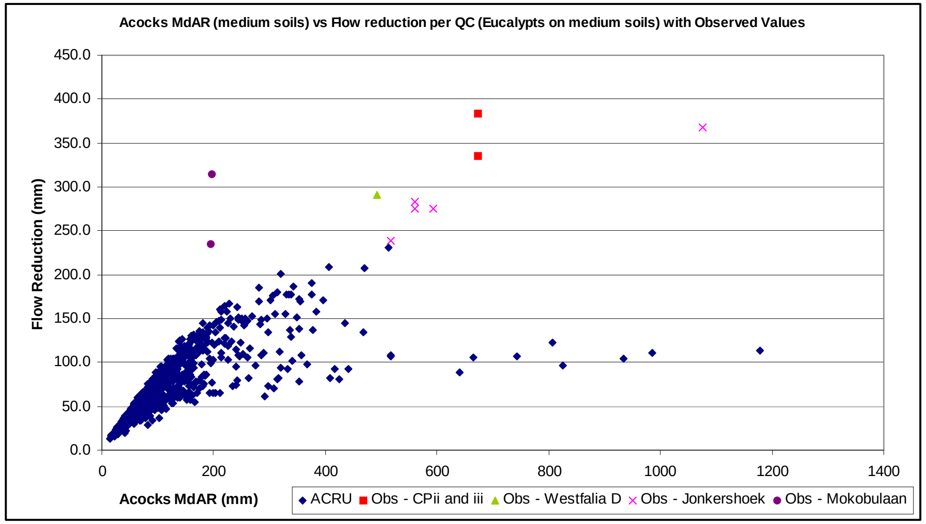


Figure 3.17 **Spatially distributed quaternary catchment median annual low flow reductions in mm assuming 100% afforestation with wattles on medium depth soils.**



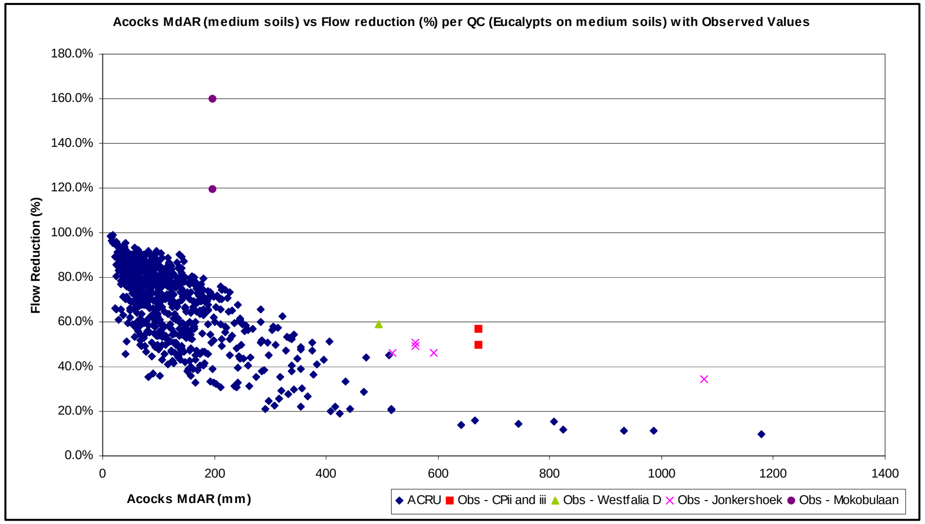
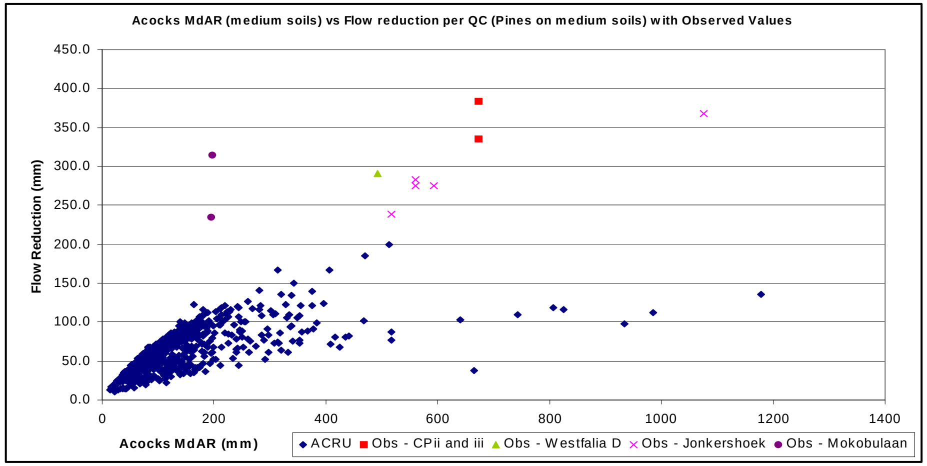


Figure 3.18 **Scatter plot of Acocks median annual runoff (medium depth soils) against streamflow reductions (in mm left and % right) under eucalypts on medium depth soils. Observed catchment experiment results are plotted for comparative purposes.**



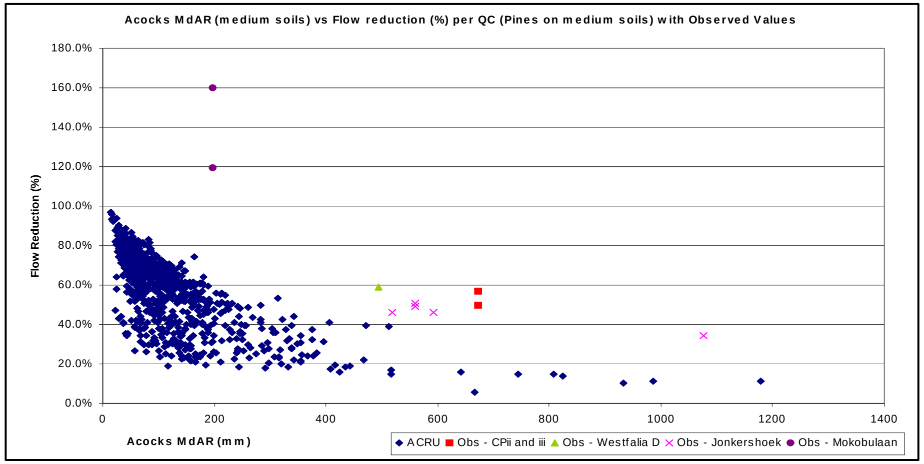
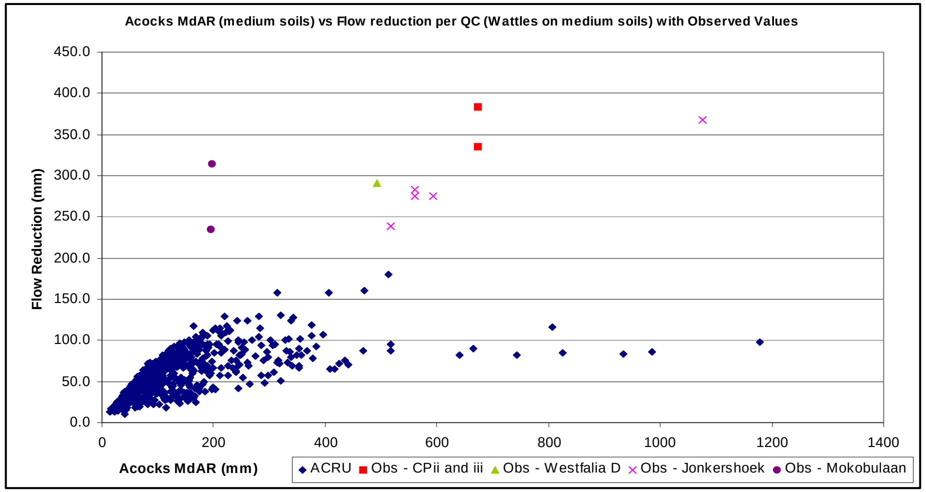


Figure 3.19 **Scatter plot of Acocks median annual runoff (medium depth soils) against streamflow reductions (in mm left and % right) under pines on medium depth soils. Observed catchment experiment results are plotted for comparative purposes.**



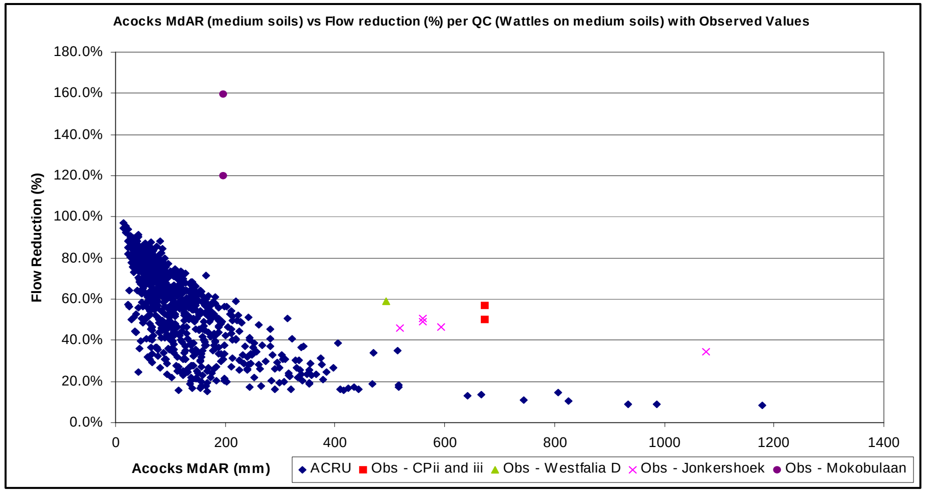


Figure 3.20 Scatter plot of Acocks median annual runoff (medium depth soils) against streamflow reductions (in mm left and % right) under wattles on medium depth soils. Observed catchment experiment results are plotted for comparative purposes.

For a baseline MdAR of up to 400mm the correlation between *ACRU*-simulated MdAR and SFR's is approximately linear with a broad range of scatter. After that the relationship appears to deviate from the trends suggested by the SFR regression equations by Scott *et al.*, 2000, based on the experimental catchments. It would be expected that SFR's would flatten out at some plateau (when the water use of the trees reaches a maximum), as shown by the Nänni Curves for example, but the point at which this occurs appears to differ between the two estimation techniques. The ceiling of SFRs is approximately 350mm using the catchment experiment regression equations, and between 100mm and 200mm using *ACRU*-simulated estimates. Values generated by *ACRU* are certainly influenced by location (if the MdAR's are ranked, all the ones over 400mm are in drainage regions G and H of the Western Cape), however there is still a large difference between those values and the Jonkershoek experimental catchment estimates. No values for SFRs by wattle are represented by the experimental catchments, but the differences between the two estimation methods are still significant for eucalypts and pines.

As a further comparative exercise, various inputs and outputs from the *ACRU* model were compared against similar information from the WR90 study by (Midgley *et al.*, 1994). Figure 3.21 compares the Quaternary Catchment MAP values used as input for the WR90 and *ACRU* modelling exercises.

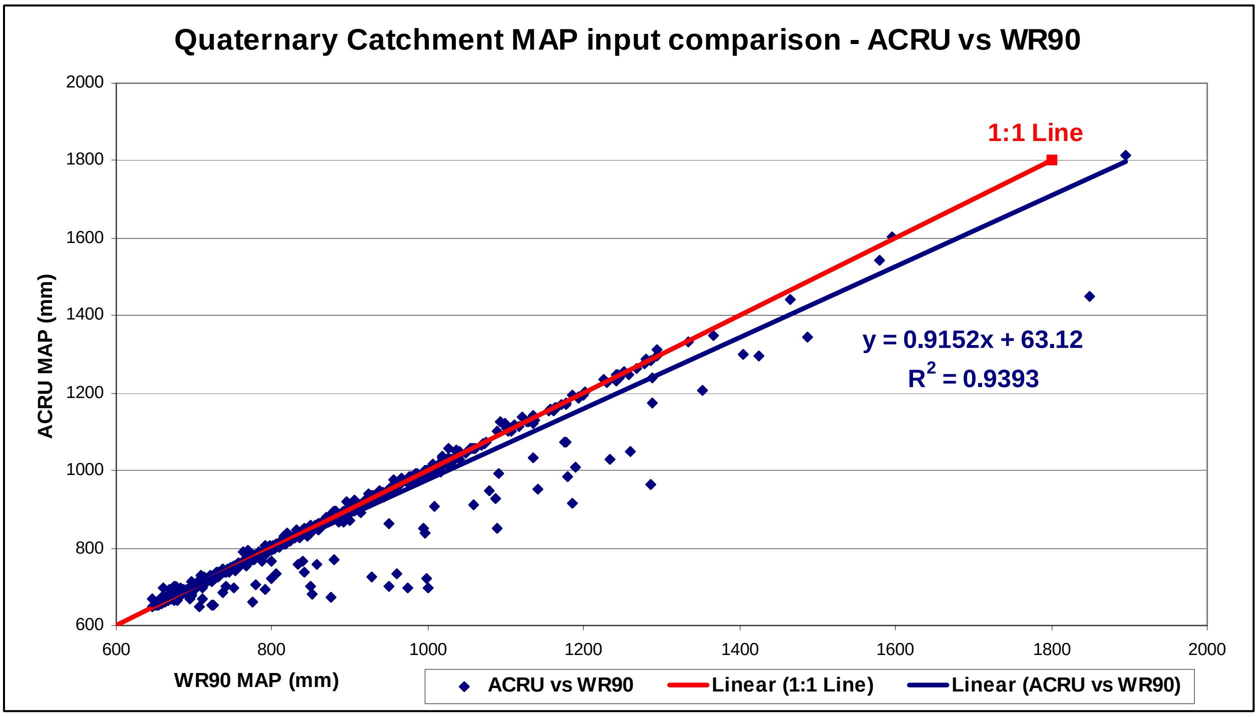


Figure 3.21 **Comparison of Mean Annual Precipitation (MAP) input for corresponding Quaternary Catchments used in this *ACRU* study and the WR90 study by Midgley *et al.* (1994).**

Analysis of Figure 3.21 reveals that the MAP values used for the majority of Quaternary Catchments were very similar for both modelling exercises (i.e. the scatter is closely associated with the 1:1 line). However for a number of the middle to high rainfall catchments, *ACRU* MAP values used were significantly lower than the WR90 values. This could be attributed to the different periods of record utilised to generate the MAP values for the two studies. Whereas the *ACRU* MAP values were derived from a 44-year daily rainfall record (1950 – 1993) assigned to each Quaternary Catchment (Meier and Schulze, 1995), the WR90 MAP values were calculated from existing records of varying lengths depending on the availability of reliable data for each particular Quaternary Catchment. Some of the effect of these lower *ACRU* MAP values is evident in Figure 3.22, which compares Median Annual Runoff (MdAR) values generated by *ACRU* (under Acocks veld types on medium depth soils, i.e. 0.9m) against Mean Annual Runoff (MAR) values calculated by the WR90 study for corresponding Quaternary Catchments.

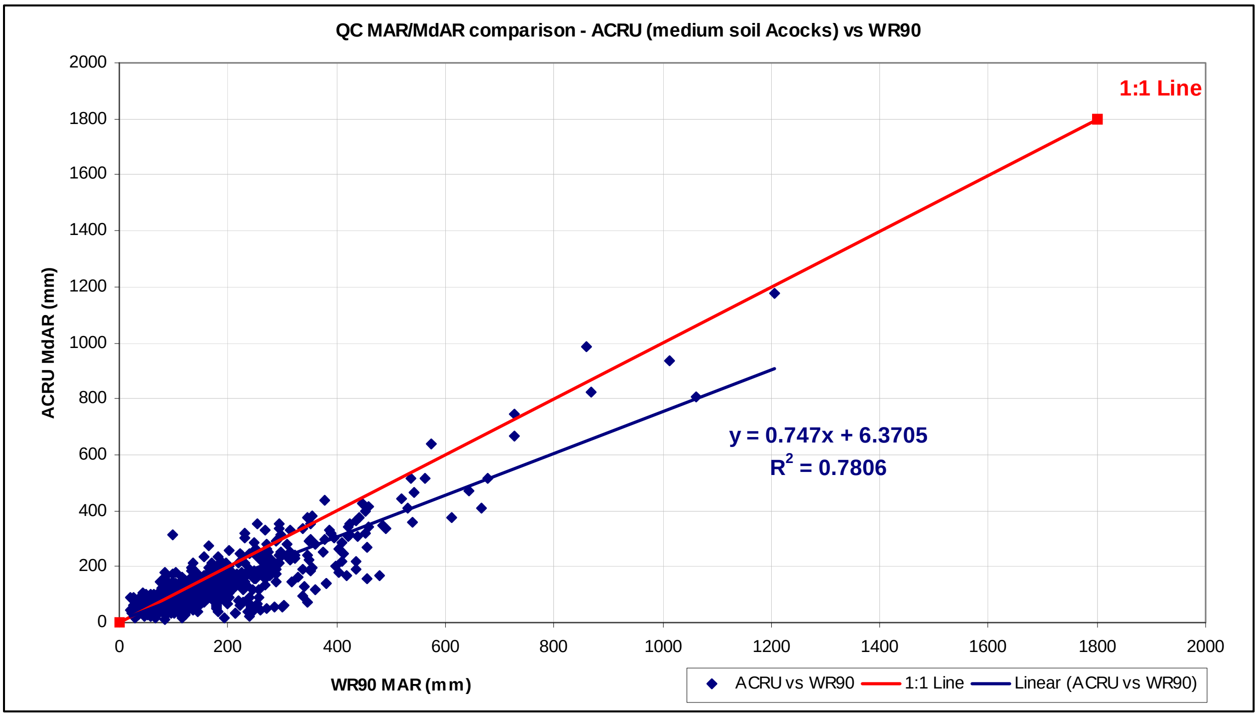


Figure 3.22 Modelled Mean Annual Runoff (MAR) outputs from the WR90 study by Midgley *et al.* (1994) against *ACRU*-modelled median annual runoff (MdAR) outputs (under Acocks veld types on medium depth soils) for corresponding Quaternary Catchments.

Firstly, it should be noted that the MAR / MdAR values generated by these two modelling techniques are not directly comparable due to the fundamentally different techniques utilised in calculating them (use of “naturalised flows” for the WR90 estimates, as opposed to the physical / conceptual modelling technique for the *ACRU* estimates). However, a comparison is still useful and does give an indication of how the estimations differ relative to each other and also indicates the presence of extreme outliers. In this regard relatively smaller MAR values are estimated by *ACRU* for the majority of catchments with the exception of the driest. What is encouraging is the acceptable overall correlation between the two estimation techniques (R^2 =0.7806) and the absence of any clear outliers. Finally, Figure 3.23 compares the use of mean and median total annual runoff values (for Acocks on medium soils) against each Quaternary Catchment’s corresponding MAP value. The clear distinction between catchments located in the G and H drainage regions of the Western Cape (upper line of points), and the remaining Quaternary Catchments is evident.

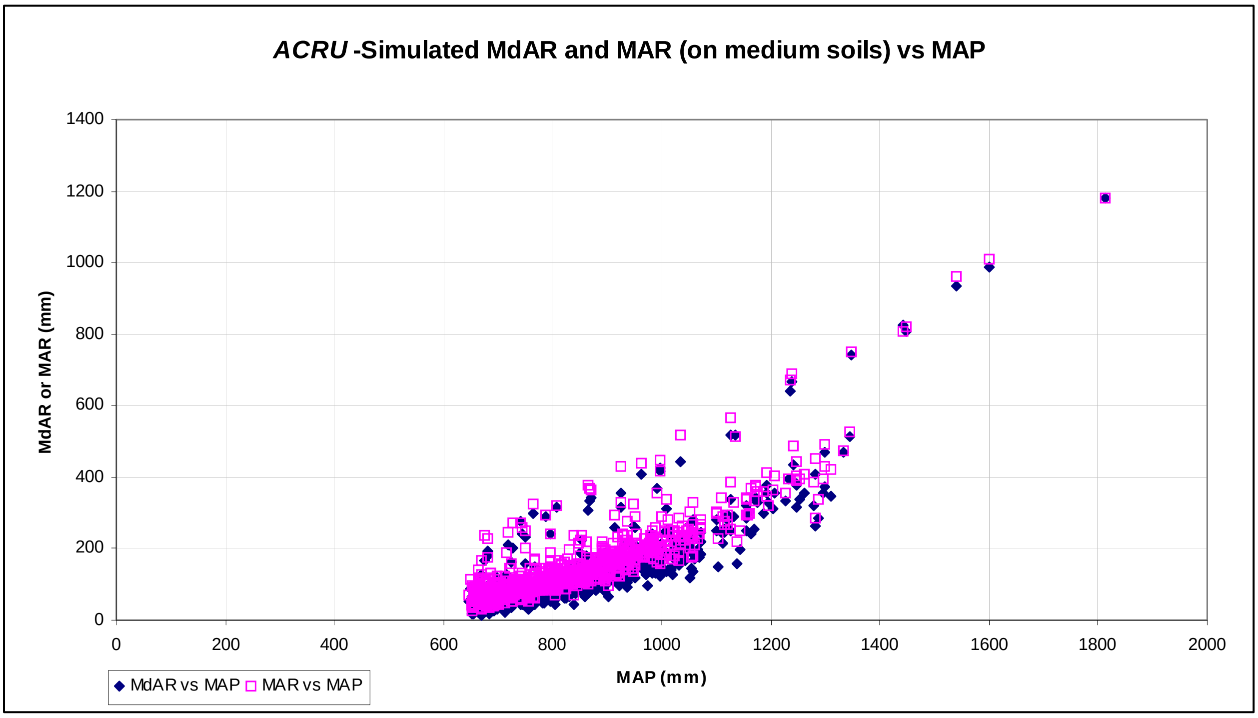


Figure 3.23 Comparison of *ACRU*-simulated estimates of mean annual runoff (MAR) and median annual runoff (MdAR) using Acocks' baseline land cover on medium depth soils against mean annual precipitation (MAP). The points on the upper line are all Quaternary Catchments within the G and H regions of the Western Cape.

4. CONCLUSIONS

The verification study, matching *ACRU* simulated flow to observed flow in afforested catchments, took a substantial amount of time and effort. This applied to catchments that are humid and well understood (i.e. theoretically easier to model). Nevertheless, some of the verifications were still not especially good, particularly those for the Jonkershoek experimental catchments in the Western Cape. The expectation is that as one moves to drier catchments, and situations where the forest hydrology is less well understood, so the risks of erroneous predictions will increase. However, strict terms of reference for the project, as well as budgetary and time constraints necessitated a pragmatic approach in order to conclude this project.

The majority of the total flow simulations generated a coefficient of determination (R^2) of above 0.75, which could be considered reasonable bearing in mind the very small size of the catchments. The treated catchment of Westfalia D was slightly below this R^2 value but the result is still encouraging considering that the catchment dried up completely for a number of years. The Ntabamhlope and Cedara simulations, however, were poor. This could partly be attributed to some low quality and / or missing data for these catchments and the short period of record. It should be borne in mind that the statistical results of the total flow simulations are enhanced by the greater opportunity for cancellation of errors over the course of the year. Simulations of low flows were less successful and tended to be under-estimated generally but overestimated during severe droughts or when the catchment dried up completely. An example that illustrates the satisfactory simulation of streamflow trends and totals for a control catchment is that of Westfalia B, however weaknesses in the simulation of low flows are also revealed, particularly in the afforested catchment (Westfalia D). Low flows are underestimated in the dry season but overestimated during the period when streamflow dried up in the catchment. In terms of streamflow volumes generated by the simulations, two-thirds of all the simulations generated greater total flow than had been observed, although regular undersimulation of the low flows was often evident. The exceptions to this were the Cathedral Peak and Cedara simulations, which underestimated all streamflow. In cases where streamflow was overestimated, this was due largely to the significant oversimulation of wet season flows. Furthermore, in catchments where observed streamflow dried up completely (specifically Westfalia D and Ntabamhlope), *ACRU* simulations still continued to generate streamflow. This illustrates a weakness in *ACRU* to account for the full storage capacity of soils, and hence their capacity to absorb rainfall following extended drying. Further evidence of this is seen in the figures comparing soil moisture estimations at Ntabamhlope, and evapotranspiration estimations at Seven Oaks. At Ntabamhlope, simulated soil moisture levels were reduced to a threshold value while observed soil moisture trends continued to decline as the trees matured. At Seven Oaks, measured transpiration by the trees was undersimulated by more than half resulting in overestimation of available water (streamflow). This again suggests a weakness in the ability of *ACRU* to account for the large storage capacity of the soil profile and the year-to-year carry-over of water storage or usage. Therefore, amounts of water used in evaporation are limited by current rainfall.

With reference to the extrapolation phase of the project, misgivings were initially expressed as to the appropriateness of a general application of *ACRU* to all Quaternary Catchments using generalised databases. This was perceived as a wholesale adjustment to the verified situations, which had utilised the highest quality, most detailed input data available. It was, in fact, not possible to transfer much of the experience gained in the verification phase to the extrapolation phase because of the different nature of the simulations. This was firstly because of the different scales (catchment to QC), different simulation modes (distributed to lumped), different input data (detailed to default) and the fact that a dynamic file was used in the verifications but not in the QC simulations (due to the assumption of even stand age distribution and the use of a single representative year in the QCs). Much detail was incorporated in the dynamic files used in the verification exercise to simulate changes in the catchment such as tree growth, planting/thinning/felling periods, loss of leaf area due to *Euproctis terminalis* at Cathedral Peak, vegetation changes in riparian zones, etc. Practicalities prevailed, however, on this issue and the extrapolation exercise enabled the calculation of individualised runoff reduction figures for the three primary commercial forestry genera over three potential soil depths for all Quaternary Catchments with afforestation potential. Results of the Quaternary Catchment simulations were plotted for each tree genus and soil depth, which illustrated streamflow reductions in percentages and actual millimetres. Reductions were calculated for both total flows as well as low flows. Both mean and median runoff data were plotted to assess the difference between them, however median values were selected for the final streamflow reduction calculations. This was because median values were deemed to be most characteristic of long-term fluctuations in streamflow as they minimised the influence of extreme events. Although confidence in these estimates remains low, they do represent a working solution for immediate application and may be improved upon with further work. Verification work on wattle remains a priority and is something that needs to be given attention once evapotranspiration and streamflow data become available.

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6. APPENDICES

6.1 Quaternary catchment streamflow reduction tables – median values

The following tables represent median reductions in streamflow within selected Quaternary Catchments across South Africa following complete afforestation with one of three primary commercial forestry tree genera. For each Quaternary Catchment (QC) number given at the far left of the table there are columns of general information (area in hectares, Mean Annual Precipitation and *ACRU*-simulated Acocks baseline streamflow) followed by 18 possible streamflow reduction values. These are represented by abbreviations at the top of the table which indicate the following:

Abbreviation	Interpretation
QC	Quaternary Catchment no.
AREA	Quaternary Catchment area (ha)
MAP	Quaternary Catchment Mean Annual Precipitation (mm)
ASTF	Acocks baseline vegetation on shallow soils – Median Annual Total Flow (mm)
AMTF	Acocks baseline vegetation on medium soils – Median Annual Total Flow (mm)
ADTF	Acocks baseline vegetation on deep soils – Median Annual Total Flow (mm)
ASLF	Acocks baseline vegetation on shallow soils – Annual Low Flow (driest three months - mm)
AMLF	Acocks baseline vegetation on medium soils – Annual Low Flow (driest three months - mm)
ADLF	Acocks baseline vegetation on deep soils – Annual Low Flow (driest three months - mm)
ESTFR	Eucalypts on shallow soils – Median Annual Total Flow Reductions (mm)
EMTFR	Eucalypts on medium soils - Median Annual Total Flow Reductions (mm)
EDTFR	Eucalypts on deep soils – Median Annual Total Flow Reductions (mm)
ESLFR	Eucalypts on shallow soils – Annual Low Flow Reductions (driest three months - mm)
EMLFR	Eucalypts on medium soils – Annual Low Flow Reductions (driest three months - mm)
EDLFR	Eucalypts on deep soils – Annual Low Flow Reductions (driest three months - mm)
PSTFR	Pines on shallow soils – Median Annual Total Flow Reductions (mm)
PMTFR	Pines on medium soils - Median Annual Total Flow Reductions (mm)
PDTFR	Pines on deep soils – Median Annual Total Flow Reductions (mm)
PSLFR	Pines on shallow soils – Annual Low Flow Reductions (driest three months - mm)
PMLFR	Pines on medium soils – Annual Low Flow Reductions (driest three months - mm)
PDLFR	Pines on deep soils – Annual Low Flow Reductions (driest three months - mm)
WSTFR	Wattle on shallow soils – Median Annual Total Flow Reductions (mm)
WMTFR	Wattle on medium soils - Median Annual Total Flow Reductions (mm)
WDTFR	Wattle on deep soils – Median Annual Total Flow Reductions (mm)
WSLFR	Wattle on shallow soils – Annual Low Flow Reductions (driest three months - mm)
WMLFR	Wattle on medium soils – Annual Low Flow Reductions (driest three months - mm)
WDLFR	Wattle on deep soils – Annual Low Flow Reductions (driest three months - mm)

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
A21A	48187	683.3	35.7	28.6	28.5	1.5	0.6	0.4	28.0	23.7	25.0	1.3	0.6	0.4	24.4	22.5	23.0	0.8	0.6	0.4	26.7	23.4	23.4	1.2	0.6	0.4
A21B	52652	672.0	54.9	44.7	43.0	1.2	0.3	0.0	45.3	39.2	37.6	0.9	0.3	0.0	38.3	35.3	35.7	0.4	0.3	0.0	38.3	37.1	36.9	0.8	0.3	0.0
A21C	76096	695.1	44.0	39.9	36.0	1.9	0.6	0.3	34.4	32.0	28.3	1.6	0.6	0.3	32.9	30.1	27.8	1.1	0.5	0.3	34.1	30.0	27.9	1.4	0.6	0.3
A21D	37155	712.6	46.3	38.9	36.5	1.7	0.6	0.0	38.1	33.7	31.5	1.6	0.6	0.0	32.4	31.2	30.3	0.7	0.6	0.0	35.0	32.3	30.7	1.2	0.6	0.0
A21E	28982	710.0	45.4	36.8	30.9	2.7	0.9	0.2	38.2	32.8	27.0	2.4	0.9	0.2	32.0	30.8	26.5	1.1	0.9	0.2	32.9	32.1	26.3	1.6	0.9	0.2
A21F	100020	676.7	44.8	36.8	36.8	1.4	0.3	0.0	34.7	30.1	30.1	1.1	0.3	0.0	28.2	28.3	28.4	0.1	0.3	0.0	29.7	29.0	29.0	0.7	0.3	0.0
A21G	16052	695.7	63.7	52.5	44.8	1.5	0.8	0.2	42.8	39.6	33.6	0.9	0.8	0.2	38.7	40.4	32.7	-0.3	0.6	0.2	36.6	39.5	31.9	0.4	0.8	0.2
A21H	51372	668.1	33.7	29.1	29.1	1.4	0.3	0.0	25.6	24.7	25.3	1.2	0.3	0.0	21.5	21.7	24.2	0.8	0.3	0.0	22.7	22.6	24.1	1.1	0.3	0.0
A21K	86415	652.4	41.8	32.3	30.4	0.8	0.2	0.0	31.5	27.9	26.1	0.7	0.2	0.0	25.4	24.8	23.9	0.1	0.2	0.0	23.7	25.0	24.6	0.3	0.2	0.0
A22G	49859	655.2	50.0	42.1	42.0	1.8	0.5	0.1	32.5	33.0	32.9	1.2	0.5	0.1	26.2	29.1	31.9	0.3	0.5	0.1	25.8	29.6	32.2	0.7	0.5	0.1
A22H	57866	660.6	50.6	41.1	34.8	2.1	0.4	0.0	34.0	32.3	26.1	1.5	0.4	0.0	30.8	30.7	26.7	0.3	0.4	0.0	26.6	31.3	25.7	0.5	0.4	0.0
A23A	68239	698.3	85.0	74.7	68.6	3.1	1.3	0.3	58.0	53.8	47.9	2.4	1.3	0.3	48.2	47.1	44.5	0.8	1.0	0.3	49.9	47.8	45.4	1.4	1.3	0.3
A23D	14482	647.0	58.2	52.5	50.5	2.3	0.6	0.1	37.2	40.6	38.6	1.7	0.6	0.1	31.6	37.7	39.0	0.2	0.6	0.1	32.6	37.9	38.2	0.8	0.6	0.1
A23E	49044	703.0	67.3	64.2	59.3	1.7	0.2	0.0	47.5	48.1	44.4	1.2	0.2	0.0	29.9	44.6	44.3	-0.1	0.2	0.0	35.5	44.8	44.1	0.3	0.2	0.0
A42B	52160	675.1	69.4	65.2	60.9	1.9	0.6	0.2	43.3	47.4	43.1	1.1	0.6	0.2	33.0	42.7	43.1	-0.6	0.1	0.2	32.6	43.1	42.5	0.1	0.5	0.2
A42C	69834	660.3	59.4	53.1	52.1	1.2	0.3	0.0	40.2	38.6	37.7	0.7	0.3	0.0	31.9	33.3	36.0	-0.5	0.3	0.0	32.0	33.4	36.2	0.0	0.3	0.0
A42D	49660	669.4	67.0	59.0	53.6	2.2	0.7	0.3	42.1	44.1	39.5	1.5	0.7	0.3	32.6	39.4	37.3	0.0	0.7	0.3	29.7	40.2	37.1	0.5	0.7	0.3
A50A	29777	655.7	45.8	33.5	31.9	1.8	0.7	0.3	36.9	28.7	28.0	1.5	0.7	0.3	26.1	23.9	27.0	0.2	0.4	0.3	26.2	24.5	26.5	0.6	0.7	0.3
A80A	28737	939.9	161.1	143.3	126.1	9.0	7.1	5.8	74.8	85.5	70.9	5.0	6.1	5.5	53.3	66.9	57.5	2.3	2.5	3.6	53.4	70.2	62.3	4.2	3.7	4.7
A80B	25132	663.6	116.8	103.5	90.0	4.3	2.2	1.0	47.7	62.9	54.9	1.2	1.9	1.0	46.8	58.1	48.3	-0.5	0.8	0.4	44.7	54.9	45.4	0.5	1.6	0.7
A91A	23230	711.5	108.8	93.3	83.3	4.6	2.6	1.5	46.4	56.6	52.4	2.6	2.3	1.5	30.1	43.1	42.8	0.9	1.3	0.9	29.3	40.0	46.2	1.8	1.8	1.2
A91C	24966	862.9	198.8	179.1	161.9	8.8	7.9	6.9	60.2	98.3	87.4	3.1	4.2	5.9	49.8	71.7	79.7	-0.3	0.9	1.3	43.3	67.0	82.1	2.1	2.7	2.6
A91D	13238	1241.0	460.5	435.3	410.2	23.2	21.8	20.6	98.5	144.9	162.5	9.5	12.3	12.9	47.7	80.5	98.6	-0.6	1.3	3.5	39.2	75.0	101.2	7.2	8.4	10.5
A91E	22309	949.8	289.0	260.7	244.5	11.8	8.4	6.7	71.4	106.0	116.2	4.2	4.1	5.4	54.5	78.2	98.4	-1.1	0.0	1.2	40.8	73.4	100.3	3.2	1.6	1.9
A91G	40578	863.8	147.1	127.6	110.5	7.0	5.8	4.4	49.7	70.3	70.0	3.3	4.2	4.2	33.1	51.4	64.9	1.1	1.8	2.3	28.8	44.5	61.9	2.1	2.9	2.7
A91H	44989	651.7	79.3	67.5	61.8	3.8	1.6	0.8	44.1	52.7	49.4	1.9	1.4	0.8	32.7	46.0	45.7	0.3	0.7	0.5	29.8	45.4	44.3	1.0	0.9	0.6
A92A	32887	838.6	142.1	120.4	111.4	9.1	7.4	6.1	59.4	71.2	63.4	4.0	5.2	5.7	43.2	48.5	54.8	0.9	1.5	2.8	40.5	53.1	59.2	2.8	2.7	3.4

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
B11A	94538	699.5	79.8	69.5	59.9	3.7	2.6	1.1	48.6	57.9	50.3	2.5	2.6	1.1	39.1	50.3	45.8	1.0	2.1	1.1	41.7	50.0	46.6	1.8	2.2	1.1
B11B	43533	687.1	57.1	49.6	45.2	2.7	0.9	0.3	43.0	41.0	36.6	2.4	0.9	0.3	34.3	37.3	35.0	0.9	0.9	0.3	35.9	38.7	35.7	1.5	0.9	0.3
B11C	38544	673.2	69.5	57.8	50.9	3.0	1.4	0.5	53.4	48.1	41.6	2.5	1.4	0.5	44.9	42.8	38.3	1.0	1.2	0.5	45.2	44.1	39.4	1.7	1.4	0.5
B11D	55093	671.1	59.1	47.3	43.6	2.5	0.9	0.3	43.9	42.0	38.4	2.4	0.9	0.3	35.9	38.4	36.8	1.0	0.9	0.3	35.8	39.4	37.0	1.6	0.9	0.3
B11E	46670	681.7	64.5	53.8	45.6	3.3	1.0	0.3	44.7	43.8	37.4	2.8	1.0	0.3	38.0	41.1	35.4	1.5	0.7	0.3	38.4	41.0	35.5	2.2	1.0	0.3
B11F	42831	690.7	67.4	55.3	47.3	3.5	1.2	0.4	46.4	44.5	38.5	3.0	1.2	0.4	39.6	42.1	36.6	1.5	0.9	0.4	40.0	41.4	36.8	2.1	1.1	0.4
B11G	36781	692.6	48.0	39.3	39.1	2.0	0.6	0.3	37.8	34.2	34.0	1.7	0.6	0.3	30.3	31.0	32.6	0.8	0.6	0.3	30.8	32.8	32.7	1.3	0.6	0.3
B11H	24599	694.5	62.3	53.2	50.3	2.1	1.1	0.3	50.5	44.8	43.0	1.8	1.1	0.3	43.6	41.2	40.5	1.1	0.8	0.3	47.3	40.8	41.3	1.4	1.1	0.3
B11J	26936	681.1	57.6	48.3	42.6	1.7	0.6	0.3	47.9	40.8	36.4	1.4	0.6	0.3	42.1	37.4	34.4	1.0	0.3	0.3	43.4	39.3	35.0	1.3	0.6	0.3
B11K	37833	683.8	57.4	48.1	41.4	1.7	0.6	0.3	47.7	40.6	35.3	1.4	0.6	0.3	42.7	37.3	33.1	1.0	0.3	0.3	44.1	39.4	33.9	1.4	0.6	0.3
B11L	24178	690.5	54.1	43.9	33.7	2.2	1.0	0.1	37.9	37.5	27.4	1.5	1.0	0.1	30.8	34.4	25.5	0.0	0.7	0.1	30.5	35.1	25.3	0.5	1.0	0.1
B12A	40528	671.7	70.0	60.4	50.8	3.3	2.0	1.0	57.3	54.3	46.3	2.6	2.0	1.0	43.6	47.4	42.4	1.0	1.5	1.0	43.0	50.1	44.7	1.4	1.8	1.0
B12B	65849	696.4	61.9	51.2	45.8	2.2	0.7	0.3	46.7	41.9	37.3	1.9	0.7	0.3	40.9	39.5	36.0	0.2	0.5	0.3	38.1	40.1	35.8	0.8	0.7	0.3
B12C	52900	706.3	66.2	53.3	47.5	2.6	1.0	0.4	48.8	43.5	37.9	2.0	1.0	0.4	42.8	40.7	36.2	0.3	0.7	0.4	40.7	40.6	36.9	1.0	1.0	0.4
B12D	36227	703.1	70.2	59.2	49.6	3.7	2.6	1.3	47.2	51.2	42.1	2.4	2.6	1.3	40.9	47.7	39.5	0.8	2.3	1.3	39.9	47.8	39.4	1.5	2.3	1.3
B12E	43583	696.5	49.3	39.6	31.4	2.2	1.0	0.3	40.7	36.9	28.7	1.9	1.0	0.3	33.7	34.9	27.4	0.9	1.0	0.3	36.8	35.9	27.7	1.5	1.0	0.3
B20A	57428	661.5	43.6	37.5	33.1	1.5	0.5	0.3	34.7	31.2	26.8	1.4	0.5	0.3	32.6	29.5	25.9	0.8	0.5	0.3	31.4	29.6	25.6	0.9	0.5	0.3
B20B	32154	666.7	54.4	45.4	40.3	2.8	0.7	0.3	44.8	39.5	34.7	2.5	0.7	0.3	38.2	37.8	32.7	1.8	0.7	0.3	40.9	38.3	33.4	2.2	0.7	0.3
B20C	36369	674.4	70.3	60.4	54.5	4.1	1.9	0.7	49.3	48.0	42.2	2.9	1.9	0.7	39.2	43.9	41.3	1.4	1.5	0.7	39.6	46.5	40.8	2.2	1.7	0.7
B20D	48038	677.0	47.7	36.3	34.9	1.8	0.8	0.2	39.7	29.4	31.2	1.5	0.8	0.2	30.0	27.5	28.8	0.8	0.7	0.2	31.6	28.5	30.3	1.3	0.8	0.2
B20E	61986	657.5	45.4	38.8	34.2	2.2	0.7	0.3	37.6	34.9	30.3	1.9	0.7	0.3	31.6	33.1	29.2	1.1	0.4	0.3	31.9	34.2	29.7	1.2	0.7	0.3
B20F	50420	666.2	36.7	28.2	27.4	1.8	0.4	0.0	30.1	24.9	24.2	1.5	0.4	0.0	25.9	24.1	23.7	1.1	0.4	0.0	27.5	24.1	23.7	1.5	0.4	0.0
B20G	52244	668.6	49.9	41.5	37.1	2.0	0.7	0.0	37.9	35.4	31.2	1.7	0.7	0.0	32.0	33.6	29.8	0.6	0.7	0.0	31.7	33.9	30.8	1.2	0.7	0.0
B20H	56250	670.9	41.4	32.2	31.7	1.1	0.4	0.0	32.5	25.3	28.0	0.8	0.4	0.0	22.4	23.0	25.5	0.1	0.3	0.0	25.1	24.4	27.0	0.6	0.4	0.0
B20J	40744	696.3	67.2	54.4	49.3	2.7	1.0	0.3	43.5	41.5	38.9	1.4	1.0	0.3	30.9	39.1	35.2	0.1	0.4	0.3	32.2	39.5	37.3	0.8	0.8	0.3
B31A	38655	677.3	37.0	29.3	26.0	1.1	0.3	0.0	30.9	27.4	24.1	0.8	0.3	0.0	23.9	26.4	23.2	0.2	0.3	0.0	25.9	26.4	23.2	0.5	0.3	0.0
B32A	80142	691.7	34.1	27.3	24.2	0.8	0.0	0.0	28.1	24.9	21.8	0.7	0.0	0.0	21.1	23.2	20.8	-0.2	0.0	0.0	24.0	24.0	21.0	0.4	0.0	0.0
B32B	61384	699.0	51.3	41.6	33.6	2.3	1.2	0.3	41.8	38.4	30.8	2.0	1.2	0.3	32.9	35.9	29.3	0.9	1.2	0.3	36.7	37.6	29.8	1.3	1.2	0.3
B32C	30281	663.9	58.5	47.2	43.4	2.5	0.8	0.3	40.2	37.6	34.7	1.5	0.8	0.3	28.1	35.6	32.1	0.3	0.5	0.3	29.8	35.2	33.2	1.0	0.8	0.3

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
B32E	20320	668.9	58.9	50.4	45.0	2.1	0.8	0.0	43.8	43.4	38.0	1.5	0.8	0.0	36.5	40.7	37.3	0.5	0.8	0.0	35.9	41.1	37.3	1.0	0.8	0.0
B32F	66720	658.2	50.9	43.1	39.0	1.2	0.3	0.0	36.6	36.1	32.0	0.9	0.3	0.0	33.8	33.6	31.3	0.1	0.3	0.0	34.2	33.3	31.6	0.7	0.3	0.0
B41A	76446	714.8	83.8	68.5	56.2	3.7	2.9	1.8	68.0	62.2	50.7	2.9	2.9	1.8	51.1	55.1	46.8	1.4	2.4	1.8	55.9	57.1	48.5	2.3	2.7	1.8
B41B	77800	705.7	71.1	60.7	54.5	3.8	2.6	0.9	53.0	54.7	49.4	3.2	2.6	0.9	39.1	44.4	47.3	1.4	2.3	0.9	40.5	50.1	48.3	2.4	2.6	0.9
B41C	30242	690.2	37.6	26.2	23.1	2.0	1.0	0.0	35.0	24.8	22.4	2.0	1.0	0.0	27.6	23.4	21.0	1.3	1.0	0.0	30.6	23.7	21.7	1.7	1.0	0.0
B41D	40291	651.8	49.2	41.7	38.0	1.1	0.3	0.0	35.4	35.1	31.4	0.8	0.3	0.0	32.8	32.5	30.7	0.0	0.3	0.0	33.4	32.4	30.9	0.6	0.3	0.0
B41F	37985	699.4	57.4	41.0	28.7	3.1	1.9	0.7	51.6	39.1	27.4	2.8	1.9	0.7	38.8	36.4	26.0	1.5	1.8	0.7	39.1	37.5	26.4	2.1	1.9	0.7
B41G	44212	651.0	24.6	18.3	16.6	1.0	0.0	0.0	23.1	17.5	16.3	1.0	0.0	0.0	19.9	16.9	15.5	0.7	0.0	0.0	21.7	16.9	15.8	1.0	0.0	0.0
B42A	31894	774.1	118.9	101.4	88.3	6.0	4.8	3.5	78.3	80.9	77.3	4.1	4.8	3.5	50.7	65.1	67.1	1.4	2.4	3.1	57.4	73.6	70.9	2.9	3.2	3.5
B42B	21374	894.9	185.9	168.7	146.9	12.0	9.8	8.6	95.9	108.6	110.5	7.1	7.2	8.3	54.1	69.7	72.6	3.3	3.3	3.9	55.3	74.1	76.0	5.1	5.0	4.9
B42C	16412	726.8	92.4	84.2	71.6	4.7	3.3	1.8	54.6	71.4	61.4	2.6	3.3	1.8	40.5	56.3	57.7	0.8	1.5	1.8	44.0	56.4	58.4	1.8	2.3	1.8
B42D	15458	1004.8	262.2	245.0	231.9	19.9	17.7	16.2	115.0	150.9	166.9	13.0	11.9	12.1	95.2	118.7	124.3	6.4	7.7	7.9	69.8	97.9	121.3	11.4	10.4	9.5
B42F	27910	735.7	105.5	89.7	74.6	4.8	3.0	2.4	71.7	71.8	60.2	3.1	2.9	2.4	47.2	58.4	52.4	1.0	1.2	2.1	49.6	62.4	54.7	2.3	2.0	2.4
B42G	32725	675.5	63.8	51.4	43.1	1.9	0.9	0.3	41.1	42.3	36.0	1.0	0.9	0.3	30.6	35.9	32.4	-0.3	0.6	0.3	34.3	37.7	33.1	0.5	0.8	0.3
B52H	56325	658.9	53.5	43.3	41.9	2.1	1.1	0.7	35.3	30.8	34.2	1.3	1.1	0.7	24.5	24.4	27.4	0.0	0.4	0.4	18.4	29.5	29.6	0.6	0.8	0.6
B60A	20942	1192.7	396.9	378.0	363.2	24.2	23.0	22.4	103.7	137.1	149.0	12.0	13.9	14.1	76.7	91.6	95.0	2.8	4.7	6.8	60.2	78.1	82.1	9.6	11.5	12.3
B60B	30222	1031.9	248.4	226.7	216.7	15.6	14.7	13.8	95.4	102.5	122.4	9.0	9.5	10.1	65.7	72.7	81.8	3.1	5.1	6.2	60.0	68.7	79.9	7.4	7.8	8.0
B60C	9411	1208.1	373.9	356.3	343.8	22.9	19.6	18.7	95.5	107.8	125.0	13.3	11.9	12.1	79.4	87.7	99.0	4.1	4.4	5.2	71.5	82.2	94.8	11.4	10.0	9.8
B60D	24347	999.3	240.0	213.5	192.5	15.7	12.7	10.8	106.4	111.4	117.6	8.7	8.0	7.9	79.9	98.7	99.7	4.2	4.8	4.7	64.1	85.4	99.8	7.6	6.2	5.6
B60E	8343	1012.9	275.5	256.6	244.3	17.6	15.5	13.7	136.6	150.1	167.0	10.2	9.2	8.5	86.8	100.9	117.3	4.2	5.4	5.3	78.5	88.1	103.1	8.9	7.9	7.0
B60F	39932	754.5	84.5	72.0	59.8	4.6	2.5	0.9	45.3	56.7	45.2	2.9	2.3	0.9	31.0	37.9	38.1	0.4	1.4	0.6	32.9	41.4	42.4	1.5	1.9	0.7
B60G	44804	680.7	68.4	54.8	48.5	3.2	1.4	0.4	43.1	41.5	38.1	2.3	1.4	0.4	30.5	35.0	33.6	0.6	0.9	0.4	29.2	34.5	35.7	1.1	1.2	0.4
B60H	38460	770.4	77.5	67.5	58.2	5.3	4.4	3.3	39.5	46.1	43.7	3.9	4.1	3.3	31.6	40.3	35.6	1.9	3.2	2.9	27.4	38.1	36.0	2.6	3.5	3.0
B71A	29763	668.6	65.3	55.3	45.8	3.7	2.4	1.2	35.6	45.8	41.0	2.4	2.4	1.2	24.5	37.0	36.5	1.0	1.7	1.2	21.6	38.9	36.4	1.8	2.1	1.2
B71C	26246	758.4	101.1	85.5	75.9	5.7	4.8	4.2	43.3	64.6	60.2	3.5	4.3	4.2	28.2	42.6	50.3	1.3	2.3	3.2	28.3	42.2	52.0	2.4	2.9	3.5
B71D	22715	692.7	68.3	57.8	47.8	3.5	2.5	1.0	37.2	47.4	42.2	2.1	2.5	1.0	23.9	38.7	37.1	0.8	1.8	0.8	21.0	40.5	36.7	1.3	2.2	0.8
B71F	54075	797.4	63.2	53.7	51.5	3.0	1.4	0.8	38.0	40.0	39.4	1.3	1.1	0.8	26.5	30.5	29.7	-0.3	0.4	0.3	23.4	36.0	34.5	0.1	0.8	0.6
B71G	24494	846.6	110.7	93.3	80.7	7.0	5.9	4.8	54.5	61.3	54.2	4.5	5.4	4.8	42.9	48.2	47.4	2.0	3.1	3.3	40.9	44.6	48.9	2.9	3.2	3.9
B72A	53405	714.2	147.5	125.4	105.1	5.4	3.1	1.1	72.7	83.6	64.9	1.9	2.8	1.1	56.1	66.1	61.7	-0.6	0.4	0.3	51.8	65.6	62.2	0.7	1.0	0.8

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
B72E	32008	766.0	54.2	47.2	46.6	2.2	0.9	0.6	33.2	35.6	36.3	1.1	0.7	0.6	25.9	27.7	28.5	-0.3	0.3	0.2	21.4	32.3	32.3	0.3	0.6	0.5
B72F	8121	937.7	110.7	91.7	78.8	7.9	6.3	4.9	46.2	57.7	53.4	3.8	5.5	4.7	31.9	38.7	39.1	1.9	3.2	3.3	28.2	41.4	44.8	2.5	3.9	4.2
B73A	16446	978.2	149.6	137.8	126.4	10.9	9.1	7.0	57.6	78.1	84.2	6.2	6.0	6.5	27.3	49.0	60.3	2.7	3.0	2.4	28.0	52.1	62.2	4.5	4.6	3.5
B81A	16907	1186.4	321.2	297.8	280.3	21.9	20.8	19.8	115.8	134.5	144.5	13.3	13.7	14.2	67.9	83.2	88.7	5.2	6.2	6.8	63.3	79.6	94.2	11.4	11.7	11.3
B81B	48123	1162.9	270.6	241.0	226.3	16.0	13.3	11.2	94.1	95.4	108.6	8.2	7.2	7.2	58.1	64.8	74.4	2.0	3.7	3.6	51.4	61.9	71.4	6.7	5.5	4.7
B81C	20840	890.9	197.9	178.0	167.5	7.6	6.3	4.5	73.8	83.1	90.7	2.8	3.9	4.1	47.4	63.2	73.0	-0.6	0.7	1.5	42.7	62.0	68.3	1.1	2.1	2.3
B81D	47879	846.4	171.3	159.2	143.0	7.6	6.6	4.9	82.9	103.9	92.9	3.0	5.4	4.6	64.3	77.8	71.8	-0.3	2.0	2.6	59.9	72.6	72.1	1.5	2.8	3.4
B81E	66490	668.5	120.0	103.1	92.3	4.2	2.4	1.0	66.8	77.1	67.6	2.3	2.2	1.0	49.9	61.3	64.0	0.4	1.2	0.4	43.3	53.9	64.0	1.3	1.3	0.7
B82A	46656	721.5	75.4	66.3	63.5	2.8	1.6	0.6	45.0	48.0	46.8	0.9	1.6	0.6	32.5	35.6	39.8	-0.3	0.6	0.4	30.1	41.7	43.2	0.0	0.9	0.6
B82B	40634	698.9	80.9	71.3	67.0	3.8	2.1	0.8	45.7	50.1	47.3	1.8	1.8	0.8	25.1	39.4	45.2	0.1	0.5	0.2	25.5	42.3	41.1	0.7	0.9	0.5
B82C	29966	726.3	68.7	57.3	51.8	3.4	1.8	0.8	38.3	39.7	37.2	1.9	1.5	0.8	29.7	29.7	30.3	-0.1	0.6	0.5	24.1	32.4	34.0	0.6	1.1	0.7
B82F	75979	671.8	61.8	51.6	48.7	2.7	0.9	0.3	44.9	39.3	38.6	1.2	0.9	0.3	28.3	33.8	34.8	-0.1	0.5	0.3	26.6	34.9	35.8	0.6	0.7	0.3
C11A	71939	743.3	67.4	55.2	49.3	3.2	1.8	0.8	50.6	46.2	41.5	2.5	1.8	0.8	37.5	41.3	38.6	1.4	1.5	0.8	43.5	44.2	39.8	1.8	1.6	0.8
C11B	53465	705.9	70.0	57.2	46.1	3.5	2.3	0.7	54.9	51.0	39.9	2.4	2.3	0.7	40.1	47.2	37.9	0.7	2.0	0.7	45.2	48.8	38.3	1.4	2.2	0.7
C11C	44875	764.3	104.5	84.1	73.7	4.6	3.5	2.5	84.3	73.0	64.0	3.9	3.5	2.5	61.3	68.4	60.5	1.8	3.0	2.5	62.1	69.5	60.8	2.7	3.4	2.5
C11D	37173	701.2	62.0	54.1	46.1	2.8	1.1	0.4	51.6	48.9	40.9	2.5	1.1	0.4	39.7	45.9	39.5	1.6	1.0	0.4	40.7	47.0	39.4	2.0	1.1	0.4
C11E	115504	702.5	63.6	53.5	43.2	2.7	1.4	0.6	53.7	47.7	37.4	2.4	1.4	0.6	39.4	44.9	36.3	1.1	1.4	0.6	41.9	44.8	36.3	1.8	1.4	0.6
C11F	92890	702.7	63.6	51.3	48.0	2.7	1.1	0.3	51.4	43.2	40.0	2.4	1.1	0.3	40.2	38.4	38.3	0.8	1.1	0.3	43.2	39.3	38.2	1.5	1.1	0.3
C11G	43171	658.8	51.8	46.6	41.5	2.1	0.9	0.3	38.8	37.9	33.8	1.8	0.9	0.3	30.5	35.6	30.5	0.7	0.9	0.3	34.0	36.6	31.5	1.4	0.9	0.3
C11H	110280	664.0	52.6	47.8	42.0	2.2	1.0	0.3	38.8	38.7	33.8	1.9	1.0	0.3	31.3	36.3	30.6	0.8	1.0	0.3	34.4	37.4	31.7	1.5	1.0	0.3
C11J	100057	657.3	50.2	43.5	39.8	1.7	0.7	0.3	39.2	34.9	32.5	1.4	0.7	0.3	30.9	32.7	29.1	0.5	0.7	0.3	32.6	33.7	30.0	1.1	0.7	0.3
C11L	94690	674.2	64.0	47.8	44.2	3.7	1.2	0.3	51.6	40.7	37.8	3.1	1.2	0.3	40.1	38.6	36.0	1.4	0.9	0.3	38.5	38.8	35.7	2.1	1.2	0.3
C12D	89834	666.1	27.7	24.0	24.0	1.2	0.3	0.0	23.8	20.6	20.6	1.2	0.3	0.0	21.2	19.3	19.4	0.8	0.3	0.0	22.1	19.7	19.8	0.9	0.3	0.0
C12K	47872	656.9	42.5	37.3	35.4	1.7	0.5	0.0	28.7	31.7	30.4	1.3	0.5	0.0	25.6	29.6	28.6	0.4	0.5	0.0	22.2	30.8	28.9	0.8	0.5	0.0
C13A	59352	779.2	106.4	87.8	76.5	6.5	4.8	3.4	58.5	70.9	61.0	3.8	4.5	3.4	44.0	55.9	58.0	1.6	2.7	3.1	43.4	58.7	59.3	2.9	3.3	3.3
C13B	61500	683.8	71.5	57.8	48.2	4.5	2.0	0.6	55.8	49.5	40.6	3.6	2.0	0.6	42.1	47.0	38.7	1.6	1.5	0.6	36.2	47.1	38.6	2.2	2.0	0.6
C13C	83615	726.9	91.6	74.3	69.4	6.3	4.7	2.5	51.6	63.2	59.6	3.8	4.7	2.5	42.0	49.3	54.9	1.3	3.1	2.3	43.1	48.3	55.7	2.4	4.0	2.5
C13D	89457	697.8	47.1	36.3	28.3	2.1	0.9	0.3	37.8	32.2	25.1	1.7	0.9	0.3	29.9	29.9	23.2	0.8	0.8	0.3	31.6	31.3	23.9	1.2	0.9	0.3
C13E	60213	698.7	59.2	47.3	45.3	2.7	1.3	0.3	44.1	40.4	39.3	2.4	1.3	0.3	41.9	34.9	36.6	0.9	1.3	0.3	42.8	34.5	36.9	1.6	1.3	0.3

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
C13F	61057	693.3	45.3	34.0	27.9	2.6	0.8	0.3	39.9	31.8	26.1	2.3	0.8	0.3	29.6	29.7	24.8	1.7	0.8	0.3	34.6	30.6	25.2	2.2	0.8	0.3
C13G	43401	672.0	76.6	66.2	54.1	3.4	1.6	0.4	59.1	57.8	47.0	2.7	1.6	0.4	41.0	49.7	43.0	0.8	1.3	0.4	43.6	53.6	43.2	1.7	1.5	0.4
C21A	70659	673.0	57.2	50.4	47.0	3.0	1.5	0.4	43.0	44.8	41.4	2.7	1.5	0.4	34.9	41.9	39.2	1.2	1.5	0.4	34.6	42.7	39.5	1.8	1.5	0.4
C21B	43056	697.5	51.0	41.5	38.8	2.0	0.6	0.3	36.7	32.1	29.9	1.7	0.6	0.3	33.7	30.0	30.0	0.7	0.4	0.3	34.2	30.5	30.1	1.1	0.6	0.3
C21C	43784	672.5	50.1	42.8	39.1	2.1	0.6	0.2	34.0	36.6	33.4	1.6	0.6	0.2	31.2	34.3	31.6	0.7	0.6	0.2	27.6	35.5	31.9	1.0	0.6	0.2
C21D	44582	698.2	66.5	51.8	40.2	2.7	1.0	0.3	57.4	46.7	35.3	2.4	1.0	0.3	47.4	44.8	33.7	1.2	0.9	0.3	47.2	44.9	34.0	1.8	1.0	0.3
C21E	62822	691.0	41.8	32.4	26.6	1.9	0.6	0.3	38.1	29.6	23.8	1.6	0.6	0.3	30.1	27.3	23.2	0.4	0.6	0.3	32.7	28.7	23.3	1.0	0.6	0.3
C21F	42655	703.6	73.5	60.5	54.4	2.7	1.1	0.5	54.9	48.5	43.0	2.2	1.1	0.5	47.9	43.0	41.0	0.1	0.8	0.5	50.4	44.0	41.6	0.7	1.1	0.5
C21G	46243	665.3	44.6	34.7	32.5	1.7	0.4	0.0	38.7	30.7	28.6	1.7	0.4	0.0	35.2	29.0	27.4	1.1	0.4	0.0	36.4	29.3	27.5	1.4	0.4	0.0
C22A	54840	693.7	40.9	33.7	31.8	1.0	0.6	0.3	30.6	25.9	27.2	0.7	0.6	0.3	26.7	25.2	23.8	0.0	0.6	0.3	29.1	25.3	25.1	0.4	0.6	0.3
C22B	39146	688.8	44.2	39.7	36.5	1.7	0.5	0.0	36.9	33.8	30.7	1.7	0.5	0.0	30.9	29.7	28.0	0.8	0.5	0.0	31.2	30.9	29.1	1.0	0.5	0.0
C22C	46519	684.8	37.8	28.6	25.4	1.7	0.4	0.2	34.3	26.0	22.8	1.6	0.4	0.2	27.6	24.6	22.3	0.5	0.4	0.2	31.1	25.4	22.4	1.2	0.4	0.2
C22D	34520	697.5	39.5	28.7	26.1	1.2	0.3	0.0	34.0	24.3	21.9	1.2	0.3	0.0	30.4	23.9	22.1	0.9	0.3	0.0	30.9	24.2	21.6	1.0	0.3	0.0
C22E	53212	668.3	31.0	24.3	22.4	0.8	0.3	0.0	27.2	23.3	21.4	0.8	0.3	0.0	24.6	21.3	20.9	0.5	0.3	0.0	24.7	21.6	21.2	0.8	0.3	0.0
C22F	44015	655.9	37.3	32.3	30.4	1.1	0.3	0.0	32.5	29.1	28.0	1.1	0.3	0.0	27.1	27.2	27.3	0.7	0.3	0.0	28.8	27.8	27.3	0.8	0.3	0.0
C23D	51009	663.4	25.9	23.3	23.0	0.6	0.0	0.0	21.8	20.8	20.5	0.6	0.0	0.0	20.3	20.4	20.4	0.3	0.0	0.0	21.4	20.6	20.3	0.6	0.0	0.0
C81A	38190	882.2	139.8	125.0	110.6	15.2	11.7	9.3	67.5	91.3	90.0	9.2	9.3	8.8	59.0	71.6	76.1	6.4	6.3	6.6	54.0	71.8	76.6	8.0	7.4	7.6
C81B	57546	764.4	83.3	65.9	57.1	7.2	5.7	3.6	57.7	56.4	52.4	5.1	5.5	3.6	50.2	48.3	47.6	2.8	4.8	3.2	50.1	53.1	47.7	4.0	5.3	3.3
C81C	24973	738.1	71.3	57.3	48.9	6.1	5.1	2.3	53.9	50.1	45.2	4.7	5.0	2.3	43.0	45.5	43.0	2.3	4.4	2.2	45.4	47.1	44.1	3.4	4.7	2.3
C81D	19478	735.8	70.9	57.2	48.8	6.0	4.8	2.3	54.0	49.9	45.1	4.6	4.8	2.3	43.1	46.0	43.0	2.2	4.2	2.2	45.9	47.1	44.1	3.3	4.4	2.3
C81E	64240	658.4	47.0	37.7	35.4	2.5	0.6	0.1	36.6	30.2	28.8	2.3	0.6	0.1	30.3	29.5	27.8	1.4	0.6	0.1	33.5	29.3	28.0	1.8	0.6	0.1
C81F	68803	895.5	165.1	148.6	134.8	13.0	9.9	7.5	94.8	99.4	103.8	7.7	7.9	7.2	67.1	80.4	81.9	4.7	4.7	5.4	74.2	86.9	81.7	6.4	5.4	5.2
C81G	43447	723.0	66.0	54.9	49.2	4.4	2.6	0.8	46.8	45.5	42.2	3.6	2.6	0.8	39.0	42.2	38.7	1.4	2.3	0.8	41.4	43.0	39.1	2.4	2.6	0.8
C81L	79342	737.7	79.0	57.5	50.7	5.3	3.2	1.1	60.9	48.6	42.0	3.7	3.2	1.1	46.3	42.2	40.4	1.6	2.6	0.9	51.2	44.2	41.2	2.6	2.9	1.1
C81M	109163	662.2	41.2	33.0	30.1	1.7	0.5	0.3	33.7	29.5	26.9	1.6	0.5	0.3	27.5	27.1	25.0	0.5	0.5	0.3	29.7	27.8	25.5	1.2	0.5	0.3
C82A	58173	670.1	44.7	36.1	33.1	2.9	1.1	0.5	37.3	30.3	28.8	2.6	1.1	0.5	28.6	29.2	26.2	1.4	0.9	0.5	33.1	29.6	27.5	1.7	1.1	0.5
C82B	49296	660.0	58.2	55.7	51.0	1.8	0.5	0.2	45.0	48.0	43.9	1.8	0.5	0.2	38.6	45.2	41.5	0.9	0.5	0.2	40.4	46.5	42.2	0.9	0.5	0.2
C82E	62205	666.7	38.3	32.4	29.5	1.6	0.5	0.1	34.0	29.4	26.7	1.6	0.5	0.1	27.7	28.0	26.1	0.9	0.5	0.1	30.5	28.8	26.0	1.3	0.5	0.1
C82G	58031	654.7	29.7	23.8	22.4	1.4	0.3	0.0	27.2	22.5	21.1	1.4	0.3	0.0	24.6	22.3	20.9	1.1	0.3	0.0	25.4	22.3	20.9	1.3	0.3	0.0

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
C83A	74550	693.8	55.6	44.3	38.9	3.1	1.7	0.5	43.5	37.8	35.3	2.1	1.7	0.5	37.8	34.3	32.8	0.8	1.4	0.5	40.3	36.2	33.7	1.5	1.7	0.5
C83B	25046	668.2	70.6	55.9	49.0	3.9	2.4	1.2	48.1	47.0	40.2	2.9	2.4	1.2	39.0	42.2	38.0	1.3	1.9	1.2	43.1	43.0	39.2	2.2	2.1	1.2
C83C	82751	663.4	55.2	46.0	41.2	2.0	1.0	0.3	43.5	37.1	33.1	1.7	1.0	0.3	37.5	34.1	30.5	0.8	1.0	0.3	39.7	35.7	31.8	1.4	1.0	0.3
C83E	42599	654.6	26.8	17.3	16.5	1.4	0.3	0.0	23.8	16.7	16.0	1.4	0.3	0.0	21.9	16.6	15.9	1.1	0.3	0.0	22.8	16.4	15.8	1.3	0.3	0.0
D11A	27822	1008.7	316.1	313.5	312.7	30.5	29.9	29.9	147.0	180.4	216.1	19.3	22.4	23.9	139.9	167.1	189.8	11.4	17.5	20.2	133.0	157.9	184.1	16.1	20.7	22.7
D11B	23633	1056.1	290.8	282.7	280.9	26.5	26.3	26.0	109.6	143.6	170.0	16.2	18.5	19.4	93.7	121.0	137.0	8.1	12.0	14.5	91.9	114.9	133.7	14.9	16.7	18.3
D11C	29145	910.8	177.0	164.7	152.9	20.2	19.5	18.1	113.2	131.4	137.2	14.9	17.2	17.4	94.6	122.3	122.6	11.1	13.9	14.9	88.3	117.3	127.2	13.2	15.4	15.9
D11D	31856	889.4	178.1	168.3	157.2	20.5	18.5	16.5	100.0	126.1	133.2	13.5	14.9	15.9	76.0	102.1	108.1	8.2	11.0	10.8	77.3	103.9	111.4	11.9	12.1	11.7
D11E	32231	736.8	69.0	59.9	46.9	6.2	4.2	2.4	48.7	53.1	41.1	4.2	4.2	2.4	36.0	46.0	38.4	2.3	3.3	2.1	38.2	48.0	39.2	3.4	3.6	2.4
D11F	41299	700.5	63.1	53.7	45.4	6.0	3.9	2.4	47.4	48.5	41.2	4.3	3.9	2.4	34.7	41.7	38.6	2.4	3.1	2.1	36.2	43.7	39.8	3.5	3.6	2.4
D11G	31970	770.9	129.4	114.8	106.4	11.9	9.4	9.2	68.4	82.8	92.8	8.5	7.1	8.7	60.1	67.9	72.8	6.2	5.0	6.3	54.9	65.7	76.3	8.0	6.1	7.1
D11H	35832	682.8	20.7	15.5	14.5	1.7	0.6	0.1	18.6	15.2	14.4	1.7	0.6	0.1	17.4	14.5	13.9	1.4	0.6	0.1	17.5	14.6	14.1	1.7	0.6	0.1
D11J	43956	660.6	45.1	37.4	28.7	3.9	2.0	0.7	35.2	34.0	26.3	3.2	2.0	0.7	28.9	30.0	24.7	1.5	1.7	0.7	30.9	33.0	25.4	2.2	2.0	0.7
D12B	38512	722.0	90.5	80.3	67.8	8.7	6.6	4.7	48.3	66.5	58.6	6.0	6.3	4.7	38.4	57.2	49.5	3.8	5.2	4.1	40.4	58.2	53.2	4.6	5.7	4.4
D13A	47483	800.4	96.8	85.8	75.8	8.6	7.4	5.9	64.2	76.8	69.5	6.6	7.3	5.9	47.8	67.4	63.5	4.0	5.9	5.4	54.9	72.7	65.7	5.0	6.3	5.7
D13B	53292	787.9	87.6	74.7	63.0	7.5	6.1	5.1	62.6	66.8	58.0	6.1	6.1	5.1	43.7	60.2	53.6	3.5	5.0	4.8	51.8	63.8	54.9	4.4	5.4	5.1
D13C	51684	701.5	47.4	34.5	26.9	3.6	2.2	1.1	41.7	32.0	26.0	3.3	2.2	1.1	30.7	29.4	24.6	2.1	2.2	1.1	34.3	30.2	24.8	2.7	2.2	1.1
D13D	63508	677.9	70.8	52.9	46.2	5.6	3.4	2.6	53.5	46.3	40.3	4.8	3.4	2.6	32.0	35.8	37.6	2.5	2.5	2.6	38.1	39.0	38.7	3.9	3.1	2.6
D13E	103089	753.1	78.0	64.5	54.8	6.4	4.6	3.5	63.9	59.7	52.4	5.1	4.6	3.5	43.9	53.4	48.4	3.4	3.8	3.5	55.1	56.4	48.7	4.3	4.3	3.5
D13F	96993	668.1	48.5	39.2	30.5	4.3	3.2	2.1	37.8	34.5	27.7	3.7	3.2	2.1	28.9	31.4	25.0	2.5	2.9	2.1	31.9	32.4	26.3	3.2	3.0	2.1
D13K	39716	731.0	86.1	74.6	66.5	8.4	6.5	5.4	49.7	64.7	58.9	5.6	6.2	5.4	40.3	53.7	57.5	3.4	4.7	5.0	39.8	53.4	58.3	4.8	5.2	5.1
D15A	43686	698.7	62.7	45.6	40.4	4.6	2.7	1.7	45.6	36.8	34.9	3.4	2.7	1.7	36.2	29.4	30.0	1.8	2.1	1.7	38.5	30.7	31.2	2.4	2.4	1.7
D15B	39329	732.5	74.9	62.1	48.9	6.2	3.6	2.1	51.3	49.5	41.5	4.5	3.3	2.1	40.4	41.2	33.9	2.5	2.5	1.8	43.3	44.7	33.3	3.6	3.1	2.1
D15C	27587	702.7	69.6	51.8	42.3	5.2	3.5	2.2	53.8	44.0	37.8	4.1	3.5	2.2	47.4	36.5	33.9	2.7	3.1	2.2	47.2	37.7	34.8	3.3	3.3	2.2
D15D	43690	723.6	78.0	61.6	47.8	5.6	3.9	2.5	59.0	51.7	41.5	4.3	3.9	2.5	50.4	43.2	35.8	2.8	3.3	2.5	51.1	45.6	37.7	3.4	3.6	2.5
D15E	61874	720.3	95.0	83.7	72.2	9.3	6.8	4.5	68.2	69.2	58.9	6.8	6.7	4.5	47.4	60.9	56.0	4.6	5.8	4.2	51.1	64.8	56.7	5.5	6.2	4.5
D15F	35242	696.2	68.2	62.4	51.8	6.9	4.5	2.5	47.2	50.8	42.0	5.6	4.5	2.5	36.8	46.8	37.9	3.5	4.1	2.5	42.6	48.2	39.4	4.4	4.2	2.5
D15G	48473	667.3	58.0	45.3	41.0	4.3	2.5	1.4	43.0	37.0	33.8	3.5	2.5	1.4	39.8	35.1	30.9	2.0	2.2	1.4	39.5	35.2	31.5	2.6	2.3	1.4
D16A	15918	913.9	264.7	260.4	259.9	24.3	24.1	23.9	115.4	146.9	174.9	15.6	18.1	18.3	106.3	127.1	144.8	10.3	14.4	15.3	100.0	123.3	142.3	15.0	17.3	17.7

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
D16B	24803	849.5	197.8	188.9	187.8	20.0	18.4	17.7	93.6	124.2	150.2	14.2	14.1	14.5	82.0	97.3	116.9	10.9	11.5	11.7	78.3	95.7	121.8	12.8	13.4	13.3
D16C	43718	652.0	26.4	18.1	13.7	2.2	1.3	0.6	24.3	17.9	13.6	2.2	1.3	0.6	21.3	17.0	13.3	1.8	1.3	0.6	23.5	17.3	13.4	2.0	1.3	0.6
D16D	33897	852.5	230.8	221.9	217.2	21.0	19.3	18.3	105.5	127.4	150.9	14.8	15.0	15.1	95.3	111.3	129.6	10.8	12.2	12.5	93.0	110.2	131.0	13.8	14.2	14.2
D16M	75280	668.9	17.4	13.8	12.5	1.0	0.4	0.0	16.3	13.6	12.5	1.0	0.4	0.0	14.5	13.4	12.1	0.8	0.4	0.0	14.8	13.4	12.3	1.0	0.4	0.0
D17A	63802	697.0	58.0	47.1	37.6	5.0	3.0	1.5	43.1	42.5	33.8	3.8	3.0	1.5	35.2	38.6	31.9	1.9	2.5	1.5	35.9	40.4	33.3	2.8	2.8	1.5
D17B	44176	719.8	100.0	89.7	79.5	6.8	5.7	4.7	57.3	74.3	67.9	4.1	5.4	4.7	44.7	61.7	63.1	1.8	3.5	4.2	46.3	64.9	62.9	3.3	4.2	4.4
D17C	52462	673.7	45.1	38.1	28.1	3.9	1.7	0.6	35.2	34.3	25.4	3.3	1.7	0.6	29.8	30.9	23.7	1.5	1.4	0.6	30.3	33.7	24.9	2.3	1.7	0.6
D17K	38313	670.4	46.8	36.4	33.8	3.4	2.2	1.1	38.6	33.9	32.1	3.1	2.2	1.1	28.4	27.2	30.3	1.4	1.9	1.1	24.9	30.1	30.6	2.0	2.1	1.1
D17L	58993	664.8	52.9	39.1	35.7	3.2	1.0	0.9	41.9	33.4	31.1	2.8	1.0	0.9	30.5	26.9	27.4	1.9	0.7	0.9	32.7	29.2	29.7	2.4	0.7	0.9
D18B	32708	685.5	42.6	32.5	26.6	3.4	2.5	1.4	33.9	29.1	25.0	3.2	2.5	1.4	28.8	23.6	23.2	1.9	2.2	1.4	30.9	26.8	23.6	2.5	2.5	1.4
D18C	46540	688.4	68.3	53.2	46.6	5.9	3.8	2.3	45.8	41.6	36.8	4.0	3.5	2.3	39.2	39.7	35.1	2.4	3.0	2.0	37.5	39.1	35.4	3.2	3.5	2.3
D18E	37567	694.6	50.9	43.2	34.8	4.5	3.3	2.1	39.3	39.0	33.0	4.0	3.3	2.1	34.0	33.0	29.8	2.6	2.8	2.1	35.9	36.2	31.6	3.2	3.3	2.1
D18F	44573	675.9	54.2	44.0	38.9	4.8	2.7	2.0	43.7	37.8	36.3	4.3	2.7	2.0	34.2	34.8	34.2	2.4	2.5	2.0	37.1	37.2	34.9	3.1	2.7	2.0
D18G	49159	767.3	90.5	82.1	73.3	7.7	6.6	5.5	67.4	75.5	68.9	6.7	6.6	5.5	48.6	68.0	64.8	3.9	5.5	5.2	56.4	72.3	66.1	4.9	6.0	5.5
D18H	38358	713.7	80.2	67.7	57.9	6.9	5.2	3.7	59.4	60.2	52.6	5.6	5.2	3.7	47.7	55.1	49.3	3.0	4.3	3.5	51.3	55.9	51.4	4.1	4.7	3.7
D18J	85855	712.4	73.4	57.6	50.5	6.2	4.2	2.9	56.7	50.5	46.5	5.3	4.2	2.9	44.6	45.8	42.6	2.9	3.7	2.9	47.1	46.5	44.6	4.0	4.0	2.9
D18K	93497	774.8	104.9	95.8	86.8	10.0	7.8	6.4	63.2	84.7	78.4	7.3	7.3	6.4	51.3	67.4	69.5	4.5	5.5	5.7	54.1	68.2	70.0	5.6	6.2	6.1
D18L	60957	664.1	61.7	50.3	43.0	4.9	2.9	1.8	44.5	40.8	34.8	3.6	2.9	1.8	40.1	38.9	32.8	2.2	2.5	1.7	39.1	39.7	33.1	3.0	2.6	1.8
D21A	30932	979.0	170.9	155.6	141.2	17.2	14.1	11.7	101.4	121.4	118.2	11.5	12.3	11.4	84.7	94.9	98.9	7.7	8.4	8.6	80.2	99.8	104.0	9.3	9.9	9.4
D21B	39366	1018.0	158.1	143.6	136.9	16.3	14.0	11.0	80.6	104.9	117.9	10.0	10.8	10.6	58.9	82.1	94.8	6.2	7.6	6.7	58.1	83.3	97.7	9.0	8.8	7.7
D21C	21158	879.8	96.5	81.8	70.4	6.2	4.6	3.2	59.4	68.6	62.6	3.7	4.3	3.2	59.0	65.0	55.7	1.5	3.1	2.7	56.3	65.0	56.0	2.5	3.9	2.9
D21D	25147	838.1	133.2	116.4	102.4	8.3	6.3	4.6	80.5	90.6	83.8	4.7	5.8	4.6	60.1	74.1	78.2	1.8	2.8	4.0	61.8	76.7	79.9	3.2	3.7	4.3
D21E	26833	784.4	59.3	49.2	41.1	3.0	1.1	0.6	45.3	43.6	37.9	2.5	1.1	0.6	41.9	39.5	37.1	1.2	0.8	0.6	42.2	40.2	37.5	2.1	1.0	0.6
D21F	47954	724.9	74.7	59.9	52.0	4.7	2.7	1.3	57.1	51.0	44.4	3.5	2.7	1.3	47.5	48.1	43.0	1.5	2.3	1.3	49.3	48.9	43.1	2.4	2.4	1.3
D21G	27809	751.9	46.5	39.4	31.6	2.1	0.7	0.4	39.1	36.9	29.3	1.8	0.7	0.4	34.8	31.8	29.2	1.3	0.7	0.4	35.6	34.2	29.2	1.7	0.7	0.4
D21H	38084	780.6	57.1	48.2	41.0	2.8	1.0	0.6	43.7	42.7	38.0	2.4	1.0	0.6	40.6	38.8	37.0	1.3	0.7	0.6	41.0	40.9	37.5	2.1	1.0	0.6
D21J	35933	989.6	150.4	130.3	117.8	13.9	11.4	8.9	76.4	98.3	93.5	8.0	9.0	8.4	65.9	82.1	83.3	4.1	5.4	5.7	67.2	83.6	90.6	6.4	6.6	6.6
D21K	32590	949.8	186.6	177.8	165.4	21.2	19.5	17.7	97.6	131.7	132.6	13.5	15.2	16.9	70.4	101.0	109.4	7.3	11.2	11.5	74.6	102.7	114.3	11.6	12.3	12.3
D21L	30422	853.4	99.6	89.3	80.1	7.0	5.5	4.1	69.8	73.4	67.7	4.4	5.2	4.1	46.2	60.5	59.7	1.7	3.3	3.2	57.5	68.8	62.6	2.9	4.1	3.8

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
D22A	63543	677.8	38.5	37.4	31.3	2.1	0.7	0.4	30.7	33.4	28.1	1.9	0.7	0.4	25.2	30.1	26.7	1.1	0.5	0.4	27.9	31.9	27.5	1.5	0.7	0.4
D22B	45704	723.1	49.2	40.6	31.8	3.0	1.7	0.7	36.8	35.6	28.5	2.7	1.7	0.7	33.1	32.1	26.4	1.3	1.7	0.7	34.0	33.3	26.5	2.1	1.7	0.7
D22C	48544	777.2	70.9	56.9	53.0	6.0	3.8	2.0	49.4	47.1	44.8	4.6	3.8	2.0	38.6	41.7	42.3	2.5	3.2	2.0	41.8	43.2	42.7	3.3	3.5	2.0
D22D	62771	692.2	45.3	37.6	32.4	3.3	1.4	0.5	38.6	33.4	29.9	3.0	1.4	0.5	30.7	32.2	27.9	2.0	1.4	0.5	31.4	32.7	28.6	2.4	1.4	0.5
D22E	49806	818.3	97.4	83.9	74.4	9.5	7.1	4.8	60.9	67.9	62.0	6.2	6.8	4.8	46.0	55.2	57.3	3.7	4.7	4.2	49.2	57.9	57.7	4.8	5.1	4.5
D22F	63275	758.2	67.7	54.7	51.2	5.4	3.4	1.5	47.2	46.2	43.8	4.1	3.4	1.5	37.2	41.1	41.3	2.2	2.8	1.5	40.9	42.6	42.3	3.0	3.1	1.5
D22G	96929	687.6	49.7	44.4	38.3	2.9	1.2	0.3	40.3	39.7	34.6	2.6	1.2	0.3	36.3	36.7	32.9	2.0	1.2	0.3	36.8	37.9	32.9	2.3	1.2	0.3
D22H	54091	731.2	81.6	70.8	63.0	5.1	3.2	1.6	61.6	61.3	55.7	3.8	3.2	1.6	51.4	53.8	52.3	2.5	2.8	1.6	50.5	57.1	52.8	3.1	3.0	1.6
D22J	65172	768.5	122.6	109.2	93.1	7.4	6.0	4.9	80.9	90.3	79.5	5.0	5.7	4.9	66.6	78.3	72.3	2.3	3.6	4.4	64.7	81.6	72.8	3.4	4.7	4.6
D22K	32365	750.6	100.7	83.0	70.1	7.2	5.8	3.6	61.0	66.1	59.0	4.3	5.5	3.6	55.7	64.0	51.6	1.8	4.0	3.3	52.8	61.2	51.8	3.2	4.7	3.4
D22L	37638	706.9	77.5	65.7	53.6	5.4	3.3	1.7	52.8	54.8	44.8	3.9	3.3	1.7	40.8	48.9	41.3	1.8	2.8	1.7	45.3	51.3	42.1	2.9	2.9	1.7
D23A	60798	686.1	65.0	49.2	43.5	4.4	2.4	1.1	45.7	41.3	37.4	3.2	2.4	1.1	39.4	36.9	36.0	1.5	1.9	1.1	41.6	38.9	36.5	2.4	2.1	1.1
D23B	59691	705.4	77.3	61.2	52.6	5.4	3.5	1.7	51.0	51.2	45.3	3.6	3.5	1.7	43.9	46.6	41.9	1.8	2.8	1.7	44.0	47.7	41.4	2.7	3.2	1.7
E10A	13373	870.3	355.6	341.5	325.6	21.3	19.7	18.2	61.6	101.8	115.3	11.4	11.2	10.5	51.3	75.0	90.3	3.5	3.3	3.5	51.6	69.5	97.3	10.9	10.8	9.7
E10B	20196	743.8	253.9	239.3	225.9	15.4	14.6	13.5	51.2	73.7	92.5	7.8	7.8	7.3	38.9	61.7	75.4	1.6	3.5	4.1	42.6	62.0	80.3	7.4	7.4	7.3
G10A	17178	1541.2	943.1	933.3	924.1	49.5	48.0	46.9	84.2	104.5	124.4	15.3	18.7	18.5	77.5	97.9	114.4	3.8	4.3	4.5	68.5	83.2	94.8	14.9	15.4	18.0
G10B	12597	1239.0	679.0	665.7	653.3	38.7	37.4	36.0	78.5	106.1	122.2	14.2	15.4	14.5	22.7	38.0	58.7	2.9	3.3	2.7	62.3	89.8	103.1	13.6	13.6	14.2
G10C	32806	997.5	442.2	425.0	412.2	27.9	26.7	26.4	65.4	81.1	100.2	12.6	12.0	12.1	61.0	68.1	82.2	2.8	3.0	3.5	56.8	71.8	89.5	12.3	12.1	12.3
G10G	18557	962.2	420.8	408.7	396.0	24.3	23.0	22.2	57.6	81.6	116.4	11.5	13.2	12.9	46.4	72.1	94.4	2.5	4.2	4.3	45.6	65.7	83.4	9.9	11.9	12.2
G22A	23799	682.1	197.9	182.1	165.8	12.6	11.4	10.8	60.3	75.8	85.9	6.4	6.1	6.7	51.0	61.1	77.7	3.7	3.9	4.4	51.4	65.7	75.3	6.2	5.9	6.4
G22B	10940	924.2	328.5	315.3	302.4	23.1	22.5	21.9	55.1	81.6	100.4	12.1	12.6	13.4	57.4	73.4	90.0	4.0	5.7	7.7	52.8	76.1	90.6	11.6	11.8	13.0
G22D	24601	742.3	290.2	274.4	260.9	17.8	17.3	16.6	77.1	96.7	105.8	9.6	9.8	9.8	51.0	68.9	69.9	4.1	5.0	5.8	61.1	81.5	94.5	9.2	9.6	9.6
G22F	6569	1442.3	837.4	824.9	812.7	50.9	48.3	48.2	77.9	96.3	114.0	19.4	18.9	19.1	93.3	115.8	131.5	7.6	6.8	7.5	67.7	84.4	98.7	18.3	17.5	18.9
G22G	10636	749.1	249.5	234.7	221.6	17.2	16.5	15.3	56.2	73.5	90.3	9.4	10.1	9.3	32.9	53.3	71.2	4.0	6.2	6.9	45.9	66.8	80.0	8.7	9.7	9.1
G22H	22730	668.5	127.6	125.6	119.4	12.3	11.4	10.8	39.1	53.6	58.1	7.2	7.2	7.8	20.1	37.9	52.8	5.3	5.5	6.2	30.8	42.7	57.7	6.6	7.0	7.2
G22J	12819	996.6	427.1	415.9	404.1	28.6	28.0	27.5	75.8	92.3	108.0	13.0	13.9	14.1	53.1	80.6	106.2	4.1	5.4	6.2	50.8	65.4	84.8	12.1	13.4	13.5
G22K	7982	795.7	255.9	241.5	225.9	19.5	18.5	17.7	62.6	79.5	95.7	10.4	10.9	10.7	46.2	66.8	76.9	3.9	6.1	6.7	52.9	67.9	77.0	9.7	10.7	10.4
G40A	7152	1136.2	532.1	516.6	502.0	35.7	34.6	33.7	84.3	107.0	123.4	15.4	16.0	15.8	75.5	87.4	101.4	5.0	6.4	6.7	73.1	95.4	96.2	14.4	14.9	15.5
G40B	12242	948.6	278.7	263.3	251.1	23.7	21.8	20.6	62.4	82.1	98.0	12.8	13.4	12.8	55.4	61.3	66.1	4.5	6.9	7.0	51.6	68.9	83.1	10.8	12.4	12.4

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
G40C	14457	1348.1	755.8	743.6	730.9	43.0	42.2	41.8	85.8	107.1	127.3	16.4	16.6	17.0	89.8	109.1	125.8	4.2	5.3	6.2	64.7	82.0	96.9	16.1	15.9	16.2
G40D	32717	992.4	380.0	366.7	353.6	26.6	26.1	25.2	77.2	97.7	112.9	13.2	15.9	16.0	70.1	88.5	104.4	3.4	7.2	8.4	70.3	86.9	99.9	11.4	15.0	15.2
G40E	27758	719.5	224.8	211.4	198.1	13.9	12.7	11.9	52.3	65.1	69.1	7.5	6.9	7.0	30.6	44.8	53.9	3.0	3.7	4.1	39.0	57.1	61.2	6.7	6.3	6.3
G40G	22047	722.8	174.4	162.1	149.5	12.8	10.8	9.8	49.0	62.8	82.5	6.9	6.6	6.5	42.1	56.1	69.8	3.6	4.3	4.5	42.7	60.5	63.8	6.2	6.1	6.1
G40H	9595	697.8	135.7	120.4	107.6	9.2	7.9	7.6	48.9	61.7	72.7	4.8	5.0	6.2	38.6	50.4	56.6	2.1	2.7	3.9	37.3	46.9	58.9	4.2	4.3	5.1
H10B	16246	727.8	222.9	203.7	187.2	17.3	17.0	16.0	55.0	65.3	70.7	9.1	10.4	10.4	39.8	52.3	56.1	4.1	6.0	7.4	33.9	40.2	45.9	8.8	9.6	9.6
H10C	25960	680.0	206.9	192.7	178.7	14.8	13.5	12.9	48.4	64.7	79.9	8.3	8.2	8.3	33.1	46.4	60.3	4.1	4.3	5.5	35.0	57.2	65.4	7.9	7.5	7.5
H10D	9696	1034.8	463.3	442.0	423.5	27.3	26.4	25.7	67.5	93.2	103.8	11.0	11.8	12.4	67.4	82.8	96.8	2.0	3.1	3.4	52.9	70.7	90.6	9.8	11.6	11.5
H10E	8481	1449.1	833.2	807.5	787.1	53.0	50.2	48.5	116.6	123.1	131.8	20.2	22.5	21.7	100.0	118.7	129.2	8.0	10.1	10.4	106.4	116.2	122.6	18.0	20.6	20.2
H10F	24787	788.5	305.1	290.9	279.0	19.7	18.7	17.9	41.9	61.3	78.8	11.0	10.6	10.3	37.0	51.9	71.5	4.2	5.3	5.8	32.3	47.7	65.3	10.4	10.3	9.9
H10G	27043	764.5	307.5	297.9	287.9	17.0	16.0	15.4	41.0	73.1	88.7	8.0	8.4	8.7	29.4	61.3	80.3	1.3	3.3	4.6	30.0	57.0	81.4	7.4	8.0	8.2
H10H	18749	865.4	327.3	307.9	287.3	21.5	21.1	20.6	62.5	69.8	75.4	9.8	11.0	11.3	49.3	72.6	82.4	2.4	3.5	4.6	46.8	60.9	66.3	9.6	10.1	10.3
H10J	21378	1601.8	996.5	985.9	976.5	51.1	50.1	49.2	90.6	110.8	130.2	15.7	19.9	20.1	90.3	112.6	126.4	3.7	5.5	5.5	74.2	86.3	101.1	14.8	16.4	19.7
H10K	19355	1237.0	655.2	641.4	627.3	35.5	34.2	32.2	71.7	89.0	103.9	12.5	14.8	14.2	80.3	103.3	119.7	2.8	5.2	5.5	67.1	82.3	96.1	11.9	13.0	13.0
H20D	10067	676.4	187.5	167.0	155.3	15.2	13.9	13.1	47.4	54.5	69.7	8.5	8.2	8.6	36.8	42.2	49.8	4.2	5.3	6.3	30.5	32.0	49.2	7.8	7.8	8.1
H20E	9520	924.8	375.1	353.9	336.6	23.4	23.0	22.4	70.2	78.5	87.7	10.4	11.5	12.1	54.4	73.6	94.7	1.6	3.1	3.6	48.7	69.0	79.6	9.5	10.7	10.5
H20F	11657	808.0	332.0	315.0	300.3	20.5	17.9	16.7	67.2	81.2	96.6	10.9	10.2	10.0	52.1	73.9	71.8	3.0	4.5	5.5	57.7	73.0	87.0	9.1	9.4	9.4
H60A	7264	1812.8	1190.8	1178.5	1166.9	69.7	68.3	67.2	93.9	113.3	132.5	23.8	27.3	27.2	116.2	135.6	151.6	9.1	11.9	11.7	82.3	97.4	109.4	21.7	23.7	25.0
H60B	21000	1125.7	530.3	516.4	503.0	29.0	28.7	28.1	87.9	108.1	119.6	12.0	15.0	15.6	61.3	77.3	91.9	3.1	4.3	5.3	64.6	87.8	100.8	10.7	14.0	14.6
H60C	21689	866.8	348.5	333.0	319.2	21.7	20.9	19.1	72.4	92.5	109.7	10.2	12.4	11.1	48.3	61.0	73.7	2.2	4.9	5.0	57.6	73.4	86.2	9.4	11.5	10.5
H70B	15309	667.4	61.7	47.7	38.4	5.9	4.4	2.4	39.5	37.6	28.4	4.6	4.4	2.4	22.4	27.1	24.7	2.4	3.7	2.3	21.5	27.8	27.0	3.0	4.1	2.4
H70E	15684	699.6	81.1	62.1	50.7	7.8	5.9	4.1	49.0	49.1	38.3	5.7	5.8	4.1	29.4	32.8	31.8	2.4	4.5	3.8	30.6	33.6	33.9	3.6	5.1	4.1
H80B	12296	806.3	87.9	72.2	61.2	12.2	8.1	6.3	52.0	53.4	49.0	9.0	7.8	6.3	37.3	42.9	39.8	5.8	4.9	5.4	36.1	44.8	43.6	6.8	6.0	5.7
H90B	11818	663.2	57.9	42.2	32.5	4.8	2.9	1.8	33.6	32.1	24.2	3.4	2.9	1.8	19.8	25.0	20.5	1.3	2.3	1.8	17.8	23.6	21.1	2.1	2.5	1.8
J34C	31893	668.8	36.2	25.4	21.7	2.2	1.3	0.4	20.2	16.7	16.0	1.7	1.3	0.4	14.4	14.7	13.2	0.6	1.0	0.4	13.0	14.3	12.4	1.0	1.3	0.4
K10E	13257	673.8	43.8	37.8	32.8	2.5	1.5	0.9	18.0	26.9	27.0	1.7	1.5	0.9	8.7	15.4	18.7	0.3	0.8	0.9	11.3	16.5	22.6	0.9	1.0	0.9
K20A	16848	713.9	34.0	22.9	22.7	2.3	1.1	0.5	19.0	15.1	16.1	1.7	1.1	0.5	9.4	10.8	11.8	0.6	1.0	0.5	8.4	13.1	13.1	1.0	1.1	0.5
K30A	19603	749.9	177.9	159.4	146.3	9.7	7.8	6.8	60.6	83.2	79.8	5.8	6.0	6.5	51.8	68.8	72.5	2.8	4.0	5.1	52.5	66.2	75.3	4.4	5.0	5.2
K30B	13864	781.2	71.3	56.9	50.8	5.5	4.0	2.8	33.1	37.4	34.2	3.4	3.8	2.8	17.1	22.1	29.3	1.4	2.2	2.5	18.0	29.0	29.7	2.3	2.9	2.8

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
K30C	19012	805.1	70.0	56.6	47.3	5.1	4.0	2.8	23.1	30.2	36.3	2.2	3.6	2.8	8.8	15.2	19.6	0.2	2.1	2.2	11.9	22.9	19.2	1.2	2.3	2.5
K30D	17787	723.5	46.2	36.1	33.5	3.5	2.2	1.3	16.0	22.7	25.3	2.1	2.2	1.3	11.0	14.9	18.6	0.3	1.5	1.0	8.4	16.0	18.8	1.0	1.7	1.3
K40A	8749	705.6	42.4	33.4	29.2	3.1	1.6	0.8	16.8	22.0	21.7	2.0	1.6	0.8	10.4	14.8	16.2	0.4	1.1	0.6	8.6	17.0	16.3	1.2	1.2	0.8
K40B	11157	831.0	73.7	67.2	60.6	5.8	3.8	2.7	24.0	34.7	42.1	2.9	3.0	2.6	17.9	29.8	25.0	0.4	1.5	1.6	15.7	30.1	26.3	1.2	2.2	1.9
K40C	9961	935.3	105.9	96.4	81.1	7.9	5.9	4.4	34.7	51.8	45.7	3.7	4.3	4.3	15.9	29.0	31.0	0.2	2.0	2.0	21.3	34.8	29.3	1.5	3.5	2.6
K40D	12984	752.8	81.2	67.7	55.6	6.6	4.8	3.5	33.7	41.8	41.8	4.1	4.5	3.5	16.6	27.9	25.9	2.5	3.2	3.1	21.7	31.5	26.5	3.0	3.7	3.2
K40E	26761	858.6	75.4	67.8	61.0	5.4	4.2	3.0	26.2	33.8	43.0	2.5	3.2	3.0	7.9	21.1	30.5	0.5	1.4	1.8	14.0	19.8	33.0	1.5	2.2	2.1
K50A	23544	855.0	85.6	73.2	62.2	6.3	4.9	3.9	30.2	38.6	38.1	3.3	3.8	3.9	16.8	27.9	22.7	0.7	1.9	2.8	15.0	26.8	29.1	2.0	2.5	2.8
K50B	20289	881.9	113.1	88.9	80.9	8.8	7.2	5.6	43.7	45.1	49.7	4.2	5.8	5.4	20.6	26.5	35.9	0.8	2.5	3.4	18.1	27.2	36.7	2.0	3.9	3.9
K60A	16144	673.0	85.4	69.0	60.4	6.0	4.1	2.9	37.5	33.8	36.7	3.6	3.8	2.9	26.1	29.5	24.5	1.8	2.6	2.6	24.4	29.2	25.9	2.4	3.0	2.6
K60B	14316	755.3	37.8	29.7	24.9	2.8	1.7	0.9	17.6	18.2	15.9	1.7	1.7	0.9	8.1	12.8	12.9	0.5	1.2	0.9	11.1	14.9	12.7	1.3	1.3	0.9
K60C	16080	743.5	56.5	43.1	38.5	3.8	2.3	1.1	17.4	22.1	25.1	2.3	2.3	1.1	5.7	14.9	16.6	0.6	1.6	0.9	9.4	15.6	17.2	1.6	1.8	1.1
K60D	29248	811.1	89.8	76.9	68.4	6.0	4.2	3.0	29.5	42.0	39.1	2.8	3.7	3.0	17.3	26.5	32.2	0.1	1.8	2.2	18.1	27.4	28.6	1.4	2.4	2.4
K60E	10016	774.5	78.2	65.4	56.0	5.4	3.6	2.2	26.5	37.8	34.5	2.8	3.3	2.2	15.8	24.6	26.4	0.1	1.6	1.7	15.6	23.9	25.8	1.4	2.1	1.9
K60F	24207	805.9	54.8	45.6	40.3	4.3	2.8	1.8	21.8	27.1	25.2	2.5	2.5	1.8	10.7	16.1	20.2	0.8	1.1	1.4	9.6	18.1	21.4	1.8	1.7	1.5
K60G	16659	864.5	90.2	74.5	64.1	7.0	6.1	5.0	34.9	44.5	48.3	3.7	4.8	4.9	14.6	22.0	29.4	0.3	2.2	2.7	16.6	27.1	34.7	2.0	3.6	3.6
K70A	17033	915.9	119.2	106.7	94.7	12.3	9.0	6.1	43.2	52.9	60.4	5.5	7.0	5.5	17.4	35.5	32.4	0.3	3.6	2.4	16.6	40.4	36.3	3.6	5.0	3.5
K70B	10643	991.0	153.1	138.2	125.8	19.5	14.1	10.2	49.1	63.4	71.4	11.1	10.5	8.3	24.3	35.7	46.4	2.8	5.2	4.6	21.6	37.9	49.8	6.0	7.2	6.1
K80A	14589	1022.3	186.0	169.4	158.7	20.8	16.4	11.2	43.0	65.0	80.4	10.7	11.7	8.6	27.5	41.1	49.6	2.9	5.5	4.1	30.7	45.1	52.9	8.6	7.6	5.6
K80B	20824	1030.9	181.2	155.6	139.8	16.8	13.5	11.8	63.5	73.4	82.4	8.5	9.0	9.2	27.4	34.6	44.0	1.1	3.9	4.7	31.2	46.3	51.1	6.1	5.9	6.4
K80C	18880	996.0	182.4	166.8	154.8	18.2	14.0	11.9	47.0	75.3	90.2	9.4	8.5	9.2	30.3	39.5	47.4	1.6	3.7	5.2	30.0	42.1	55.9	6.3	6.5	6.5
K80D	17297	932.8	153.8	141.4	128.1	13.8	11.2	8.3	43.0	68.4	81.8	6.6	7.4	6.5	23.7	34.0	42.7	0.2	3.4	2.7	22.7	39.2	53.3	4.3	5.2	4.8
K80E	26582	894.0	155.4	141.1	128.9	16.9	12.8	11.4	50.4	69.3	76.4	10.3	8.7	9.7	33.0	48.4	55.3	5.1	5.9	6.6	30.3	54.4	55.5	8.3	6.8	8.0
K80F	22089	766.4	156.7	149.1	127.8	12.5	9.6	7.8	72.6	96.6	89.0	7.8	7.7	7.7	52.8	80.7	70.2	4.7	4.9	5.9	38.9	81.0	72.3	6.1	6.0	5.9
K90A	21354	722.0	97.3	77.2	67.3	7.4	6.1	4.9	39.7	36.1	49.0	4.0	5.6	4.8	6.7	20.1	23.4	1.8	3.9	3.9	18.2	24.9	29.0	2.7	4.4	4.4
K90B	14960	771.2	123.3	101.4	96.4	9.2	7.4	6.7	51.9	48.6	63.0	4.8	6.1	6.4	23.9	27.0	39.3	1.6	3.7	4.8	26.8	36.3	45.8	2.8	4.4	5.3
K90D	21524	694.6	78.8	65.0	55.5	6.7	4.7	3.1	37.5	39.5	36.7	4.1	4.4	3.1	19.2	23.9	31.4	1.3	2.2	2.6	16.3	29.6	32.3	2.6	3.0	2.9
K90E	17639	672.0	70.2	57.2	47.1	6.2	4.3	2.1	34.3	37.4	31.7	4.1	4.0	2.1	17.6	22.1	29.2	1.2	2.5	1.8	16.6	29.0	27.8	2.6	3.1	2.0
K90F	25030	698.4	78.6	65.0	55.5	6.6	4.7	3.1	37.4	39.5	36.7	4.0	4.4	3.1	18.9	24.2	31.8	1.2	2.2	2.6	16.1	29.6	32.3	2.5	3.0	2.9

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
K90G	28650	655.4	61.5	50.5	39.3	5.2	3.0	1.4	30.6	35.0	26.1	3.9	3.0	1.4	14.3	21.3	23.8	1.2	1.9	1.4	14.8	24.4	22.9	2.2	2.5	1.4
L82B	40469	681.0	78.9	67.5	57.6	5.6	4.0	2.9	31.4	36.8	39.3	3.8	3.7	2.9	18.4	27.4	26.2	2.1	2.9	2.6	16.3	27.2	28.2	2.5	3.2	2.7
L82C	36207	666.7	74.0	63.4	54.3	5.3	3.6	2.4	29.2	35.5	37.9	3.7	3.3	2.4	18.2	26.2	25.0	2.1	2.6	2.1	17.3	25.8	27.1	2.6	2.9	2.2
M20A	36146	696.3	91.2	80.2	74.2	6.5	4.3	3.2	32.4	54.3	52.4	4.6	4.0	3.2	23.0	32.8	42.9	1.8	2.5	2.6	21.7	40.6	45.1	3.1	3.3	2.9
M20B	30747	722.2	83.7	73.8	62.8	7.2	5.4	4.0	35.2	49.8	48.2	4.4	5.1	4.0	28.2	37.6	37.4	2.0	3.2	3.3	25.3	38.6	39.8	3.1	3.5	3.5
P20A	42182	716.0	96.8	76.1	64.2	7.5	5.3	4.1	35.6	37.5	36.5	4.3	5.0	4.1	25.9	29.2	35.2	1.9	2.7	3.6	29.8	27.6	35.3	3.3	3.3	3.8
P40D	24566	667.7	89.5	72.0	62.7	6.5	4.7	3.6	40.1	49.6	44.4	4.2	4.4	3.6	29.3	39.3	41.7	2.2	3.0	3.3	27.3	39.5	40.6	3.5	3.3	3.4
Q92A	32404	664.5	84.0	74.2	66.1	5.5	4.1	3.4	53.9	61.1	53.5	3.8	4.1	3.4	46.5	55.2	53.0	2.6	3.4	3.4	45.1	54.7	52.2	3.2	3.5	3.4
Q94A	25891	803.2	73.4	67.4	61.3	7.0	4.7	3.1	51.3	58.3	53.3	5.6	4.7	3.1	36.9	51.2	50.2	3.7	4.3	3.1	40.1	53.1	52.4	4.6	4.4	3.1
Q94B	14742	717.4	57.3	44.0	37.6	4.5	3.0	1.8	42.0	35.2	29.6	3.7	3.0	1.8	32.1	33.2	28.7	2.7	2.6	1.8	31.6	34.4	28.4	3.1	2.8	1.8
Q94C	13519	766.0	51.4	43.0	39.7	4.0	1.9	1.3	37.5	33.4	31.3	3.1	1.9	1.3	29.8	30.1	28.9	1.7	1.5	1.3	33.0	31.6	29.0	2.3	1.8	1.3
R10A	13780	827.2	91.8	76.2	72.0	9.5	7.1	5.4	54.0	54.4	56.4	6.5	6.3	5.3	44.3	42.4	54.0	3.7	4.7	4.5	47.8	45.5	55.7	4.5	5.4	5.0
R10B	22220	850.6	119.5	100.8	91.1	9.7	7.9	6.7	69.5	81.3	76.2	5.7	7.0	6.7	57.4	62.8	67.8	3.2	4.8	5.7	60.7	63.7	70.9	4.6	5.7	6.0
R10C	12548	788.4	115.4	104.8	90.4	10.7	7.9	5.9	61.8	72.6	66.3	6.4	7.3	5.9	48.0	54.3	54.8	4.0	5.1	5.1	51.1	60.4	58.4	5.0	6.0	5.5
R10D	17844	698.4	46.8	37.0	27.0	2.3	1.4	0.6	39.9	33.7	23.8	2.0	1.4	0.6	32.2	29.9	22.6	1.6	1.4	0.6	34.4	30.4	22.9	1.9	1.4	0.6
R10F	7072	1054.6	223.5	203.1	191.4	29.0	24.8	22.1	118.0	134.9	140.1	19.4	19.6	20.2	101.3	113.6	117.3	11.1	14.6	15.8	101.8	114.2	118.6	16.7	16.4	16.4
R20A	13940	1007.8	151.9	134.5	120.7	18.8	13.6	10.6	81.8	92.2	88.1	12.6	11.8	10.3	64.0	71.8	74.6	9.9	8.4	8.7	60.8	67.7	74.7	10.8	8.9	9.2
R20B	15474	680.5	35.1	25.4	20.9	3.0	1.3	0.5	23.6	20.5	16.2	2.5	1.3	0.5	16.6	16.3	14.9	1.4	1.0	0.5	16.5	16.3	14.8	1.6	1.1	0.5
R20C	12103	795.8	118.5	107.2	96.2	11.3	8.2	6.1	64.3	71.3	70.9	6.7	7.4	6.0	50.6	55.4	59.0	4.4	5.4	5.3	49.7	60.8	63.4	5.5	6.3	5.6
R20E	24945	657.8	71.2	57.8	44.4	5.8	3.8	2.0	35.3	42.3	33.9	3.4	3.7	2.0	30.4	38.0	29.0	1.8	3.1	1.8	30.9	39.2	30.6	2.7	3.4	1.9
R20F	26092	676.6	76.9	60.2	51.8	6.9	4.1	2.5	35.2	44.6	39.6	3.2	3.8	2.5	26.5	31.7	34.1	1.6	2.7	2.2	25.7	35.6	34.0	2.5	3.0	2.4
R20G	10323	816.2	132.8	113.7	100.1	13.1	8.5	6.4	39.2	56.4	52.4	4.8	5.8	5.9	11.2	35.2	43.3	2.0	3.2	4.3	11.6	36.2	43.4	3.5	3.6	4.6
R30A	42545	866.5	125.4	103.3	91.8	12.0	8.2	5.8	34.2	36.9	43.3	4.9	5.9	5.0	12.4	24.3	33.8	1.1	3.6	3.3	18.4	22.8	29.2	2.7	4.7	4.0
R30B	52705	791.7	117.0	97.7	88.5	11.8	8.1	6.4	43.8	52.6	57.6	6.6	6.5	6.1	33.9	48.6	49.1	3.6	4.6	4.9	34.7	40.3	48.8	4.4	5.1	5.2
R30C	50706	688.4	62.3	49.0	39.3	5.6	3.2	1.8	28.7	30.3	24.3	3.1	2.9	1.8	17.6	25.4	23.0	1.8	1.8	1.5	20.5	24.8	22.7	2.5	2.3	1.8
R30D	15063	780.0	103.0	82.4	71.4	9.7	6.3	4.2	24.2	29.0	29.8	3.3	5.1	4.0	16.0	24.7	25.3	0.9	2.1	2.9	10.4	22.0	24.3	1.5	2.5	3.4
R30E	47157	672.3	74.6	58.5	51.3	6.8	3.9	2.3	34.5	44.1	39.9	3.3	3.6	2.3	26.1	32.1	34.1	1.7	2.6	2.1	25.9	36.3	35.1	2.5	2.9	2.2
R30F	20864	793.3	109.0	91.0	75.8	10.5	6.7	4.8	25.5	33.8	31.3	3.6	5.2	4.6	12.9	29.1	26.5	1.0	1.9	3.4	8.0	27.8	25.1	1.5	2.6	3.9
R40A	33252	765.4	111.1	87.2	77.0	9.5	6.3	4.3	37.3	38.9	39.2	3.4	4.6	4.1	17.5	31.7	32.3	1.8	2.6	3.1	18.3	29.6	33.5	1.6	2.9	3.3

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
R40C	19464	665.0	54.6	41.8	35.5	3.4	1.6	0.9	11.3	19.0	19.7	1.9	1.4	0.9	11.3	14.7	18.3	-0.1	0.5	0.9	9.0	10.3	17.0	0.9	0.9	0.9
S20D	30961	681.3	45.5	37.2	30.7	2.4	0.8	0.5	29.1	30.7	25.7	1.8	0.8	0.5	20.0	24.3	24.6	1.0	0.6	0.5	20.0	28.7	24.7	1.2	0.8	0.5
S32D	30724	709.2	71.0	63.2	55.4	6.4	4.3	2.9	57.8	54.6	49.8	5.4	4.3	2.9	50.5	51.5	48.8	3.9	3.7	2.9	50.0	52.1	48.4	4.7	4.0	2.9
S50A	22397	730.9	80.1	68.5	57.6	6.1	4.9	3.6	57.1	59.8	50.9	4.4	4.9	3.6	39.2	47.4	46.9	2.5	3.7	3.3	47.9	49.0	47.1	3.4	4.3	3.6
S50B	33356	817.2	86.5	74.2	65.5	7.4	6.5	5.3	48.4	63.5	58.3	4.6	6.0	5.3	41.9	49.8	52.4	2.5	4.2	5.0	33.9	53.7	56.4	3.4	4.7	5.1
S50C	38337	667.9	51.0	40.2	33.0	3.1	1.8	0.6	41.9	36.9	29.8	2.7	1.8	0.6	29.0	34.6	29.0	1.6	1.5	0.6	34.9	36.2	29.1	2.0	1.8	0.6
S50D	39547	707.3	66.0	57.0	47.9	4.6	3.0	1.8	47.7	51.6	43.1	3.6	3.0	1.8	34.4	44.9	41.3	1.9	2.2	1.8	37.4	47.1	42.2	2.8	2.7	1.8
S50E	44792	783.4	93.9	82.5	68.3	8.5	7.1	5.5	69.1	69.7	62.0	5.6	6.8	5.5	46.7	60.4	56.0	4.2	5.3	5.2	54.2	67.4	57.9	4.6	6.0	5.4
S50F	8683	698.6	66.6	53.4	47.8	4.0	2.0	1.0	44.1	45.5	41.7	3.2	2.0	1.0	36.7	36.5	37.3	1.8	1.7	1.0	37.7	38.1	38.6	2.5	1.7	1.0
S50G	50116	675.3	36.7	27.7	21.8	2.6	1.4	0.6	29.0	26.1	21.3	2.2	1.4	0.6	23.9	24.7	20.6	1.5	1.4	0.6	25.7	25.2	21.0	1.9	1.4	0.6
S50J	68511	667.7	46.5	40.4	32.2	4.2	2.6	1.4	33.9	35.0	28.8	3.7	2.6	1.4	26.7	30.9	27.3	2.2	2.4	1.4	30.6	31.7	26.9	3.1	2.6	1.4
S60A	32753	809.8	92.0	80.1	62.3	8.0	6.5	4.6	55.1	65.4	54.3	5.5	6.2	4.6	43.2	56.0	50.1	3.5	4.7	4.2	46.5	60.5	51.8	4.5	5.7	4.5
S60C	21584	681.0	61.7	51.7	45.4	6.0	3.9	2.6	40.9	43.3	37.5	4.7	3.7	2.6	36.8	38.4	36.1	2.8	2.9	2.6	34.5	39.0	36.4	3.4	3.4	2.6
S70A	33911	686.0	112.1	103.5	93.9	7.5	5.6	4.6	35.2	57.8	61.4	2.2	4.4	4.6	26.3	44.2	60.3	0.0	2.1	3.3	22.5	40.9	58.4	0.9	3.0	4.2
S70B	26729	742.1	91.0	79.0	65.0	7.4	5.4	3.4	28.3	44.1	40.6	3.9	4.6	3.4	27.3	40.5	33.6	1.4	3.0	2.6	20.9	38.5	33.4	2.0	3.7	3.0
S70C	19755	666.5	74.9	58.5	45.6	5.2	3.2	2.3	48.2	48.6	37.1	3.8	3.2	2.3	35.6	42.6	35.5	2.4	2.7	2.3	37.4	44.9	35.8	3.2	2.9	2.3
S70D	51361	684.0	73.2	58.8	48.8	4.5	3.2	1.9	52.2	50.9	43.5	3.0	3.2	1.9	44.4	45.0	40.7	1.5	2.5	1.9	44.1	46.4	40.2	2.1	2.9	1.9
S70E	48065	744.2	97.0	81.8	72.2	8.9	6.2	4.1	56.9	63.3	56.4	6.4	5.8	4.1	49.5	52.5	51.9	3.7	4.3	3.8	49.2	56.2	51.4	4.9	4.7	3.8
S70F	35865	804.7	122.5	100.4	88.6	10.5	7.5	5.3	47.4	54.3	56.6	5.2	5.8	5.0	36.7	49.7	47.9	2.1	3.9	3.7	37.5	40.3	46.8	2.9	4.2	3.9
T11A	32970	738.8	79.9	66.3	58.0	6.0	4.7	3.4	57.9	57.2	50.9	4.5	4.7	3.4	40.9	44.9	46.9	2.3	3.5	3.1	49.0	47.3	47.1	3.3	4.1	3.4
T11B	41469	751.1	88.3	72.8	62.7	7.2	5.8	4.7	59.4	65.6	57.0	5.0	5.7	4.7	45.7	51.2	53.5	2.6	4.1	4.4	48.0	55.0	55.6	3.9	4.4	4.4
T11C	38548	851.5	128.0	111.2	100.1	10.3	7.8	6.0	75.6	91.7	85.0	6.4	7.0	5.7	62.0	70.1	75.1	4.0	4.7	4.5	60.5	71.4	75.4	5.3	5.2	5.4
T11D	34256	849.0	108.4	95.1	85.3	10.6	8.2	6.8	64.9	81.2	76.9	7.8	7.0	6.6	50.2	61.0	68.8	5.3	5.6	5.1	49.4	62.9	73.4	6.8	6.2	6.0
T11E	23285	939.6	159.3	141.1	125.6	15.5	11.1	8.8	95.3	115.6	106.6	11.3	10.1	8.5	59.5	87.0	97.1	8.0	6.3	6.2	61.9	84.4	99.1	9.6	7.6	7.4
T11F	27517	897.2	126.9	116.7	101.9	10.3	7.8	6.1	79.2	96.8	88.6	7.4	7.2	6.1	51.3	80.9	78.0	4.4	4.9	4.7	56.3	85.0	79.5	5.6	5.8	5.5
T11G	29079	747.4	92.4	78.5	64.7	7.2	4.9	3.8	53.5	55.8	51.3	4.4	4.7	3.8	43.4	50.2	41.1	2.5	3.1	3.4	39.6	49.2	41.5	3.4	3.8	3.5
T11H	21618	719.7	82.3	68.3	54.9	5.8	3.9	3.0	49.2	50.5	43.7	3.6	3.8	3.0	40.3	44.6	38.7	1.9	2.8	2.9	39.2	43.9	40.7	2.6	3.2	3.0
T12A	27884	845.1	97.8	82.9	67.0	9.3	7.1	5.7	65.7	70.8	58.2	6.5	6.7	5.7	55.0	59.6	53.0	4.3	4.6	5.0	55.2	61.2	56.0	5.6	5.5	5.4
T12B	22979	738.3	72.8	61.3	52.1	5.7	3.3	2.4	46.4	52.0	44.5	4.3	3.3	2.4	40.6	44.9	42.3	2.9	2.7	2.4	41.4	50.3	42.8	3.5	3.0	2.4

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T12C	28365	740.0	55.1	42.9	35.0	3.8	2.5	1.0	45.9	39.2	32.7	3.2	2.5	1.0	34.2	35.2	31.6	1.7	2.2	1.0	40.5	36.5	31.7	2.6	2.4	1.0
T12D	32034	720.9	51.7	41.0	36.3	4.0	2.2	1.3	31.8	33.6	32.7	3.4	2.2	1.3	27.6	29.0	28.3	1.9	1.9	1.3	30.1	32.3	30.5	2.6	2.2	1.3
T12E	41206	720.8	54.5	41.9	36.8	4.0	2.2	1.6	34.5	34.4	32.1	3.4	2.2	1.6	30.1	29.4	28.8	1.7	1.9	1.6	32.7	33.1	30.5	2.5	2.1	1.6
T12F	34614	745.3	60.0	48.2	39.6	5.1	3.1	1.7	45.3	41.8	35.0	4.1	2.8	1.7	34.6	38.9	32.6	2.8	2.3	1.7	38.0	39.8	33.1	3.5	2.8	1.7
T12G	27626	678.4	63.6	53.4	43.9	3.7	2.8	1.4	46.5	46.1	38.8	2.6	2.8	1.4	41.7	41.9	36.5	1.0	2.5	1.4	40.1	45.0	37.7	1.9	2.6	1.4
T13A	28747	748.4	94.6	79.4	66.2	7.5	5.2	4.4	55.2	56.3	52.5	4.7	4.9	4.4	44.1	50.7	42.6	2.7	3.3	3.9	39.8	49.3	42.7	3.6	4.0	4.0
T13B	28529	701.7	78.3	64.6	51.2	5.7	4.2	3.4	48.6	49.3	41.4	3.6	4.1	3.4	38.5	43.4	35.4	1.6	3.1	3.2	35.9	41.4	38.2	2.7	3.7	3.4
T13C	31827	722.1	82.5	70.1	59.1	5.8	3.6	2.6	56.3	59.8	51.6	3.9	3.5	2.6	43.9	52.4	46.2	2.1	2.5	2.6	42.9	51.7	48.4	3.1	2.8	2.6
T13D	35733	889.4	129.2	105.3	98.0	13.2	8.0	5.9	55.9	62.9	65.8	8.0	6.3	5.6	36.3	36.6	49.8	5.1	4.4	4.1	36.1	48.8	52.1	6.1	4.9	4.5
T13E	16748	940.9	170.4	152.9	139.8	19.9	15.3	10.1	63.6	84.4	96.2	10.2	12.1	9.7	51.9	66.6	75.9	3.9	8.0	7.2	41.8	68.8	71.2	6.4	9.3	7.5
T20A	48080	936.8	150.4	137.2	123.7	15.2	11.9	10.2	91.8	104.9	103.1	10.8	10.2	9.9	64.4	83.6	88.0	7.2	6.9	7.0	65.6	92.8	89.4	8.6	8.5	8.2
T20B	40518	844.9	93.6	80.5	71.9	7.7	6.0	4.8	65.2	66.3	63.9	5.3	5.6	4.8	46.6	56.2	58.2	3.0	4.0	4.1	42.7	58.4	59.8	3.9	4.6	4.5
T20C	31973	687.6	58.1	47.7	43.4	5.5	3.7	1.8	39.2	36.9	33.0	3.7	3.7	1.8	28.0	32.5	29.1	2.0	3.4	1.8	28.5	32.2	29.5	2.4	3.4	1.8
T20D	38755	763.6	98.6	76.3	67.9	7.9	5.9	4.5	61.8	59.0	52.8	5.3	5.6	4.5	46.1	50.0	46.3	3.1	4.6	4.0	51.0	51.5	48.0	4.1	4.6	4.2
T20E	34942	828.8	108.8	99.2	76.2	10.5	8.0	6.1	50.1	61.9	54.4	6.2	7.2	6.1	48.0	51.2	36.5	3.7	4.5	5.0	46.7	50.7	41.1	4.8	4.9	5.6
T20F	44301	763.9	86.0	68.1	53.5	7.9	5.2	3.2	46.1	48.6	38.3	5.6	5.1	3.2	33.5	41.7	33.4	2.4	3.8	2.9	31.6	39.9	32.1	3.6	4.2	3.1
T20G	21291	955.1	178.1	148.7	133.5	18.1	13.6	8.6	64.8	78.9	73.8	10.0	10.0	8.2	44.8	59.6	63.2	4.6	6.7	5.5	40.4	50.3	59.3	8.3	7.3	4.7
T31A	22130	906.7	147.1	134.2	123.9	14.3	11.7	10.8	99.0	116.2	116.2	10.9	9.9	10.5	76.0	87.6	94.7	7.1	7.2	7.5	64.6	79.6	92.3	8.6	8.2	8.1
T31B	28395	829.1	108.4	96.8	82.8	8.7	7.1	6.0	82.2	88.1	74.8	6.5	6.9	6.0	55.6	72.3	68.9	4.1	4.7	5.3	57.0	74.9	71.4	5.0	5.5	5.7
T31C	29058	828.2	103.0	91.0	76.2	7.9	6.7	5.5	73.1	81.5	68.0	5.3	6.4	5.5	47.5	66.0	60.7	3.1	4.2	4.8	53.5	69.3	65.3	4.3	5.1	5.2
T31D	35251	735.9	66.6	56.9	46.9	4.7	3.6	2.4	53.7	53.2	43.9	4.2	3.6	2.4	39.4	44.3	40.7	1.9	3.2	2.4	37.4	46.3	40.7	2.6	3.3	2.4
T31E	50866	755.6	71.9	58.3	51.7	5.0	3.9	2.7	51.9	51.6	47.3	4.1	3.9	2.7	35.9	42.5	41.1	1.6	3.0	2.4	36.8	45.3	44.1	2.5	3.3	2.7
T31F	60466	715.3	70.6	61.1	51.5	5.9	4.5	2.6	59.0	53.8	44.2	5.5	4.5	2.6	46.3	50.0	43.2	3.0	3.9	2.6	48.4	52.1	42.9	3.8	4.2	2.6
T31G	20838	800.1	123.7	108.1	94.6	7.6	6.1	5.0	83.4	87.6	77.1	4.9	5.7	5.0	64.3	70.1	70.5	2.1	3.2	4.0	66.3	70.6	70.7	3.3	3.9	4.5
T31H	61624	808.4	125.1	107.3	93.1	10.0	7.7	6.3	82.0	87.1	78.5	6.6	7.0	6.3	54.1	66.6	66.1	4.0	4.2	4.8	58.8	68.9	69.4	5.3	5.1	5.6
T31J	50645	806.7	127.4	111.1	98.3	7.7	6.5	5.3	80.3	85.6	79.3	4.0	5.6	5.3	58.0	65.2	68.0	1.4	3.0	4.2	63.7	69.7	72.8	2.9	3.6	4.4
T32A	34707	802.8	106.1	89.8	74.8	6.9	5.5	4.2	78.6	79.3	66.2	5.4	5.3	4.2	61.3	68.2	58.4	2.7	4.3	3.8	55.6	71.5	62.9	3.9	4.7	4.1
T32B	30648	817.2	159.9	139.8	122.6	11.4	9.3	8.0	104.5	112.7	106.6	8.1	8.0	7.8	76.4	82.1	86.3	4.8	4.9	4.8	66.3	76.8	79.2	6.2	5.7	5.6
T32C	37292	777.9	114.7	92.0	80.8	7.7	6.6	5.5	85.6	80.2	71.2	6.1	6.3	5.5	67.5	63.9	59.3	3.4	5.0	4.7	66.4	67.1	61.5	4.4	5.2	5.0

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T32D	35018	786.7	99.5	84.2	73.0	7.2	5.8	4.7	74.4	72.1	62.6	5.7	5.5	4.7	56.2	57.3	55.6	3.2	4.2	4.0	53.5	60.1	56.4	4.1	4.6	4.4
T32E	38205	844.2	133.3	113.9	98.7	9.6	7.6	6.6	84.6	90.7	83.3	6.6	6.6	6.4	67.6	74.0	64.5	3.8	4.0	5.1	68.6	79.9	70.7	5.3	4.9	5.7
T32F	29670	930.0	163.9	147.1	138.3	15.0	11.8	9.5	77.7	97.6	107.0	9.8	9.3	8.9	48.0	76.1	88.6	6.0	5.9	6.5	56.2	80.6	89.2	7.8	7.2	7.2
T32G	43775	861.1	112.1	92.1	78.7	9.5	8.2	7.3	71.7	77.4	66.6	6.6	7.6	7.2	55.3	63.4	57.1	4.0	4.9	6.3	58.6	65.4	62.4	5.4	6.0	6.6
T32H	45216	879.3	136.6	122.6	111.8	15.0	10.0	7.4	69.6	83.5	85.1	10.3	8.8	7.1	54.7	66.4	71.5	6.7	4.7	4.7	51.7	67.3	75.1	8.5	6.3	5.5
T33A	67192	757.3	78.0	64.8	54.1	5.2	3.8	2.9	62.1	57.9	47.9	4.5	3.8	2.9	45.3	50.8	42.7	2.2	3.1	2.6	50.8	55.1	45.5	3.2	3.5	2.9
T33B	60189	801.1	89.4	75.6	67.9	7.2	5.9	4.4	53.1	58.0	55.2	5.1	5.6	4.4	28.8	45.4	46.6	3.0	4.4	3.7	37.1	49.5	48.2	3.9	4.9	4.1
T33C	36692	768.9	78.5	69.2	61.8	6.4	4.8	2.9	51.6	53.9	51.2	4.7	4.5	2.9	29.4	43.3	45.7	3.1	3.7	2.3	37.8	50.1	44.9	3.9	4.3	2.6
T33D	46100	737.8	66.3	58.7	52.2	5.3	3.3	1.7	46.3	46.4	43.8	4.2	3.3	1.7	31.7	40.1	40.2	3.0	2.6	1.7	35.5	43.5	41.6	3.2	2.9	1.7
T33E	26712	749.0	90.1	80.7	71.4	6.4	5.0	3.5	54.2	68.4	61.5	4.0	4.7	3.5	47.2	56.8	58.6	2.1	3.0	3.2	44.9	54.3	59.5	3.0	3.6	3.5
T33F	43704	827.9	91.1	74.7	63.8	8.0	6.4	4.6	58.1	59.5	53.1	6.1	6.1	4.6	45.3	52.7	46.8	3.4	4.7	4.1	46.3	51.3	49.9	4.5	5.1	4.4
T33G	50253	836.6	117.7	98.3	84.0	8.5	6.9	5.4	73.9	77.5	67.5	5.1	6.1	5.4	50.5	60.1	60.5	2.7	3.6	4.4	56.5	60.4	61.5	3.9	4.4	4.8
T33H	51602	781.0	99.1	89.0	79.4	6.3	5.4	4.1	59.8	73.9	70.2	3.9	5.0	4.1	48.8	58.5	64.6	1.7	3.0	3.8	47.9	56.5	65.7	3.0	3.8	3.8
T33J	45645	725.6	62.5	49.8	42.7	4.4	2.9	1.7	37.6	40.8	36.2	3.0	2.9	1.7	28.4	34.9	33.7	1.1	2.2	1.7	30.1	37.5	34.8	2.1	2.4	1.7
T33K	16907	858.5	106.4	93.4	84.8	11.9	8.4	6.8	54.1	59.0	61.4	8.0	7.8	6.6	38.5	47.5	52.6	5.3	4.1	5.6	39.7	52.1	53.7	6.6	5.4	5.9
T34A	24149	905.9	153.9	134.8	124.1	15.5	13.4	11.2	92.2	105.8	98.1	10.8	11.1	10.8	77.4	83.8	85.3	7.3	8.2	8.6	84.9	82.4	88.8	9.3	9.4	8.6
T34B	24608	860.5	116.3	99.3	94.4	10.3	7.9	6.1	66.7	77.0	79.1	7.0	7.2	6.0	63.0	67.4	65.1	4.6	5.2	5.1	61.0	60.8	69.8	5.6	5.5	5.6
T34C	28194	805.7	121.1	106.6	97.5	8.6	6.8	5.7	73.4	83.7	82.1	4.4	6.1	5.7	55.9	63.1	67.8	1.8	3.1	4.3	54.1	62.1	74.4	3.6	4.0	4.8
T34D	34142	849.8	141.2	125.7	116.2	10.8	8.3	7.0	77.6	91.7	95.7	6.0	6.3	6.9	57.6	69.4	72.4	3.0	3.6	4.4	56.0	66.8	76.0	4.7	4.7	4.7
T34E	26817	901.2	150.6	131.0	121.3	15.0	12.8	10.7	89.1	102.3	97.2	10.5	10.8	10.4	76.5	81.5	83.1	6.9	7.7	8.3	83.0	78.8	86.8	9.0	8.9	8.4
T34F	23769	874.8	120.2	105.5	97.2	11.1	8.1	6.6	67.1	82.2	81.1	7.6	7.4	6.5	64.5	70.5	66.2	5.0	4.9	5.4	63.2	62.7	71.5	6.2	5.4	6.0
T34G	35802	895.5	132.4	120.1	111.9	12.8	9.0	7.6	77.2	83.9	86.3	9.1	8.1	7.3	55.1	69.1	73.7	5.8	5.3	6.4	55.8	71.7	73.4	7.7	6.4	6.7
T34H	59013	863.7	111.6	100.5	88.9	8.6	7.0	5.7	62.8	75.5	69.2	6.0	6.6	5.7	54.2	67.4	60.4	3.1	4.7	5.0	50.0	64.6	66.4	4.7	5.5	5.3
T34J	29628	766.7	65.8	58.7	48.5	5.6	4.5	3.0	38.1	51.3	42.9	3.9	4.5	3.0	31.6	40.5	40.2	1.9	3.8	3.0	31.3	44.3	39.9	3.1	4.0	3.0
T34K	33294	713.9	70.6	61.7	52.3	5.0	3.3	2.0	36.9	44.0	36.6	3.0	3.2	2.0	30.4	38.7	33.4	1.4	2.4	1.9	30.4	41.6	34.1	2.3	2.7	2.0
T35A	47510	911.9	147.4	129.2	119.4	14.6	12.2	10.2	84.7	100.3	96.2	10.0	10.5	9.9	74.3	80.2	80.9	6.6	7.2	8.1	80.2	76.0	85.3	8.6	8.3	8.2
T35B	39567	916.9	151.5	132.4	122.2	15.1	13.1	10.6	87.3	102.4	96.6	10.5	11.2	10.3	74.7	80.5	82.3	6.9	7.7	7.9	81.8	77.6	85.5	8.8	8.9	8.3
T35C	30613	905.5	162.5	143.6	126.2	13.0	10.4	8.9	88.7	102.7	98.8	8.1	7.8	8.4	59.7	81.5	79.6	4.5	5.1	5.1	72.0	82.0	86.1	6.3	6.5	5.8
T35D	34776	811.7	97.1	84.0	77.7	6.9	5.9	4.8	65.7	66.9	62.8	4.5	5.6	4.8	45.5	54.2	58.4	2.1	3.6	3.9	49.9	58.7	59.4	3.3	4.3	4.5

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T35E	49179	920.5	131.6	117.2	98.5	12.4	9.8	8.2	68.1	89.1	82.7	8.5	8.5	8.1	52.1	66.5	68.5	5.3	5.6	6.1	55.3	68.7	73.4	7.1	6.6	7.2
T35F	35866	847.3	123.0	114.3	102.3	10.1	7.9	6.5	70.4	87.6	84.8	7.0	7.0	6.5	53.3	71.9	74.5	4.6	4.8	4.8	55.7	79.5	76.4	6.0	5.6	5.7
T35G	57449	759.3	87.4	76.2	66.7	5.7	4.1	2.6	58.2	64.5	58.6	4.3	4.1	2.6	49.1	54.8	52.5	2.4	2.8	2.3	49.3	57.6	55.4	3.3	3.3	2.4
T35H	51929	847.5	100.2	87.7	78.7	8.5	6.6	5.6	64.3	72.3	70.2	5.8	6.1	5.6	47.5	59.4	63.2	3.2	4.1	4.7	44.6	59.8	63.0	4.3	4.7	5.2
T35J	18836	923.0	129.6	116.3	103.3	13.1	10.1	8.6	90.1	103.2	94.4	10.5	9.6	8.6	65.8	72.9	80.5	6.9	6.5	6.1	71.7	80.2	87.3	8.6	7.8	7.2
T35K	62478	784.3	73.9	57.9	50.0	6.3	5.0	3.3	50.3	48.6	42.1	4.5	4.9	3.3	37.5	43.5	40.6	2.6	3.6	3.1	40.5	43.7	40.4	3.6	4.1	3.2
T35L	34011	765.9	70.1	54.0	46.9	5.9	4.6	3.0	48.5	45.4	39.8	4.1	4.5	3.0	37.5	41.0	38.3	2.4	3.6	2.9	39.5	41.0	38.0	3.3	3.7	3.0
T35M	30452	863.4	155.4	131.7	113.2	14.1	9.1	6.8	65.7	80.3	74.8	8.4	6.8	6.3	43.0	54.2	55.0	4.4	4.1	3.4	46.3	53.9	58.5	5.8	5.1	4.4
T36A	46195	929.3	149.2	141.3	129.7	16.3	12.5	8.5	48.3	76.8	90.4	8.6	10.2	8.0	35.6	50.0	61.5	5.1	7.4	6.1	32.8	54.5	60.7	6.5	8.7	6.2
T36B	26438	1030.7	185.5	158.0	141.4	24.6	19.6	16.0	60.3	76.3	88.2	12.3	13.8	13.5	33.1	43.7	47.9	3.6	7.2	8.2	37.2	36.5	47.6	6.2	9.3	9.6
T40A	20813	986.9	194.9	174.9	158.7	18.7	16.5	15.8	113.8	129.0	135.3	12.6	12.7	14.5	88.2	106.5	109.0	9.3	9.6	10.9	84.2	101.1	107.7	11.0	11.1	12.0
T40B	27773	984.3	195.7	180.2	165.1	16.0	14.2	11.5	94.6	118.2	126.3	11.1	11.7	10.9	70.5	85.0	95.0	6.4	7.7	7.0	49.9	78.0	91.7	8.7	8.5	7.5
T40C	23702	829.5	117.8	101.1	90.2	7.4	6.2	5.6	86.7	85.4	82.8	4.5	5.9	5.6	62.5	72.0	72.9	1.7	3.8	5.0	63.3	74.3	73.0	2.7	4.4	5.3
T40D	37151	814.5	102.4	84.0	65.2	8.1	7.0	5.1	72.9	69.0	58.1	5.5	6.7	5.1	50.9	55.4	48.5	2.7	4.8	4.5	52.0	58.9	48.6	3.5	5.4	4.8
T40E	48490	823.5	77.1	63.2	55.4	8.6	6.7	4.4	36.5	49.0	43.0	4.9	6.2	4.4	22.4	29.5	38.8	1.8	3.7	3.6	22.7	30.2	41.0	3.1	4.6	3.7
T40F	33379	1070.7	208.5	184.0	161.9	27.8	22.2	17.8	43.6	85.0	80.4	12.3	15.1	15.1	15.9	36.2	35.5	4.7	6.7	8.1	11.3	37.6	40.2	6.2	8.6	9.1
T40G	29963	1056.6	212.0	183.1	156.8	25.8	20.5	16.5	60.0	85.7	98.2	13.5	15.0	13.4	40.8	56.4	50.7	4.9	8.4	9.2	28.8	50.1	46.6	6.5	9.8	9.9
T51A	32733	1050.9	286.2	268.3	251.2	24.2	22.5	21.0	132.1	153.1	165.0	16.0	16.7	16.0	98.5	117.5	124.4	9.1	11.6	12.4	80.4	100.5	105.4	14.8	14.0	14.1
T51B	20999	982.9	219.7	201.3	186.5	16.2	14.7	13.6	111.1	120.3	133.2	10.9	11.2	11.1	82.2	86.2	92.0	6.8	7.8	7.6	69.8	85.0	94.2	9.0	9.8	9.2
T51C	46141	951.9	177.2	164.2	150.2	15.7	13.4	11.4	111.9	126.6	121.7	11.6	12.1	11.1	83.5	97.5	94.7	8.5	8.3	7.8	82.9	98.1	105.0	9.7	9.2	8.4
T51D	14133	1028.3	207.4	191.4	178.9	17.5	16.3	15.0	121.2	136.2	147.0	13.1	13.4	13.1	91.7	101.3	108.8	9.8	10.5	10.6	85.4	91.4	100.7	11.3	11.8	11.2
T51E	25544	956.7	171.0	160.8	149.0	13.9	12.4	10.7	103.0	129.8	127.3	9.9	10.8	10.4	69.4	87.2	95.3	5.9	7.1	6.8	61.4	79.0	91.5	7.7	8.0	7.6
T51F	30619	952.1	206.6	193.6	183.4	18.1	15.4	13.9	121.1	142.1	154.1	13.8	12.6	13.3	84.3	99.1	118.2	10.3	9.1	9.0	77.1	94.8	110.8	12.0	10.6	10.1
T51G	25529	926.1	158.5	144.6	133.0	15.5	13.7	12.2	111.6	126.0	125.2	12.0	12.1	11.9	87.4	97.2	103.2	8.3	9.0	8.7	76.4	93.0	103.6	9.8	10.0	9.4
T51H	51922	947.2	158.8	142.2	134.2	13.4	11.5	10.6	102.9	111.8	122.2	10.1	10.1	10.4	74.9	82.4	90.3	7.1	7.0	7.9	81.2	86.5	100.8	8.3	8.3	8.6
T51J	26464	909.4	153.2	136.8	125.2	11.8	9.6	8.2	97.3	108.4	106.1	9.0	8.8	8.1	78.6	80.9	90.5	6.1	5.5	5.9	78.6	86.1	90.9	7.4	6.5	6.8
T52A	38179	910.4	159.6	146.2	138.5	14.1	12.3	10.3	86.1	106.9	114.3	10.2	11.0	10.0	63.1	75.9	86.1	6.3	7.3	6.9	59.7	66.1	83.7	8.0	8.6	7.7
T52B	25539	879.2	119.7	101.3	89.9	8.5	7.7	6.8	82.0	88.3	82.5	6.2	7.5	6.8	61.7	70.2	76.2	2.8	4.5	5.9	54.0	66.4	75.1	3.9	5.1	6.2
T52C	26046	835.9	108.9	90.9	79.3	7.0	5.8	4.6	80.9	74.8	66.8	5.1	5.5	4.6	53.0	59.2	56.7	2.7	3.5	3.9	50.9	61.6	59.7	3.6	4.3	4.3

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T52D	52995	791.5	86.8	74.4	62.5	7.9	6.1	4.3	57.4	56.9	46.2	6.4	6.1	4.3	45.8	53.0	45.3	4.1	4.9	4.3	43.3	54.2	44.1	4.6	5.6	4.3
T52E	23257	903.7	141.4	120.8	105.9	10.3	8.9	8.3	98.4	103.6	97.4	7.3	8.6	8.3	77.0	78.8	89.8	3.8	4.8	6.6	64.0	75.6	85.4	5.1	5.6	6.9
T52F	41683	907.8	156.1	137.0	123.9	11.3	9.8	8.3	118.9	123.4	112.3	8.3	9.3	8.2	94.6	94.9	97.1	5.0	5.7	5.6	88.3	93.7	100.3	6.5	6.8	6.4
T52G	22070	900.1	113.6	101.7	88.8	8.3	7.0	6.2	74.4	80.5	75.1	6.3	6.7	6.2	38.5	55.4	57.4	2.9	4.5	5.2	34.4	49.2	56.3	4.1	5.4	5.7
T52H	34359	781.5	72.7	56.7	47.9	4.3	2.8	1.8	52.0	48.5	41.9	3.6	2.8	1.8	41.3	38.6	33.8	2.3	2.2	1.5	39.3	41.2	37.1	2.9	2.5	1.8
T52J	36680	823.9	79.8	64.1	51.8	5.7	4.3	2.9	54.0	51.3	42.6	4.5	4.3	2.9	39.8	40.2	33.5	3.1	3.5	2.6	33.2	40.8	35.2	3.5	3.9	2.8
T52K	42510	805.0	79.8	66.3	52.5	5.6	4.5	3.0	55.0	54.0	43.7	4.3	4.5	3.0	38.1	42.7	34.3	3.0	3.7	2.6	32.7	42.8	36.2	3.5	3.9	2.8
T52L	17837	889.7	176.5	160.1	136.0	17.1	14.3	10.8	75.6	91.3	79.4	10.9	12.7	10.6	66.7	66.3	61.4	7.0	9.0	8.2	62.4	64.1	59.8	8.6	9.8	9.0
T52M	31255	899.9	124.8	115.9	114.2	11.3	8.1	5.6	22.3	47.5	63.0	5.2	6.6	5.6	14.4	22.2	41.0	2.0	3.0	3.4	11.2	18.4	39.4	3.0	3.7	4.0
T60A	54553	872.5	125.5	112.5	93.9	11.1	8.3	7.4	79.2	92.1	80.5	6.9	6.8	7.4	50.6	71.0	64.4	3.6	4.3	5.9	50.2	74.3	70.3	4.7	5.4	6.4
T60B	52697	895.2	131.8	116.9	109.8	16.5	12.8	8.8	58.2	74.6	81.2	11.2	10.4	8.5	37.1	47.5	61.6	7.0	6.8	4.9	35.0	49.4	65.3	9.0	8.3	6.1
T60C	36258	954.8	176.7	164.0	149.7	21.2	18.6	15.4	63.5	93.3	98.5	12.3	15.7	14.5	49.3	64.4	70.8	7.8	12.9	12.0	47.3	64.2	68.8	10.6	14.1	12.1
T60D	41392	1070.2	196.6	175.1	158.1	25.4	21.4	16.8	52.3	79.7	70.1	12.1	13.8	14.8	24.8	43.3	54.9	0.5	5.2	6.2	19.0	41.9	50.2	5.8	8.7	8.6
T60E	19788	883.7	123.9	110.7	100.5	15.4	11.5	8.2	52.8	71.4	73.6	10.4	10.0	7.9	36.7	47.7	58.8	6.8	5.9	4.7	32.3	47.8	59.5	8.4	7.4	6.1
T60F	46323	937.7	173.7	161.1	146.8	21.0	18.3	15.3	63.3	94.9	98.9	12.3	15.6	14.5	49.3	64.6	70.9	8.0	12.7	12.2	46.9	64.6	69.0	10.5	13.9	12.2
T60G	35939	1112.5	239.0	213.2	193.0	28.1	24.4	21.7	70.9	105.3	92.7	12.6	15.5	19.0	52.9	68.0	76.8	1.5	6.1	8.7	46.9	66.9	75.6	6.8	10.3	11.9
T60H	32158	1277.6	346.9	320.4	302.2	34.4	29.9	27.4	54.1	94.4	130.5	9.1	14.2	17.9	34.8	64.5	77.6	-0.6	3.6	5.1	26.4	51.4	75.0	5.5	7.4	11.3
T60J	29342	1108.6	258.9	246.9	234.4	28.2	25.4	24.1	77.8	107.2	120.0	13.4	17.9	20.5	61.2	87.0	93.4	4.1	10.8	14.4	51.4	81.8	91.7	8.8	12.8	15.8
T60K	24195	1073.0	276.9	243.6	215.3	26.4	21.5	16.8	69.7	108.4	107.3	11.1	13.9	11.6	42.0	44.7	53.2	1.3	4.5	5.3	34.2	41.6	56.4	6.0	8.8	8.1
T70A	31404	861.5	184.9	161.1	139.1	18.6	16.2	11.5	89.9	107.8	99.9	12.1	13.7	10.8	66.1	79.3	77.5	8.0	10.7	7.8	66.5	75.3	78.0	9.8	11.8	8.6
T70B	27637	970.7	145.9	127.0	107.8	17.5	13.2	8.8	34.7	64.2	48.8	8.5	9.6	8.3	19.3	41.3	37.7	1.2	5.3	4.3	11.4	39.0	44.3	6.1	6.3	5.2
T70C	19761	932.2	118.1	105.5	94.4	10.0	6.5	4.3	38.0	58.2	52.2	4.9	5.2	4.2	33.3	50.6	48.2	1.6	2.8	3.3	28.8	44.2	47.3	3.2	3.7	3.4
T70D	33230	1004.4	162.1	140.1	121.3	19.2	16.1	10.6	34.7	66.8	56.5	8.8	11.5	9.8	18.4	42.1	37.6	1.2	6.4	4.9	13.6	38.5	47.9	6.3	7.9	5.8
T70E	22814	828.1	158.3	134.1	116.0	16.0	13.0	9.0	81.3	90.1	82.5	11.0	11.2	8.8	56.9	68.1	67.1	7.4	8.4	6.2	61.0	68.3	68.1	8.7	9.5	7.1
T70F	26462	928.8	119.3	104.9	88.4	13.7	8.1	6.6	41.7	59.2	47.3	8.7	6.8	6.5	36.4	51.3	43.3	5.5	4.5	5.6	31.8	45.3	42.5	7.1	5.4	5.7
T70G	26828	943.3	154.4	130.1	110.2	15.9	11.5	7.7	41.8	60.3	51.8	7.8	8.0	7.3	21.0	40.0	41.7	2.4	4.6	4.1	16.3	33.4	37.7	6.2	5.1	3.7
T80A	21284	998.0	185.1	156.2	140.1	20.2	15.0	10.7	45.0	66.7	71.8	10.1	9.5	9.8	23.7	43.3	51.2	3.6	5.9	5.3	19.0	31.3	47.5	7.0	7.4	5.3
T80B	23350	934.0	146.6	122.4	103.7	15.2	10.6	7.0	39.9	57.5	47.2	7.4	7.6	6.7	20.1	38.6	38.5	2.3	4.1	4.3	15.8	30.4	34.5	5.9	4.4	3.3
T80C	31438	796.4	94.9	85.0	73.3	8.1	6.3	4.1	45.8	56.2	51.2	4.9	5.7	4.1	24.9	49.3	43.6	2.2	4.3	3.3	32.2	51.7	47.0	3.2	4.9	3.8

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T80D	28023	967.0	163.4	134.6	119.1	20.4	13.8	9.3	47.9	59.4	62.3	10.0	9.9	8.4	30.2	38.0	42.2	2.6	5.6	5.3	20.0	35.5	40.6	4.6	6.2	5.9
T90A	32848	701.1	64.7	50.4	44.9	5.5	3.8	3.0	41.5	39.4	38.0	3.4	3.6	3.0	33.2	32.6	33.3	2.0	2.6	2.8	34.9	35.4	33.5	2.8	3.1	2.9
T90B	40213	966.6	181.3	157.3	143.5	16.5	10.8	8.3	38.8	56.8	69.5	7.7	6.2	5.7	20.2	45.8	60.3	1.9	2.9	2.6	24.2	42.9	55.2	5.8	4.9	3.8
T90C	36646	897.3	150.8	127.6	112.6	12.1	8.2	6.9	33.2	52.9	55.4	5.0	4.8	5.4	16.6	41.8	42.9	0.4	1.8	2.4	19.5	39.4	49.0	4.2	3.2	3.6
T90D	37432	810.6	123.6	108.4	90.7	7.8	5.7	3.9	47.9	62.0	62.7	4.5	5.1	3.7	41.3	57.4	49.9	1.3	3.1	3.0	40.0	57.0	50.3	2.8	4.1	3.5
T90E	41184	899.5	146.4	131.3	114.4	13.8	8.4	6.1	38.3	66.7	69.9	6.4	5.9	5.1	20.6	41.5	47.1	1.8	2.4	3.2	20.4	32.5	44.9	3.7	3.7	3.7
T90F	28177	975.4	184.4	157.4	146.2	20.2	14.9	9.9	41.9	62.8	75.5	10.2	10.8	8.2	22.9	33.7	50.0	2.8	5.7	4.6	24.0	28.1	41.6	6.5	7.1	5.6
T90G	46025	867.2	130.3	111.1	98.4	10.2	7.9	6.0	31.0	50.8	53.8	3.7	4.9	5.0	22.1	31.7	41.4	1.4	2.6	2.8	20.8	30.5	42.3	2.8	3.2	3.2
U10A	41812	1173.7	350.5	338.2	323.4	30.7	29.3	28.1	152.6	177.7	192.2	20.9	20.6	20.6	100.8	133.7	137.1	11.4	12.4	12.7	80.9	124.1	134.2	17.0	18.6	18.2
U10B	39207	1071.5	230.5	219.8	203.1	19.5	17.6	17.0	146.4	163.9	148.1	13.9	14.0	14.8	109.8	120.7	126.9	8.9	11.0	11.8	107.9	129.6	128.4	11.5	12.2	12.6
U10C	26694	992.5	196.1	186.7	178.0	16.7	14.6	13.6	102.7	129.2	145.6	11.1	11.3	12.9	71.6	92.1	103.2	6.3	7.4	7.7	62.9	81.2	97.7	9.3	8.8	8.8
U10D	33697	999.3	194.2	175.4	162.4	17.7	15.7	14.6	121.9	135.3	147.2	13.6	13.7	14.1	101.8	107.2	111.8	10.1	11.0	11.4	82.7	92.3	104.1	11.3	11.2	11.7
U10E	32712	1031.7	257.5	230.8	217.4	20.8	18.9	17.5	136.4	150.4	174.2	15.0	15.2	15.4	104.8	116.6	124.2	8.8	11.4	11.3	107.0	111.6	121.0	12.6	13.0	12.6
U10F	37894	964.6	193.1	181.2	163.9	16.1	13.2	11.0	122.4	144.3	138.0	11.9	11.0	10.6	92.2	115.8	114.5	8.7	8.0	7.2	87.8	105.4	111.3	9.9	8.8	7.8
U10G	35304	973.8	179.5	155.2	144.4	16.1	12.3	10.5	101.3	108.7	119.9	11.7	10.2	9.9	74.6	80.0	95.4	8.3	7.2	6.8	68.1	84.1	94.9	9.9	8.3	7.6
U10H	45770	938.9	125.6	115.8	105.0	11.2	8.0	6.6	91.8	96.3	88.6	8.6	7.4	6.6	64.0	81.4	81.3	5.9	5.2	5.5	58.7	73.7	82.3	6.9	5.5	5.9
U10J	50500	889.6	126.8	109.8	95.7	9.2	7.4	6.6	85.5	87.2	76.0	6.5	6.9	6.6	51.7	68.3	61.7	3.3	4.2	4.8	49.1	63.8	70.0	4.6	5.1	5.9
U10K	36433	789.7	89.3	76.3	66.2	5.7	3.9	2.4	61.0	59.3	51.0	4.3	3.9	2.4	49.4	56.2	49.8	2.2	3.1	2.4	47.7	57.0	48.8	2.6	3.5	2.4
U10L	30716	754.5	66.2	52.9	45.1	6.1	4.2	1.9	48.5	40.3	34.0	5.5	4.2	1.9	38.8	38.6	32.1	3.8	3.9	1.9	36.2	37.1	31.1	4.2	3.9	1.9
U10M	28001	857.8	113.2	89.8	76.0	7.1	5.0	3.1	51.6	57.1	46.7	3.2	4.6	3.1	23.3	41.8	44.4	0.3	2.6	2.6	22.4	40.5	43.9	1.1	3.1	2.8
U20A	29329	1007.2	209.6	188.9	176.1	18.7	16.4	14.2	117.0	132.9	136.3	14.3	14.2	13.7	82.9	94.8	100.6	10.3	11.0	10.2	81.5	93.7	101.9	12.2	12.1	11.0
U20B	35291	989.1	189.0	168.9	155.3	15.9	13.4	10.2	111.1	116.3	119.4	12.2	11.8	9.9	78.8	88.6	94.1	8.7	9.1	7.5	71.1	93.0	100.2	10.4	10.4	8.3
U20C	27887	930.8	148.2	128.0	114.2	9.7	7.7	6.2	87.2	97.3	89.0	7.4	7.1	6.2	68.8	73.3	74.3	4.8	5.2	5.1	67.9	74.6	79.1	5.6	5.8	5.6
U20D	33821	1040.2	235.0	211.6	195.5	17.8	15.2	14.4	142.2	160.1	157.0	11.9	11.4	13.1	100.5	116.8	132.6	7.0	7.8	8.4	91.2	115.1	129.6	9.6	9.2	9.4
U20E	38983	974.3	116.5	97.3	86.7	7.6	5.8	4.2	75.1	74.5	69.6	6.0	5.4	4.2	56.8	56.8	61.8	4.2	3.7	3.1	55.8	53.4	62.3	5.2	4.3	3.6
U20F	43473	981.0	216.7	198.7	184.7	15.6	13.4	11.2	128.4	141.7	130.1	9.2	10.5	10.6	78.0	94.7	111.5	3.5	5.6	6.0	82.7	112.1	120.9	6.8	7.4	6.9
U20G	49371	894.7	98.1	87.6	74.2	9.0	7.2	5.8	59.9	71.1	63.0	6.1	6.9	5.8	37.8	55.7	52.5	3.4	4.3	4.8	39.4	56.9	55.2	4.2	4.9	5.3
U20H	21964	941.8	167.5	148.3	134.2	11.5	8.8	7.2	109.6	118.3	108.5	7.4	7.7	7.1	85.6	91.1	90.9	4.0	4.2	4.1	87.6	89.1	88.8	5.2	5.0	4.7
U20J	67838	839.6	57.4	42.1	29.9	4.8	3.2	1.6	47.2	38.7	26.6	4.2	3.2	1.6	33.8	30.4	23.0	2.1	2.6	1.6	32.0	31.8	24.0	2.8	2.9	1.6

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
U20K	27086	951.5	132.7	116.7	102.1	15.2	11.4	8.8	72.3	91.6	81.5	10.7	10.3	8.8	54.4	63.6	67.6	7.3	7.2	7.2	43.5	64.6	67.6	8.4	7.8	7.6
U20L	32845	807.8	79.3	64.9	55.1	6.8	4.4	2.2	41.7	51.5	44.0	4.5	4.3	2.2	34.2	39.6	40.8	2.0	3.0	2.1	28.8	38.3	39.9	2.7	3.3	2.2
U20M	35976	923.0	147.5	132.0	124.0	11.5	7.9	6.0	47.2	65.9	62.9	5.2	5.8	5.9	21.7	39.6	40.6	0.9	3.0	3.4	12.7	32.4	41.0	2.4	3.3	3.5
U30A	37562	968.0	208.6	188.1	167.4	20.3	17.9	15.5	87.2	122.7	124.0	13.3	14.5	14.7	68.9	88.9	86.5	8.1	10.5	10.5	65.2	82.5	84.5	11.0	11.9	11.4
U30B	22124	983.6	161.9	157.0	136.4	17.8	12.4	8.5	57.8	100.5	92.8	10.5	9.5	8.3	20.1	67.8	71.6	2.8	5.1	4.7	10.0	50.3	56.6	5.0	5.0	4.9
U30C	24162	1000.4	168.6	147.9	127.5	15.1	10.7	7.5	64.9	84.8	82.4	7.9	7.9	7.4	39.8	55.1	54.4	2.3	3.4	3.2	33.5	50.4	51.5	5.3	4.3	3.8
U30D	18058	986.8	166.0	138.6	125.2	17.0	11.1	8.1	58.8	59.5	73.2	9.5	9.0	7.8	28.1	42.9	42.8	1.5	3.2	4.3	12.9	28.5	31.7	4.8	3.6	3.8
U30E	29023	1016.3	156.4	140.5	129.6	13.7	9.8	7.5	46.7	65.7	74.1	8.3	8.5	7.5	21.7	32.0	46.8	3.4	4.4	4.2	17.0	23.7	36.7	4.5	4.5	4.1
U40A	31706	922.9	107.0	96.8	86.8	9.0	7.5	5.8	78.0	88.7	79.4	7.6	7.5	5.8	58.5	71.9	76.3	4.8	5.9	5.6	49.4	69.8	76.0	5.6	5.9	5.5
U40B	38840	872.3	124.3	109.6	100.5	9.5	7.2	5.3	67.1	86.2	83.0	6.3	6.6	5.3	52.2	65.4	74.1	3.6	3.8	4.1	50.7	61.1	72.2	5.0	4.3	4.4
U40C	26351	880.0	95.8	84.8	74.5	7.9	5.9	4.8	71.8	73.8	66.5	6.5	5.9	4.8	50.5	59.6	57.8	4.0	3.9	4.2	50.3	59.6	58.3	4.8	4.4	4.4
U40D	26654	866.3	92.3	74.0	61.7	8.3	6.4	4.5	62.3	63.6	52.1	6.4	6.3	4.5	42.8	55.5	48.3	4.4	4.6	4.1	40.1	53.4	48.6	5.2	4.8	4.2
U40E	31813	842.9	89.4	74.4	59.1	8.0	6.0	3.8	61.8	63.9	48.9	6.5	6.0	3.8	45.5	54.7	44.7	4.0	4.6	3.5	40.8	53.3	44.4	4.8	5.1	3.7
U40F	28975	850.5	107.8	90.7	74.2	7.4	5.9	4.6	71.8	78.2	62.0	4.9	5.8	4.6	51.5	58.8	56.5	2.5	3.5	4.0	52.5	66.9	57.7	3.4	4.1	4.2
U40G	25279	891.4	114.6	96.7	82.7	11.2	8.4	6.5	66.9	74.2	65.1	7.8	8.1	6.5	49.3	57.2	54.7	4.6	5.1	5.5	41.7	59.7	58.7	5.6	5.8	5.7
U40H	36119	921.8	165.0	147.1	127.2	14.4	10.8	8.1	102.5	117.9	101.0	10.2	10.3	8.1	80.0	98.9	93.4	6.9	7.3	7.1	78.4	97.3	92.7	7.9	7.9	7.4
U40J	27922	998.1	140.8	123.1	111.8	16.5	11.2	7.1	54.2	70.0	72.1	9.9	9.5	7.0	34.7	49.0	48.9	2.7	4.6	4.2	19.5	37.7	36.1	5.8	4.5	3.7
U50A	29769	1056.6	164.9	136.3	113.6	16.8	12.5	8.5	65.8	84.1	65.8	9.8	10.2	8.2	32.4	49.4	59.3	1.4	5.4	4.0	-3.1	25.7	36.2	5.3	5.6	4.1
U60A	10494	985.4	185.2	165.0	153.6	15.9	12.5	11.1	99.8	113.9	126.4	11.2	10.0	9.9	73.8	85.8	100.7	7.4	6.9	7.0	66.6	86.8	98.3	9.2	8.0	8.0
U60B	31552	823.2	71.3	63.4	52.1	5.7	4.2	2.7	45.7	54.6	45.9	4.2	4.2	2.7	36.1	47.6	40.8	2.6	3.4	2.5	29.8	48.0	42.0	2.9	3.8	2.6
U60C	36451	771.8	76.3	60.4	48.9	7.0	5.4	3.7	51.9	49.0	37.6	5.4	5.4	3.7	39.0	44.9	36.1	3.0	4.5	3.7	37.0	44.2	35.5	3.8	5.0	3.7
U60D	18465	887.8	157.1	137.4	115.6	12.2	8.1	5.4	53.8	74.3	62.9	6.0	6.3	5.0	31.5	57.2	59.2	1.9	3.4	3.7	26.3	52.7	59.7	4.1	3.8	3.7
U60E	27989	902.8	134.2	116.3	101.8	10.3	7.6	5.3	36.5	60.9	60.3	5.6	6.6	5.3	20.2	34.6	40.8	2.0	3.3	3.9	15.6	29.2	40.0	3.3	3.6	4.0
U60F	27208	968.3	176.3	155.1	138.8	17.2	13.7	9.8	57.7	81.9	79.8	8.6	10.4	9.1	29.2	46.4	48.5	2.3	6.6	4.5	27.7	47.2	55.4	6.0	7.3	5.3
U70A	11447	1043.6	230.8	212.9	189.5	21.3	18.0	15.4	125.7	158.1	145.7	14.2	14.7	13.9	84.9	119.0	118.3	7.8	10.3	9.9	82.8	110.1	111.7	11.9	11.7	11.1
U70B	27211	859.9	110.5	91.1	76.5	9.1	7.0	5.5	76.6	72.8	65.4	6.9	6.9	5.5	57.1	62.7	57.1	4.5	5.3	5.0	52.1	61.7	55.4	5.5	5.5	5.2
U70C	35014	861.1	108.7	95.8	80.7	8.8	6.5	5.2	62.3	74.3	66.9	6.0	6.2	5.2	47.9	56.3	51.9	4.0	4.7	4.6	42.6	61.1	50.3	4.4	5.3	4.9
U70D	20822	944.4	141.4	122.4	111.6	13.4	8.7	7.1	43.4	57.3	66.4	7.1	7.4	7.0	25.5	29.5	35.2	2.2	3.3	3.6	26.9	28.0	31.4	4.8	4.1	4.4
U70E	8653	992.3	167.7	142.1	122.8	20.6	16.1	11.7	56.4	79.6	66.6	10.5	11.6	10.9	27.3	43.2	39.1	2.3	6.0	5.9	20.0	46.2	45.3	6.9	7.1	6.6

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
U70F	5940	1000.1	205.5	180.1	167.6	20.3	14.1	11.1	57.4	73.4	70.9	9.6	9.4	10.3	21.7	46.5	56.3	0.9	2.6	4.8	26.1	46.8	54.5	4.5	5.2	5.8
U80A	15783	1036.2	181.5	165.1	155.8	23.0	19.3	16.0	52.3	71.2	84.8	10.9	12.5	14.1	23.3	34.9	52.9	2.1	5.3	8.0	16.9	29.6	50.3	5.5	8.6	9.0
U80B	33894	799.7	104.4	94.0	81.2	9.9	7.3	5.0	30.5	45.6	43.2	5.3	6.0	5.0	15.3	30.0	27.5	2.7	3.0	3.7	7.6	27.1	27.4	3.7	3.5	4.3
U80C	20225	962.0	174.6	154.1	136.8	18.9	13.4	10.0	48.5	59.8	61.1	10.0	8.9	9.2	22.4	36.8	40.7	2.6	4.1	3.6	20.2	26.1	31.7	5.6	5.3	4.7
U80D	12012	1046.7	216.6	199.4	186.0	25.7	20.7	16.5	43.2	65.5	72.8	11.7	13.7	14.4	33.1	52.1	63.5	2.2	5.3	8.1	27.9	42.9	55.6	3.6	8.4	8.7
U80E	41502	831.2	140.7	112.4	105.0	11.3	7.8	5.3	48.1	60.8	63.4	5.5	6.4	5.1	24.7	28.0	41.8	1.3	2.9	3.5	17.2	27.9	35.4	2.8	3.8	3.9
U80F	13738	935.2	165.3	151.0	137.3	18.1	13.5	8.8	41.0	57.2	53.8	8.9	10.3	8.3	27.4	43.5	44.0	1.8	5.7	4.2	21.1	35.9	43.6	5.1	6.2	4.7
U80G	26120	940.0	138.1	114.8	102.8	14.6	10.2	7.3	46.7	60.2	71.5	8.5	8.9	7.2	27.7	41.2	43.5	3.7	4.3	4.0	18.7	30.9	37.1	6.2	5.2	4.6
U80H	24325	1011.3	165.5	139.5	127.5	21.4	16.9	11.9	65.4	83.0	72.7	10.8	13.0	11.0	36.2	47.4	54.2	4.0	8.0	6.5	33.5	48.6	54.8	5.5	8.1	7.4
U80J	37143	839.6	135.4	118.5	104.3	11.2	8.2	6.3	74.5	85.7	76.8	7.3	7.8	6.3	45.2	71.5	74.4	4.4	5.7	5.8	45.2	69.5	74.2	5.2	6.4	5.9
U80K	18355	946.8	157.7	135.1	121.8	18.0	14.2	9.8	55.2	60.6	56.3	9.5	11.7	9.5	35.7	52.3	42.5	2.6	6.9	5.2	30.7	51.6	42.4	6.5	7.3	5.7
U80L	10742	981.9	187.4	157.9	134.0	22.5	14.8	11.4	71.0	85.9	64.6	12.3	11.3	10.8	43.0	63.2	49.6	4.6	5.4	5.7	35.4	55.4	54.0	7.5	6.5	6.7
V11A	20692	1298.5	392.8	375.0	360.1	34.8	33.1	31.9	160.7	190.0	208.7	20.4	22.5	22.6	118.9	139.5	152.6	10.7	13.3	13.8	97.2	118.2	127.9	15.3	20.2	20.3
V11B	25263	1344.9	525.5	513.2	500.7	40.8	39.4	38.5	201.2	231.5	250.6	22.7	27.3	28.1	152.5	199.7	215.2	11.1	14.0	17.1	127.8	179.5	192.4	18.3	22.1	23.8
V11C	25245	1034.4	206.5	178.0	160.5	19.5	17.7	15.6	122.6	126.7	121.4	12.9	14.6	14.1	95.0	108.9	105.7	8.6	10.9	10.6	101.1	104.2	109.1	10.6	11.6	11.3
V11D	26593	895.6	184.0	158.5	140.2	10.4	8.2	6.9	110.9	116.0	101.4	5.9	6.7	6.6	76.2	87.7	90.3	2.9	3.7	4.5	74.8	93.7	93.0	4.6	4.8	5.2
V11E	19263	1072.0	244.7	219.8	205.1	22.3	20.2	18.7	121.0	127.3	144.2	15.3	15.5	14.9	96.9	103.6	111.4	8.8	11.8	11.9	81.1	88.1	101.8	12.7	13.6	13.3
V11F	16069	820.2	140.7	123.9	105.0	7.2	5.8	4.3	90.4	94.2	77.7	4.4	5.4	4.3	68.6	86.3	70.9	2.3	3.1	3.2	67.8	89.9	72.3	3.1	3.9	3.8
V11G	31348	1297.9	482.6	470.6	459.7	36.9	35.8	35.7	181.5	207.7	228.0	20.5	24.7	25.8	141.7	185.2	200.9	9.0	11.9	15.3	116.3	160.4	172.1	15.7	19.7	22.6
V11H	13293	991.5	207.3	187.8	174.0	17.0	14.4	12.4	100.7	127.2	128.0	10.5	10.3	11.0	74.1	86.8	100.2	6.4	6.7	6.2	72.3	88.1	100.5	8.8	8.2	7.3
V11J	14404	830.3	144.8	128.5	110.1	7.6	6.2	4.6	91.8	97.5	81.6	4.5	5.6	4.6	68.7	87.1	74.2	2.5	3.3	3.5	68.1	93.0	75.9	3.4	4.1	4.1
V11K	24676	912.3	202.8	180.5	169.9	13.7	10.3	8.7	112.0	128.6	132.6	9.0	8.2	8.4	84.8	95.8	100.1	5.7	4.6	4.7	87.6	94.9	101.4	7.2	6.0	5.6
V11L	31168	738.9	98.8	82.1	68.8	5.1	3.4	2.1	69.5	64.3	52.7	3.5	3.3	2.1	55.4	58.7	47.3	2.3	2.6	1.7	55.9	60.4	49.7	2.9	2.6	1.9
V11M	15432	740.8	70.4	57.1	53.9	4.1	2.7	1.1	48.1	42.2	39.9	3.3	2.7	1.1	30.0	37.0	36.8	1.1	1.9	1.1	28.1	40.1	37.4	2.1	2.4	1.1
V12A	30706	923.0	208.4	185.3	174.9	14.2	10.8	9.1	114.1	129.2	136.0	9.3	8.5	8.8	82.6	95.5	100.0	5.7	4.9	4.7	85.9	94.1	102.9	7.6	6.3	5.8
V12B	29327	884.8	185.8	169.7	159.1	11.9	9.1	7.9	109.3	123.9	125.9	7.7	7.6	7.7	82.9	93.7	99.8	4.5	4.2	4.5	82.1	94.0	100.6	6.1	5.3	5.2
V12C	15479	799.5	135.9	120.2	105.1	7.3	5.6	4.3	94.1	98.8	88.7	4.8	5.3	4.3	72.3	79.8	77.0	2.4	2.9	3.6	71.2	81.1	81.3	3.5	3.6	4.0
V12D	23596	1004.6	268.7	244.4	230.8	20.1	17.8	15.7	131.9	148.4	159.4	12.7	13.2	13.7	79.4	107.6	115.8	6.2	9.4	9.0	75.5	100.5	112.6	10.5	11.0	9.9
V12E	32435	787.1	91.5	78.0	67.7	5.9	4.7	3.5	62.5	62.4	55.6	4.0	4.6	3.5	49.1	55.8	49.8	2.1	3.4	3.1	46.2	55.0	49.5	2.9	3.4	3.3

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
V12F	33243	733.7	71.9	59.7	52.4	4.5	3.4	1.8	51.9	48.6	43.8	3.4	3.4	1.8	43.6	42.8	39.3	1.9	2.8	1.8	40.3	44.8	39.3	2.4	3.1	1.8
V12G	50589	739.1	70.4	50.8	40.9	4.8	3.3	1.2	47.9	40.3	34.1	3.5	3.3	1.2	30.5	33.6	29.0	1.8	2.7	1.2	30.1	33.2	29.2	2.5	2.7	1.2
V13A	23169	1280.9	423.4	406.2	391.0	35.7	34.8	34.0	178.4	208.9	222.5	20.8	23.8	24.0	144.8	167.5	180.7	10.1	14.1	14.9	118.7	157.4	161.7	14.5	19.3	20.7
V13B	29378	985.9	207.1	187.2	174.0	16.8	14.5	12.3	101.0	127.5	128.1	10.4	10.5	11.1	74.5	86.6	101.2	6.3	6.9	6.2	72.5	87.0	100.0	8.6	8.4	7.2
V13C	25565	820.4	107.5	96.2	85.8	8.1	6.5	5.3	70.4	75.5	70.7	5.4	6.2	5.3	53.2	64.9	59.8	3.1	3.6	4.6	44.4	67.6	65.6	3.9	4.3	4.9
V13D	28337	818.4	139.2	122.1	103.6	7.2	5.9	4.2	90.1	93.4	77.3	4.4	5.5	4.2	67.8	85.1	70.4	2.3	3.3	3.1	67.0	89.1	71.6	3.2	4.1	3.7
V13E	28088	706.3	50.1	38.5	34.0	3.9	1.8	0.8	42.1	35.3	31.2	3.6	1.8	0.8	35.9	30.9	29.9	2.6	1.4	0.8	32.7	33.0	30.3	3.0	1.5	0.8
V14A	22389	732.3	83.9	69.7	61.9	4.2	2.5	0.9	62.6	55.3	48.4	3.5	2.5	0.9	45.0	50.9	45.3	1.4	1.7	0.9	42.8	53.7	46.0	2.3	2.2	0.9
V14B	17014	714.5	58.1	48.0	38.2	3.2	1.6	0.3	41.8	41.9	32.2	2.2	1.6	0.3	30.3	36.8	30.2	0.9	1.1	0.3	30.9	37.3	30.8	1.6	1.4	0.3
V14C	19519	784.2	80.5	68.8	61.4	5.2	3.6	2.1	58.5	57.3	53.1	4.2	3.6	2.1	41.0	48.0	47.8	2.0	2.8	2.1	42.4	50.1	48.7	3.1	3.0	2.1
V14D	63178	713.1	40.9	34.1	29.8	2.4	0.6	0.1	30.9	29.6	25.5	2.2	0.6	0.1	24.3	27.2	24.1	0.9	0.6	0.1	23.0	27.3	24.0	1.4	0.6	0.1
V14E	28656	760.9	77.3	65.3	53.8	3.8	2.9	1.0	48.5	54.9	45.5	2.2	2.9	1.0	35.1	43.6	42.4	0.7	1.7	1.0	38.8	44.7	42.2	1.6	2.2	1.0
V20A	26709	1024.4	245.6	225.1	209.4	22.3	20.5	18.6	135.6	145.0	154.4	15.1	16.1	15.6	94.5	107.2	108.7	9.0	12.0	11.2	87.9	99.7	106.1	13.8	13.5	12.5
V20B	19026	971.0	192.6	175.3	163.1	17.8	14.5	13.0	114.5	121.7	133.2	13.1	11.8	12.2	82.4	92.2	102.7	8.8	8.2	8.2	77.3	88.3	98.0	10.8	9.8	9.1
V20C	18787	954.0	214.0	204.8	197.4	15.8	14.0	12.7	113.9	146.6	159.7	11.5	11.0	10.5	74.7	103.9	123.2	7.3	7.9	8.0	62.0	95.4	118.5	9.4	9.4	9.0
V20D	29924	856.5	102.0	85.4	67.1	7.2	6.2	5.1	82.2	77.1	61.1	5.9	6.2	5.1	60.1	66.3	56.1	3.8	4.7	4.8	58.1	66.4	57.0	4.6	5.1	4.9
V20E	59867	756.8	78.1	63.8	53.1	4.9	3.4	2.4	57.8	56.4	46.3	3.9	3.4	2.4	43.4	48.5	42.9	2.0	2.5	2.4	44.6	50.4	43.9	2.9	3.0	2.4
V20F	15386	872.2	114.0	104.5	88.1	8.3	7.2	6.1	86.1	94.9	80.3	6.8	6.9	6.1	58.8	76.1	72.7	4.1	4.9	5.4	58.5	76.8	72.6	4.8	5.5	5.6
V20G	25365	756.7	45.2	31.6	27.1	3.7	1.7	0.8	37.7	29.0	24.6	3.5	1.7	0.8	28.9	24.2	23.5	2.5	1.5	0.8	33.8	25.5	23.6	2.8	1.7	0.8
V20H	60337	683.6	44.3	39.3	36.7	2.9	1.4	0.3	34.1	31.4	29.2	2.2	1.4	0.3	22.6	27.2	27.7	0.7	1.1	0.3	25.2	29.7	27.6	1.2	1.3	0.3
V20J	31398	667.1	40.8	37.1	31.9	2.6	1.1	0.2	31.4	29.8	25.1	2.1	1.1	0.2	21.8	26.2	23.6	0.5	0.8	0.2	24.1	28.2	23.8	1.3	1.1	0.2
V31A	62170	915.0	201.3	180.9	159.2	13.5	9.9	7.6	120.8	134.8	128.0	8.5	7.9	7.3	87.1	108.6	105.5	4.4	3.7	4.6	88.7	110.2	106.8	6.7	5.1	5.2
V31B	50531	857.8	137.5	123.5	110.1	11.2	8.5	6.8	81.9	96.1	93.9	6.8	7.8	6.8	61.2	73.7	79.5	3.7	4.2	5.3	55.9	73.6	81.8	4.8	4.7	5.9
V31C	39589	809.2	91.5	78.7	66.0	6.2	4.8	2.9	65.7	66.7	55.0	4.2	4.8	2.9	50.5	54.0	51.5	2.0	3.7	2.9	52.8	58.9	53.8	2.7	4.0	2.9
V31D	46712	787.9	87.6	73.7	65.5	5.3	3.9	2.0	66.1	64.3	57.6	3.7	3.9	2.0	51.6	56.0	55.7	1.5	2.8	1.7	52.6	53.7	55.5	2.5	3.5	2.0
V31E	83388	853.4	113.4	102.5	90.2	7.2	5.7	4.6	69.3	85.5	78.5	4.7	5.6	4.6	52.3	67.1	62.6	2.4	4.0	4.0	48.5	61.5	63.3	3.5	4.3	4.3
V31F	15559	912.6	142.4	125.8	116.7	9.2	7.5	6.1	80.3	94.8	97.1	5.9	7.1	6.1	68.0	78.8	82.8	3.0	4.5	5.1	60.9	72.1	81.9	4.1	5.2	5.4
V31G	25472	788.5	97.3	81.4	70.2	6.3	4.8	2.9	65.9	66.2	58.6	4.6	4.8	2.9	51.7	53.6	51.6	2.3	3.5	2.6	48.3	54.5	54.1	3.3	4.1	2.7
V31H	12848	981.5	185.0	174.5	160.7	15.2	13.3	11.2	93.8	113.6	120.2	10.1	11.5	10.9	60.7	97.9	114.4	4.9	7.4	8.0	54.0	93.5	108.3	7.2	8.1	7.6

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
V31J	35794	873.0	143.0	124.3	114.5	8.8	7.1	6.2	83.8	95.7	92.0	4.8	6.1	6.2	58.7	70.7	79.9	1.8	2.5	4.3	57.9	71.5	82.4	3.5	3.3	4.5
V31K	22665	796.1	97.1	83.4	71.4	6.3	4.9	2.8	65.9	68.3	59.3	4.6	4.9	2.8	50.8	55.5	52.4	2.5	3.7	2.5	48.1	56.6	55.6	3.2	4.2	2.6
V32A	19470	932.6	228.9	210.4	193.9	13.3	10.7	8.3	100.0	124.5	135.8	7.4	7.3	7.8	81.2	96.3	100.3	2.3	3.4	3.1	74.1	95.6	99.9	5.4	5.0	4.1
V32B	55695	797.0	136.9	121.8	109.5	6.3	4.7	3.2	79.3	91.8	83.6	3.4	4.5	3.2	53.2	71.6	73.0	1.2	2.1	2.7	53.9	77.9	77.2	2.2	2.8	3.2
V32C	62992	729.3	91.1	76.7	64.6	4.4	3.1	1.7	62.6	64.1	55.3	3.1	3.1	1.7	49.1	55.4	51.5	1.1	2.2	1.7	45.8	54.0	51.3	1.9	2.8	1.7
V32D	58992	743.8	86.4	73.0	62.2	4.0	2.6	1.7	67.4	64.6	56.9	3.0	2.6	1.7	48.3	59.2	55.2	1.4	2.0	1.7	47.5	56.9	55.2	2.1	2.2	1.7
V32E	78328	775.1	125.7	110.6	103.0	5.6	3.8	2.7	79.7	85.0	78.3	3.6	3.8	2.7	58.7	72.5	74.7	1.2	2.3	2.4	61.1	72.2	74.7	2.3	2.9	2.7
V32F	20143	736.4	86.4	71.5	61.5	4.0	2.8	1.9	68.0	63.6	56.4	3.1	2.8	1.9	48.2	58.3	54.8	1.4	2.2	1.9	47.5	54.7	54.8	2.1	2.5	1.9
V32G	54434	855.0	155.4	140.5	125.8	8.6	7.0	5.7	86.1	98.2	100.6	4.8	6.1	5.7	58.9	81.8	81.5	1.6	3.1	3.4	60.6	83.7	89.2	3.1	4.1	4.4
V32H	51742	723.1	80.2	68.7	62.6	4.5	3.1	1.9	56.9	58.6	55.4	3.3	3.1	1.9	44.2	47.3	51.8	1.6	2.2	1.9	46.0	50.3	51.5	2.5	2.5	1.9
V33A	57686	743.9	109.7	89.3	79.8	6.3	4.9	3.9	76.8	74.8	66.7	4.7	4.9	3.9	52.4	62.2	61.6	2.1	3.2	3.6	57.6	62.5	62.3	3.2	3.6	3.8
V33B	40664	736.3	99.7	85.4	75.5	6.0	4.2	3.3	70.6	71.6	63.4	4.5	4.2	3.3	47.5	62.5	58.1	2.0	3.0	3.0	52.1	63.0	58.9	3.1	3.2	3.3
V33C	39805	771.4	105.2	92.7	81.3	6.1	4.3	2.3	61.6	72.1	64.8	4.3	4.3	2.3	46.5	60.5	58.5	1.9	3.3	2.3	46.1	61.4	58.5	2.5	3.8	2.3
V33D	45519	746.6	62.2	58.7	58.6	4.4	2.6	1.3	35.3	42.0	46.4	3.2	2.6	1.3	23.1	33.0	38.8	1.2	1.9	1.0	21.9	34.6	39.2	2.1	2.2	1.3
V40A	37222	901.6	83.6	66.2	60.2	6.8	5.3	4.0	60.2	56.5	53.1	4.8	5.1	4.0	36.4	44.5	47.2	1.8	3.1	3.4	38.2	47.2	47.8	2.9	4.1	3.7
V40B	29231	764.0	74.5	61.5	51.6	3.5	2.4	0.9	55.9	51.8	44.4	2.5	2.4	0.9	37.6	43.5	38.2	0.5	1.7	0.9	38.8	44.1	38.8	1.4	2.0	0.9
V40C	45486	845.3	125.5	112.5	99.9	8.6	7.5	5.8	81.3	88.6	80.6	5.6	7.5	5.8	49.2	65.0	66.1	2.7	4.4	5.1	52.9	69.3	68.8	4.1	5.0	5.5
V40D	33329	801.1	94.5	81.2	66.9	6.5	5.2	3.7	69.1	64.2	53.0	4.5	5.2	3.7	43.6	54.5	44.7	2.2	3.7	3.7	46.8	56.6	49.3	3.2	4.2	3.7
V40E	30091	727.2	54.0	43.4	38.2	2.7	1.0	0.3	40.3	36.7	33.2	2.4	1.0	0.3	28.0	30.1	29.7	0.6	0.7	0.3	30.2	30.2	29.3	1.2	1.0	0.3
V50A	40892	758.5	62.4	50.4	39.5	4.1	2.5	0.8	39.6	41.8	31.8	3.1	2.5	0.8	28.6	36.5	28.6	1.5	1.9	0.8	26.6	36.8	29.0	2.1	2.2	0.8
V50B	38378	835.6	86.7	77.4	64.2	6.9	4.7	3.1	44.6	60.5	50.0	4.5	4.6	3.1	29.1	46.4	44.5	2.3	2.5	2.6	29.7	44.1	45.1	3.3	3.0	2.8
V50C	40909	982.2	146.2	133.7	124.9	17.5	14.1	11.3	75.6	89.3	86.3	11.7	12.9	11.3	49.8	69.5	75.6	8.0	9.0	9.4	48.9	68.8	75.1	9.4	9.6	9.8
V50D	14680	1019.9	153.1	127.4	116.0	16.8	12.8	8.5	69.9	78.1	70.5	9.2	10.3	7.8	36.7	45.2	55.5	2.1	6.1	5.0	33.6	46.9	54.8	5.4	6.7	5.9
V60A	10682	892.1	193.6	172.8	162.2	13.8	10.9	8.7	108.1	124.0	127.7	9.2	9.0	8.4	81.0	91.1	95.1	6.0	5.5	4.9	82.9	90.7	96.9	7.5	6.6	5.6
V60B	55165	854.9	130.7	120.3	109.4	7.6	5.6	4.2	86.1	96.3	92.4	5.2	5.6	4.2	59.3	77.3	80.3	2.1	3.1	3.6	59.5	78.3	82.4	3.4	4.0	3.9
V60C	36064	728.3	69.3	62.0	59.8	3.9	2.2	1.1	48.5	51.1	48.9	2.7	2.2	1.1	30.8	47.5	48.2	1.0	1.5	0.9	32.2	48.4	47.5	1.7	1.9	1.1
V60D	30789	846.8	158.1	140.0	128.5	7.5	5.7	4.0	90.8	103.0	95.7	4.1	5.4	4.0	65.7	80.9	81.6	1.4	2.7	3.2	68.4	82.9	88.3	2.8	3.3	3.7
V60E	74718	718.1	98.5	85.7	85.7	4.4	3.0	1.7	71.1	64.4	69.9	3.1	3.0	1.7	46.9	54.5	66.6	0.5	1.8	1.7	43.5	57.7	67.4	1.6	2.5	1.7
V60F	40601	769.2	74.9	60.0	57.4	4.6	2.5	1.2	50.4	41.5	43.7	3.2	2.5	1.2	35.6	36.4	35.8	1.5	1.6	1.2	36.9	37.3	35.6	2.3	2.0	1.2

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
V60G	46139	679.5	43.7	37.4	32.8	2.5	0.8	0.2	33.8	29.6	25.4	2.1	0.8	0.2	26.3	26.4	23.9	0.7	0.5	0.2	27.9	27.8	24.0	1.5	0.8	0.2
V60H	35494	700.9	48.8	48.1	45.4	2.9	1.4	0.5	30.9	37.6	37.0	2.4	1.4	0.5	19.7	31.5	34.0	0.9	1.1	0.5	18.8	33.1	34.4	1.4	1.1	0.5
V60J	18594	811.0	89.0	74.3	67.5	5.3	3.8	2.2	51.3	52.0	50.0	3.1	3.5	2.2	39.8	45.3	44.5	1.2	1.6	1.8	42.5	45.1	42.8	2.2	2.3	2.0
V60K	22802	684.2	46.7	40.5	39.2	3.2	1.7	0.5	34.4	32.2	31.3	2.4	1.7	0.5	23.4	27.7	29.6	0.8	1.4	0.5	25.6	30.4	29.4	1.3	1.5	0.5
V70A	28025	1171.2	358.7	342.6	331.3	30.8	29.2	27.2	167.5	186.9	206.1	20.6	21.1	20.2	123.7	150.3	162.9	11.1	14.0	13.7	100.5	127.5	142.4	16.7	18.6	18.2
V70B	12123	1101.2	290.5	281.9	271.9	25.9	24.0	23.0	152.1	184.7	204.1	18.4	18.1	18.6	115.1	140.4	155.7	11.7	13.1	13.7	105.3	128.6	145.0	15.9	16.1	15.8
V70C	34152	879.6	160.6	146.5	131.0	13.1	10.6	8.6	83.8	114.3	103.9	8.4	8.4	8.2	65.9	85.0	85.9	5.5	5.1	4.8	58.8	83.6	86.5	7.0	6.2	5.5
V70D	19837	817.3	105.4	89.8	77.5	7.1	5.5	3.8	72.2	73.2	65.7	5.3	5.5	3.8	50.2	54.4	58.7	2.8	3.3	3.3	52.7	60.2	60.3	4.1	4.0	3.6
V70E	10528	773.5	86.7	71.4	63.7	5.8	4.1	2.5	62.1	59.5	55.2	4.5	4.1	2.5	44.4	45.9	50.0	2.5	2.9	2.2	45.1	49.6	50.2	3.5	3.1	2.5
V70F	36446	693.1	36.6	26.7	25.8	2.3	0.9	0.1	30.1	23.7	22.8	2.2	0.9	0.1	22.6	20.5	21.4	1.0	0.9	0.1	22.9	21.4	21.4	1.5	0.9	0.1
V70G	50447	666.8	27.2	22.4	21.9	1.6	0.3	0.0	23.8	20.0	19.5	1.6	0.3	0.0	18.2	18.4	18.7	0.8	0.3	0.0	19.1	19.0	19.1	1.2	0.3	0.0
W11A	44514	1059.1	193.0	170.0	151.5	17.2	15.3	13.2	115.6	123.5	113.0	11.1	12.8	12.8	83.4	91.2	95.4	5.5	8.8	8.5	84.0	88.0	93.0	7.9	9.2	9.5
W11B	12682	1052.3	139.6	119.1	101.7	15.5	10.0	6.7	51.7	69.0	59.2	7.8	8.1	5.9	26.6	45.8	42.2	1.4	3.6	3.1	32.2	48.1	47.6	4.9	4.8	3.3
W11C	38222	1103.6	170.5	147.9	138.0	20.6	16.3	11.3	57.5	80.3	84.8	11.7	12.1	10.5	36.0	44.0	50.7	1.0	5.8	5.1	24.7	37.0	46.2	4.7	7.5	5.3
W12A	62329	877.8	151.8	134.3	122.1	10.1	8.9	7.3	94.7	103.6	97.5	6.4	8.2	7.3	55.4	71.4	74.9	3.2	4.9	5.7	56.5	74.7	82.3	4.6	5.8	6.1
W12B	65632	935.2	125.1	111.9	96.4	12.3	9.2	6.7	77.9	88.7	76.5	8.1	8.8	6.7	52.0	72.4	68.9	5.1	5.0	5.2	51.5	73.8	69.0	6.0	5.9	5.9
W12C	57006	850.1	99.3	82.2	69.3	5.9	4.0	2.5	51.4	57.9	48.3	3.6	3.6	2.5	36.0	42.9	45.1	0.9	1.7	1.8	32.6	39.6	44.1	2.0	2.6	2.0
W12D	56893	846.7	126.1	107.9	97.1	7.3	5.3	3.8	55.8	63.3	55.3	3.2	5.1	3.8	38.9	55.2	52.5	0.8	2.3	3.2	38.3	55.5	51.0	1.0	2.6	3.5
W12E	24858	1051.1	223.7	198.5	183.2	19.6	14.9	10.4	78.9	103.3	104.5	10.3	10.5	9.8	49.9	68.1	72.0	2.4	6.7	5.0	48.4	66.6	67.8	7.6	7.1	5.9
W12F	39900	1282.6	295.5	264.5	249.0	31.8	28.3	24.0	89.5	116.3	130.0	16.5	20.6	20.6	54.0	75.0	86.5	4.2	9.5	12.5	19.6	46.9	64.3	5.5	10.7	12.4
W12G	32635	834.4	125.5	107.0	105.9	8.0	5.0	2.6	38.4	46.1	58.7	3.1	4.6	2.6	29.2	39.6	44.6	0.2	2.1	1.9	28.2	37.8	50.7	1.1	2.4	2.2
W12H	48456	1042.7	185.8	168.0	152.0	17.9	12.5	8.6	52.9	78.9	76.7	10.0	10.7	8.2	20.9	39.2	51.9	1.6	4.4	3.9	7.9	25.2	43.1	4.8	5.1	4.1
W12J	33212	1286.8	315.0	285.0	259.2	38.5	31.5	26.8	95.2	108.7	122.4	20.2	23.3	20.4	53.4	84.0	97.3	7.6	12.4	11.6	28.7	57.9	65.7	7.0	11.9	13.6
W13A	27583	1139.0	185.8	156.8	136.4	18.0	15.0	12.1	71.1	94.0	87.2	8.8	10.6	11.0	35.6	51.6	56.7	0.7	3.9	5.3	38.7	52.6	59.5	6.6	6.5	6.0
W13B	22244	1296.2	386.5	353.9	331.2	36.6	31.8	27.0	104.6	137.7	156.8	17.5	20.6	20.9	41.2	77.1	78.1	1.6	7.4	8.5	23.1	66.9	70.4	5.4	11.5	11.5
W21A	34014	880.4	148.1	127.8	109.6	9.6	7.0	5.6	89.8	104.1	92.2	6.8	6.5	5.6	61.5	82.0	79.1	3.7	3.6	4.3	69.0	86.6	82.1	5.0	4.7	4.7
W21B	58038	813.5	125.0	109.9	97.3	6.5	4.7	3.4	79.2	91.8	81.4	3.9	4.6	3.4	63.7	70.7	73.2	1.1	2.4	3.0	60.3	71.5	76.4	2.3	3.2	3.1
W21C	36963	728.2	78.5	68.1	61.8	4.3	3.0	1.8	55.5	58.0	54.9	3.1	3.0	1.8	43.6	47.0	51.1	1.5	2.1	1.8	44.8	51.3	50.8	2.3	2.4	1.8
W21D	46869	719.9	76.8	66.7	60.4	4.3	3.0	1.8	54.7	57.1	53.9	3.1	3.0	1.8	42.3	46.4	50.2	1.5	2.1	1.8	44.0	50.5	49.9	2.4	2.4	1.8

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
W21E	41598	731.6	108.7	96.8	95.1	5.8	4.3	2.7	64.2	70.5	75.7	3.8	4.2	2.7	48.2	57.6	66.3	1.4	2.6	2.3	49.3	59.5	67.2	2.4	3.3	2.6
W21F	24275	703.6	91.2	86.0	77.6	4.6	3.1	2.0	58.0	64.3	62.0	3.2	3.0	2.0	41.4	55.1	56.4	1.2	2.2	1.7	43.7	56.7	55.8	1.9	2.7	2.0
W21G	56284	731.5	107.0	96.1	94.2	5.7	4.0	2.6	62.4	69.9	74.8	3.7	3.9	2.6	46.4	56.9	65.3	1.3	2.3	2.2	47.5	58.8	66.2	2.3	2.9	2.5
W21H	43281	780.8	80.5	67.0	57.8	4.7	2.9	1.6	53.2	55.3	48.8	3.2	2.9	1.6	35.5	44.9	44.0	1.0	2.3	1.6	38.7	45.0	43.9	2.0	2.6	1.6
W21J	53004	802.9	112.8	100.2	90.1	6.4	4.8	3.0	64.9	74.4	70.2	4.1	4.8	3.0	47.5	58.8	60.6	1.5	3.4	2.7	48.9	61.7	61.6	2.4	3.8	3.0
W21K	79744	759.4	78.2	69.6	68.6	3.8	2.0	1.0	37.9	44.1	48.2	2.0	2.0	1.0	22.2	38.0	40.0	-0.4	1.2	0.9	23.4	39.2	45.2	0.7	1.5	1.0
W21L	53280	733.6	61.8	54.3	44.7	4.2	2.7	1.2	31.9	32.0	28.8	2.7	2.7	1.2	24.7	33.0	23.6	1.0	1.8	1.1	23.1	31.5	26.2	1.8	2.3	1.2
W22A	23871	910.4	168.5	147.5	133.0	10.3	8.1	6.2	91.1	105.7	103.1	5.9	6.8	6.2	61.2	79.4	76.4	1.4	3.0	3.5	58.0	75.0	79.4	3.9	3.9	4.0
W22B	33168	812.3	119.0	106.1	93.7	6.2	4.2	3.1	77.9	88.9	78.0	4.0	4.2	3.1	61.3	71.8	71.6	1.3	2.3	2.8	58.8	70.7	73.5	2.2	2.8	3.0
W22C	18561	874.5	130.6	109.2	93.4	6.9	5.3	3.5	76.5	83.4	70.2	3.9	4.9	3.5	52.7	59.3	56.5	0.7	2.4	2.7	46.1	60.2	57.2	1.9	3.2	2.8
W22D	19748	781.3	78.9	65.8	56.7	4.6	2.7	1.4	52.8	54.2	47.7	3.3	2.7	1.4	34.9	45.1	43.1	1.2	2.1	1.4	38.3	44.0	43.0	2.0	2.4	1.4
W22E	38542	1055.4	163.8	146.2	127.0	14.4	9.7	7.6	112.3	117.6	107.3	10.5	9.0	7.5	71.8	85.6	88.7	5.9	4.7	4.7	66.2	87.5	90.6	7.2	6.1	5.9
W22F	31203	797.6	82.6	65.4	55.6	4.4	2.4	1.0	40.6	44.0	35.3	2.4	2.4	1.0	31.5	36.0	31.6	0.6	1.6	0.8	30.7	36.0	30.7	1.5	2.0	1.0
W22G	24935	775.6	74.4	59.4	51.2	4.1	2.0	0.9	36.9	40.6	33.4	2.4	2.0	0.9	27.6	32.6	29.6	0.5	1.3	0.7	27.9	33.2	29.4	1.4	1.6	0.9
W22H	30611	741.8	69.7	64.5	63.4	3.3	1.8	0.6	33.8	45.1	44.3	1.7	1.8	0.6	18.4	37.5	37.7	-0.2	1.1	0.6	22.9	38.0	42.6	0.6	1.4	0.6
W22J	60494	720.6	61.5	58.0	56.9	2.8	1.2	0.5	31.1	40.5	39.5	1.6	1.2	0.5	18.2	35.2	34.9	-0.2	0.7	0.5	24.7	35.4	39.1	0.4	1.0	0.5
W22K	47552	753.9	68.6	55.0	48.4	3.5	1.7	0.7	34.8	37.7	32.1	1.8	1.7	0.7	24.6	30.0	28.6	0.1	1.0	0.6	24.6	31.2	28.5	1.0	1.4	0.7
W22L	27929	730.5	97.2	82.8	76.7	5.4	3.5	1.6	44.6	48.3	47.6	2.2	3.4	1.6	29.3	41.1	42.2	-0.1	2.7	1.4	27.8	39.5	42.7	0.7	2.5	1.5
W23A	41372	834.4	93.9	78.8	70.3	7.2	4.3	2.9	44.7	47.8	46.1	4.7	3.9	2.9	27.7	36.9	37.2	1.7	2.6	2.3	22.8	34.4	37.9	2.0	2.7	2.5
W23B	19279	923.8	163.6	136.9	119.0	12.9	8.7	5.9	57.8	66.9	55.5	6.6	6.6	5.6	24.9	39.3	42.1	0.8	3.7	3.8	15.8	29.8	36.0	3.0	3.6	3.1
W23C	31256	1143.4	223.1	197.8	186.5	25.4	20.4	17.3	66.5	77.5	99.4	15.1	14.9	14.3	46.1	61.5	78.3	6.8	8.9	8.9	26.4	39.9	57.2	5.6	11.5	10.0
W23D	24793	1040.7	195.9	173.7	162.5	23.6	18.5	14.0	52.7	70.6	84.1	13.2	14.8	13.1	21.3	41.2	55.4	1.9	8.1	7.7	17.9	38.1	51.0	4.8	8.7	7.6
W31A	36971	811.1	111.5	94.0	89.3	4.8	3.7	2.8	70.2	65.7	70.9	3.2	3.5	2.8	54.2	53.5	60.1	0.8	2.0	2.4	50.0	58.7	62.8	1.9	3.0	2.7
W31B	30427	794.9	105.4	94.5	92.2	5.6	3.8	2.1	60.8	65.3	69.1	3.4	3.7	2.1	42.4	57.1	58.5	0.7	1.8	1.8	46.8	56.5	62.8	1.9	2.2	2.1
W31C	17155	896.3	92.6	78.2	68.6	5.4	3.9	3.1	71.7	67.6	60.1	4.3	3.9	3.1	54.9	57.6	55.6	1.8	2.5	2.7	55.7	59.4	56.9	2.3	3.3	2.8
W31D	29456	785.4	101.4	90.5	87.7	5.1	3.5	1.8	60.3	62.9	65.6	3.3	3.5	1.8	41.5	55.0	56.6	0.6	1.8	1.5	45.3	55.7	59.5	1.6	2.3	1.8
W31E	33418	714.8	104.0	82.6	68.9	4.8	3.2	1.3	68.4	57.0	44.5	3.1	3.1	1.3	47.0	49.6	43.4	0.4	1.8	1.0	45.6	53.1	42.3	1.6	2.5	1.2
W31F	58333	692.7	105.2	90.1	82.6	5.2	2.4	1.2	46.8	59.5	52.2	2.1	2.3	1.2	35.5	47.8	44.8	0.2	1.3	0.9	33.6	47.5	47.1	0.9	1.7	1.2
W31J	55259	653.9	74.5	59.5	45.5	3.3	1.9	0.6	31.5	34.2	20.3	1.6	1.9	0.6	14.7	25.1	18.3	-0.3	1.3	0.6	9.4	18.8	15.4	0.1	1.5	0.6

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
W31L	32138	661.7	78.0	62.8	49.6	3.6	2.1	0.6	33.5	36.7	23.6	1.7	2.0	0.6	16.0	26.1	21.3	0.0	1.5	0.6	10.8	19.2	18.7	0.3	1.6	0.6
W32A	41739	702.0	90.9	67.9	61.8	4.8	3.0	1.3	40.8	33.8	27.7	2.9	3.0	1.3	21.4	23.4	22.6	0.1	1.7	1.2	20.2	22.7	18.1	1.2	2.1	1.1
W32B	93412	901.0	167.2	145.3	130.4	12.0	7.2	4.1	54.9	68.0	65.9	5.4	6.3	4.1	39.9	33.5	52.4	0.0	2.1	2.5	16.5	31.0	49.8	2.2	2.5	3.0
W32C	72822	688.2	98.5	83.5	69.9	3.5	2.2	1.2	55.2	46.2	46.5	2.1	2.0	1.2	36.6	39.6	27.5	0.2	1.0	0.9	35.8	34.5	23.3	0.4	1.1	1.1
W32D	26722	785.0	66.7	49.4	44.6	4.1	2.3	1.1	30.2	32.3	32.1	2.7	2.2	1.1	18.4	27.7	26.2	0.8	1.3	0.8	11.2	27.8	26.5	1.2	1.6	1.1
W32E	45591	771.1	92.0	83.3	65.4	3.9	2.0	1.2	47.7	58.4	42.7	2.4	1.9	1.2	31.2	50.7	35.7	0.5	1.3	0.9	20.4	45.2	34.4	0.6	1.3	1.1
W32F	18734	783.6	112.0	101.1	100.2	6.7	3.6	2.3	50.1	56.2	59.6	4.1	3.4	2.3	24.4	38.5	48.2	0.7	0.9	1.9	29.0	40.8	44.0	0.8	1.5	2.0
W32G	64749	845.4	112.8	93.0	84.0	8.3	5.8	3.7	41.4	50.9	53.1	3.8	4.7	3.7	24.9	31.1	41.1	0.6	2.5	2.2	12.2	21.6	33.6	1.0	2.7	2.3
W32H	127506	959.2	163.0	147.6	136.2	16.3	10.4	6.4	47.5	62.1	71.9	8.5	8.9	6.2	31.0	40.3	44.7	1.1	5.0	4.5	17.3	31.2	35.6	4.0	4.5	4.8
W41A	18761	1019.4	248.3	223.7	209.9	19.8	17.0	15.1	128.3	158.3	170.2	13.5	13.7	14.1	94.5	113.0	132.2	7.2	9.0	9.5	92.8	117.1	138.9	10.7	10.6	10.3
W41B	30561	938.1	177.9	158.4	140.2	13.3	9.5	7.5	96.8	122.6	116.4	9.5	7.8	7.2	67.8	93.8	98.5	5.8	4.8	5.2	75.0	97.3	98.4	6.9	6.0	5.7
W41C	21731	927.8	172.7	153.2	134.7	12.6	8.8	6.9	95.3	118.7	112.0	8.9	7.3	6.6	66.3	92.2	94.8	5.4	4.6	4.8	73.4	96.0	94.6	6.5	5.5	5.3
W41D	23801	880.5	140.8	121.4	102.7	8.6	6.5	5.0	87.2	99.0	87.6	6.0	6.0	5.0	60.2	79.7	75.6	3.0	3.4	3.7	66.1	84.1	78.3	4.2	4.4	4.2
W41E	30317	837.5	108.3	91.8	79.9	5.6	4.3	3.7	71.6	77.5	70.7	3.5	4.2	3.7	57.9	68.1	62.4	1.4	2.8	3.4	54.5	69.6	60.7	2.6	3.3	3.4
W41F	34345	826.3	115.6	98.1	93.4	4.9	3.6	2.8	72.0	68.4	73.4	3.3	3.3	2.8	56.5	55.5	62.8	0.9	1.9	2.4	52.3	59.7	65.5	2.0	2.7	2.7
W41G	9579	778.3	82.3	76.3	65.4	4.0	2.4	0.9	46.7	51.8	44.4	2.6	2.4	0.9	29.2	43.0	39.2	0.2	1.3	0.8	31.8	44.9	39.3	1.0	1.7	0.9
W42A	39736	1058.3	270.4	241.8	223.8	20.4	17.8	16.0	135.7	163.5	174.2	13.4	14.1	14.6	104.4	119.5	136.5	5.8	8.4	9.3	101.1	123.9	143.1	10.1	10.7	10.6
W42B	41655	937.7	174.2	155.8	137.6	12.8	8.9	6.8	97.0	120.1	114.4	9.1	7.4	6.5	69.3	96.2	96.6	5.7	4.7	4.6	75.9	99.4	96.3	6.7	5.8	5.4
W42C	37656	1021.4	233.7	209.9	194.8	18.4	14.6	12.0	116.0	147.7	155.5	12.3	11.9	11.3	85.9	105.9	122.6	6.5	7.2	7.0	83.7	111.0	127.9	9.5	8.6	7.9
W42D	48940	885.8	126.4	111.3	96.8	6.9	5.5	4.2	85.9	89.4	76.3	3.8	5.0	4.2	62.6	76.2	72.0	1.1	2.4	3.3	61.9	78.2	73.2	2.6	3.1	3.9
W42E	23174	833.5	103.5	89.7	77.5	5.4	4.1	2.7	75.6	74.3	63.6	3.3	3.8	2.7	60.4	63.6	59.8	0.9	2.7	2.2	59.7	68.4	60.6	1.9	3.1	2.4
W42F	30553	830.6	105.1	90.8	78.9	5.5	4.1	2.7	76.4	75.3	65.0	3.4	3.8	2.7	61.1	64.6	61.1	1.0	2.6	2.2	60.3	69.4	61.9	2.0	3.1	2.4
W42G	24816	811.6	115.7	102.1	91.2	5.7	4.0	2.6	63.5	74.6	67.0	3.2	3.8	2.6	48.6	64.0	62.4	0.3	1.8	2.3	48.3	63.8	63.6	1.6	2.5	2.6
W42H	27290	774.0	94.0	85.9	80.5	4.7	3.1	1.5	57.8	62.1	60.4	3.3	3.1	1.5	40.0	53.2	54.2	0.7	2.0	1.3	43.5	55.1	55.0	1.7	2.3	1.5
W42J	29046	761.9	78.7	72.0	61.5	3.9	2.3	0.8	45.6	49.1	42.3	2.6	2.3	0.8	28.5	40.9	37.5	0.3	1.3	0.7	31.2	42.7	37.1	1.3	1.7	0.8
W42K	41597	803.3	114.0	92.6	83.6	6.0	4.7	3.7	77.2	71.4	69.1	4.0	4.7	3.7	57.7	60.1	59.9	1.3	2.8	3.4	58.6	57.2	64.1	2.4	3.4	3.7
W42L	25065	763.9	97.7	84.1	72.3	4.4	3.0	1.5	58.8	64.3	56.5	2.6	3.0	1.5	45.8	56.1	51.1	0.7	2.0	1.5	42.4	56.9	51.3	1.2	2.3	1.5
W42M	39157	747.2	94.6	77.7	66.3	3.9	2.6	1.4	61.2	59.5	50.5	2.6	2.6	1.4	47.0	53.0	43.2	0.4	1.6	1.4	47.3	52.2	44.3	1.5	2.0	1.4
W43A	24821	779.0	84.5	71.6	65.3	4.9	3.4	2.4	51.0	54.0	52.6	3.1	3.4	2.4	34.3	41.9	44.2	0.5	1.8	2.3	35.9	41.0	47.5	1.8	2.3	2.4

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
W43B	33170	783.2	81.5	70.3	64.3	4.7	3.3	1.9	48.6	53.2	51.7	3.2	3.3	1.9	35.6	40.6	45.0	0.8	1.9	1.9	37.1	41.9	46.6	1.8	2.3	1.9
W43C	39507	737.4	87.0	80.8	71.5	5.2	3.7	1.9	55.6	59.4	50.5	2.8	3.7	1.9	30.9	52.1	48.5	0.7	1.9	1.9	31.7	53.1	47.1	1.6	2.5	1.9
W43F	63143	654.7	50.4	37.3	34.4	1.3	0.6	0.3	34.9	26.5	24.7	1.0	0.6	0.3	24.1	24.1	21.9	0.0	0.3	0.3	18.9	19.7	20.0	0.2	0.4	0.3
W44A	25470	685.8	87.0	65.0	56.1	4.1	2.0	0.8	57.6	44.8	37.0	2.8	2.0	0.8	45.6	42.1	34.1	0.9	1.4	0.6	47.2	41.8	33.9	1.9	1.6	0.8
W44B	48608	660.1	50.7	40.2	35.3	1.5	0.4	0.0	32.2	28.3	26.1	1.2	0.4	0.0	23.6	26.5	23.4	0.0	0.4	0.0	22.5	25.8	21.9	0.5	0.4	0.0
W51A	62429	922.6	144.7	129.3	120.4	10.8	9.1	7.1	94.9	104.3	101.5	7.6	8.6	7.1	67.9	78.7	85.7	4.1	5.1	5.1	64.3	78.3	88.0	5.6	6.2	6.1
W51B	49644	864.3	150.6	128.4	112.9	8.7	6.1	4.7	97.0	97.4	87.1	5.7	5.8	4.7	66.2	80.8	75.3	2.4	2.9	4.0	72.2	82.4	79.4	3.7	3.8	4.4
W51C	67770	902.8	150.9	134.6	124.0	7.8	6.3	4.9	94.5	105.1	102.1	4.7	6.0	4.9	63.2	79.5	84.4	2.0	3.1	3.9	62.1	76.9	85.3	3.2	3.8	4.5
W51D	52741	901.1	143.3	120.2	103.3	7.5	6.6	5.4	99.4	101.2	92.1	5.1	6.0	5.4	74.9	79.1	77.9	2.1	3.4	4.5	75.9	78.0	78.6	3.4	4.4	4.8
W51E	27427	836.0	120.6	112.4	95.7	7.4	6.1	4.9	78.1	94.6	81.9	4.7	5.7	4.9	56.0	76.9	74.1	1.8	3.8	3.9	55.5	73.8	75.5	3.2	4.2	4.4
W51F	58934	872.8	131.5	116.1	108.0	6.4	5.4	4.1	84.0	96.6	89.9	4.1	5.4	4.1	56.3	67.4	79.1	1.0	2.9	3.5	55.1	68.0	82.0	2.2	3.7	3.8
W51G	42009	887.3	140.7	126.0	113.4	8.2	6.6	5.0	71.7	87.9	82.5	4.4	5.6	5.0	48.9	71.7	70.2	1.8	3.2	3.8	43.8	73.5	75.0	2.4	3.9	4.4
W51H	28644	865.0	115.0	97.8	90.0	6.0	4.2	2.6	52.0	64.1	62.6	2.8	3.4	2.6	34.9	49.7	52.8	0.0	1.5	1.9	30.4	51.4	54.3	0.9	2.0	2.1
W52A	28944	835.5	136.5	116.2	100.6	7.8	5.6	4.0	91.9	91.1	78.5	5.3	5.4	4.0	62.9	74.7	68.6	2.2	3.0	3.3	67.3	76.6	71.7	3.4	4.0	3.7
W52B	33618	860.8	137.3	118.1	98.9	7.9	5.9	4.7	95.3	102.0	83.3	5.3	5.8	4.7	70.6	83.7	76.8	2.3	3.3	4.1	69.6	87.0	76.8	3.6	3.9	4.4
W52C	17784	839.7	133.0	114.3	99.0	7.2	5.6	4.1	91.6	96.6	82.0	4.6	5.6	4.1	68.3	77.7	75.6	2.1	3.2	3.6	69.4	81.1	77.6	3.2	3.8	3.8
W52D	11929	854.0	142.0	122.3	106.5	7.8	6.0	4.6	94.3	102.4	87.6	5.0	5.8	4.6	73.2	82.0	79.7	2.2	3.1	4.0	73.3	84.4	83.4	3.5	3.8	4.3
W53A	54747	824.2	101.2	92.2	84.4	7.0	5.7	4.0	66.3	75.8	69.8	5.4	5.7	4.0	47.5	67.9	66.9	3.3	4.3	3.7	45.5	67.9	64.9	3.9	4.7	4.0
W53B	21854	857.0	120.6	102.7	94.6	8.2	6.5	5.3	79.0	82.4	76.3	5.6	6.2	5.3	58.0	66.6	69.5	3.6	3.9	4.7	57.1	67.6	70.7	4.2	4.2	5.0
W53C	31561	912.9	187.9	162.9	151.2	10.0	7.8	6.4	101.7	112.5	117.2	6.2	5.9	6.4	68.3	81.5	93.7	2.9	2.9	3.5	71.2	86.6	98.1	4.4	4.2	4.2
W53D	31471	866.5	154.5	135.0	122.9	7.4	5.9	4.9	91.8	103.9	97.9	4.8	5.4	4.9	65.8	79.5	86.9	1.9	2.6	3.7	69.3	86.3	91.0	2.9	3.6	4.5
W53E	42186	904.3	153.4	140.6	126.6	7.4	6.3	5.3	96.9	125.1	114.1	4.6	6.0	5.3	76.6	100.3	98.3	1.6	3.1	4.7	64.4	96.4	96.2	2.7	3.7	5.0
W53F	44733	903.9	188.0	174.8	162.4	11.8	9.0	7.6	101.7	122.8	129.2	6.9	7.1	7.6	69.9	92.7	101.2	3.2	3.6	4.0	64.6	89.2	100.5	5.1	4.9	4.9
W53G	38230	945.9	185.5	165.1	151.4	10.6	8.4	6.8	81.8	98.9	108.9	4.9	5.9	6.4	47.0	66.4	75.6	0.3	2.2	2.3	40.7	62.2	76.5	2.9	3.6	3.3
W54A	25108	784.6	86.1	70.7	60.1	4.2	2.9	1.7	62.7	60.0	50.5	3.3	2.9	1.7	47.9	54.0	46.9	1.7	2.4	1.7	47.9	51.9	47.7	2.3	2.6	1.7
W54B	28193	845.8	117.8	107.3	94.2	6.6	4.8	3.6	83.8	95.2	83.2	4.7	4.8	3.6	60.3	75.3	77.6	2.3	2.5	3.2	64.5	77.6	76.6	3.1	3.5	3.6
W54C	10745	867.3	132.7	122.6	106.2	7.3	5.5	4.6	90.0	104.3	93.9	5.0	5.4	4.6	67.9	80.9	82.7	2.1	2.5	3.9	69.8	85.7	84.5	3.2	3.5	4.4
W54D	13874	895.4	149.9	136.0	122.2	8.3	6.3	5.0	100.4	114.5	106.3	5.5	6.0	5.0	73.9	88.5	88.7	2.2	2.8	3.5	75.0	91.5	90.5	3.8	3.8	4.5
W54E	19412	962.5	183.5	173.9	160.8	12.3	10.3	8.7	110.0	133.2	138.8	7.6	8.6	8.7	74.0	105.2	107.8	3.7	4.6	5.1	78.4	98.8	108.3	5.4	5.7	6.0

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
W54F	26829	995.1	197.7	188.2	174.4	13.5	11.3	9.7	116.0	139.1	147.2	8.5	9.3	9.5	77.7	112.0	113.2	3.9	5.0	5.5	79.7	105.5	111.2	6.2	6.1	6.4
W54G	26532	948.9	150.5	126.6	104.7	8.2	6.1	5.1	78.1	91.7	81.4	4.0	4.5	5.1	59.2	68.6	70.6	1.2	1.2	3.0	50.4	67.1	69.6	2.2	2.1	3.3
W55A	68869	766.5	95.1	82.8	71.3	5.4	4.4	3.0	74.1	71.1	63.7	4.0	4.4	3.0	56.2	60.4	58.1	1.9	3.1	2.7	52.4	63.5	58.7	2.5	3.5	3.0
W55B	21783	849.7	137.6	119.5	105.9	6.9	5.5	4.5	90.6	103.7	94.2	4.4	5.5	4.5	66.9	81.8	83.6	1.5	3.0	3.9	63.2	82.1	84.5	2.7	3.6	4.1
W55C	53219	904.9	177.1	158.8	139.7	9.7	7.8	6.2	107.4	126.6	120.3	6.0	7.3	6.2	74.9	96.1	101.9	2.7	3.5	3.8	70.1	93.1	97.0	4.4	4.2	4.4
W55D	27086	901.4	158.3	142.1	129.6	8.8	6.7	5.4	106.0	119.2	112.4	5.8	6.4	5.4	76.4	92.0	92.0	2.4	2.8	3.6	78.3	94.5	94.3	4.0	4.0	4.7
W55E	16123	934.3	171.0	161.1	145.9	11.1	8.9	7.8	105.7	127.1	127.1	6.9	7.5	7.8	70.9	99.4	100.6	3.3	3.8	4.8	75.9	93.6	100.8	4.7	4.7	5.7
W56A	35972	921.8	186.5	171.7	163.0	11.7	9.0	7.6	102.6	127.0	128.8	7.5	7.5	7.3	67.4	84.7	104.9	4.1	3.7	4.1	71.4	90.0	104.3	5.3	5.1	4.9
W56B	22465	981.2	235.1	211.6	201.4	15.2	12.4	10.5	126.5	139.2	155.7	10.1	9.6	9.8	82.5	96.3	112.0	5.1	5.8	5.4	85.9	92.1	111.5	7.7	7.2	6.5
W56C	25269	1161.7	319.4	302.4	281.2	22.9	21.2	19.8	119.6	171.3	188.4	12.9	14.5	15.3	85.2	115.0	128.9	4.7	7.4	9.9	78.8	100.0	119.3	10.4	11.8	12.0
W56D	16568	1033.1	240.8	228.3	202.6	16.7	14.5	12.6	118.5	167.0	164.2	10.1	10.5	11.9	75.1	113.3	126.9	4.1	7.0	7.3	66.3	111.4	127.7	7.9	8.5	8.1
W56E	.	1126.9	271.4	250.7	236.5	18.8	16.4	14.5	98.9	149.4	169.6	10.4	10.6	11.3	60.2	88.6	110.4	2.5	4.9	7.0	55.7	83.6	107.5	7.7	8.3	8.2
W56F	.	904.7	126.8	109.0	95.8	8.1	5.8	3.9	65.7	78.0	72.5	3.8	4.9	3.9	42.2	52.9	62.5	0.4	1.6	2.6	40.7	52.3	62.2	1.7	2.3	3.1
W57A	.	823.1	147.5	129.2	111.5	7.8	5.7	3.7	50.8	71.0	70.5	3.6	4.9	3.7	41.0	53.3	67.6	0.7	2.3	2.9	33.0	55.9	66.2	1.9	2.7	3.3
W57B	.	784.9	102.1	90.9	80.9	5.9	4.3	2.5	51.0	53.1	54.0	3.2	4.0	2.5	28.6	41.3	34.9	1.0	1.7	2.0	28.5	41.6	33.8	2.0	2.4	2.1
W57C	.	753.7	80.8	69.4	62.2	4.0	2.3	1.4	43.8	44.3	39.4	2.3	2.3	1.4	25.8	39.5	33.6	0.7	1.7	1.1	29.4	39.7	33.6	1.3	1.8	1.4
W57D	.	860.9	113.0	96.2	88.4	6.0	4.2	2.7	51.3	63.7	62.0	2.8	3.4	2.7	34.7	49.2	52.6	0.1	1.5	2.0	30.7	50.8	53.9	1.0	2.0	2.3
W57E	.	699.4	87.4	75.2	69.3	4.7	2.3	0.9	37.2	51.1	46.6	2.6	2.3	0.9	21.7	45.0	47.2	0.8	1.7	0.8	24.0	41.9	46.1	1.7	1.9	0.9
W57F	.	770.8	76.8	66.3	57.4	4.5	2.7	1.5	33.0	44.5	42.8	2.8	2.4	1.5	24.8	36.0	38.2	0.9	1.7	1.3	25.8	40.0	38.3	1.4	1.8	1.5
W57H	.	711.7	72.8	59.3	55.2	4.6	2.7	1.0	45.2	39.4	37.5	3.2	2.6	1.0	32.6	33.0	36.4	0.8	2.2	1.0	32.6	34.8	36.0	1.3	2.3	1.0
W60A	.	1154.2	311.4	285.9	267.8	26.0	23.9	23.0	109.0	148.3	172.8	16.7	16.5	17.0	90.4	107.8	119.8	7.4	9.5	10.9	66.3	94.5	114.6	13.0	13.9	14.2
W60B	.	1204.8	338.5	310.0	290.3	27.8	25.3	24.5	115.7	154.8	179.9	17.5	17.1	17.8	90.9	110.7	125.6	7.3	9.6	10.8	67.9	95.8	114.2	12.1	14.4	14.3
W60C	.	1154.1	268.9	248.4	226.1	21.3	20.0	18.6	97.9	123.1	138.9	12.8	13.4	13.7	76.6	99.9	103.2	4.4	7.7	8.7	53.1	81.6	102.0	10.0	11.3	10.8
W60D	.	942.4	185.6	163.4	149.5	8.8	6.3	4.7	86.5	94.3	87.4	3.7	4.3	4.3	52.8	65.1	64.4	0.1	1.3	2.3	53.5	73.0	63.7	1.4	1.8	2.7
W60E	.	807.3	113.4	99.6	96.9	5.2	3.4	1.8	61.6	66.9	64.6	2.6	3.1	1.8	39.7	44.4	57.0	0.1	1.5	1.2	42.0	46.0	60.9	1.0	1.9	1.5
W60F	41808	807.9	98.8	84.1	75.1	6.8	4.7	2.9	46.8	52.0	47.4	3.5	4.0	2.9	32.0	38.7	40.7	1.0	2.5	2.3	30.2	38.5	41.8	2.2	2.9	2.6
W60G	.	909.7	167.9	152.0	137.0	8.8	6.5	4.8	69.2	89.5	91.3	4.2	5.4	4.6	50.7	70.5	71.3	0.5	1.9	2.8	49.2	69.1	70.5	2.0	3.0	3.8
W60H	.	794.7	106.1	93.7	87.7	6.2	4.5	2.8	52.6	54.3	59.5	3.4	4.2	2.8	27.2	42.4	40.3	0.8	1.6	2.2	26.7	42.9	39.3	2.0	2.2	2.4
W60J	.	819.1	110.4	93.3	81.2	6.2	4.1	2.5	56.4	58.4	49.5	3.8	3.6	2.5	42.1	44.6	43.6	1.1	2.1	1.9	45.3	42.2	42.5	1.8	2.9	2.1

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
W60K	66479	822.7	114.7	97.6	90.2	6.7	4.8	2.9	55.8	62.1	56.1	3.7	4.4	2.9	31.0	44.0	49.2	1.4	2.5	2.2	30.8	39.8	49.1	2.1	2.9	2.5
W70A	258736	767.7	117.4	98.0	83.0	6.7	4.2	2.7	46.5	48.6	34.4	3.4	3.9	2.7	23.7	40.0	28.5	0.4	1.9	2.2	14.3	34.6	25.7	1.3	2.2	2.3
X11A	67182	687.7	61.5	51.6	47.0	2.7	1.1	0.3	46.2	40.9	36.2	2.3	1.1	0.3	36.9	39.2	36.5	1.3	1.1	0.3	36.6	39.1	35.9	1.7	1.1	0.3
X11B	59662	716.2	60.1	51.1	44.0	3.9	2.6	1.1	46.1	43.1	39.1	3.2	2.6	1.1	33.9	40.0	35.5	1.4	2.3	1.1	35.6	40.5	37.5	2.2	2.4	1.1
X11C	31880	715.1	76.7	63.5	55.2	4.1	2.6	1.2	61.1	56.6	48.7	2.9	2.6	1.2	40.5	50.8	46.3	0.9	1.5	1.2	43.9	52.4	47.4	1.7	2.3	1.2
X11D	59035	744.0	89.3	78.2	69.0	5.1	3.2	2.0	65.1	67.7	60.6	3.4	3.2	2.0	41.8	54.1	56.4	1.0	1.3	1.9	46.1	57.6	57.3	2.2	2.2	2.0
X11E	24140	760.8	100.6	82.8	72.6	5.4	3.6	2.5	77.2	71.8	63.6	3.8	3.6	2.5	51.6	56.8	59.0	1.3	1.7	2.3	53.3	58.1	59.6	2.4	2.5	2.5
X11F	18251	817.0	121.5	104.5	92.3	5.0	3.8	3.1	88.1	88.4	79.2	3.5	3.8	3.1	65.0	71.2	72.9	1.0	1.9	2.8	60.6	74.8	73.9	2.3	2.5	2.9
X11G	26373	864.4	154.3	142.3	130.4	8.3	7.1	6.1	86.2	113.4	108.8	4.5	6.1	6.1	59.1	79.0	90.0	1.7	2.8	3.9	56.7	77.7	91.1	3.4	3.6	4.5
X11H	26513	947.1	165.7	145.7	132.3	10.7	8.3	7.1	100.1	116.2	112.6	7.0	7.1	7.1	78.0	85.6	90.6	4.2	4.0	5.0	78.0	88.1	92.2	5.4	4.9	5.2
X11J	18620	1030.9	226.8	212.7	202.9	17.9	14.8	13.4	129.5	149.0	167.0	12.1	11.6	12.8	93.7	109.1	127.7	7.5	7.3	7.5	86.6	105.1	123.1	10.3	8.8	8.8
X11K	21070	891.3	124.9	104.8	90.9	7.9	6.4	5.2	72.3	85.5	80.3	5.3	6.1	5.2	58.9	65.9	70.0	2.9	3.8	4.6	55.0	62.8	69.0	4.0	4.2	4.9
X12A	24433	800.9	137.9	121.7	103.4	6.5	5.2	3.9	95.6	99.1	81.5	4.4	4.9	3.9	67.4	81.7	71.0	1.7	2.5	3.3	70.2	83.9	76.2	2.9	3.4	3.6
X12B	15477	832.8	159.5	143.0	127.1	7.9	6.5	5.1	104.3	114.2	100.8	5.1	6.2	5.1	77.4	86.0	85.5	1.9	2.9	3.4	71.0	88.6	90.2	3.3	4.0	4.4
X12C	18613	882.0	189.2	166.4	150.0	9.8	7.7	6.1	119.4	129.7	115.7	6.3	7.2	6.1	86.2	94.8	96.3	2.7	3.3	3.3	79.1	96.8	99.8	4.4	4.4	4.5
X12D	22295	862.4	168.4	145.9	134.0	8.5	6.8	5.1	109.3	113.7	104.7	5.6	6.5	5.1	80.9	85.9	88.5	2.4	3.2	3.4	74.7	90.4	93.8	3.8	4.2	4.3
X12E	33265	887.6	149.8	138.2	122.8	9.5	7.5	6.3	94.6	116.7	105.7	6.5	7.3	6.3	55.9	81.9	89.4	3.0	3.9	4.6	50.5	87.2	93.6	4.6	4.7	5.1
X12F	31271	880.8	188.3	162.9	151.9	10.3	7.8	6.3	118.0	126.1	117.4	6.8	7.2	6.3	83.5	90.5	97.6	3.2	3.3	3.3	77.4	92.6	100.7	4.8	4.4	4.5
X12G	23873	901.7	132.8	112.3	97.0	8.3	6.7	5.5	77.9	91.8	85.4	5.6	6.4	5.5	61.8	68.5	74.7	3.1	3.9	4.9	60.0	64.6	73.7	4.2	4.4	5.1
X12H	28568	916.1	164.3	152.5	142.6	9.6	7.5	6.4	96.9	110.5	111.0	5.9	6.9	6.3	60.3	83.7	94.2	2.8	3.3	4.1	60.6	79.2	96.9	3.9	4.3	4.7
X12J	29567	1156.4	335.3	320.9	307.6	26.1	24.7	23.7	161.0	201.1	211.4	15.8	17.4	17.7	110.0	135.8	155.4	5.2	8.0	9.5	96.5	130.5	151.4	11.7	13.1	13.8
X12K	28619	902.5	162.7	152.2	139.8	9.5	7.5	6.3	98.0	111.8	109.3	5.8	6.9	6.2	59.7	84.5	92.6	2.8	3.3	4.0	60.5	80.2	94.0	4.0	4.3	4.6
X13A	24480	1193.2	371.3	353.8	337.6	25.1	23.8	23.1	128.5	171.7	187.7	14.7	15.6	16.3	94.3	108.6	131.2	4.5	7.8	9.6	82.0	89.6	111.4	11.2	13.6	13.9
X13B	23673	1158.9	324.0	304.9	294.4	20.6	19.1	17.5	131.1	176.0	192.1	12.1	12.3	12.0	85.4	109.7	137.0	3.1	7.4	8.5	74.5	93.7	126.6	9.2	10.4	10.0
X13C	19521	1262.2	380.4	355.2	329.1	30.6	28.0	26.9	122.1	170.1	199.1	18.0	18.2	18.8	93.0	121.7	135.9	6.8	9.3	10.7	75.9	101.1	118.0	12.9	14.8	15.3
X13D	18066	1194.0	349.8	330.6	317.3	22.3	20.6	19.4	128.2	177.0	196.2	12.8	13.1	12.9	87.5	105.8	132.2	2.8	6.2	8.2	76.9	87.2	118.4	9.6	11.3	10.8
X13E	21153	1037.5	235.4	219.2	204.9	15.4	11.0	8.2	100.0	121.7	128.3	8.1	7.9	7.2	69.6	86.1	95.3	0.3	3.0	3.0	63.3	89.3	99.4	5.4	4.1	3.7
X13F	21686	1015.7	264.9	236.6	221.7	15.5	11.9	10.4	119.8	140.5	153.2	7.7	7.2	8.5	83.5	97.1	111.0	1.3	2.7	3.6	66.6	88.0	105.4	5.6	4.9	5.0
X13G	33471	833.3	122.3	106.4	95.7	6.3	4.6	3.1	77.3	77.2	75.7	3.1	4.2	3.1	49.5	64.7	71.2	0.6	2.3	2.4	44.6	60.6	72.3	1.6	2.8	2.7

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
X13H	30548	741.3	110.8	97.7	88.6	4.9	3.3	1.8	53.5	59.8	53.4	2.3	3.1	1.8	41.1	46.6	47.3	-0.2	0.8	1.3	37.3	48.3	47.1	0.8	1.8	1.6
X13J	78930	680.7	57.3	47.6	41.1	2.9	1.6	0.6	35.8	33.2	29.5	2.1	1.6	0.6	24.4	29.8	26.1	0.5	1.1	0.6	20.7	29.7	27.4	0.9	1.3	0.6
X14A	14080	1246.6	404.4	375.4	359.4	31.4	30.2	29.7	151.7	177.1	192.0	16.2	18.9	19.9	104.0	121.6	140.8	5.3	7.7	10.3	84.8	106.2	123.6	13.2	14.0	15.9
X14B	18523	1227.2	352.1	334.8	322.0	25.6	24.8	23.9	135.6	176.9	195.2	12.4	15.4	15.8	77.9	109.3	133.7	1.3	4.6	6.4	63.7	101.2	125.0	8.7	10.4	11.6
X14C	16577	1120.6	300.8	282.2	266.9	18.8	17.3	15.5	130.9	169.8	178.8	10.8	11.2	11.3	83.2	116.0	131.1	3.4	7.4	7.6	72.7	104.8	131.4	8.7	9.7	8.9
X14D	12858	1131.7	312.6	289.9	278.1	18.0	15.8	13.5	89.0	111.5	131.6	8.8	9.1	8.7	56.0	76.9	87.1	-0.1	2.6	3.7	52.9	75.9	84.8	6.6	6.4	5.7
X14E	17731	980.8	212.9	195.4	183.1	10.0	8.4	7.4	73.2	99.6	117.5	4.2	5.5	6.5	52.5	60.6	70.5	0.5	1.8	2.4	46.7	60.4	70.2	2.6	3.2	3.5
X14F	11747	1248.5	404.9	383.6	360.8	23.2	20.9	19.0	123.3	157.5	169.3	11.3	11.8	11.9	71.2	99.3	109.9	0.8	2.4	3.8	58.1	93.2	99.3	7.0	8.0	8.3
X14G	20417	894.4	140.6	128.6	127.4	7.4	5.7	4.1	52.5	81.6	85.9	3.2	4.5	3.8	40.1	56.4	68.1	0.4	0.6	1.4	30.5	59.8	70.7	1.7	2.1	2.2
X14H	35978	741.2	70.7	70.2	67.0	4.1	2.5	1.1	31.7	48.1	44.9	2.2	2.2	1.1	22.7	40.9	42.1	0.3	1.5	0.6	14.3	42.2	40.9	1.1	1.9	0.8
X21A	26493	764.4	124.1	106.1	93.1	6.5	5.3	4.0	81.2	85.2	79.7	4.4	5.2	4.0	51.3	69.3	68.2	1.5	2.6	3.5	60.4	75.2	75.6	3.3	3.4	3.7
X21B	37831	706.0	68.2	58.0	52.1	4.4	3.1	1.8	51.9	51.4	45.8	3.7	3.1	1.8	41.1	43.9	41.4	1.7	2.5	1.5	42.2	44.9	44.1	2.7	2.8	1.8
X21C	31103	758.7	75.8	63.6	52.5	4.2	2.5	0.7	51.7	52.3	44.1	3.2	2.5	0.7	37.4	44.7	35.7	1.0	1.9	0.4	35.0	45.4	36.8	1.7	2.2	0.7
X21D	21913	733.7	58.4	51.8	47.0	4.1	2.8	1.2	44.0	43.8	40.1	3.6	2.8	1.2	31.2	38.3	35.4	1.7	2.2	0.9	29.5	36.2	37.8	2.4	2.5	1.2
X21E	34510	870.7	108.0	88.5	74.2	7.6	6.2	5.1	76.6	73.6	63.3	5.3	5.9	5.1	53.9	55.9	52.7	2.7	3.0	3.8	51.8	53.9	54.7	3.8	3.5	4.2
X21F	39672	755.8	91.1	74.9	67.1	3.7	2.6	1.5	69.1	64.8	58.5	2.7	2.6	1.5	48.2	55.4	54.1	0.9	1.7	1.5	55.4	59.6	55.2	2.0	2.2	1.5
X21G	34733	796.5	104.7	90.2	78.6	5.4	4.3	2.8	58.4	70.3	64.6	2.4	4.0	2.8	31.4	52.5	54.5	0.1	1.5	2.3	33.2	50.8	58.2	1.5	2.1	2.5
X21H	22885	1067.3	219.9	197.9	185.2	17.2	14.5	12.8	110.6	122.7	138.2	10.9	10.6	11.8	72.8	79.7	91.9	5.1	6.1	6.0	64.6	74.8	89.9	8.8	8.0	7.4
X21J	35460	917.4	186.4	170.3	153.5	13.1	10.4	8.3	97.9	117.3	122.2	8.5	7.6	7.9	60.4	80.6	85.6	4.1	3.6	3.0	50.6	83.5	85.5	6.5	5.1	4.5
X21K	24513	1058.2	252.2	232.1	210.6	16.5	14.1	12.7	111.3	124.5	130.4	9.0	8.7	9.2	74.2	83.0	87.4	1.5	3.8	4.9	64.0	76.3	79.0	7.0	6.5	6.3
X22A	25136	985.1	211.9	192.7	184.7	16.8	14.2	11.7	92.5	104.6	125.6	11.0	10.0	9.7	64.0	76.0	92.5	6.9	6.5	5.4	55.6	64.3	85.8	9.4	8.1	6.5
X22B	22665	977.5	200.0	178.9	163.2	9.6	7.6	6.7	94.6	116.8	116.5	4.8	4.8	6.4	63.1	73.2	82.9	0.6	1.3	1.9	58.3	75.0	84.7	2.4	3.0	3.0
X22C	36619	942.3	159.6	141.9	125.7	10.6	8.7	7.3	90.8	105.9	93.5	6.4	6.8	6.9	59.3	74.0	75.9	2.5	3.6	4.1	58.2	72.0	77.1	4.0	4.6	4.9
X22D	27445	1174.9	356.4	328.0	309.8	27.1	24.1	22.7	127.6	154.9	168.3	16.0	16.0	16.1	104.5	123.0	124.8	5.8	6.9	8.0	80.8	100.0	117.5	12.4	13.5	13.1
X22E	15300	1121.9	320.1	294.6	275.1	17.6	15.5	13.3	104.7	150.0	165.1	8.9	9.4	9.2	71.9	90.8	107.4	1.3	4.9	4.4	62.3	86.0	103.0	6.7	7.3	6.4
X22F	21241	937.8	203.7	180.9	161.0	9.6	7.7	6.5	97.7	113.7	114.5	4.5	5.1	6.0	79.1	82.0	74.8	1.3	1.7	2.2	61.2	72.0	76.8	2.7	2.8	3.0
X22G	10744	1100.0	267.0	250.0	236.2	17.6	14.6	12.6	118.8	146.9	134.6	8.6	9.1	9.0	62.2	81.4	95.1	0.8	4.1	3.9	66.0	91.3	108.6	6.0	6.1	5.7
X22H	20017	923.0	192.3	173.3	153.3	10.6	8.6	7.0	88.5	110.5	110.0	5.8	6.2	6.7	73.7	77.3	69.0	2.8	2.9	3.1	56.3	72.3	70.9	4.0	3.9	3.8
X22J	23988	816.7	95.7	78.5	68.0	6.4	4.9	3.5	49.7	56.1	52.4	3.9	4.6	3.5	35.1	40.1	45.2	1.3	1.9	2.8	27.8	39.4	46.4	2.3	2.7	3.0

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
X22K	33490	866.7	138.5	118.5	104.6	7.5	6.6	5.5	65.9	75.2	70.4	3.4	5.9	5.5	46.4	51.2	56.9	-0.2	1.9	3.7	39.7	51.9	57.5	1.3	2.6	4.2
X23A	12681	1114.2	263.2	245.6	231.4	19.3	16.9	14.2	122.8	149.6	166.6	11.8	12.2	11.0	66.0	89.5	110.9	6.2	8.5	7.0	39.7	70.2	92.0	9.8	10.1	8.7
X23B	22913	838.6	116.5	101.1	89.0	6.1	4.5	3.0	57.2	72.1	64.6	3.0	4.2	3.0	44.1	60.5	60.7	-0.2	1.4	2.2	43.7	57.6	61.7	1.5	2.3	2.7
X23C	8129	1116.2	275.6	253.8	233.5	18.3	15.5	13.0	117.6	142.1	155.3	10.5	10.1	10.0	76.4	100.7	114.9	2.5	4.6	4.6	67.9	97.6	114.9	8.5	7.4	6.6
X23D	18187	818.1	102.3	88.5	75.1	6.0	4.5	3.0	48.4	64.8	53.9	3.1	4.3	3.0	40.7	55.7	49.1	0.5	2.1	2.5	36.8	51.5	49.9	1.9	2.9	2.7
X23E	18039	1018.4	202.9	182.1	161.6	12.8	9.8	8.4	90.7	116.0	118.3	7.0	6.5	7.8	54.3	72.2	82.0	2.4	2.6	2.7	51.1	71.1	85.4	4.9	4.0	4.0
X23F	30958	838.4	115.1	100.2	86.8	6.8	5.0	3.7	55.8	71.2	62.5	3.6	4.7	3.7	43.4	60.4	58.6	0.6	2.2	2.9	42.2	56.6	59.5	2.2	2.8	3.4
X23G	22509	896.4	144.9	123.7	103.9	8.3	7.0	5.9	71.8	88.3	78.2	4.8	5.6	5.9	45.6	54.3	60.1	1.8	2.7	3.4	48.7	57.6	61.7	3.0	3.9	3.8
X23H	30605	884.9	126.5	113.5	100.5	6.7	5.6	4.7	67.3	80.0	75.9	3.7	5.0	4.5	38.3	59.6	61.2	1.0	2.4	3.2	36.1	52.6	61.1	2.3	3.1	3.6
X24A	24851	729.2	84.3	69.3	63.8	5.1	3.4	1.6	54.3	46.9	48.1	2.8	3.1	1.6	35.4	38.5	39.1	0.6	1.9	1.2	35.4	41.5	38.6	1.6	2.2	1.3
X24B	33496	708.0	55.0	48.4	45.4	3.1	1.9	1.1	30.9	32.1	30.4	2.1	1.7	1.1	21.6	25.0	26.7	0.6	1.0	0.8	26.4	24.6	26.1	1.2	1.4	1.1
X24C	28570	739.0	73.3	60.8	52.3	4.0	2.5	0.7	42.8	43.3	35.7	2.3	2.5	0.7	27.9	35.9	32.3	0.3	1.6	0.6	22.9	38.1	32.5	1.0	2.0	0.7
X24D	30185	831.1	139.9	125.6	110.2	7.6	5.4	3.0	60.8	68.1	54.5	3.3	4.6	2.7	49.8	58.3	45.6	1.2	2.0	1.2	44.9	62.0	49.8	2.3	2.4	2.2
X24E	52598	650.2	100.8	85.7	77.4	4.2	2.2	1.1	53.1	53.7	47.8	2.4	2.0	1.1	33.4	41.1	42.7	0.0	1.2	0.8	31.5	38.5	43.7	1.0	1.5	1.1
X24F	26206	663.0	105.5	89.3	81.6	4.5	2.2	1.3	52.6	55.3	49.2	2.4	1.9	1.3	33.7	40.2	44.8	0.1	0.8	1.0	33.0	36.9	46.3	1.1	1.4	1.2
X31A	23007	1232.6	411.3	396.1	377.3	28.3	26.8	25.4	140.3	171.2	183.2	16.5	17.8	17.3	97.4	123.3	139.0	5.9	8.6	9.7	83.6	106.4	116.2	12.3	15.0	14.7
X31B	19517	1248.0	340.8	317.8	302.5	22.7	21.1	19.5	94.5	111.7	132.6	12.1	12.7	12.1	68.2	86.1	92.5	1.5	4.9	5.5	54.4	72.0	79.4	8.3	10.7	10.1
X31C	15397	1311.3	365.8	348.0	335.5	25.8	24.2	22.8	128.0	151.4	168.9	14.5	14.7	14.6	88.5	105.7	119.5	4.0	6.0	6.3	59.7	82.4	104.2	11.1	13.0	12.0
X31D	19199	937.0	129.2	105.7	96.8	8.5	6.4	5.1	53.5	56.2	55.7	4.7	4.4	4.5	40.3	40.1	36.2	1.8	1.7	2.9	34.6	35.8	41.8	3.5	2.9	3.2
X31E	21383	1254.2	353.6	339.1	325.1	23.7	22.2	20.6	112.9	128.8	143.5	13.0	13.5	12.9	71.8	95.0	100.4	2.8	5.2	5.5	55.6	79.7	87.0	8.4	11.3	10.7
X31F	9399	1334.1	503.3	467.4	440.1	25.2	24.3	23.2	129.8	134.6	153.2	11.2	13.7	14.0	83.6	102.2	118.2	1.6	4.1	5.3	57.4	87.1	88.2	7.7	10.6	11.5
X31G	16854	983.5	249.2	239.9	222.8	11.6	8.2	6.6	88.8	115.3	129.6	5.6	4.7	5.5	53.2	78.4	88.2	0.5	0.9	1.0	44.1	76.1	89.4	4.1	2.7	2.3
X31H	6042	1169.0	282.0	252.4	240.6	20.4	17.7	15.5	92.7	110.2	124.6	11.0	10.7	10.0	50.4	67.2	82.2	2.0	4.6	5.3	29.7	54.8	70.8	7.4	7.8	6.9
X31J	15429	896.7	200.6	189.0	171.7	8.3	6.0	4.5	69.4	111.9	101.3	3.4	3.5	4.2	57.6	67.7	72.3	0.0	0.4	1.0	56.7	68.9	71.4	2.2	1.8	2.0
X31K	48754	680.2	73.9	62.3	57.8	3.3	1.8	0.6	40.4	37.5	34.1	2.0	1.8	0.6	25.9	30.0	31.3	0.0	1.1	0.6	26.7	32.6	31.5	0.8	1.5	0.6
X31L	30384	743.5	123.1	105.6	95.3	6.6	4.5	2.9	50.6	61.5	54.4	2.9	4.2	2.9	35.7	48.6	49.6	0.3	1.5	2.5	35.6	46.6	50.5	1.2	2.2	2.6
X32A	11220	1048.6	238.1	226.7	216.0	13.2	11.2	9.6	91.5	118.8	114.0	6.8	7.0	7.3	61.4	84.4	85.0	1.4	2.7	2.7	41.6	57.7	78.9	5.0	5.2	4.4
X32B	5531	972.3	166.5	147.3	136.3	9.7	8.3	7.5	69.5	79.9	91.6	5.4	5.7	6.9	45.3	56.0	73.3	2.2	2.5	3.3	41.9	52.5	67.9	3.5	3.6	4.1
X32C	23334	759.0	122.6	97.2	87.1	6.0	4.0	2.9	52.8	58.3	48.3	2.9	3.5	2.9	39.4	46.6	43.1	0.3	1.1	1.7	36.8	45.9	43.9	1.7	1.8	2.1

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
X32D	9999	1126.7	368.5	337.2	312.1	23.5	21.4	19.1	97.9	136.5	143.4	12.0	12.8	11.6	58.5	93.3	93.6	1.4	3.2	3.5	46.4	86.6	91.3	8.2	9.6	9.2
X32E	7826	920.8	211.8	187.8	172.5	14.3	10.4	8.2	69.5	86.0	97.8	7.2	5.9	7.4	42.7	70.5	75.0	0.8	1.7	1.6	38.3	62.6	69.5	4.9	3.4	2.9
X32F	15731	719.7	62.1	45.8	39.9	4.6	2.7	1.6	42.4	37.7	33.0	3.1	2.7	1.6	33.7	32.1	30.2	1.6	1.9	1.5	28.4	29.0	31.2	2.2	2.1	1.6
X32G	33554	662.8	72.0	61.7	56.6	3.4	2.0	0.7	35.9	39.4	37.0	1.6	2.0	0.7	23.6	34.1	33.3	-0.2	1.4	0.7	27.8	32.5	33.0	0.7	1.6	0.7
All QC's	**AREA**	**MAP**	**ASTF**	**AMTF**	**ADTF**	**ASLF**	**AMLF**	**ADLF**	**ESTFR**	**EMTFR**	**EDTFR**	**ESLFR**	**EMLFR**	**EDLFR**	**PSTFR**	**PMTFR**	**PDTFR**	**PSLFR**	**PMLFR**	**PDLFR**	**WSTFR**	**WMTFR**	**WDTFR**	**WSLFR**	**WMLFR**	**WDLFR**
Max	258736.0	1812.8	1190.8	1178.5	1166.9	69.7	68.3	67.2	201.2	231.5	250.6	23.8	27.3	28.1	152.5	199.7	215.2	11.7	17.5	20.2	133.0	179.5	192.4	21.7	23.7	25.0
Min	5531.0	647.0	17.4	13.8	12.5	0.6	0.0	0.0	11.3	13.6	12.5	0.6	0.0	0.0	5.7	10.8	11.8	-1.1	0.0	0.0	-3.1	10.3	12.3	0.0	0.0	0.0
Average	35399.9	840.2	138.5	123.7	113.0	10.0	8.0	6.5	64.8	73.6	72.1	6.0	6.1	5.4	46.9	57.3	59.2	2.6	3.6	3.6	45.1	56.5	59.0	4.4	4.7	4.4

6.2 Quaternary catchment streamflow reduction tables – mean values

The following tables represent mean reductions in streamflow within selected Quaternary Catchments across South Africa following complete afforestation with one of three primary commercial forestry tree genera. For each Quaternary Catchment (QC) number given at the far left of the table there are columns of general information (area in hectares, Mean Annual Precipitation and *ACRU*-simulated Acocks baseline streamflow) followed by 18 possible streamflow reduction values. These are represented by abbreviations at the top of the table which indicate the following:

Abbreviation	Interpretation
QC	Quaternary Catchment no.
AREA	Quaternary Catchment area (ha)
MAP	Quaternary Catchment Mean Annual Precipitation (mm)
ASTF	Acocks baseline vegetation on shallow soils – Mean Annual Total Flow (mm)
AMTF	Acocks baseline vegetation on medium soils – Mean Annual Total Flow (mm)
ADTF	Acocks baseline vegetation on deep soils – Mean Annual Total Flow (mm)
ASLF	Acocks baseline vegetation on shallow soils – Mean Annual Low Flow (driest three months - mm)
AMLF	Acocks baseline vegetation on medium soils – Mean Annual Low Flow (driest three months - mm)
ADLF	Acocks baseline vegetation on deep soils – Mean Annual Low Flow (driest three months - mm)
ESTFR	Eucalypts on shallow soils – Mean Annual Total Flow Reductions (mm)
EMTFR	Eucalypts on medium soils - Mean Annual Total Flow Reductions (mm)
EDTFR	Eucalypts on deep soils – Mean Annual Total Flow Reductions (mm)
ESLFR	Eucalypts on shallow soils – Mean Annual Low Flow Reductions (driest three months - mm)
EMLFR	Eucalypts on medium soils – Mean Annual Low Flow Reductions (driest three months - mm)
EDLFR	Eucalypts on deep soils – Mean Annual Low Flow Reductions (driest three months - mm)
PSTFR	Pines on shallow soils – Mean Annual Total Flow Reductions (mm)
PMTFR	Pines on medium soils - Mean Annual Total Flow Reductions (mm)
PDTFR	Pines on deep soils – Mean Annual Total Flow Reductions (mm)
PSLFR	Pines on shallow soils – Mean Annual Low Flow Reductions (driest three months - mm)
PMLFR	Pines on medium soils – Mean Annual Low Flow Reductions (driest three months - mm)
PDLFR	Pines on deep soils – Mean Annual Low Flow Reductions (driest three months - mm)
WSTFR	Wattle on shallow soils – Mean Annual Total Flow Reductions (mm)
WMTFR	Wattle on medium soils - Mean Annual Total Flow Reductions (mm)
WDTFR	Wattle on deep soils – Mean Annual Total Flow Reductions (mm)
WSLFR	Wattle on shallow soils – Mean Annual Low Flow Reductions (driest three months - mm)
WMLFR	Wattle on medium soils – Mean Annual Low Flow Reductions (driest three months - mm)
WDLFR	Wattle on deep soils – Mean Annual Low Flow Reductions (driest three months - mm)

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
A21A	48187	683.3	63.2	55.3	50.5	4.4	3.4	2.5	35.4	36.5	36.0	2.1	2.1	2.0	29.3	32.3	31.7	0.9	1.4	1.1	29.3	32.1	31.8	1.5	1.7	1.2
A21B	52652	672.0	55.8	48.9	45.4	3.2	2.1	1.4	34.0	35.3	34.2	1.6	1.7	1.2	29.2	32.0	31.5	0.5	1.0	0.9	28.6	31.9	31.3	1.0	1.3	1.0
A21C	76096	695.1	69.6	61.7	56.6	4.6	3.3	2.2	40.3	42.9	41.9	2.4	2.5	2.2	32.9	36.9	37.4	1.1	1.5	1.4	33.4	37.1	38.1	1.8	1.6	1.6
A21D	37155	712.6	64.5	57.1	52.9	4.2	3.0	2.2	38.1	39.1	38.1	2.4	2.1	1.7	31.0	34.4	34.3	1.3	1.4	1.2	31.7	34.7	35.0	2.0	1.7	1.3
A21E	28982	710.0	72.1	63.3	58.1	5.3	3.6	2.6	39.6	42.3	40.1	2.6	2.4	1.9	32.7	36.8	36.1	1.2	1.4	1.1	32.7	37.0	36.5	1.9	1.8	1.4
A21F	100020	676.7	67.7	60.4	56.3	5.0	3.7	2.9	38.0	41.0	39.8	2.4	2.6	2.4	30.1	35.5	35.7	0.8	1.6	1.6	30.4	35.6	35.9	1.6	2.0	1.8
A21G	16052	695.7	84.1	75.5	70.3	5.6	4.0	2.7	45.3	49.7	47.9	2.8	2.9	2.2	37.5	43.7	44.0	1.0	1.8	1.5	36.7	43.0	44.0	1.7	2.0	1.6
A21H	51372	668.1	74.4	67.5	63.8	3.7	2.5	1.8	30.6	33.0	32.4	2.0	2.0	1.5	26.3	29.3	29.4	0.8	1.3	1.1	26.0	28.9	29.4	1.3	1.6	1.3
A21K	86415	652.4	60.1	53.7	50.1	3.1	1.9	1.2	36.9	39.1	37.0	1.7	1.5	1.1	28.1	33.2	33.4	0.2	0.8	0.7	27.0	32.9	33.1	0.6	0.9	0.7
A22G	49859	655.2	71.9	64.2	59.3	6.1	4.7	3.7	42.0	45.6	42.6	3.2	3.5	2.9	33.4	39.5	38.8	1.8	2.3	2.2	31.5	38.3	38.3	2.3	2.5	2.3
A22H	57866	660.6	75.5	66.5	61.1	7.2	5.6	4.5	42.4	46.1	44.6	3.8	3.8	3.4	34.5	39.6	39.8	2.2	2.7	2.5	31.3	38.1	38.8	2.8	3.0	2.7
A23A	68239	698.3	97.6	86.1	78.9	5.3	3.4	2.2	52.4	55.1	50.9	2.6	2.6	1.8	42.0	47.2	46.0	0.7	1.4	1.3	42.0	47.0	46.7	1.6	1.6	1.4
A23D	14482	647.0	81.1	71.0	65.8	4.7	2.9	2.0	44.3	46.4	43.8	2.4	2.4	1.6	36.8	41.2	40.1	0.9	1.5	1.2	36.2	40.9	40.1	1.4	1.7	1.4
A23E	49044	703.0	75.7	66.8	62.6	3.6	2.0	1.1	39.6	42.6	41.6	1.2	1.3	1.0	31.1	36.6	36.5	-0.4	0.5	0.3	31.5	36.6	36.8	0.1	0.6	0.4
A42B	52160	675.1	89.9	80.9	75.4	4.1	3.1	2.3	46.7	53.4	53.0	2.1	2.3	2.0	34.2	43.6	46.0	0.2	1.3	1.2	32.2	42.7	45.5	1.0	1.6	1.4
A42C	69834	660.3	83.9	76.7	72.7	3.1	2.1	1.6	43.4	48.1	47.5	1.5	1.6	1.3	31.9	40.2	41.8	0.0	0.6	0.8	30.9	39.4	41.4	0.6	1.0	0.9
A42D	49660	669.4	82.8	74.2	69.2	4.6	3.3	2.3	45.3	49.1	48.3	2.8	2.5	1.9	34.6	40.8	41.8	1.0	1.3	0.9	32.1	39.4	40.7	1.8	1.8	1.2
A50A	29777	655.7	62.2	53.0	47.9	3.4	2.3	1.9	34.3	37.3	37.2	2.1	1.7	1.6	24.6	28.7	30.8	0.8	0.9	0.9	21.2	26.9	29.5	1.3	1.1	1.1
A80A	28737	939.9	231.0	215.4	203.1	17.1	15.1	13.7	65.4	79.2	82.7	7.7	7.9	7.3	48.3	60.7	64.9	3.2	3.9	3.8	37.6	52.0	57.5	5.8	6.1	5.8
A80B	25132	663.6	151.5	140.4	132.3	7.9	6.3	5.3	44.9	58.2	61.4	2.1	2.8	2.7	35.5	46.0	50.1	-0.5	0.3	0.4	28.7	40.8	46.2	1.3	1.4	1.5
A91A	23230	711.5	132.7	121.0	113.3	9.4	8.0	7.1	45.3	53.8	56.9	4.3	4.4	4.3	32.6	41.6	44.6	1.3	2.2	2.4	26.4	37.4	41.0	3.1	3.4	3.2
A91C	24966	862.9	235.4	220.6	209.6	14.2	12.5	11.2	55.9	73.7	83.5	5.2	6.2	6.5	41.3	54.8	62.4	1.3	2.7	3.0	32.2	47.4	56.3	3.6	4.6	4.7
A91D	13238	1241.0	510.4	487.4	469.3	32.3	29.4	27.2	102.4	130.5	143.6	11.7	13.2	13.3	70.2	93.8	104.3	3.8	5.4	5.8	58.8	84.5	96.7	8.8	9.9	10.0
A91E	22309	949.8	310.0	290.5	275.9	18.2	15.7	13.7	76.1	100.1	108.9	6.6	7.5	6.9	52.5	72.7	82.1	1.1	2.6	2.9	43.1	66.0	76.8	4.4	5.3	5.0
A91G	40578	863.8	158.1	144.0	133.0	10.4	8.8	7.6	52.1	64.8	68.7	4.8	5.0	4.8	36.4	48.5	52.8	1.6	2.3	2.3	28.1	42.3	47.7	3.5	3.7	3.5
A91H	44989	651.7	106.7	96.3	89.4	5.4	4.3	3.5	39.2	48.3	51.2	2.5	2.4	2.1	29.4	38.1	42.6	0.6	0.9	1.0	22.6	33.3	38.7	1.7	1.7	1.5
A92A	32887	838.6	251.3	237.3	226.7	12.2	10.9	10.0	61.5	78.2	85.1	5.2	5.7	5.8	41.6	55.5	62.5	0.3	1.3	2.0	34.2	50.1	58.2	3.7	4.1	4.3
B11A	94538	699.5	92.3	81.5	74.4	4.9	3.8	2.9	57.5	61.4	58.0	2.9	3.2	2.8	44.7	51.4	51.6	0.8	2.0	2.0	45.7	52.4	52.5	1.8	2.4	2.1
B11B	43533	687.1	69.3	58.8	53.5	3.9	2.4	1.5	42.1	41.9	38.9	2.2	1.7	1.1	34.6	37.5	36.3	0.8	1.2	0.8	35.3	37.6	36.7	1.4	1.4	0.9

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
B11C	38544	673.2	72.3	63.6	57.9	4.2	2.9	2.3	45.0	47.2	43.8	2.3	2.4	2.0	35.3	40.0	39.0	0.9	1.4	1.6	36.3	41.1	40.1	1.7	1.8	1.7
B11D	55093	671.1	67.7	58.3	52.9	3.6	2.3	1.5	40.9	40.9	37.8	2.1	1.9	1.4	32.6	36.3	34.1	0.9	1.3	1.0	32.6	36.5	34.5	1.6	1.5	1.1
B11E	46670	681.7	72.9	62.6	56.4	4.3	2.8	1.9	45.2	45.7	43.2	2.5	2.1	1.6	36.6	40.1	40.1	0.8	1.2	1.2	37.4	40.7	40.5	1.7	1.6	1.5
B11F	42831	690.7	75.6	64.9	58.6	4.5	2.8	1.9	46.7	47.2	44.7	2.5	2.1	1.6	37.6	41.2	41.3	0.9	1.2	1.2	38.4	41.8	41.8	1.6	1.6	1.3
B11G	36781	692.6	64.6	54.7	49.7	3.6	2.2	1.5	42.4	42.6	39.7	2.1	1.9	1.5	35.2	37.0	36.4	1.0	1.2	1.1	35.4	37.4	36.8	1.6	1.3	1.1
B11H	24599	694.5	72.5	63.7	57.9	4.1	2.8	2.2	44.6	46.3	44.3	2.2	2.1	1.9	36.6	40.1	40.1	0.8	1.1	1.4	37.2	40.7	40.8	1.6	1.5	1.6
B11J	26936	681.1	64.8	56.9	51.8	3.6	2.4	1.7	40.3	41.9	40.1	2.0	1.8	1.4	33.9	36.9	36.7	0.8	1.1	1.1	34.2	37.3	37.2	1.4	1.4	1.2
B11K	37833	683.8	64.3	56.4	51.4	3.5	2.4	1.7	40.0	41.5	39.8	1.9	1.8	1.4	33.7	36.5	36.4	0.7	1.1	1.1	34.0	36.9	36.9	1.4	1.4	1.2
B11L	24178	690.5	64.9	55.9	49.7	4.2	2.9	1.8	38.0	41.4	38.2	1.9	2.2	1.8	28.5	34.4	34.3	0.3	1.3	1.1	29.6	34.9	35.3	1.0	1.5	1.4
B12A	40528	671.7	82.5	71.5	64.4	4.2	3.0	2.2	51.0	52.2	48.8	2.4	2.5	1.9	39.6	44.1	44.3	0.7	1.4	1.5	40.4	45.3	45.4	1.5	1.8	1.8
B12B	65849	696.4	76.1	65.2	59.3	4.7	3.3	2.5	47.6	47.6	44.5	2.8	2.5	2.3	36.5	40.1	39.8	1.1	1.5	1.5	37.0	41.2	40.6	1.8	1.9	1.7
B12C	52900	706.3	80.2	69.0	62.4	5.0	3.6	2.8	49.4	50.1	46.6	2.9	2.8	2.4	37.6	41.7	41.4	1.0	1.7	1.8	38.3	43.1	42.4	1.8	2.1	1.9
B12D	36227	703.1	85.0	74.4	66.2	6.1	4.8	3.6	51.6	56.3	52.9	3.2	3.8	3.5	40.7	46.9	46.6	1.3	2.5	2.5	41.9	47.7	47.9	2.3	2.8	2.7
B12E	43583	696.5	63.8	54.1	47.8	3.7	2.3	1.4	44.5	43.2	38.2	2.5	2.1	1.4	34.6	37.8	35.0	1.1	1.4	1.1	36.1	39.0	35.6	1.7	1.7	1.1
B20A	57428	661.5	65.1	58.3	53.6	3.6	2.5	1.9	37.3	40.6	39.2	1.8	1.9	1.7	30.9	35.2	35.0	0.7	0.9	1.1	30.7	35.5	35.2	1.2	1.2	1.3
B20B	32154	666.7	65.6	56.4	51.4	4.1	2.7	1.8	41.4	41.4	40.4	2.5	2.1	1.8	34.5	36.9	36.7	1.3	1.5	1.4	35.0	37.0	36.9	1.9	1.7	1.4
B20C	36369	674.4	97.6	85.3	78.4	8.0	5.7	4.2	48.9	50.7	48.3	3.5	3.7	3.1	39.1	44.1	43.6	1.3	2.2	2.1	39.0	43.9	43.5	2.1	2.6	2.3
B20D	48038	677.0	61.4	53.4	48.3	3.8	2.6	1.7	37.2	38.8	37.8	2.1	2.0	1.6	30.0	33.7	33.8	0.7	1.0	1.0	30.7	34.3	34.1	1.4	1.4	1.1
B20E	61986	657.5	67.6	58.9	53.4	4.0	2.8	2.1	40.8	42.3	40.2	2.3	2.2	1.8	31.7	35.7	36.1	0.8	1.2	1.3	32.5	36.0	37.0	1.5	1.5	1.6
B20F	50420	666.2	59.0	51.2	46.9	3.1	1.9	1.3	33.3	34.2	32.4	1.5	1.4	1.0	27.2	30.1	29.5	0.3	0.7	0.6	27.6	30.0	29.6	1.1	1.0	0.9
B20G	52244	668.6	62.4	53.9	49.0	3.3	2.1	1.3	39.6	40.3	37.7	1.7	1.5	1.0	32.3	36.1	34.8	0.2	0.9	0.6	32.9	36.2	35.3	1.0	1.1	0.8
B20H	56250	670.9	54.5	47.4	43.5	3.1	1.9	1.3	29.9	32.6	32.9	1.4	1.2	1.2	22.5	27.4	28.8	-0.1	0.3	0.6	23.2	28.0	29.1	0.6	0.7	0.7
B20J	40744	696.3	77.7	67.1	60.5	4.9	3.4	2.2	38.8	45.8	43.8	1.9	2.2	1.8	28.8	37.3	38.1	0.2	1.0	1.0	28.2	37.4	38.5	1.1	1.3	1.1
B31A	38655	677.3	47.7	40.6	36.8	3.1	1.9	1.2	26.9	28.0	26.9	1.3	1.3	0.9	20.4	23.4	23.3	0.1	0.5	0.3	20.8	23.8	23.5	0.7	0.8	0.5
B32A	80142	691.7	49.1	41.5	38.4	2.3	1.0	0.4	32.4	31.5	29.4	1.3	0.9	0.4	23.8	27.3	26.9	0.1	0.4	0.1	25.1	28.1	27.5	0.6	0.5	0.2
B32B	61384	699.0	67.3	57.2	50.5	4.0	2.6	1.7	46.4	45.7	40.7	2.7	2.3	1.7	35.6	39.6	37.0	1.1	1.6	1.3	37.1	40.8	37.7	1.7	1.9	1.3
B32C	30281	663.9	69.6	59.5	53.4	4.5	2.9	1.9	37.1	42.1	40.0	2.0	2.0	1.6	27.7	35.0	35.0	0.5	1.0	0.9	27.3	35.3	35.5	1.2	1.3	1.0
B32E	20320	668.9	67.3	58.7	53.5	3.2	2.1	1.5	41.0	42.6	40.1	2.0	1.6	1.3	31.3	35.3	34.9	0.7	0.9	0.8	33.0	37.0	36.3	1.4	1.2	1.0
B32F	66720	658.2	52.2	45.4	41.7	2.4	1.4	0.7	32.0	33.0	31.2	1.1	1.0	0.6	26.1	30.0	29.1	0.1	0.6	0.3	27.0	30.4	29.3	0.6	0.8	0.3

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
B41A	76446	714.8	88.6	76.6	68.5	6.2	4.6	3.5	57.9	59.2	55.0	3.7	3.6	3.0	43.9	49.7	48.4	1.3	2.1	2.0	46.7	51.4	49.4	2.6	2.7	2.4
B41B	77800	705.7	83.3	71.9	63.9	5.0	3.7	2.8	56.4	58.4	53.1	3.1	3.0	2.4	43.0	49.5	49.1	1.3	1.8	1.8	45.7	51.4	50.3	2.2	2.4	2.1
B41C	30242	690.2	48.2	38.8	32.6	3.5	2.3	1.5	32.5	31.4	28.0	2.2	1.8	1.5	26.8	27.7	25.5	1.5	1.4	1.0	28.1	28.2	26.0	1.9	1.7	1.2
B41D	40291	651.8	51.2	44.4	40.8	2.4	1.3	0.7	31.5	32.4	30.7	1.2	0.9	0.6	25.5	29.4	28.6	0.1	0.5	0.3	26.4	29.8	28.8	0.7	0.7	0.3
B41F	37985	699.4	60.6	49.6	41.4	4.4	3.4	2.4	39.8	39.7	35.7	2.8	2.8	2.2	30.9	34.4	31.9	1.5	2.2	1.7	32.8	35.1	32.7	2.4	2.5	1.9
B41G	44212	651.0	33.8	27.2	24.1	2.2	1.4	0.9	22.6	22.3	20.8	1.2	1.1	0.9	18.6	19.6	19.2	0.8	0.8	0.6	19.1	20.2	19.6	1.0	0.9	0.7
B42A	31894	774.1	125.0	111.3	100.3	8.1	6.5	5.4	72.8	80.3	78.3	4.5	4.6	4.3	53.7	63.5	67.1	2.0	2.5	2.8	57.6	66.7	69.4	3.4	3.5	3.5
B42B	21374	894.9	199.8	182.3	168.4	17.5	15.5	13.7	89.6	105.9	110.3	9.4	10.6	10.6	59.3	73.9	80.4	4.6	5.9	6.0	56.2	72.1	80.5	7.3	7.7	7.6
B42C	16412	726.8	103.3	90.2	80.6	7.5	5.9	4.6	58.4	64.1	62.2	3.9	4.3	4.2	44.7	52.4	53.1	2.0	2.6	2.7	46.0	53.2	54.3	3.0	3.2	3.1
B42D	15458	1004.8	261.0	246.2	234.7	19.6	18.1	17.4	102.8	117.4	127.1	11.1	11.2	11.6	73.3	87.6	97.1	4.8	5.6	6.5	64.1	78.4	88.6	8.9	9.0	9.3
B42F	27910	735.7	123.1	109.5	99.3	7.7	6.1	4.9	65.1	73.0	72.2	3.8	4.1	3.8	48.7	58.4	60.7	1.3	2.2	2.3	50.7	60.3	62.5	2.8	3.1	2.9
B42G	32725	675.5	76.3	66.4	60.8	4.1	2.8	2.1	40.6	46.1	46.2	1.6	1.8	1.8	30.0	36.9	39.4	0.1	0.6	0.8	31.1	37.7	40.4	1.0	1.1	1.1
B52H	56325	658.9	99.6	91.5	85.4	5.5	4.4	3.7	36.2	43.6	47.2	2.1	2.3	2.4	26.7	33.9	37.8	0.1	0.5	0.9	22.3	30.5	35.0	1.3	1.4	1.6
B60A	20942	1192.7	427.0	410.7	397.9	31.1	29.6	28.4	119.1	139.2	153.0	13.5	14.0	14.0	87.6	107.1	119.2	5.3	6.5	6.8	74.6	93.4	106.2	11.0	11.6	11.6
B60B	30222	1031.9	302.2	287.1	275.4	20.0	18.4	17.2	90.8	104.1	112.5	10.4	10.7	10.5	63.9	76.5	83.3	4.8	5.9	6.0	57.7	70.7	78.3	8.5	9.1	8.9
B60C	9411	1208.1	420.8	405.2	392.8	27.7	26.2	25.1	110.8	132.5	145.1	12.1	13.0	13.2	79.4	97.2	108.4	4.1	5.4	6.1	69.2	86.8	98.8	9.7	10.4	10.6
B60D	24347	999.3	303.8	287.9	275.6	24.3	22.2	20.6	81.1	98.4	107.5	9.3	10.2	10.6	57.2	72.1	80.6	3.2	4.8	5.4	50.8	66.1	75.1	6.7	7.5	7.7
B60E	8343	1012.9	295.8	280.0	267.5	22.3	20.8	19.7	98.8	114.5	123.6	10.5	10.6	10.6	71.5	86.9	95.5	4.0	4.9	5.3	62.4	77.2	86.9	8.5	8.6	8.5
B60F	39932	754.5	105.9	94.0	86.3	5.8	4.2	3.3	54.6	60.9	60.8	2.8	2.9	2.7	38.2	46.0	49.5	0.4	0.9	1.3	37.3	45.3	48.9	1.4	1.6	1.6
B60G	44804	680.7	86.2	75.3	68.2	5.7	3.9	2.6	45.5	50.4	47.6	2.5	2.9	2.2	34.0	40.0	40.2	0.3	1.1	1.1	33.3	39.6	40.3	1.2	1.5	1.3
B60H	38460	770.4	127.4	117.1	109.0	8.7	7.8	7.0	44.4	53.1	56.2	4.7	5.1	4.7	33.2	41.4	45.4	2.5	3.3	3.4	28.1	36.8	41.5	3.8	4.3	4.1
B71A	29763	668.6	98.8	88.5	80.9	5.9	4.8	4.1	35.2	43.7	44.6	2.9	3.0	3.0	25.0	32.0	35.9	0.6	1.1	1.6	19.4	27.5	32.9	2.0	2.0	2.2
B71C	26246	758.4	138.7	126.8	118.0	8.5	7.4	6.4	45.8	56.9	62.4	4.3	4.6	4.6	32.5	41.4	46.5	1.1	1.9	2.3	25.0	35.4	41.4	3.0	3.2	3.3
B71D	22715	692.7	101.9	91.3	83.6	5.9	4.9	4.1	36.0	44.5	45.5	2.8	3.1	3.0	25.7	32.7	36.7	0.6	1.2	1.6	20.1	28.3	33.7	2.0	2.1	2.2
B71F	54075	797.4	198.7	187.0	180.0	10.1	8.6	7.8	51.5	58.2	62.3	4.1	3.7	3.6	37.0	45.1	48.7	0.6	1.0	1.0	29.5	39.1	43.2	2.7	2.8	2.5
B71G	24494	846.6	159.2	148.3	139.4	11.0	10.0	9.0	51.5	63.1	68.0	5.6	6.2	5.8	37.6	47.9	53.3	2.9	3.8	3.9	29.1	40.2	46.7	4.3	4.9	4.8
B72A	53405	714.2	204.7	188.8	178.4	14.6	12.4	10.6	64.7	81.2	82.5	3.6	5.1	5.4	49.0	62.9	66.9	-0.1	1.7	2.1	43.3	59.4	65.1	1.9	2.9	2.9
B72E	32008	766.0	175.8	166.3	160.7	8.5	7.5	6.9	45.7	52.7	57.4	3.3	3.3	3.2	33.6	41.4	45.6	0.4	1.0	1.0	27.0	36.2	40.6	2.2	2.5	2.3
B72F	8121	937.7	290.3	275.2	263.7	16.6	15.0	13.7	71.9	84.8	87.5	7.2	7.9	7.4	50.2	63.9	68.1	2.3	3.6	3.7	39.3	55.3	60.4	5.3	6.4	6.0

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
B73A	16446	978.2	231.5	216.2	204.2	15.7	14.3	13.1	69.1	82.9	88.8	6.8	7.3	7.3	46.4	59.6	65.2	1.9	3.1	3.2	37.5	52.3	58.8	4.7	5.3	5.3
B81A	16907	1186.4	377.1	359.6	345.9	25.1	23.2	22.0	97.5	118.6	126.7	11.1	12.1	12.1	68.9	86.4	94.9	4.1	5.2	5.6	50.6	69.6	80.0	8.5	9.3	9.3
B81B	48123	1162.9	387.8	370.8	358.7	22.3	20.3	19.2	86.4	104.8	114.7	8.0	8.4	8.4	61.4	76.9	85.7	1.0	1.9	2.5	44.9	61.5	71.3	5.5	6.1	6.1
B81C	20840	890.9	235.4	218.7	207.1	12.3	10.5	9.3	68.5	85.5	90.2	4.8	5.3	5.3	44.4	59.2	65.2	-0.1	1.2	1.6	37.7	55.1	62.4	2.8	3.5	3.5
B81D	47879	846.4	227.3	214.1	203.9	14.4	13.1	11.8	66.9	83.4	88.1	5.2	6.1	5.8	46.1	61.1	67.2	0.8	2.3	2.6	38.7	55.3	62.8	3.4	4.3	4.1
B81E	66490	668.5	140.2	127.2	118.8	8.5	6.7	5.5	54.5	64.1	64.4	3.3	3.5	3.4	41.4	51.2	54.5	1.0	1.6	1.7	35.9	47.7	52.6	2.3	2.4	2.3
B82A	46656	721.5	155.6	146.6	140.2	7.3	6.4	5.7	46.0	56.4	58.8	2.6	3.1	3.0	35.6	44.1	47.8	0.1	0.9	1.2	29.8	39.6	43.6	1.8	2.2	2.2
B82B	40634	698.9	135.0	124.8	117.5	7.3	6.0	5.2	45.4	56.5	59.8	3.4	3.4	3.2	32.5	42.5	47.1	1.0	1.4	1.6	25.9	38.1	43.9	2.2	2.4	2.4
B82C	29966	726.3	115.5	105.1	97.5	6.9	5.7	4.8	40.3	49.5	52.5	3.3	3.3	3.0	29.8	38.5	42.6	1.2	1.7	1.7	23.5	33.4	38.5	2.3	2.6	2.3
B82F	75979	671.8	124.1	114.2	108.2	5.6	4.4	3.8	41.8	49.6	52.2	2.3	2.4	2.4	30.2	39.0	42.7	-0.2	0.7	1.1	26.5	36.5	41.0	1.3	1.7	1.7
C11A	71939	743.3	97.7	86.8	78.9	5.8	4.4	3.5	51.1	56.3	54.5	3.1	2.9	2.6	39.9	46.9	47.3	1.4	1.7	1.6	40.6	47.2	48.1	2.5	2.3	2.0
C11B	53465	705.9	80.5	69.6	60.9	5.5	4.1	3.0	48.0	51.3	47.5	3.0	3.0	2.6	36.9	44.0	42.3	1.1	2.0	1.8	38.5	44.7	42.8	2.1	2.4	1.9
C11C	44875	764.3	102.4	90.0	80.4	8.0	6.3	5.0	66.8	67.8	62.3	5.1	4.9	4.1	50.9	58.1	54.7	2.6	3.5	3.1	49.9	57.8	54.3	3.5	4.0	3.4
C11D	37173	701.2	67.0	57.5	51.3	3.7	2.6	1.7	49.6	47.5	42.4	2.7	2.4	1.7	38.4	42.5	40.3	1.2	1.7	1.4	38.4	42.7	40.1	1.7	2.0	1.5
C11E	115504	702.5	71.4	60.9	54.2	5.4	3.9	2.9	45.8	44.9	41.8	3.2	3.0	2.4	36.0	39.4	37.0	1.5	2.1	1.6	36.8	39.6	37.3	2.3	2.4	1.9
C11F	92890	702.7	75.6	64.8	58.3	4.7	3.1	2.2	48.7	48.1	44.2	3.0	2.6	1.9	39.0	42.9	41.2	1.7	1.8	1.6	40.0	42.9	41.4	2.3	2.1	1.7
C11G	43171	658.8	67.3	59.7	54.7	4.1	3.2	2.5	41.2	42.6	41.8	2.1	2.1	2.1	32.7	37.0	36.9	0.7	1.4	1.4	34.1	37.5	37.5	1.4	1.7	1.5
C11H	110280	664.0	68.6	60.8	55.8	4.4	3.4	2.8	42.1	43.2	42.4	2.4	2.3	2.4	33.6	37.7	37.6	0.9	1.5	1.6	34.9	38.2	38.1	1.7	1.9	1.8
C11J	100057	657.3	63.3	56.4	51.7	3.9	3.1	2.3	38.6	40.2	39.3	1.9	2.1	1.9	30.8	35.0	34.9	0.7	1.4	1.2	32.0	35.4	35.3	1.5	1.7	1.4
C11L	94690	674.2	73.4	62.6	56.0	5.2	3.5	2.6	48.1	48.4	44.0	3.2	2.9	2.2	38.4	42.4	41.2	1.5	1.8	1.7	39.4	42.9	41.5	2.2	2.0	1.9
C12D	89834	666.1	49.3	42.9	39.5	3.0	1.8	1.3	32.4	33.1	31.9	1.8	1.4	1.3	26.2	27.9	28.4	0.6	0.6	0.8	26.8	28.7	28.9	1.1	0.9	0.9
C12K	47872	656.9	52.1	44.9	40.5	3.4	2.4	1.6	34.6	34.5	31.3	2.0	1.9	1.5	28.4	31.7	29.9	1.0	1.6	1.3	28.3	32.0	30.0	1.3	1.7	1.3
C13A	59352	779.2	117.1	103.3	92.8	10.0	7.9	6.4	64.3	71.7	70.2	5.0	5.5	5.4	46.8	57.1	58.7	1.8	3.2	3.7	48.6	58.3	59.7	3.2	3.9	4.0
C13B	61500	683.8	83.0	71.1	63.0	6.3	4.2	3.1	53.2	54.3	49.5	3.8	3.3	2.7	41.7	46.8	45.2	2.0	2.1	1.9	42.7	47.5	45.8	2.6	2.4	2.1
C13C	83615	726.9	121.5	107.0	97.1	11.2	8.4	6.6	64.1	69.6	67.1	5.7	5.9	5.1	48.9	57.7	58.6	2.4	3.8	3.8	49.8	57.9	59.4	3.8	4.3	4.1
C13D	89457	697.8	67.8	59.2	52.9	4.7	3.4	2.6	35.9	38.2	35.4	2.4	2.3	1.9	27.8	32.5	31.4	1.1	1.4	1.2	28.7	33.2	31.6	1.7	1.8	1.5
C13E	60213	698.7	75.6	64.0	57.0	6.9	4.5	2.9	47.1	47.8	43.6	4.0	3.7	2.4	37.8	42.0	39.7	1.8	2.6	1.8	38.5	42.4	40.1	2.5	2.7	2.0
C13F	61057	693.3	54.7	46.2	40.7	5.1	3.6	2.4	33.9	35.2	32.3	3.2	3.0	2.1	27.9	30.9	29.8	2.1	2.3	1.8	28.0	30.7	29.8	2.5	2.4	1.8
C13G	43401	672.0	81.2	70.8	63.8	5.3	3.5	2.3	48.3	50.5	45.8	3.2	2.9	2.2	39.0	43.9	42.8	1.7	2.0	1.7	39.8	44.5	43.1	2.3	2.2	1.7

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
C21A	70659	673.0	63.5	54.3	48.1	3.9	2.6	1.7	40.1	40.7	37.0	2.5	2.2	1.5	32.1	35.8	34.5	1.1	1.5	1.3	32.4	35.9	35.0	1.6	1.7	1.4
C21B	43056	697.5	68.3	59.0	53.9	4.6	3.2	2.4	38.7	39.9	37.9	2.5	2.3	1.8	32.6	35.5	34.8	1.1	1.4	1.4	32.3	35.4	34.9	1.8	1.8	1.5
C21C	43784	672.5	59.6	51.3	46.4	3.9	2.6	1.7	40.3	39.8	36.4	2.3	2.1	1.5	33.8	36.7	34.7	1.2	1.7	1.3	33.7	37.1	34.9	1.6	1.8	1.3
C21D	44582	698.2	71.4	61.5	54.9	4.8	3.3	2.2	44.9	44.6	40.7	3.0	2.6	1.9	35.9	39.4	37.1	1.2	1.7	1.4	36.7	39.6	37.7	2.0	2.1	1.6
C21E	62822	691.0	67.1	58.3	52.5	4.4	3.2	2.5	42.8	43.0	39.8	2.6	2.4	2.0	33.9	36.9	35.6	1.3	1.5	1.4	34.8	37.8	36.1	1.9	1.8	1.7
C21F	42655	703.6	79.7	69.8	64.1	4.5	3.1	2.1	45.3	48.0	47.1	2.2	2.2	2.1	35.8	41.0	42.6	0.6	1.3	1.4	36.0	41.0	43.1	1.3	1.5	1.6
C21G	46243	665.3	58.3	50.6	46.6	3.2	1.8	1.1	41.1	39.2	36.7	2.0	1.4	1.0	34.8	35.4	33.9	0.8	0.9	0.7	35.6	35.9	34.6	1.3	1.1	0.8
C22A	54840	693.7	64.4	57.5	53.3	4.4	3.5	2.8	35.3	38.6	38.3	1.8	2.2	2.1	29.3	32.9	33.9	0.5	1.2	1.3	29.4	33.4	34.2	1.2	1.6	1.6
C22B	39146	688.8	59.1	51.3	46.9	4.1	2.6	1.7	38.0	37.1	35.0	2.4	1.9	1.4	32.6	33.5	32.6	1.1	1.0	1.0	32.4	33.5	32.4	1.6	1.3	1.1
C22C	46519	684.8	62.9	54.5	49.3	4.1	2.9	2.2	40.9	40.5	37.6	2.4	2.1	1.8	32.5	35.0	33.7	1.2	1.4	1.3	33.4	35.9	34.2	1.7	1.7	1.4
C22D	34520	697.5	65.5	57.8	54.1	4.2	3.0	2.3	39.1	39.4	38.7	2.3	2.1	1.8	32.5	33.5	34.1	0.8	1.1	1.1	32.6	33.7	34.5	1.5	1.5	1.3
C22E	53212	668.3	50.0	43.1	39.1	2.8	1.9	1.3	33.0	32.3	30.3	1.5	1.5	1.0	28.2	29.2	28.3	0.6	0.9	0.9	28.7	29.5	28.6	1.0	1.1	1.0
C22F	44015	655.9	50.6	43.4	38.9	2.7	1.5	0.7	33.6	32.8	30.4	1.5	1.2	0.7	28.6	29.9	28.3	0.5	0.8	0.4	28.8	29.9	28.4	0.8	0.8	0.4
C23D	51009	663.4	46.7	41.7	38.0	2.9	1.8	1.3	29.5	32.4	30.5	1.2	1.4	1.3	24.7	28.7	28.6	0.4	0.8	1.0	24.6	28.9	28.8	0.8	0.9	1.0
C81A	38190	882.2	171.6	153.8	140.0	19.7	17.2	15.1	80.5	93.6	95.2	9.6	11.2	10.6	64.4	76.6	78.4	5.7	7.6	7.5	63.5	74.9	77.7	8.0	9.1	8.8
C81B	57546	764.4	102.1	88.1	78.3	11.8	9.6	7.7	56.6	61.7	61.5	6.7	7.0	6.4	46.1	52.0	51.7	4.2	5.3	4.7	45.5	51.2	51.2	5.5	5.9	5.0
C81C	24973	738.1	89.0	76.3	67.7	10.2	8.1	6.4	50.7	55.6	55.2	6.0	6.1	5.6	41.7	46.5	46.9	3.8	4.5	4.2	41.2	45.9	46.5	4.9	5.0	4.4
C81D	19478	735.8	87.9	75.5	66.9	10.1	8.0	6.1	50.3	55.3	54.8	5.9	6.1	5.4	41.5	46.3	46.6	3.9	4.7	4.0	40.9	45.8	46.2	4.8	5.1	4.1
C81E	64240	658.4	68.5	58.9	53.6	4.5	2.9	2.0	42.3	43.1	40.9	2.6	2.2	1.6	36.1	38.1	37.7	1.3	1.5	1.3	36.0	38.1	37.9	1.8	1.6	1.3
C81F	68803	895.5	203.4	185.3	172.4	20.3	17.4	15.4	91.0	103.7	107.2	8.8	9.3	9.5	69.2	82.4	87.3	4.1	5.0	5.9	70.1	82.9	88.0	6.6	6.7	7.1
C81G	43447	723.0	99.6	87.6	79.4	8.1	6.0	4.5	50.5	54.6	52.0	4.0	4.2	3.6	40.7	46.9	45.9	1.8	2.9	2.7	41.2	47.1	46.2	2.7	3.3	2.9
C81L	79342	737.7	105.5	91.5	82.5	9.1	6.7	5.1	59.9	63.8	61.9	5.6	5.3	4.4	47.4	53.4	53.8	3.1	3.6	3.3	48.1	54.2	54.8	4.1	4.3	3.8
C81M	109163	662.2	63.8	54.0	48.5	4.8	3.1	2.3	41.5	42.0	39.9	2.7	2.3	1.9	33.3	36.5	36.1	1.6	1.5	1.5	34.0	37.0	36.2	2.0	1.8	1.7
C82A	58173	670.1	71.3	61.1	54.9	5.4	3.7	2.5	44.7	45.3	43.8	3.6	3.2	2.2	36.4	39.7	39.3	2.0	2.2	1.7	37.1	40.6	39.8	2.7	2.5	2.0
C82B	49296	660.0	71.5	62.7	57.8	5.3	3.9	3.2	49.9	49.6	46.8	3.2	3.0	2.7	43.3	45.7	44.4	2.2	2.5	2.5	43.5	46.1	44.8	2.4	2.7	2.5
C82E	62205	666.7	54.2	45.9	41.4	3.7	2.3	1.6	39.8	38.1	35.7	2.5	1.9	1.5	33.1	34.5	33.0	1.4	1.4	1.2	34.0	34.9	33.1	1.8	1.5	1.2
C82G	58031	654.7	45.8	37.6	33.1	3.4	2.0	1.4	35.9	33.3	29.5	2.5	1.8	1.3	30.4	31.2	28.8	1.5	1.5	1.2	31.1	31.6	28.8	1.8	1.7	1.2
C83A	74550	693.8	68.2	58.9	52.5	6.1	4.5	3.4	41.9	44.9	42.1	3.4	3.4	2.9	34.9	40.1	38.5	2.2	2.7	2.4	35.5	40.3	38.7	2.7	2.9	2.4
C83B	25046	668.2	78.5	66.0	57.8	7.8	5.4	3.8	49.7	50.0	45.2	4.2	4.0	3.0	41.5	44.9	42.3	2.8	3.1	2.7	42.4	45.5	42.4	3.3	3.4	2.8

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
C83C	82751	663.4	76.7	68.0	63.0	6.6	5.2	4.4	45.7	46.7	45.4	2.8	2.9	2.9	40.6	42.3	41.3	1.8	1.9	1.9	40.6	42.1	41.4	2.3	2.2	2.0
C83E	42599	654.6	41.6	34.3	30.1	3.2	1.9	1.3	31.2	28.6	25.3	2.4	1.8	1.3	26.5	26.6	24.0	1.6	1.5	1.2	26.8	26.8	24.2	1.9	1.6	1.2
D11A	27822	1008.7	343.7	336.8	334.6	36.7	36.2	36.2	132.0	159.1	182.4	17.7	21.3	24.2	121.0	146.2	166.2	11.9	16.1	19.1	114.3	139.7	160.0	16.0	19.3	21.8
D11B	23633	1056.1	337.6	328.1	323.0	33.6	32.6	32.2	117.0	145.0	165.5	15.7	19.4	21.2	97.8	121.7	139.4	9.5	13.5	15.4	94.4	118.0	137.1	13.8	17.2	19.1
D11C	29145	910.8	223.4	214.6	209.8	24.3	23.2	22.6	98.1	114.4	127.8	12.7	14.8	16.1	88.3	105.1	115.7	8.6	11.4	12.9	83.8	100.5	111.5	11.5	13.3	14.7
D11D	31856	889.4	215.9	203.0	193.1	24.1	22.2	20.7	100.6	122.0	130.8	13.0	14.6	15.2	77.3	98.6	107.7	7.1	9.4	10.4	78.6	99.2	108.0	10.5	11.8	12.3
D11E	32231	736.8	87.9	76.7	69.1	9.7	7.8	6.5	46.7	52.4	51.5	5.3	5.8	5.2	34.7	42.6	44.3	3.3	4.2	4.0	35.3	43.2	45.2	4.1	4.6	4.4
D11F	41299	700.5	83.4	72.5	65.2	9.3	7.4	6.3	46.4	51.1	50.0	5.5	5.6	5.2	34.9	41.8	43.4	3.6	4.2	4.2	35.6	42.6	44.4	4.3	4.8	4.6
D11G	31970	770.9	157.4	146.6	140.6	16.2	14.8	14.2	72.5	82.4	92.2	9.8	10.3	10.9	60.7	71.9	80.0	6.9	8.1	8.7	60.0	70.8	78.7	8.9	9.6	10.0
D11H	35832	682.8	43.5	36.1	31.5	4.6	3.6	3.0	26.8	28.0	27.3	2.9	2.8	2.7	21.8	23.5	23.5	1.7	2.0	2.1	22.0	23.7	23.7	2.4	2.3	2.4
D11J	43956	660.6	62.1	53.2	47.1	6.5	5.0	4.0	35.9	38.5	37.0	3.8	3.9	3.4	26.7	32.1	32.4	2.5	2.9	2.7	27.3	32.8	33.0	2.9	3.2	3.0
D12B	38512	722.0	108.1	95.1	85.7	13.6	11.4	9.6	57.8	65.8	65.0	8.5	8.8	8.0	46.3	55.4	56.3	5.8	7.1	6.5	46.1	55.0	56.3	7.0	7.8	6.9
D13A	47483	800.4	102.3	91.3	83.4	12.5	11.0	9.9	65.9	73.7	73.8	8.7	9.3	9.3	48.3	59.9	63.3	5.6	7.2	7.6	50.3	61.1	64.5	6.9	7.9	7.9
D13B	53292	787.9	92.8	82.2	74.3	11.2	9.7	8.7	62.1	67.9	66.3	8.0	8.3	8.3	46.0	56.3	58.0	5.3	6.7	7.0	48.3	57.5	59.1	6.4	7.1	7.3
D13C	51684	701.5	51.3	42.1	35.4	5.8	4.4	3.4	37.2	37.2	31.7	4.3	4.0	3.4	28.9	32.8	30.0	3.0	3.4	3.1	30.1	33.2	30.4	3.5	3.6	3.1
D13D	63508	677.9	82.8	71.8	64.7	10.1	8.4	7.3	49.9	52.8	51.8	6.8	6.6	6.4	36.7	43.2	44.5	4.3	4.9	4.9	38.0	43.5	44.5	5.5	5.6	5.3
D13E	103089	753.1	74.8	63.8	55.9	10.6	8.5	7.2	49.3	52.3	48.8	7.2	7.4	6.7	38.6	44.4	44.3	4.9	5.7	5.8	40.2	45.0	44.6	5.7	6.1	6.0
D13F	96993	668.1	61.2	52.5	46.6	9.0	7.4	6.2	34.1	37.2	36.7	5.7	5.8	5.3	27.1	32.5	33.0	4.1	4.9	4.6	27.2	32.4	32.9	4.7	5.3	4.9
D13K	39716	731.0	109.1	98.3	89.9	17.7	15.6	13.9	53.5	63.8	64.4	10.3	11.9	11.3	41.6	52.7	55.4	7.7	9.5	9.5	41.5	52.0	55.2	8.5	10.1	10.1
D15A	43686	698.7	78.6	67.8	60.5	9.9	8.4	7.2	43.7	47.4	46.7	6.1	6.4	5.8	33.3	40.6	42.0	3.9	5.1	5.0	34.1	40.6	41.6	4.9	5.6	5.3
D15B	39329	732.5	91.6	79.9	71.4	11.7	9.9	8.8	49.1	54.3	53.8	7.0	7.2	7.0	37.5	46.0	47.6	4.5	5.6	5.8	38.4	46.1	47.0	5.7	6.3	6.3
D15C	27587	702.7	82.6	70.0	61.7	10.0	8.1	6.9	51.4	51.9	49.2	6.6	6.4	5.7	41.3	45.9	45.3	4.6	5.2	4.9	42.3	45.9	45.3	5.4	5.6	5.2
D15D	43690	723.6	90.9	77.8	68.5	11.1	9.1	7.6	55.2	56.8	54.0	7.2	7.0	6.2	44.3	49.9	49.2	4.9	5.7	5.3	45.3	49.8	49.0	5.8	6.2	5.6
D15E	61874	720.3	115.5	101.1	90.4	13.1	10.7	8.9	60.5	65.0	61.5	8.3	8.1	7.0	49.6	56.9	55.3	5.9	6.6	6.0	49.7	56.6	55.0	6.9	7.3	6.3
D15F	35242	696.2	95.7	82.2	73.0	10.5	8.2	6.6	52.8	53.2	50.6	7.0	6.2	5.2	43.5	48.1	46.1	4.9	5.3	4.6	43.7	47.7	45.4	5.9	5.7	4.8
D15G	48473	667.3	82.5	72.3	64.4	7.4	5.9	4.6	43.8	47.3	45.3	3.9	4.1	3.7	37.7	42.9	42.2	2.6	3.2	3.0	37.1	41.9	41.4	3.3	3.5	3.1
D16A	15918	913.9	298.9	292.3	290.3	29.4	28.5	28.5	118.7	144.5	166.0	15.8	18.7	20.4	103.2	126.3	145.4	10.8	13.8	15.7	99.5	123.7	142.8	14.1	17.2	19.0
D16B	24803	849.5	230.4	221.7	217.8	23.1	21.9	21.6	99.3	118.7	134.3	13.1	14.9	16.2	83.7	101.7	116.4	9.1	11.0	12.5	81.8	99.7	114.4	11.7	13.7	14.7
D16C	43718	652.0	47.3	38.8	33.8	5.1	4.0	3.3	30.3	29.8	29.2	3.4	3.0	3.0	25.1	25.9	25.6	2.1	2.5	2.4	25.2	26.1	25.6	2.8	2.7	2.7

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
D16D	33897	852.5	247.0	238.8	234.5	26.4	25.3	25.0	103.4	124.6	142.4	13.8	15.0	16.3	87.7	107.6	122.9	8.3	10.3	11.9	86.4	105.9	120.9	12.4	13.6	14.7
D16M	75280	668.9	37.0	30.9	26.9	3.8	3.0	2.5	22.9	24.7	23.5	2.4	2.5	2.2	18.1	20.3	20.5	1.2	1.7	1.9	18.3	20.6	20.7	1.9	2.0	1.9
D17A	63802	697.0	73.7	63.7	57.1	8.0	6.3	5.3	41.3	45.3	44.2	4.7	4.9	4.4	30.8	37.3	38.4	3.0	3.6	3.6	31.4	38.0	39.3	3.6	4.0	3.9
D17B	44176	719.8	100.0	88.2	79.8	9.8	7.9	6.6	51.6	61.2	62.2	5.2	5.9	5.9	39.5	48.6	51.9	2.6	3.6	4.2	40.2	49.0	53.0	4.0	4.4	4.6
D17C	52462	673.7	62.2	53.3	47.1	6.5	5.0	4.1	36.0	38.5	36.7	3.8	3.9	3.5	27.0	32.3	32.3	2.4	2.9	2.8	27.5	33.0	32.8	2.8	3.2	3.0
D17K	38313	670.4	69.7	60.9	54.4	6.5	5.3	4.3	40.2	43.2	42.4	3.5	3.6	3.3	29.9	35.1	36.6	1.7	2.2	2.3	31.1	36.2	37.4	2.6	2.8	2.8
D17L	58993	664.8	84.3	75.2	69.3	9.2	7.4	6.3	35.1	40.6	41.6	3.6	3.8	3.6	28.4	34.8	37.0	1.6	2.0	2.5	27.7	33.7	36.0	2.8	2.8	2.8
D18B	32708	685.5	68.8	60.5	54.4	7.1	5.9	5.0	32.0	36.5	37.6	3.4	3.8	3.7	27.3	31.6	33.4	2.1	2.6	3.0	26.8	31.2	33.0	2.8	3.2	3.3
D18C	46540	688.4	95.7	84.1	75.4	9.4	7.6	6.2	45.0	50.4	49.9	4.9	5.0	4.7	36.5	43.9	44.2	2.8	3.7	3.5	36.1	42.8	43.2	3.7	4.3	3.8
D18E	37567	694.6	80.2	71.4	64.5	8.7	7.2	6.3	38.1	43.1	44.7	4.6	4.7	4.9	32.6	37.5	39.6	2.8	3.4	3.9	31.9	37.1	39.2	3.8	4.1	4.3
D18F	44573	675.9	70.7	60.3	53.3	10.8	8.2	6.4	40.3	41.5	39.0	6.0	5.7	4.9	33.2	38.2	37.1	4.1	4.9	4.5	33.4	37.6	36.7	4.6	4.9	4.4
D18G	49159	767.3	94.6	84.7	77.5	11.4	10.0	9.0	65.4	71.3	70.2	8.5	8.7	8.6	50.0	60.3	62.5	6.0	7.3	7.3	52.2	61.4	63.3	7.1	7.7	7.6
D18H	38358	713.7	91.1	79.6	71.1	14.3	12.2	9.9	50.1	55.0	52.6	7.4	8.8	7.7	40.1	48.8	48.6	5.0	7.1	6.8	40.5	48.2	48.0	5.8	7.4	6.7
D18J	85855	712.4	84.8	73.7	65.7	13.4	10.8	8.6	47.3	50.5	48.2	7.2	7.6	6.6	38.2	45.7	44.9	4.8	6.3	6.0	38.6	45.1	44.4	5.4	6.4	5.8
D18K	93497	774.8	120.3	107.6	97.6	19.2	17.1	15.2	62.3	72.9	71.5	9.5	11.7	11.7	48.9	61.5	63.4	6.5	9.0	9.7	49.4	61.2	63.0	7.6	9.4	9.7
D18L	60957	664.1	89.0	77.5	69.3	8.1	6.5	5.3	46.6	50.0	48.7	4.3	4.5	4.1	39.9	45.0	44.5	2.8	3.5	3.4	39.4	43.9	43.4	3.5	3.8	3.6
D21A	30932	979.0	191.0	175.4	163.9	22.4	20.1	18.4	91.1	105.5	110.5	11.0	12.5	12.8	68.4	86.3	91.9	6.0	8.3	9.1	69.3	85.8	91.8	8.4	10.0	10.5
D21B	39366	1018.0	233.2	219.5	208.9	26.7	24.7	23.0	92.9	114.0	122.1	12.9	14.8	15.0	74.3	94.5	104.3	7.2	9.8	10.7	73.1	91.9	102.1	10.7	12.2	12.9
D21C	21158	879.8	189.3	175.3	165.5	20.5	18.5	16.9	80.6	88.7	89.9	9.9	10.5	9.8	65.3	75.5	78.1	6.0	7.4	7.3	66.3	75.5	77.7	8.4	9.0	8.7
D21D	25147	838.1	145.4	130.3	119.5	14.6	11.8	9.9	72.1	82.4	82.2	7.7	8.7	8.3	53.8	67.0	70.5	3.8	5.9	6.5	55.1	68.1	72.2	5.5	6.6	7.2
D21E	26833	784.4	129.2	118.6	111.7	13.9	12.2	11.2	60.3	65.5	65.0	6.8	6.8	6.2	48.7	55.1	56.7	4.3	4.9	4.9	49.5	55.0	56.8	5.8	5.8	5.6
D21F	47954	724.9	80.2	67.0	58.7	9.0	6.5	4.8	50.6	50.9	46.5	4.8	4.7	4.1	42.7	45.9	43.3	3.5	3.9	3.4	43.1	46.0	43.4	3.9	4.0	3.4
D21G	27809	751.9	109.0	99.5	93.5	11.8	10.3	9.3	53.7	58.0	56.7	5.8	5.7	5.0	43.4	48.2	49.7	3.9	4.2	4.1	44.0	48.3	49.9	4.8	4.8	4.5
D21H	38084	780.6	125.3	114.9	108.2	13.6	11.9	10.9	59.4	64.6	63.8	6.6	6.6	6.0	48.0	54.0	55.7	4.3	4.9	4.9	48.8	54.0	55.8	5.6	5.7	5.4
D21J	35933	989.6	273.4	259.8	249.2	29.3	27.4	26.0	95.5	114.3	121.6	12.6	14.6	14.8	75.8	95.4	102.7	6.5	9.2	10.2	75.9	94.1	101.1	10.6	12.4	12.9
D21K	32590	949.8	226.9	211.5	200.1	25.2	23.1	21.3	101.6	122.2	130.6	13.1	14.7	15.2	76.3	97.4	105.7	6.8	9.4	10.1	77.4	97.8	106.0	10.3	11.8	12.1
D21L	30422	853.4	123.8	110.2	99.7	13.4	11.3	9.6	66.7	75.0	73.8	7.5	8.1	7.9	51.7	61.1	62.7	4.0	5.3	5.6	52.5	61.5	63.7	5.7	6.3	6.4
D22A	63543	677.8	58.4	50.0	44.9	4.8	3.4	2.4	37.9	38.9	36.7	2.8	2.7	2.3	33.3	35.4	34.7	1.8	2.1	1.9	33.7	35.4	34.7	2.4	2.3	1.9
D22B	45704	723.1	63.7	54.4	48.2	6.4	4.6	3.4	40.2	41.4	38.4	4.0	3.7	3.1	32.9	36.7	35.6	2.4	2.8	2.7	33.4	37.0	35.7	3.0	3.1	2.7

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
D22C	48544	777.2	95.1	82.8	74.6	9.4	7.3	5.8	57.9	61.2	58.5	5.7	5.6	4.8	47.1	53.2	52.8	3.3	4.2	3.9	47.9	53.1	53.4	4.4	4.6	4.1
D22D	62771	692.2	60.7	51.4	45.4	5.4	3.7	2.3	42.3	42.0	38.1	3.6	3.3	2.3	36.2	37.9	35.6	2.4	2.5	1.9	36.2	37.9	35.5	2.8	2.7	1.9
D22E	49806	818.3	132.6	118.4	107.1	14.1	11.7	9.9	74.2	81.7	80.9	8.2	8.4	7.9	58.6	68.2	69.2	4.6	5.8	6.0	59.5	68.3	69.1	6.5	6.8	6.5
D22F	63275	758.2	92.1	79.6	70.8	8.7	6.7	5.0	58.7	60.4	56.4	5.4	5.2	4.3	48.6	53.3	51.3	3.1	3.9	3.3	49.2	53.3	51.8	4.2	4.3	3.5
D22G	96929	687.6	63.7	54.9	48.2	5.1	3.7	2.6	42.2	43.1	40.0	3.1	2.8	2.5	36.9	39.6	37.0	1.8	2.3	1.9	36.8	39.7	37.2	2.4	2.4	1.9
D22H	54091	731.2	84.6	71.5	63.2	7.1	5.0	3.7	54.7	56.9	52.0	4.4	4.3	3.7	44.7	49.3	48.1	2.6	2.9	3.0	45.6	49.9	48.7	3.4	3.2	3.0
D22J	65172	768.5	115.1	101.1	90.4	10.7	8.4	6.8	63.8	71.9	70.2	6.0	6.4	6.2	51.6	59.2	60.2	3.0	4.1	4.5	52.3	59.5	60.9	4.5	4.8	4.7
D22K	32365	750.6	117.3	101.7	90.5	10.7	8.5	6.7	65.6	71.2	68.6	5.8	6.4	5.8	54.1	60.9	60.6	3.3	4.2	4.3	53.6	60.6	60.4	4.7	4.9	4.6
D22L	37638	706.9	92.2	80.0	71.8	7.3	5.3	4.0	54.2	57.0	54.3	4.1	4.2	3.7	44.8	50.1	49.2	2.1	2.9	3.0	45.4	50.2	49.6	3.0	3.3	3.2
D23A	60798	686.1	79.5	67.4	59.3	6.8	4.8	3.5	48.4	50.4	46.6	4.1	3.9	3.2	40.7	44.9	43.6	2.5	2.8	2.8	40.6	44.7	43.5	3.3	3.1	2.8
D23B	59691	705.4	91.6	78.4	68.8	8.1	6.0	4.5	54.4	57.6	53.6	4.8	4.7	4.1	45.4	50.6	49.1	2.9	3.3	3.2	45.2	50.3	49.1	3.8	3.7	3.4
E10A	13373	870.3	380.1	365.0	351.1	24.5	23.2	22.4	64.1	81.7	96.2	11.2	11.6	11.9	52.2	68.4	81.8	4.0	4.8	5.6	51.3	67.8	81.5	10.2	10.7	11.0
E10B	20196	743.8	275.9	261.0	247.3	17.8	16.8	15.9	54.3	69.1	79.9	8.6	8.9	8.9	42.9	57.8	69.6	2.7	3.7	4.4	42.6	57.6	69.2	7.7	8.2	8.3
G10A	17178	1541.2	974.7	959.6	946.1	65.2	63.3	62.1	77.0	97.9	115.6	20.4	22.4	23.7	76.8	96.5	111.9	8.1	10.6	12.1	65.8	83.9	98.9	18.8	20.2	22.0
G10B	12597	1239.0	704.3	688.8	675.2	45.8	44.0	42.6	71.3	88.7	103.7	16.4	17.9	17.8	69.2	86.6	100.0	6.9	8.5	8.9	60.7	77.4	89.7	15.1	16.9	17.0
G10C	32806	997.5	461.5	447.0	434.0	34.5	33.4	32.6	62.7	80.0	96.9	14.4	15.0	15.2	57.0	72.9	87.3	5.8	6.8	7.4	52.9	68.4	82.4	13.7	14.4	14.6
G10G	18557	962.2	455.4	440.0	426.1	29.6	28.2	27.2	68.3	86.9	102.6	13.2	13.7	13.7	56.5	73.3	87.3	4.9	6.0	6.6	54.3	71.8	85.9	11.8	12.7	12.8
G22A	23799	682.1	190.3	177.0	164.2	19.6	18.6	17.7	49.0	62.9	73.5	8.5	9.3	9.6	41.7	55.5	65.3	4.3	5.8	6.9	41.1	55.1	64.9	7.9	8.8	9.0
G22B	10940	924.2	341.4	328.5	316.3	27.3	26.3	25.7	61.8	79.0	95.5	12.2	12.5	13.2	61.3	76.1	90.4	5.6	6.6	7.5	56.1	70.4	83.9	11.7	12.1	12.5
G22D	24601	742.3	287.8	274.0	260.9	23.1	22.3	21.5	53.9	69.6	82.8	10.1	10.6	10.8	48.3	62.8	75.6	4.2	5.2	6.0	46.0	60.8	73.6	9.5	10.2	10.4
G22F	6569	1442.3	820.2	806.4	794.4	68.0	66.8	66.0	90.1	109.2	126.8	21.6	22.3	22.3	88.9	107.4	122.1	7.3	9.2	10.7	79.4	96.5	109.6	19.5	20.8	21.1
G22G	10636	749.1	265.0	251.9	239.8	21.1	20.1	19.4	46.8	64.1	79.4	9.4	9.9	10.3	39.8	55.7	69.5	4.1	5.2	6.1	38.4	54.4	67.9	8.9	9.4	9.8
G22H	22730	668.5	177.1	164.8	153.0	15.9	15.1	14.2	42.4	55.4	63.7	7.7	8.4	8.2	36.8	50.7	58.8	4.1	5.3	5.8	35.2	48.8	56.7	7.3	8.0	7.9
G22J	12819	996.6	432.2	417.6	404.6	37.6	36.6	35.8	68.5	86.2	102.7	13.5	14.1	14.5	62.1	78.6	92.1	5.0	6.4	7.4	58.3	73.3	86.3	12.7	13.4	13.6
G22K	7982	795.7	255.8	242.1	229.4	23.1	22.2	21.5	54.9	69.8	82.5	10.0	10.5	10.6	49.3	63.4	74.7	4.6	5.7	6.3	46.7	60.5	71.6	9.5	10.0	10.3
G40A	7152	1136.2	526.8	513.1	500.5	46.0	45.0	44.2	80.5	99.4	116.5	16.0	18.1	18.3	78.2	96.0	109.2	7.0	9.4	10.1	71.9	88.3	100.4	14.9	16.9	17.5
G40B	12242	948.6	341.3	326.5	313.3	33.2	31.7	30.5	68.8	86.7	101.6	13.9	15.2	15.5	58.1	73.9	86.4	7.1	8.8	9.4	56.2	71.5	83.6	12.3	13.9	14.1
G40C	14457	1348.1	764.5	750.4	737.7	52.8	51.4	50.2	81.9	101.5	119.0	18.2	20.2	20.3	74.5	93.3	107.8	7.1	8.9	9.3	69.4	87.0	100.6	16.4	18.4	19.0
G40D	32717	992.4	371.6	357.1	344.3	36.7	35.0	34.0	75.4	94.3	112.3	15.0	16.3	17.0	64.0	81.1	95.6	7.2	8.9	10.0	62.3	78.9	92.6	13.2	14.9	15.6

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
G40E	27758	719.5	258.0	243.7	230.1	19.1	18.0	17.0	49.5	63.9	75.4	8.1	8.5	8.6	38.3	53.5	64.8	2.8	4.0	4.7	38.1	53.4	64.5	7.4	8.1	8.2
G40G	22047	722.8	173.9	159.7	146.6	17.3	16.0	14.9	51.6	65.7	76.6	8.5	9.4	9.7	41.2	54.6	64.8	4.6	6.5	7.3	41.6	55.2	65.3	7.7	8.6	9.0
G40H	9595	697.8	135.7	122.1	109.9	16.2	14.6	13.2	49.8	61.1	67.5	8.2	8.9	9.0	35.0	47.4	54.2	4.2	6.0	6.7	36.5	48.4	55.4	7.0	7.7	8.0
H10B	16246	727.8	284.5	271.4	259.5	19.8	18.9	18.0	52.4	70.1	82.9	9.2	9.8	10.0	41.9	57.3	68.9	3.8	4.8	5.3	40.9	56.5	68.9	8.5	9.0	9.1
H10C	25960	680.0	241.9	227.7	214.8	16.7	15.8	15.1	48.6	64.9	75.9	7.6	8.4	8.7	38.1	53.0	64.1	2.6	3.6	4.5	37.7	52.9	64.4	7.1	7.5	8.0
H10D	9696	1034.8	535.6	519.9	506.0	37.6	36.1	35.1	70.8	88.9	104.7	14.4	15.5	15.9	60.1	77.7	91.5	6.1	7.5	8.3	56.9	74.8	88.3	13.1	14.6	14.8
H10E	8481	1449.1	838.3	820.7	807.0	64.0	61.7	60.5	94.1	113.9	130.8	21.0	21.9	21.5	87.8	107.2	121.7	7.3	8.7	8.9	79.7	97.7	110.8	18.8	20.2	20.2
H10F	24787	788.5	307.5	292.6	278.9	21.6	20.5	19.6	52.1	67.9	80.1	9.8	10.3	10.2	42.8	58.1	69.8	3.5	4.5	5.1	41.0	56.8	68.8	9.0	9.6	9.7
H10G	27043	764.5	339.8	324.6	311.1	26.8	25.3	24.4	50.6	66.3	79.3	9.5	10.3	10.8	38.4	53.8	66.4	3.9	5.1	6.1	37.9	53.1	65.7	8.7	9.5	10.1
H10H	18749	865.4	393.1	378.2	364.7	26.9	25.8	24.9	59.0	76.1	90.3	11.5	12.1	12.2	48.0	63.6	76.3	4.4	5.4	6.1	46.1	61.9	74.7	10.5	11.2	11.4
H10J	21378	1601.8	1025.0	1009.8	996.3	68.6	66.7	65.4	82.9	104.1	122.0	21.7	22.9	24.4	83.4	103.1	118.7	8.2	10.9	12.5	71.7	89.8	104.9	20.0	20.9	22.4
H10K	19355	1237.0	686.4	671.6	657.9	48.9	47.7	46.8	77.8	99.0	116.7	15.2	18.0	19.1	69.4	88.9	104.8	5.9	8.2	9.6	64.0	82.8	98.1	13.8	16.2	17.7
H20D	10067	676.4	248.8	234.9	222.2	17.1	16.0	15.3	51.3	67.5	77.7	8.0	8.5	8.7	41.0	54.8	64.1	3.1	4.0	4.6	40.2	54.6	64.6	7.3	7.7	8.0
H20E	9520	924.8	444.7	429.2	415.4	30.8	29.4	28.5	65.5	82.5	97.1	12.8	13.3	13.6	54.2	70.2	83.2	5.2	6.2	6.9	51.8	68.1	80.9	11.6	12.3	12.6
H20F	11657	808.0	338.0	321.7	307.5	33.3	31.3	29.9	58.4	76.1	88.6	11.6	13.2	13.7	44.7	62.3	74.5	6.2	8.0	8.9	43.9	61.3	74.0	10.4	12.1	12.8
H60A	7264	1812.8	1195.0	1181.6	1169.9	85.2	83.8	82.7	100.4	122.0	140.7	27.5	28.3	28.8	94.2	114.4	129.9	8.3	11.9	13.6	86.7	104.2	118.4	25.1	26.0	26.3
H60B	21000	1125.7	583.1	568.0	554.4	42.4	41.2	40.0	70.3	90.0	106.9	14.5	16.3	16.6	60.4	78.1	92.3	5.6	7.5	8.3	57.0	74.2	88.2	13.2	15.0	15.7
H60C	21689	866.8	384.7	368.9	353.9	29.2	27.7	26.4	63.3	83.2	97.8	11.1	12.3	12.1	47.6	66.1	80.0	3.6	5.3	6.0	47.9	66.5	80.4	9.7	11.0	11.2
H70B	15309	667.4	70.4	57.9	49.4	12.3	9.5	7.7	33.8	35.0	31.5	6.9	6.6	6.2	21.0	26.8	25.9	4.0	5.1	4.7	22.3	27.3	26.8	4.7	5.2	5.1
H70E	15684	699.6	86.4	71.9	62.0	15.6	12.2	10.1	40.8	43.8	40.0	8.5	8.6	7.9	24.8	32.5	32.1	5.1	6.3	6.1	26.5	33.4	33.4	5.9	6.4	6.4
H80B	12296	806.3	102.9	89.6	79.7	20.7	17.4	15.1	49.9	57.1	56.1	11.9	12.9	12.3	33.0	41.7	43.4	7.8	9.1	9.4	34.5	42.8	44.7	9.1	9.7	9.9
H90B	11818	663.2	65.5	54.0	46.2	10.8	8.1	6.4	30.2	34.5	30.1	5.8	6.3	5.2	18.6	25.2	24.3	3.4	4.5	4.3	18.7	25.3	25.0	3.8	4.5	4.4
J34C	31893	668.8	73.4	65.4	59.4	10.0	8.2	7.1	20.6	25.8	22.7	3.9	4.8	4.3	14.4	19.8	19.1	2.4	3.5	3.6	13.4	19.0	18.7	2.6	3.5	3.6
K10E	13257	673.8	60.5	51.8	45.7	10.1	7.9	6.5	19.7	24.8	24.7	3.4	4.4	4.5	9.9	15.7	17.5	1.4	2.4	2.8	9.6	15.5	17.5	1.7	2.4	2.8
K20A	16848	713.9	69.3	60.2	55.1	11.0	8.8	7.5	22.6	25.5	27.3	3.8	4.6	5.2	10.8	16.1	17.6	1.5	2.5	2.9	11.5	16.7	18.1	1.7	2.7	3.0
K30A	19603	749.9	217.4	201.5	188.6	17.6	15.5	14.0	66.3	88.1	94.4	7.6	9.0	9.6	54.0	72.2	78.2	4.1	6.0	6.7	50.4	68.4	75.3	6.3	7.2	7.5
K30B	13864	781.2	101.5	90.1	82.1	17.8	15.2	13.3	37.7	45.0	44.8	7.6	9.1	9.0	24.7	33.2	34.8	4.9	6.9	7.0	24.0	33.3	35.0	5.2	6.8	6.9
K30C	19012	805.1	96.0	83.2	74.3	15.0	12.3	10.5	25.4	34.8	34.7	4.3	6.3	6.4	12.3	21.1	22.5	1.5	3.6	4.0	11.6	20.5	22.5	1.8	3.5	4.0
K30D	17787	723.5	82.0	71.1	63.8	13.9	11.5	10.0	21.7	28.1	28.2	4.4	5.4	5.1	11.2	18.3	18.7	2.1	3.5	3.5	10.6	17.8	18.7	2.3	3.5	3.6

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
K40A	8749	705.6	75.7	65.1	58.7	12.8	10.5	9.2	20.7	26.1	26.0	4.2	5.1	4.9	10.8	17.0	17.7	2.1	3.4	3.4	10.2	16.3	17.5	2.3	3.4	3.5
K40B	11157	831.0	120.1	106.9	97.6	21.1	18.1	16.1	29.2	39.9	41.2	6.1	7.8	7.7	15.1	24.7	27.4	2.6	4.6	5.2	14.2	24.5	27.7	3.1	4.8	5.3
K40C	9961	935.3	167.8	151.6	140.2	27.2	23.7	20.9	34.9	47.3	49.7	7.8	10.5	10.5	16.7	27.7	31.6	3.3	5.8	6.3	16.9	27.6	32.7	4.1	6.2	7.0
K40D	12984	752.8	107.5	94.6	85.1	18.0	15.3	13.3	38.0	47.6	45.8	7.8	9.3	8.5	23.9	33.6	34.4	4.8	6.8	6.5	23.3	33.8	35.2	5.3	7.1	6.9
K40E	26761	858.6	131.5	117.1	106.8	21.3	18.0	15.8	28.7	38.6	40.3	6.3	8.2	8.3	13.9	23.5	26.2	2.4	4.5	5.1	13.4	23.4	26.4	3.3	4.9	5.5
K50A	23544	855.0	118.7	104.8	94.9	20.3	17.6	15.5	32.4	42.4	43.1	7.3	9.0	8.0	15.9	25.2	28.0	3.3	5.4	5.5	16.0	25.6	29.1	4.4	6.2	6.3
K50B	20289	881.9	132.6	114.7	102.2	20.3	17.2	15.4	40.7	51.8	51.2	7.4	8.9	8.5	16.6	28.4	33.1	2.8	4.7	5.4	17.9	30.6	35.3	4.3	6.1	6.4
K60A	16144	673.0	118.0	104.9	96.1	18.5	16.2	14.6	33.3	42.1	42.0	6.3	7.9	7.4	22.6	31.0	32.4	4.1	5.7	5.9	21.2	30.3	32.0	4.7	6.1	6.1
K60B	14316	755.3	60.6	51.3	45.2	9.7	7.9	6.6	19.9	25.5	25.2	4.1	4.8	4.3	10.9	16.7	18.7	2.1	3.0	3.1	10.2	16.8	18.8	2.6	3.2	3.4
K60C	16080	743.5	69.8	59.0	51.2	12.8	10.6	8.7	22.4	29.7	27.6	5.0	6.2	5.3	11.7	19.6	19.5	2.6	4.2	3.7	10.8	19.2	19.9	3.0	4.3	3.9
K60D	29248	811.1	115.3	101.2	91.5	17.9	14.4	12.0	30.4	40.5	41.5	5.6	7.5	7.6	16.2	25.3	27.4	2.3	4.0	4.6	14.8	24.6	27.5	2.5	4.2	4.6
K60E	10016	774.5	101.6	88.7	79.6	15.6	12.4	10.3	26.8	36.2	36.6	5.0	6.4	6.6	13.5	21.9	23.9	1.8	3.3	3.9	12.2	21.4	24.1	2.0	3.6	3.9
K60F	24207	805.9	81.5	70.0	62.2	13.2	11.2	9.6	24.3	31.8	32.4	5.0	6.2	6.0	12.1	19.6	21.9	2.2	3.5	3.8	11.8	19.9	22.7	3.0	4.2	4.3
K60G	16659	864.5	118.5	102.8	90.4	17.1	14.8	12.9	39.5	48.6	48.1	7.3	8.4	7.8	17.4	28.4	31.0	2.8	4.6	4.9	18.8	30.8	33.1	4.4	5.9	5.9
K70A	17033	915.9	142.9	125.5	112.0	25.3	21.2	17.9	41.3	55.4	55.5	8.8	11.6	11.1	18.1	31.5	34.4	3.2	6.2	6.6	19.7	32.9	36.5	4.3	6.8	7.1
K70B	10643	991.0	180.4	161.7	147.0	32.6	28.2	24.7	49.7	66.7	69.3	10.5	14.4	14.5	22.1	36.4	41.6	4.1	7.2	8.3	24.2	38.4	44.6	5.7	7.8	9.1
K80A	14589	1022.3	199.5	179.1	163.8	32.9	28.9	26.1	54.4	73.2	77.6	11.5	14.4	14.9	24.4	38.6	43.8	4.5	7.1	8.1	26.8	41.1	48.0	6.7	9.1	9.8
K80B	20824	1030.9	186.2	167.0	152.7	26.6	23.1	20.8	51.6	67.7	72.6	9.7	11.9	12.2	23.6	36.7	42.3	3.6	6.0	6.8	25.5	38.2	45.3	6.0	8.0	8.3
K80C	18880	996.0	187.6	168.6	154.1	28.4	24.9	22.5	52.2	67.2	71.0	10.1	12.2	12.2	22.9	36.9	42.7	3.2	5.6	6.5	26.7	40.6	46.5	5.9	8.2	8.6
K80D	17297	932.8	158.2	140.4	127.2	23.7	20.5	18.2	45.6	58.5	60.9	8.7	10.5	10.1	20.0	32.3	37.2	2.9	5.1	5.6	23.4	35.3	41.2	5.3	7.0	7.3
K80E	26582	894.0	197.4	179.8	166.4	26.4	23.3	21.4	64.5	79.7	85.1	10.9	12.5	12.9	38.9	53.8	60.6	6.1	8.2	8.8	40.8	56.0	63.2	8.2	9.8	10.4
K80F	22089	766.4	189.0	171.9	158.8	18.5	16.3	14.4	76.1	88.6	90.6	8.7	9.7	9.6	57.2	69.7	73.3	4.5	6.1	6.6	56.4	69.2	72.6	6.8	7.7	7.6
K90A	21354	722.0	123.7	109.7	99.2	16.3	13.9	12.4	38.5	50.0	49.7	7.1	7.9	7.8	23.7	33.9	36.4	4.1	5.6	5.6	23.5	34.5	37.3	5.3	6.3	6.1
K90B	14960	771.2	148.3	133.1	121.8	19.9	17.2	15.6	44.4	58.1	59.4	8.1	9.6	9.3	27.2	38.4	43.0	4.8	6.4	6.8	26.8	39.2	44.4	6.0	7.5	7.5
K90D	21524	694.6	117.6	104.1	94.2	17.0	14.5	12.6	38.1	46.8	45.1	7.1	8.5	7.8	22.8	32.3	35.4	3.2	5.0	5.4	22.6	32.5	36.2	4.3	5.6	6.0
K90E	17639	672.0	106.9	94.0	84.7	15.4	12.9	11.3	35.0	42.8	40.8	6.5	7.6	7.1	20.9	29.9	32.2	2.8	4.3	4.9	20.7	30.0	32.9	3.8	5.1	5.5
K90F	25030	698.4	117.4	103.9	94.0	17.0	14.5	12.6	38.0	46.7	45.0	7.1	8.5	7.8	22.7	32.3	35.3	3.2	5.0	5.4	22.5	32.4	36.1	4.3	5.6	6.1
K90G	28650	655.4	97.1	84.7	75.9	13.8	11.4	9.7	31.8	39.0	36.2	5.8	6.8	5.9	19.8	27.9	28.9	2.6	4.0	4.2	19.3	27.7	29.6	3.5	4.5	4.7
L82B	40469	681.0	103.3	90.9	82.8	15.1	12.9	11.6	31.4	39.3	40.0	5.8	6.7	6.5	22.3	29.2	31.2	3.7	4.9	5.0	19.8	28.1	30.9	4.4	5.3	5.4

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
L82C	36207	666.7	96.9	85.2	77.4	14.2	12.1	10.9	29.2	37.1	37.6	5.5	6.3	6.2	20.6	27.3	29.2	3.5	4.6	4.8	18.1	26.4	28.9	4.1	5.2	5.2
M20A	36146	696.3	115.3	100.9	91.3	15.9	13.8	12.4	42.7	48.1	48.1	7.2	8.0	7.6	27.6	34.7	36.1	4.0	5.0	5.2	28.1	35.8	37.5	5.3	6.0	6.2
M20B	30747	722.2	108.2	94.7	85.1	17.4	14.8	12.9	40.8	48.6	47.6	7.8	9.5	9.5	27.7	34.6	37.0	4.9	6.5	6.9	27.7	34.7	37.5	5.9	6.9	7.2
P20A	42182	716.0	122.9	109.8	100.2	16.4	13.9	12.2	36.2	46.6	45.9	7.1	8.3	8.0	25.8	33.5	36.6	4.4	5.6	6.2	24.5	32.5	36.4	5.2	6.1	6.6
P40D	24566	667.7	110.4	98.4	89.6	18.0	15.5	13.7	40.1	48.4	48.1	8.3	10.1	9.6	31.8	39.4	41.7	6.2	7.8	8.4	30.4	38.1	40.7	6.3	7.8	8.4
Q92A	32404	664.5	110.7	100.0	92.1	18.2	15.0	13.1	53.9	61.5	59.6	8.4	9.7	9.2	45.3	52.1	53.1	6.1	7.4	7.9	44.5	51.1	52.7	6.3	7.3	7.8
Q94A	25891	803.2	94.2	82.7	74.3	14.1	10.9	8.4	56.9	61.8	56.8	8.6	9.5	7.8	45.9	52.0	50.8	6.0	7.1	6.4	46.1	52.3	51.2	6.4	7.2	6.5
Q94B	14742	717.4	75.0	65.3	57.6	13.6	11.1	8.9	36.4	41.3	39.0	6.7	7.1	6.1	29.1	35.3	34.5	4.7	5.6	4.9	28.4	34.7	34.3	4.9	5.6	5.0
Q94C	13519	766.0	72.9	61.5	54.4	10.5	8.0	6.6	36.5	40.1	38.2	5.2	5.3	5.0	27.4	32.5	32.4	3.3	4.0	3.9	27.1	32.1	32.0	3.8	4.2	3.9
R10A	13780	827.2	146.5	132.9	123.3	21.8	18.5	15.9	61.2	70.7	71.9	9.1	11.7	12.0	48.3	58.8	60.5	5.6	8.6	8.9	47.1	57.5	59.8	5.9	8.4	8.9
R10B	22220	850.6	135.3	122.2	112.3	19.7	16.6	14.2	67.7	78.0	78.6	9.4	11.3	11.5	53.4	63.9	67.3	5.8	7.6	8.7	54.2	64.2	67.4	6.7	8.2	8.6
R10C	12548	788.4	160.3	145.1	134.0	24.2	20.5	17.8	64.9	77.6	77.0	10.4	13.2	12.8	54.4	66.1	67.8	7.3	9.8	10.2	52.1	64.0	66.2	7.4	9.7	10.2
R10D	17844	698.4	55.5	46.8	41.6	8.0	5.9	4.7	35.7	35.2	31.5	5.7	5.1	4.0	29.8	31.7	29.9	4.0	4.2	3.6	29.1	30.8	29.6	4.2	4.1	3.6
R10F	7072	1054.6	249.0	231.5	218.3	40.3	36.9	34.2	119.5	139.0	145.5	19.6	23.8	24.9	91.6	111.3	118.3	13.0	17.0	18.7	92.5	111.9	119.5	15.0	18.1	19.7
R20A	13940	1007.8	198.8	183.4	172.0	31.5	28.1	25.5	83.9	99.3	103.9	14.3	16.8	17.6	68.1	83.6	88.3	9.7	12.3	13.0	66.0	80.1	86.0	10.3	12.1	13.1
R20B	15474	680.5	66.1	55.7	50.0	10.4	8.0	6.9	27.4	29.4	27.8	4.8	5.3	5.0	21.8	24.7	24.6	3.4	4.1	4.3	20.1	23.4	23.9	3.3	3.8	4.2
R20C	12103	795.8	164.7	149.1	137.8	24.9	21.1	18.3	66.3	79.2	78.9	10.7	13.5	13.2	55.4	67.4	69.3	7.5	10.0	10.4	53.0	65.3	67.8	7.6	9.9	10.4
R20E	24945	657.8	95.6	83.0	73.9	15.7	12.7	10.6	32.0	38.9	36.8	5.9	7.2	6.9	25.2	33.0	32.3	4.0	5.7	5.7	22.9	31.4	30.5	4.1	5.4	5.3
R20F	26092	676.6	117.9	102.6	92.7	18.8	15.3	13.2	33.8	43.4	41.8	6.1	7.9	7.7	27.0	36.1	36.5	4.4	6.1	6.4	23.7	33.9	35.0	4.1	5.8	6.2
R20G	10323	816.2	173.4	153.5	139.7	26.8	22.4	19.6	31.0	45.6	48.1	6.1	9.1	9.2	18.1	32.8	36.9	2.5	5.6	6.5	14.3	29.5	34.2	2.7	5.3	6.3
R30A	42545	866.5	167.3	149.4	136.6	30.9	26.8	23.9	34.2	47.6	51.5	6.6	9.4	10.1	19.1	32.7	36.6	2.7	5.7	6.5	17.3	30.5	34.5	3.1	5.6	6.4
R30B	52705	791.7	155.4	139.5	127.3	25.4	21.9	19.1	45.5	58.7	61.0	7.8	10.1	10.2	33.5	45.8	49.0	4.4	7.0	7.4	31.2	43.4	47.5	4.8	6.9	7.5
R30C	50706	688.4	90.5	77.8	69.5	14.7	11.7	9.9	33.1	40.4	40.0	5.6	6.7	7.0	25.2	32.4	33.9	3.5	4.9	5.3	23.4	30.5	32.7	3.5	4.7	5.1
R30D	15063	780.0	152.7	135.2	122.9	22.9	19.0	16.4	28.3	41.6	42.3	5.6	8.2	7.9	16.6	30.3	33.7	2.3	5.2	5.9	13.6	27.4	31.6	2.4	5.1	5.9
R30E	47157	672.3	115.0	99.8	90.1	18.3	14.9	12.8	33.4	42.5	40.7	6.0	7.8	7.5	26.6	35.5	35.7	4.3	6.1	6.2	23.5	33.3	34.2	4.1	5.8	6.0
R30F	20864	793.3	160.8	142.7	129.9	24.2	20.2	17.5	29.5	43.5	44.5	5.8	8.6	8.3	17.2	31.3	35.2	2.3	5.4	6.2	14.1	28.3	33.0	2.2	5.2	6.1
R40A	33252	765.4	147.3	129.0	117.1	22.2	18.3	15.7	27.0	39.0	40.4	5.1	7.6	7.4	16.2	28.8	32.5	2.1	5.0	5.6	12.7	25.8	30.3	2.2	4.7	5.4
R40C	19464	665.0	112.3	100.3	92.8	14.6	11.8	10.0	17.7	26.3	27.5	3.2	5.0	4.8	12.5	20.5	23.4	1.6	3.4	3.8	9.2	17.5	21.5	1.2	3.0	3.6
S20D	30961	681.3	61.0	52.5	46.9	6.5	5.0	4.0	30.0	33.8	32.0	3.1	3.3	2.7	21.9	27.6	28.7	1.7	2.3	2.4	22.7	28.2	29.3	2.3	2.6	2.4

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
S32D	30724	709.2	86.2	76.2	68.7	14.9	12.8	11.1	49.4	52.7	50.1	8.9	9.1	8.4	41.5	46.6	46.4	6.7	7.7	7.6	40.7	45.8	46.2	7.2	7.9	7.8
S50A	22397	730.9	111.2	99.7	91.2	13.3	11.1	9.2	58.3	64.1	63.5	6.6	7.4	7.0	45.7	54.3	55.6	3.9	5.3	5.2	46.9	54.4	55.7	4.8	5.7	5.6
S50B	33356	817.2	115.2	102.1	92.2	17.0	14.4	12.5	59.9	69.9	70.5	8.6	10.0	10.1	47.4	57.3	60.0	5.6	6.9	7.5	47.0	56.7	60.2	6.6	7.5	8.0
S50C	38337	667.9	73.2	63.9	58.2	9.4	7.6	6.4	41.9	45.2	45.0	4.3	4.8	4.7	32.8	37.9	39.0	2.5	3.3	3.5	33.1	37.6	38.9	2.9	3.3	3.6
S50D	39547	707.3	91.9	81.0	73.3	11.9	9.7	8.3	49.8	54.4	54.1	5.4	5.7	5.8	37.8	45.1	46.4	3.0	3.9	4.3	38.6	45.2	46.1	3.6	4.1	4.3
S50E	44792	783.4	112.5	100.1	90.1	16.5	13.9	11.9	59.9	68.4	67.4	8.7	9.5	9.2	47.3	58.3	60.2	5.4	7.2	7.7	47.7	58.5	60.1	6.7	7.9	8.0
S50F	8683	698.6	83.0	72.4	65.8	9.1	7.3	6.2	45.1	48.9	47.9	4.9	5.1	4.6	35.7	41.0	42.7	3.2	3.7	3.9	36.4	41.5	43.5	4.1	4.1	4.1
S50G	50116	675.3	53.8	45.1	38.7	7.4	6.0	4.9	31.7	33.7	30.9	4.3	4.3	3.9	25.7	29.1	27.5	3.1	3.7	3.2	25.8	28.9	27.7	3.7	3.8	3.4
S50J	68511	667.7	62.8	53.2	46.2	10.2	8.1	6.6	36.1	37.4	35.0	5.8	5.6	5.0	29.6	32.8	30.9	4.3	4.5	3.9	30.0	32.6	31.0	4.8	4.8	4.1
S60A	32753	809.8	104.1	91.0	80.2	15.7	13.3	11.0	55.0	62.1	59.1	8.0	9.5	8.9	43.4	51.8	51.5	5.5	7.4	7.0	43.4	52.2	51.6	6.3	7.9	7.3
S60C	21584	681.0	84.5	72.4	64.4	13.2	10.6	8.9	43.1	48.0	47.4	6.8	7.4	7.4	34.7	40.2	41.7	4.7	5.7	5.9	34.3	39.7	41.3	5.3	5.9	5.9
S70A	33911	686.0	144.4	130.7	121.6	23.7	20.4	18.1	42.5	55.1	58.7	6.0	8.4	9.2	33.0	44.7	49.5	3.2	5.5	6.5	30.5	42.3	48.0	3.5	5.3	6.2
S70B	26729	742.1	128.4	114.3	103.7	20.2	16.9	14.5	36.8	49.4	50.2	5.6	7.7	7.5	27.6	38.7	40.8	3.0	5.2	5.4	25.3	36.7	39.7	3.2	5.1	5.3
S70C	19755	666.5	76.3	65.0	56.7	13.5	11.1	9.3	41.4	45.4	42.7	7.4	8.1	7.8	34.3	39.8	38.5	5.6	6.9	6.7	33.4	39.1	38.0	5.7	6.9	6.7
S70D	51361	684.0	85.9	75.5	67.4	11.3	9.2	7.6	43.7	49.2	46.1	6.4	7.2	6.5	34.4	41.9	41.0	4.3	5.4	5.3	34.6	41.9	41.2	5.0	5.9	5.6
S70E	48065	744.2	123.2	109.7	100.0	22.5	19.7	17.6	54.4	63.1	62.3	9.7	11.5	11.0	43.5	53.2	54.4	6.9	9.3	9.3	42.0	51.9	53.8	7.1	9.1	9.3
S70F	35865	804.7	156.7	141.6	129.5	24.8	21.4	18.6	44.3	58.6	61.4	6.8	9.3	9.3	31.9	45.4	49.0	3.3	6.0	6.6	29.7	42.9	47.4	3.6	6.0	6.6
T11A	32970	738.8	111.0	99.6	91.1	13.0	10.7	8.9	57.9	63.6	63.0	6.3	7.0	6.7	45.7	54.2	55.3	3.8	4.9	4.9	46.7	54.2	55.4	4.6	5.5	5.2
T11B	41469	751.1	101.1	88.1	78.5	12.9	10.7	9.1	52.5	59.4	57.7	6.9	7.3	6.9	39.8	48.1	49.1	4.6	5.4	5.3	40.4	48.3	49.1	5.6	5.9	5.6
T11C	38548	851.5	192.0	178.9	169.1	20.6	17.9	15.7	65.2	76.9	79.8	8.0	9.6	9.6	51.2	62.4	67.2	3.9	6.0	6.6	50.5	61.9	67.5	5.3	7.0	7.4
T11D	34256	849.0	125.8	113.1	103.3	16.1	14.1	12.7	60.7	68.3	72.5	8.5	8.8	9.2	48.8	58.1	61.5	5.8	6.7	7.0	47.9	56.9	60.0	7.3	7.8	7.6
T11E	23285	939.6	158.1	143.1	132.0	18.4	16.3	14.6	81.2	93.1	94.4	9.1	10.2	10.2	61.6	73.4	77.0	5.1	6.5	6.8	63.8	74.5	78.4	7.2	8.0	8.1
T11F	27517	897.2	131.6	117.6	106.8	14.9	12.8	11.1	71.6	79.6	79.0	7.3	8.2	8.0	54.0	63.8	64.9	3.8	5.1	5.2	56.1	64.6	66.3	5.6	6.3	6.2
T11G	29079	747.4	122.0	109.9	100.7	17.1	14.7	12.8	58.2	68.3	69.3	8.6	10.0	9.5	46.2	56.8	59.7	5.6	7.5	7.7	45.5	55.9	59.1	6.6	8.0	8.0
T11H	21618	719.7	109.0	97.7	89.1	15.3	12.9	11.1	53.5	62.3	62.6	7.8	8.9	8.3	42.8	52.7	54.7	5.4	7.0	6.9	42.2	51.6	54.1	6.1	7.2	7.2
T12A	27884	845.1	117.1	104.1	94.1	14.2	12.0	10.2	58.3	65.1	66.5	7.5	7.9	7.7	48.2	54.6	56.4	4.8	5.5	5.5	48.3	54.5	56.1	6.3	6.4	6.2
T12B	22979	738.3	133.6	123.2	115.6	13.7	11.4	9.7	48.2	54.6	54.4	6.2	6.4	6.1	38.4	46.6	48.2	3.4	4.6	4.7	38.0	46.5	48.7	4.3	5.1	5.1
T12C	28365	740.0	65.4	56.3	49.5	7.5	6.0	4.9	40.9	43.7	41.4	4.3	4.6	4.5	32.5	37.8	38.1	2.6	3.5	3.8	33.6	38.3	38.7	3.4	3.8	3.9
T12D	32034	720.9	70.0	59.9	53.7	9.9	8.0	6.8	40.0	42.0	41.5	5.8	5.6	5.5	33.1	37.0	36.7	4.2	4.7	4.5	33.4	36.7	36.8	4.9	5.0	4.8

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T12E	41206	720.8	72.3	61.9	55.4	10.3	8.3	7.0	41.1	43.1	42.4	6.1	5.8	5.6	33.9	37.8	37.5	4.2	4.8	4.6	34.1	37.5	37.5	5.3	5.1	4.7
T12F	34614	745.3	72.6	62.3	55.3	9.5	7.7	6.6	41.3	45.2	44.3	5.5	5.7	5.5	34.0	38.6	39.9	4.0	4.3	4.6	33.7	38.0	40.0	4.6	4.6	4.8
T12G	27626	678.4	78.7	68.6	61.0	10.1	8.0	6.5	40.8	44.6	41.7	5.8	6.2	5.6	32.8	39.0	37.2	4.0	5.0	4.7	32.9	39.0	37.5	4.6	5.3	4.9
T13A	28747	748.4	125.4	113.0	103.7	17.6	15.1	13.3	59.3	69.8	71.2	8.8	10.1	9.9	46.6	57.4	60.8	5.7	7.5	7.9	46.0	56.6	60.1	6.9	8.1	8.3
T13B	28529	701.7	106.1	95.0	86.4	14.9	12.5	10.8	52.4	61.1	61.5	7.8	8.7	8.2	41.4	51.3	53.3	5.2	6.6	6.7	40.9	50.3	52.8	6.1	7.1	7.0
T13C	31827	722.1	97.9	86.8	78.3	12.8	10.7	9.1	48.1	55.4	52.8	7.0	8.2	7.7	37.7	46.3	46.8	4.5	5.9	6.2	37.7	46.3	46.9	5.3	6.4	6.5
T13D	35733	889.4	222.4	207.7	196.5	25.3	22.1	19.8	51.0	63.0	66.3	7.2	8.6	9.2	35.7	48.4	51.9	3.4	5.3	5.8	34.9	47.5	50.6	4.5	6.0	6.2
T13E	16748	940.9	208.7	188.7	173.4	34.0	29.5	26.0	66.8	84.1	86.9	12.9	16.2	15.8	47.3	64.9	68.4	7.9	11.6	12.1	45.1	62.5	67.0	8.4	11.9	12.4
T20A	48080	936.8	169.3	154.4	143.1	21.0	18.9	17.4	80.9	90.4	92.9	9.8	10.4	10.4	62.1	74.1	77.7	5.4	7.0	7.3	64.4	75.3	78.0	7.9	8.8	8.7
T20B	40518	844.9	110.8	97.8	89.3	13.3	11.0	9.5	59.6	65.5	65.1	7.3	7.5	7.2	45.7	53.3	55.9	4.8	5.3	5.6	46.4	53.6	56.1	5.9	6.1	6.0
T20C	31973	687.6	93.6	83.8	76.1	11.5	9.4	7.7	47.7	55.0	53.8	6.3	7.3	6.4	37.6	45.9	47.2	4.0	5.0	4.9	37.3	45.6	47.3	4.8	5.4	5.3
T20D	38755	763.6	116.1	103.8	94.6	15.2	12.9	11.2	54.4	63.0	63.5	7.5	8.2	7.8	42.3	52.4	54.1	4.4	5.8	5.9	41.2	51.3	53.5	5.5	6.6	6.4
T20E	34942	828.8	133.9	120.7	110.5	19.7	17.0	14.9	46.6	56.9	58.2	7.2	9.0	8.7	32.2	42.9	46.8	4.2	5.7	6.5	33.0	43.0	46.6	5.5	6.5	7.1
T20F	44301	763.9	115.3	100.7	90.1	17.3	14.3	12.1	41.2	48.2	46.5	7.0	8.2	7.8	27.8	37.0	37.8	3.8	5.4	5.5	27.4	36.5	37.4	4.6	5.7	5.7
T20G	21291	955.1	216.1	196.5	182.1	28.0	24.1	21.2	61.7	79.1	83.4	8.1	10.0	10.0	42.9	58.0	62.2	2.9	5.3	5.6	40.4	56.1	61.1	4.7	6.4	6.4
T31A	22130	906.7	177.3	164.9	155.0	21.2	19.6	18.4	96.3	109.1	113.6	12.2	13.3	14.0	72.0	85.2	91.8	8.4	9.9	10.8	63.7	78.3	86.8	9.6	10.9	11.3
T31B	28395	829.1	138.7	124.6	113.1	16.9	14.6	12.7	81.0	84.9	80.7	9.8	9.9	9.3	58.9	67.1	68.1	5.8	6.9	6.7	57.6	66.2	67.1	7.0	7.6	7.3
T31C	29058	828.2	133.6	119.5	108.1	16.2	13.9	12.0	70.8	76.3	73.2	8.6	8.8	8.3	51.3	60.2	61.7	4.6	5.9	5.8	54.7	62.5	63.0	6.4	7.0	6.7
T31D	35251	735.9	94.0	83.2	75.6	8.9	7.2	6.1	61.3	62.8	60.8	5.6	5.5	5.0	46.8	51.5	52.5	3.3	3.4	3.8	44.9	50.1	51.7	4.2	4.0	4.1
T31E	50866	755.6	99.1	88.0	79.8	9.6	8.1	6.6	56.1	60.9	59.9	5.4	5.8	5.0	43.0	49.1	50.7	3.1	3.6	3.3	44.4	49.9	52.2	4.3	4.5	4.2
T31F	60466	715.3	94.6	83.0	74.8	11.4	9.4	7.6	61.0	61.6	57.9	7.3	7.3	6.2	46.7	52.2	51.9	4.6	5.4	4.9	45.3	51.3	51.4	5.2	5.7	5.2
T31G	20838	800.1	148.0	134.2	125.0	16.3	14.3	12.9	78.1	84.2	84.8	9.2	9.7	9.5	58.9	67.1	70.2	5.7	6.6	6.8	57.2	65.4	69.4	7.0	7.7	7.7
T31H	61624	808.4	145.5	131.0	120.3	16.2	14.3	12.7	72.4	80.6	79.9	8.1	9.3	8.9	53.7	64.5	68.0	4.5	6.2	6.6	55.8	65.9	68.8	6.2	7.4	7.6
T31J	50645	806.7	152.3	138.6	129.2	16.7	14.6	13.2	70.9	79.3	81.6	8.5	9.0	9.0	53.7	63.2	67.4	5.1	6.0	6.4	55.4	64.1	68.6	6.9	7.5	7.6
T32A	34707	802.8	122.3	109.7	100.1	13.9	12.2	10.8	71.8	75.6	74.6	7.7	8.6	8.7	53.7	61.0	62.8	4.5	6.1	6.6	51.3	59.2	61.4	5.3	6.6	6.8
T32B	30648	817.2	173.4	160.0	149.3	21.0	19.4	17.8	95.2	105.8	108.8	12.2	13.6	14.2	70.8	82.0	87.0	7.3	9.6	10.2	63.6	76.1	81.6	8.4	10.2	10.5
T32C	37292	777.9	130.1	118.1	109.5	15.1	13.2	11.8	69.1	73.6	75.1	8.8	8.9	8.8	51.3	59.5	62.1	5.5	6.4	6.5	48.8	56.9	60.1	6.6	7.1	7.1
T32D	35018	786.7	123.5	111.5	103.1	14.3	12.3	11.0	66.8	70.7	71.9	8.3	8.5	8.4	50.2	57.3	59.5	5.1	5.9	6.2	48.2	55.2	58.1	6.2	6.7	6.7
T32E	38205	844.2	151.9	138.5	128.9	17.0	14.8	13.2	68.5	76.2	79.0	8.4	8.9	8.8	51.5	61.4	65.4	4.8	5.8	6.0	53.6	62.3	66.2	6.9	7.2	7.2

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T32F	29670	930.0	218.3	202.4	190.7	23.9	21.4	19.7	85.8	97.4	101.3	10.6	11.6	11.6	63.4	76.3	82.9	5.9	7.2	8.0	66.0	77.8	83.9	8.5	9.2	9.7
T32G	43775	861.1	136.1	123.5	114.3	17.7	15.7	14.4	68.7	76.1	78.5	8.9	10.2	10.5	52.2	61.5	65.4	5.3	7.2	8.1	54.0	62.9	66.8	6.9	8.4	9.0
T32H	45216	879.3	167.9	153.8	144.0	29.4	26.6	24.6	71.6	81.9	86.2	13.7	16.3	17.1	55.3	66.5	71.7	9.4	12.4	13.7	55.8	66.3	71.9	10.4	13.1	14.3
T33A	67192	757.3	95.7	84.7	76.5	10.6	8.9	7.7	54.1	58.6	58.3	6.0	6.1	6.0	42.3	49.3	50.8	3.8	4.3	4.6	43.7	49.3	51.0	4.9	5.0	5.0
T33B	60189	801.1	142.7	128.7	118.7	16.1	14.0	12.0	59.2	66.8	68.6	6.9	7.5	7.3	46.6	56.5	59.3	3.5	5.1	5.3	45.9	55.0	57.8	5.3	6.0	5.7
T33C	36692	768.9	128.9	116.2	106.5	14.3	12.0	10.1	55.4	62.1	62.9	6.1	6.4	6.0	44.5	53.4	55.3	3.1	4.2	4.3	44.0	51.8	54.0	4.7	5.0	4.7
T33D	46100	737.8	110.0	98.5	90.5	12.3	10.1	8.6	47.1	52.8	53.6	5.2	5.3	5.1	38.4	45.6	48.0	2.8	3.4	3.8	37.9	44.1	46.9	4.2	4.0	4.2
T33E	26712	749.0	111.0	99.3	90.6	12.9	11.1	9.5	56.7	64.4	63.7	6.5	7.4	6.9	46.0	54.9	57.2	3.6	5.3	5.7	46.4	55.0	57.6	4.9	6.1	6.1
T33F	43704	827.9	121.6	109.0	99.9	14.2	12.1	10.7	62.8	69.0	68.8	7.6	8.5	8.2	48.5	56.3	58.5	4.7	5.7	6.2	50.0	57.0	59.4	6.2	6.7	7.1
T33G	50253	836.6	142.2	127.7	117.2	15.6	13.5	11.8	69.8	77.6	76.4	7.7	8.6	8.1	52.5	63.0	65.9	4.2	5.6	6.0	54.2	63.9	66.3	5.7	6.7	6.8
T33H	51602	781.0	110.1	99.5	91.3	16.8	14.9	13.3	52.8	63.0	62.7	8.1	10.3	10.3	41.2	51.4	54.7	5.6	7.9	8.7	40.8	51.5	55.8	6.4	8.3	9.1
T33J	45645	725.6	76.0	65.5	57.8	12.1	10.0	8.4	33.8	39.2	36.9	5.5	6.9	6.3	24.0	31.5	31.7	3.4	5.2	5.2	23.9	32.0	32.4	4.0	5.5	5.5
T33K	16907	858.5	137.6	124.2	113.6	25.9	22.9	20.8	53.1	62.3	64.1	12.4	14.2	14.6	39.1	48.8	52.1	8.6	10.8	11.8	39.2	48.4	51.9	9.5	11.5	12.4
T34A	24149	905.9	177.7	163.1	151.4	20.1	18.1	16.6	81.5	93.1	96.5	9.9	10.7	11.0	62.6	76.5	81.4	5.7	7.3	7.9	63.1	76.2	80.7	8.0	9.1	9.3
T34B	24608	860.5	140.2	126.3	115.5	15.9	13.9	12.2	67.7	77.1	78.2	7.8	8.5	8.3	53.0	63.6	66.0	4.7	6.0	6.0	53.2	62.8	66.0	6.4	7.0	6.9
T34C	28194	805.7	148.4	134.3	123.7	17.1	15.1	13.3	70.6	80.9	82.0	8.1	9.5	9.1	56.4	67.7	71.2	4.4	6.4	6.8	57.4	67.1	71.2	6.2	7.5	7.9
T34D	34142	849.8	171.8	157.1	145.3	19.5	17.4	15.5	78.0	90.5	92.7	8.9	10.5	10.3	61.2	75.2	78.8	4.5	6.9	7.4	62.5	74.5	78.5	6.7	8.4	8.4
T34E	26817	901.2	174.3	159.5	147.9	19.8	17.7	16.1	80.2	91.4	94.6	9.7	10.6	10.6	61.5	75.0	79.6	5.7	7.2	7.6	62.1	74.8	79.0	7.8	8.8	8.8
T34F	23769	874.8	145.6	131.5	120.4	16.4	14.4	12.7	69.3	78.9	80.2	7.9	8.7	8.5	53.7	64.9	67.6	4.6	6.1	6.1	54.1	64.3	67.4	6.5	7.3	7.1
T34G	35802	895.5	169.8	156.4	146.0	18.6	16.5	14.9	74.7	86.2	88.4	9.4	10.5	10.3	57.4	70.6	75.7	5.0	7.1	7.8	58.4	70.8	75.2	7.4	8.6	8.8
T34H	59013	863.7	144.5	132.0	122.0	15.4	13.2	11.5	66.2	74.5	74.4	8.3	8.6	8.0	50.9	62.6	65.7	4.5	6.2	6.2	51.9	62.6	65.5	6.5	7.3	6.9
T34J	29628	766.7	140.2	129.1	120.6	16.2	14.1	12.5	55.1	63.3	62.3	7.7	8.9	8.1	42.9	52.0	54.1	4.9	6.3	6.3	42.7	51.9	53.8	5.9	7.0	6.9
T34K	33294	713.9	86.6	76.8	69.1	9.8	7.7	6.1	36.3	43.8	41.9	3.8	4.7	4.0	25.5	34.2	36.1	1.1	2.6	2.8	26.0	34.6	36.2	1.9	3.1	3.1
T35A	47510	911.9	171.9	157.0	145.4	19.4	17.3	15.6	78.9	90.0	93.1	9.3	10.3	10.3	60.5	73.8	78.2	5.4	6.9	7.3	61.1	73.4	77.6	7.5	8.4	8.4
T35B	39567	916.9	175.9	160.9	149.1	19.8	17.8	16.1	80.3	91.8	94.9	9.5	10.5	10.5	61.5	75.1	79.7	5.4	7.1	7.5	62.0	74.8	79.0	7.7	8.7	8.7
T35C	30613	905.5	186.9	172.6	160.5	19.2	17.1	15.2	88.0	101.5	106.3	9.3	10.4	10.4	64.7	80.6	86.7	4.3	6.1	6.6	67.2	82.9	88.6	6.9	8.1	8.2
T35D	34776	811.7	123.6	110.4	100.2	12.5	10.4	8.8	65.7	74.1	73.2	6.5	7.0	6.6	49.4	59.2	61.6	3.0	4.2	4.5	51.8	61.1	63.4	4.7	5.4	5.3
T35E	49179	920.5	146.6	131.9	120.8	15.3	13.1	11.4	74.7	85.9	88.6	8.4	9.2	9.1	56.2	67.6	72.4	4.1	5.7	6.1	58.6	69.4	74.1	6.6	7.2	7.1
T35F	35866	847.3	145.0	131.5	121.3	16.6	14.6	13.0	70.5	79.3	82.0	8.2	8.5	8.4	56.0	66.7	70.7	4.8	6.1	6.4	56.2	66.2	70.4	6.7	7.2	7.1

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T35G	57449	759.3	99.9	88.1	79.5	11.5	9.6	8.4	53.7	59.1	59.9	6.0	6.1	5.9	43.1	49.6	51.4	3.7	4.4	4.6	43.7	49.5	51.8	5.0	5.0	5.1
T35H	51929	847.5	118.4	104.8	95.3	14.2	12.1	10.5	63.2	69.9	69.9	7.6	8.3	8.1	48.5	56.7	59.1	5.0	5.9	6.0	49.4	57.1	59.3	6.2	6.8	6.7
T35J	18836	923.0	136.6	121.9	111.4	16.1	13.9	12.3	76.3	82.2	84.2	9.7	9.9	9.7	58.3	66.3	68.5	5.9	6.7	6.8	61.5	67.4	69.7	7.9	8.1	7.8
T35K	62478	784.3	100.8	90.7	83.2	13.5	11.5	9.7	48.0	54.0	54.4	6.5	7.2	6.6	37.2	45.1	47.4	3.5	5.0	5.1	37.5	44.4	46.8	4.5	5.5	5.3
T35L	34011	765.9	96.1	86.4	79.0	12.9	10.9	9.2	45.9	51.7	51.8	6.3	6.8	6.4	35.6	43.3	45.3	3.3	4.8	4.8	35.8	42.6	44.7	4.4	5.4	5.1
T35M	30452	863.4	193.7	177.5	165.4	29.0	25.4	22.7	57.0	70.7	73.6	10.0	12.5	13.0	39.2	51.4	56.6	6.1	8.6	9.6	39.2	50.9	56.9	6.5	8.7	9.8
T36A	46195	929.3	230.3	214.3	202.0	36.9	33.6	30.8	56.8	74.2	80.4	9.7	12.9	13.6	39.9	55.2	60.7	5.9	8.9	9.9	38.2	53.2	59.4	6.6	9.3	10.1
T36B	26438	1030.7	212.7	190.3	173.8	34.1	30.0	27.0	51.2	70.6	78.3	9.4	12.9	14.1	25.6	40.6	46.4	3.6	6.2	7.4	25.0	39.4	46.6	4.9	7.2	8.5
T40A	20813	986.9	219.8	205.5	194.2	27.8	25.9	24.3	98.6	112.6	118.8	13.4	15.1	15.9	77.9	92.8	99.9	8.0	10.3	11.8	78.5	93.0	100.1	11.0	12.3	13.5
T40B	27773	984.3	202.5	189.0	176.6	23.4	21.5	19.8	78.1	94.7	98.8	10.2	11.6	11.5	51.4	65.6	71.6	4.6	6.4	6.9	42.2	57.1	64.6	6.9	8.0	7.9
T40C	23702	829.5	126.5	113.5	103.7	15.5	13.2	11.5	59.9	68.8	68.6	7.7	9.1	8.9	44.1	54.4	56.8	4.4	6.2	6.7	44.8	55.0	57.3	5.6	7.0	7.3
T40D	37151	814.5	113.5	100.6	89.0	14.4	12.3	10.3	48.6	57.3	55.1	6.9	8.4	7.9	33.1	43.1	43.6	3.5	5.4	5.6	34.0	43.7	44.0	4.8	6.2	6.1
T40E	48490	823.5	133.5	118.1	107.7	16.6	13.6	11.5	40.5	48.9	49.4	6.8	8.2	7.8	25.5	34.4	36.5	3.2	5.1	5.3	25.3	34.1	36.0	4.1	5.8	5.8
T40F	33379	1070.7	282.6	257.1	237.5	38.9	34.7	31.2	66.2	84.7	88.3	11.3	14.2	14.4	35.3	51.3	54.2	5.3	7.7	8.0	29.6	47.5	52.6	6.7	9.0	9.4
T40G	29963	1056.6	252.3	229.7	213.1	37.5	33.3	30.0	58.1	77.5	84.3	10.0	14.2	15.7	32.4	47.3	53.2	3.8	6.8	7.9	25.2	41.7	49.9	4.9	7.5	8.6
T51A	32733	1050.9	317.3	303.4	291.3	30.0	28.6	27.5	135.3	154.7	165.7	14.7	16.6	17.4	111.0	128.8	138.5	8.6	10.7	11.7	89.4	108.5	119.4	11.5	13.5	14.1
T51B	20999	982.9	241.9	227.9	216.7	26.3	24.6	23.0	112.0	125.8	133.9	13.8	15.3	15.8	82.6	95.6	104.0	8.1	9.8	10.4	76.3	91.0	100.6	10.7	11.9	12.3
T51C	46141	951.9	208.4	193.4	182.0	23.1	21.1	19.5	109.8	119.7	122.0	12.9	14.0	13.8	81.4	93.3	98.0	7.5	9.1	9.5	78.1	90.3	95.7	9.8	10.8	11.0
T51D	14133	1028.3	258.3	246.2	236.4	24.4	23.0	22.1	118.9	131.1	139.5	13.8	14.5	15.1	94.3	106.8	114.2	8.9	10.0	10.7	80.1	92.5	101.4	11.1	11.9	12.5
T51E	25544	956.7	200.1	186.5	175.7	21.6	19.9	18.7	104.9	118.0	122.3	12.3	13.8	14.4	77.4	91.1	98.4	7.9	9.2	10.3	69.9	84.5	93.7	9.4	10.6	11.3
T51F	30619	952.1	212.8	198.5	187.5	25.3	23.4	22.1	111.4	124.2	131.5	14.3	15.3	16.3	84.4	97.0	104.7	9.0	10.6	11.7	76.1	89.7	98.5	11.1	12.3	12.9
T51G	25529	926.1	186.3	172.3	160.5	22.6	20.8	19.2	105.1	116.0	118.5	13.3	14.5	14.6	80.1	92.2	96.7	9.6	11.0	11.3	72.6	86.1	92.8	10.7	11.9	12.1
T51H	51922	947.2	195.9	183.1	173.1	20.3	18.5	17.3	103.8	115.1	119.3	11.4	11.7	11.8	78.6	91.1	98.1	6.6	7.6	8.1	72.4	85.7	93.8	9.0	9.4	9.4
T51J	26464	909.4	176.3	162.3	152.0	19.8	17.7	16.2	96.7	103.5	105.3	11.5	11.9	11.9	71.5	81.5	85.2	6.8	7.9	8.3	68.8	79.3	83.7	8.6	9.4	9.4
T52A	38179	910.4	194.1	179.7	168.9	22.6	20.3	18.5	92.7	104.7	108.1	10.7	12.9	13.6	71.1	83.0	89.1	5.4	8.0	9.4	65.0	77.3	84.2	6.6	8.5	9.6
T52B	25539	879.2	153.7	141.2	131.1	17.1	15.4	14.0	83.3	92.0	91.9	8.9	9.7	9.8	62.2	73.0	77.0	4.9	6.2	7.1	58.2	69.7	74.0	6.4	7.2	7.6
T52C	26046	835.9	142.8	129.3	120.1	16.5	14.0	12.3	68.7	74.0	74.0	8.1	8.9	8.9	49.7	58.5	61.6	3.9	5.5	6.2	47.8	57.8	61.3	5.0	6.2	6.7
T52D	52995	791.5	109.5	96.0	84.2	14.5	12.1	9.7	59.1	61.2	54.7	8.0	8.9	7.9	43.9	50.3	46.3	5.1	6.4	6.0	42.0	49.3	45.7	5.8	6.5	6.0
T52E	23257	903.7	169.5	156.8	146.7	18.7	17.1	15.7	90.8	101.2	102.3	9.7	10.8	11.0	67.7	79.7	84.9	5.2	6.8	7.9	63.0	75.4	81.1	7.0	7.9	8.3

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T52F	41683	907.8	172.1	158.8	148.5	25.6	23.3	21.5	94.4	103.4	104.5	13.9	15.3	15.5	71.6	82.5	86.5	9.7	11.8	12.6	66.3	78.3	83.8	10.7	11.9	12.9
T52G	22070	900.1	137.3	124.9	114.4	21.1	19.0	17.3	63.9	71.6	70.7	9.8	11.6	11.8	41.0	51.3	54.0	5.2	7.6	8.4	38.5	49.8	53.4	5.7	7.9	8.7
T52H	34359	781.5	94.5	84.2	77.2	11.5	9.8	8.6	50.3	54.3	52.8	6.0	6.9	6.9	38.5	44.0	45.4	3.5	4.9	5.2	35.7	42.5	44.3	4.2	5.1	5.3
T52J	36680	823.9	98.8	88.2	79.5	12.6	11.0	9.7	44.9	51.1	49.6	5.9	7.1	7.2	31.3	39.1	39.6	3.2	4.7	5.1	27.6	37.0	38.4	4.0	5.0	5.3
T52K	42510	805.0	98.8	88.2	79.4	12.7	11.0	9.7	44.7	51.1	49.8	6.0	7.2	7.1	30.8	38.8	39.3	3.2	4.7	5.0	26.7	36.3	37.9	4.0	5.0	5.3
T52L	17837	889.7	213.9	198.1	184.2	27.1	24.1	21.4	68.1	83.3	84.2	10.6	13.7	13.7	50.5	64.3	67.2	6.5	9.5	10.4	45.4	60.3	64.6	6.9	9.6	10.5
T52M	31255	899.9	182.7	165.4	153.1	22.3	18.9	16.4	37.8	51.7	53.3	5.9	8.8	8.9	21.4	33.3	37.5	2.1	4.7	5.8	16.4	29.6	34.9	2.4	4.8	5.8
T60A	54553	872.5	140.2	126.5	114.4	17.7	15.4	13.5	57.1	69.2	69.7	8.0	9.9	10.0	38.5	51.6	54.1	4.3	6.3	6.9	39.3	52.4	54.9	5.8	7.5	7.8
T60B	52697	895.2	166.4	151.5	139.5	30.6	27.8	25.3	61.1	72.1	75.7	13.3	16.2	16.8	42.7	54.8	58.6	8.2	11.8	12.8	43.5	54.8	59.2	9.3	12.8	13.6
T60C	36258	954.8	257.1	241.1	227.6	41.3	38.2	35.4	69.2	88.7	95.3	12.1	15.9	16.7	51.3	67.9	73.1	8.0	11.3	12.5	49.5	66.0	71.8	8.9	11.9	12.8
T60D	41392	1070.2	266.8	243.1	226.4	43.8	39.5	36.0	57.2	77.5	85.4	11.3	15.8	17.5	27.4	42.7	48.4	4.6	7.9	9.2	26.8	42.4	49.9	6.2	8.8	10.2
T60E	19788	883.7	159.1	144.5	132.7	29.4	26.5	24.1	59.3	69.6	72.5	13.0	15.6	16.1	42.0	53.4	57.0	8.3	11.6	12.5	42.7	53.3	57.3	9.5	12.3	13.3
T60F	46323	937.7	252.4	236.6	223.2	40.6	37.5	34.8	68.0	87.4	93.9	12.0	15.6	16.7	50.3	66.8	71.9	7.9	11.2	12.4	48.6	65.0	70.6	8.8	11.6	12.7
T60G	35939	1112.5	311.6	288.6	272.0	49.2	44.6	41.5	83.7	106.7	115.7	13.9	18.3	20.6	51.6	69.5	76.8	7.1	9.9	11.8	51.1	69.3	78.4	8.9	11.0	13.0
T60H	32158	1277.6	409.9	384.2	364.8	70.2	65.8	62.4	69.1	94.3	103.1	11.3	17.7	20.8	31.4	51.3	59.2	3.1	7.3	10.1	31.2	51.1	60.2	5.6	8.7	11.5
T60J	29342	1108.6	360.9	343.7	327.2	57.4	54.1	51.0	90.3	116.4	126.5	16.1	20.9	22.8	65.6	87.5	94.3	10.3	14.2	15.5	63.9	84.7	92.7	11.7	15.1	16.5
T60K	24195	1073.0	303.7	280.0	262.8	46.1	40.9	37.2	55.7	76.7	84.8	10.1	13.9	15.4	28.7	44.5	51.2	3.6	7.0	8.3	27.4	43.5	51.7	4.5	7.6	9.0
T70A	31404	861.5	207.9	193.0	179.5	33.2	29.9	26.7	66.5	82.2	84.7	13.3	16.4	16.4	47.7	61.8	66.2	9.2	12.2	12.8	47.8	61.5	66.6	9.8	12.4	13.0
T70B	27637	970.7	210.7	188.5	172.9	30.3	26.1	23.3	39.7	57.9	59.6	6.5	9.6	10.1	21.6	36.9	41.1	1.9	4.7	5.7	18.7	34.2	39.9	3.3	5.4	6.3
T70C	19761	932.2	252.9	237.4	225.4	30.4	27.3	24.8	51.3	63.6	66.4	7.5	9.8	10.0	35.8	50.0	53.0	3.5	6.1	6.5	34.7	48.7	51.4	5.0	7.2	7.5
T70D	33230	1004.4	228.7	205.2	188.7	32.8	28.3	25.3	42.2	61.6	64.6	7.0	10.1	10.9	22.9	38.7	43.4	2.0	4.8	5.7	19.8	35.9	42.4	3.4	5.6	6.5
T70E	22814	828.1	186.2	171.4	159.1	29.5	26.1	23.4	61.1	74.7	76.1	12.1	14.5	14.7	44.3	56.6	60.6	8.5	10.8	11.7	44.5	56.2	60.9	8.9	11.0	11.9
T70F	26462	928.8	256.0	241.4	228.4	31.9	29.0	26.4	57.3	70.2	71.8	9.4	11.8	11.9	41.9	56.7	58.6	5.5	8.2	8.4	40.8	55.4	57.0	7.0	9.3	9.4
T70G	26828	943.3	193.4	172.7	158.3	26.4	22.6	20.0	40.4	56.1	60.5	6.7	8.6	8.8	21.4	35.2	39.3	1.4	3.8	4.4	19.2	33.2	38.2	3.3	5.0	5.3
T80A	21284	998.0	227.3	204.6	188.5	30.6	26.6	23.6	45.8	63.8	69.5	7.4	9.8	10.1	23.8	39.2	44.4	1.5	4.0	4.8	21.6	36.6	43.2	3.7	5.6	6.0
T80B	23350	934.0	187.1	166.7	152.5	25.6	21.8	19.2	39.3	54.9	58.7	6.5	8.2	8.4	20.9	34.4	38.2	1.3	3.7	4.3	18.7	32.6	37.1	3.1	4.8	5.1
T80C	31438	796.4	182.6	168.7	158.9	20.8	17.9	15.9	44.2	52.0	53.2	6.5	7.5	7.9	31.3	40.8	43.1	3.3	4.9	5.2	30.8	39.7	42.1	4.2	5.4	5.6
T80D	28023	967.0	200.4	177.6	161.3	32.5	27.4	23.8	45.8	63.2	66.6	9.2	12.5	12.3	24.4	40.9	45.2	3.7	7.2	8.0	21.9	38.2	43.9	4.1	7.4	8.4
T90A	32848	701.1	94.0	83.2	75.5	13.4	11.3	9.6	45.6	52.7	51.9	7.3	8.2	8.0	36.0	44.0	45.6	5.0	6.1	6.3	35.7	43.5	45.5	5.7	6.4	6.5

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
T90B	40213	966.6	200.3	180.1	165.6	32.5	28.2	25.2	38.9	54.3	60.7	7.5	10.0	11.1	21.6	36.7	41.2	2.6	5.7	6.5	19.8	33.9	39.1	3.7	6.1	6.8
T90C	36646	897.3	169.4	151.5	138.7	27.3	23.5	20.8	34.0	47.9	53.8	6.3	8.7	9.7	19.4	32.7	36.5	2.3	5.1	5.7	17.6	30.1	34.7	3.2	5.2	5.8
T90D	37432	810.6	136.0	122.6	111.8	20.1	17.5	15.5	47.4	58.6	59.3	6.8	9.1	9.1	34.8	46.6	48.0	3.8	6.4	6.9	34.4	45.8	47.7	4.7	6.5	7.0
T90E	41184	899.5	189.5	169.4	154.9	33.5	28.9	25.4	38.7	54.7	56.7	7.6	11.1	11.1	22.3	36.9	40.2	3.5	6.8	7.4	19.9	33.8	38.3	3.6	6.4	7.0
T90F	28177	975.4	231.1	209.1	193.1	41.3	36.3	32.6	44.3	65.1	68.7	8.9	13.3	13.9	24.6	41.6	47.0	3.6	7.8	8.9	22.0	37.7	44.8	4.4	7.3	8.7
T90G	46025	867.2	164.4	147.9	136.1	26.1	23.1	20.8	30.4	44.6	51.5	5.5	7.7	9.0	17.3	30.3	35.9	2.0	4.6	5.3	15.3	27.6	33.6	3.2	4.9	5.3
U10A	41812	1173.7	386.5	371.9	359.9	40.1	38.8	37.5	155.6	177.7	191.7	19.2	22.4	23.1	122.0	142.5	153.8	11.1	14.7	15.9	103.6	124.6	136.5	15.0	18.2	19.1
U10B	39207	1071.5	279.8	265.6	254.8	28.0	26.2	25.1	125.6	139.3	148.5	16.0	16.8	17.2	99.7	113.2	121.3	9.8	11.5	12.3	83.7	98.8	108.4	12.2	13.6	14.3
U10C	26694	992.5	233.6	219.5	208.3	25.0	23.0	21.7	115.3	131.2	139.2	13.9	15.1	16.0	86.7	100.9	109.7	8.9	10.1	10.9	76.6	91.9	102.5	10.8	11.8	12.3
U10D	33697	999.3	212.6	198.6	187.4	25.3	23.5	22.2	119.9	131.2	136.6	15.8	17.4	17.9	96.9	109.9	116.1	11.3	13.5	14.5	80.0	95.5	103.6	12.3	13.9	14.7
U10E	32712	1031.7	249.1	233.4	221.4	29.6	27.6	26.1	118.9	135.3	143.2	14.4	16.3	17.1	87.0	102.5	110.2	7.2	9.5	10.6	81.2	97.6	106.9	10.5	12.1	12.7
U10F	37894	964.6	214.8	199.2	187.0	23.3	20.9	19.4	108.7	120.8	124.7	11.9	12.3	12.7	82.2	94.9	100.4	6.4	7.7	8.5	76.3	90.0	96.7	8.9	9.3	9.7
U10G	35304	973.8	221.4	206.9	195.3	26.7	24.3	22.2	103.5	117.8	123.7	12.9	14.8	15.0	77.9	91.9	97.7	6.7	9.1	10.0	72.1	87.3	93.7	8.5	10.4	10.9
U10H	45770	938.9	186.8	173.8	164.1	20.1	18.0	16.2	81.4	88.8	90.2	10.1	11.0	10.8	62.3	72.2	75.9	6.1	7.8	8.0	57.4	68.1	72.8	6.8	8.4	8.4
U10J	50500	889.6	158.8	145.3	133.6	19.7	17.2	15.0	69.0	78.7	77.5	9.5	11.0	10.7	46.7	59.0	61.4	4.7	7.0	7.4	44.5	57.7	61.8	6.1	7.8	8.0
U10K	36433	789.7	109.7	96.6	87.3	12.4	9.7	7.8	62.1	63.7	59.4	6.3	6.8	6.2	47.7	53.7	51.5	3.6	4.5	4.4	45.9	52.9	50.9	4.1	4.5	4.4
U10L	30716	754.5	87.1	74.5	65.3	11.4	8.9	6.9	48.8	47.3	42.1	6.8	6.7	5.8	38.1	40.6	36.4	4.5	5.3	4.6	36.6	39.5	35.7	4.7	5.1	4.5
U10M	28001	857.8	142.6	126.5	116.1	14.9	11.7	9.7	33.8	41.4	40.0	5.0	5.9	5.5	19.2	29.7	30.7	1.6	3.3	3.7	15.3	26.6	28.7	2.1	3.6	3.7
U20A	29329	1007.2	239.3	223.8	211.4	26.1	23.8	21.9	111.6	125.4	130.9	13.7	15.2	15.5	84.9	98.1	104.5	7.7	9.8	10.8	78.8	92.8	100.5	10.3	11.3	12.1
U20B	35291	989.1	213.5	197.9	185.5	23.0	20.8	18.9	100.9	112.1	115.7	12.0	13.5	13.6	76.9	88.3	93.9	6.7	8.8	9.7	72.2	84.4	90.8	8.9	10.2	10.9
U20C	27887	930.8	168.2	153.8	142.9	17.4	15.2	13.5	81.9	90.0	91.9	9.3	10.3	10.1	62.5	71.8	75.7	4.9	6.7	7.2	59.0	69.0	73.7	6.4	7.5	8.0
U20D	33821	1040.2	236.7	221.7	210.1	26.4	24.7	23.3	116.9	134.5	142.0	14.0	16.5	17.4	87.0	102.5	110.7	7.6	10.6	11.9	78.5	94.6	104.4	9.6	11.9	13.1
U20E	38983	974.3	211.9	198.6	188.7	20.6	18.3	16.6	84.4	94.3	97.7	9.6	10.5	10.4	68.4	76.7	79.7	4.5	5.6	6.1	60.8	70.2	74.2	6.5	7.1	7.3
U20F	43473	981.0	240.9	222.9	209.4	24.2	21.0	18.6	107.7	126.1	130.2	10.0	12.7	12.8	76.1	92.1	99.8	2.7	5.4	7.0	75.5	92.2	101.4	5.4	7.4	8.7
U20G	49371	894.7	125.9	112.2	99.4	16.8	14.4	11.9	65.2	75.5	72.5	9.8	11.3	10.5	44.5	56.1	57.2	5.8	7.9	7.6	41.5	54.5	56.6	6.6	8.3	7.8
U20H	21964	941.8	220.4	204.7	193.3	19.4	16.8	14.8	88.1	98.0	99.9	8.7	9.6	9.2	66.0	76.4	80.5	3.2	4.9	5.4	62.0	73.2	78.7	5.3	6.3	6.5
U20J	67838	839.6	82.3	71.1	61.7	10.1	8.4	6.7	44.3	47.6	43.0	6.1	6.4	5.4	30.6	36.5	36.0	3.6	4.5	4.1	27.5	34.3	34.6	4.0	4.7	4.2
U20K	27086	951.5	166.5	151.6	138.1	21.1	18.6	16.2	77.6	91.7	92.0	11.3	13.3	12.9	52.5	66.9	71.1	5.8	8.4	8.9	47.9	63.5	68.9	6.9	9.0	9.4
U20L	32845	807.8	110.5	96.6	87.5	11.5	8.5	6.5	44.4	49.4	47.0	5.4	5.8	4.8	31.1	38.3	39.3	2.0	3.6	3.5	28.9	36.9	38.3	2.7	3.8	3.6

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
U20M	35976	923.0	186.5	167.1	153.4	19.3	15.7	12.9	53.3	63.8	63.0	7.6	9.3	8.6	25.1	37.7	39.8	1.5	3.9	4.4	15.0	30.3	34.0	2.4	4.5	4.8
U30A	37562	968.0	246.7	230.0	215.3	28.0	25.2	22.6	92.5	112.1	115.6	13.3	17.1	17.6	66.2	82.6	87.3	6.8	10.3	11.5	62.8	80.9	87.2	8.6	11.6	12.8
U30B	22124	983.6	209.0	187.7	172.3	24.8	20.5	17.2	58.6	72.0	73.0	9.3	11.2	11.0	26.8	40.8	43.7	2.0	4.7	5.1	11.2	29.0	34.0	2.1	4.9	5.1
U30C	24162	1000.4	205.6	184.8	169.5	22.4	18.5	15.9	52.9	69.2	70.6	8.5	10.8	10.6	28.0	40.7	45.6	2.4	4.4	5.4	24.5	38.4	44.8	4.1	5.5	6.4
U30D	18058	986.8	193.2	171.4	156.1	24.5	20.0	16.8	58.9	73.4	73.6	9.8	12.5	12.0	26.4	40.4	44.4	2.4	5.0	5.9	12.3	30.0	36.3	2.2	4.9	5.7
U30E	29023	1016.3	190.2	171.0	156.2	20.4	16.7	13.9	56.6	70.8	70.1	9.2	11.0	10.2	27.3	40.4	44.1	2.2	4.6	5.1	11.3	27.7	34.0	2.7	4.7	5.1
U40A	31706	922.9	157.8	145.5	135.1	17.5	15.9	14.5	85.6	93.6	92.0	10.6	12.5	12.0	63.1	73.5	76.2	6.2	8.6	9.6	57.8	69.1	73.2	7.4	9.4	10.4
U40B	38840	872.3	153.0	138.7	127.7	15.8	13.3	11.4	75.4	85.0	86.9	8.0	8.8	8.6	57.8	66.8	70.0	4.0	5.4	5.8	53.5	63.7	68.2	5.1	6.0	6.3
U40C	26351	880.0	133.0	119.2	108.7	13.9	11.5	9.8	79.2	85.5	83.6	9.1	9.4	8.9	58.8	65.8	67.6	5.4	6.3	6.4	54.6	63.3	66.5	6.4	6.8	6.8
U40D	26654	866.3	125.0	111.5	100.0	14.6	12.4	10.3	63.0	70.7	68.0	8.8	9.4	8.5	44.4	54.2	54.8	4.4	6.1	6.1	41.1	51.9	53.0	5.8	7.0	6.7
U40E	31813	842.9	118.7	106.6	96.1	14.9	12.9	10.8	56.5	63.7	61.7	8.2	9.4	8.7	40.6	49.7	49.9	5.1	6.8	6.6	37.7	48.1	49.0	5.5	7.0	6.8
U40F	28975	850.5	128.9	115.3	104.6	14.1	11.7	9.8	70.9	80.3	77.4	7.8	8.7	7.9	53.5	63.5	65.6	3.9	5.8	6.0	50.5	61.6	64.5	5.0	6.1	6.2
U40G	25279	891.4	152.7	137.3	125.0	17.3	14.8	12.7	71.4	79.4	78.3	9.9	11.0	10.2	52.5	62.1	64.2	5.1	7.1	7.5	50.4	60.9	64.0	6.6	8.1	8.4
U40H	36119	921.8	191.0	175.3	161.4	21.3	18.7	16.4	77.2	89.5	88.8	11.1	13.0	12.4	57.6	70.5	70.8	6.4	8.6	8.9	52.8	67.1	68.7	7.5	9.3	9.5
U40J	27922	998.1	179.7	159.0	144.0	21.6	17.6	14.7	55.4	67.9	67.0	8.6	10.7	9.8	27.8	40.2	43.2	2.5	4.8	5.3	12.7	28.4	33.3	2.3	4.5	5.0
U50A	29769	1056.6	203.3	181.7	165.9	23.0	19.3	16.6	65.4	78.0	78.0	9.7	11.7	11.2	30.3	43.7	46.6	2.5	4.6	5.1	13.2	30.8	35.9	2.9	5.1	5.4
U60A	10494	985.4	230.0	215.4	203.6	27.0	24.5	22.6	104.6	119.9	126.0	12.3	14.1	14.7	78.6	92.9	99.1	5.9	8.5	9.5	72.5	87.8	94.6	8.0	9.7	10.5
U60B	31552	823.2	99.4	87.9	78.6	11.7	9.6	8.0	50.6	56.2	53.8	6.7	7.4	6.8	37.1	43.3	43.7	3.6	4.7	4.8	33.6	41.4	42.4	4.4	5.1	5.0
U60C	36451	771.8	107.2	94.2	83.9	12.3	9.7	7.3	52.1	53.5	48.9	7.2	7.2	5.8	38.4	44.7	42.6	4.0	5.4	4.8	36.8	43.8	41.8	4.7	5.7	4.8
U60D	18465	887.8	164.1	146.7	134.3	18.9	15.2	12.4	40.4	54.3	56.8	6.0	8.9	8.8	21.8	33.7	36.8	1.5	4.0	4.5	17.6	31.0	35.3	2.3	4.5	5.0
U60E	27989	902.8	145.6	128.1	115.9	18.0	14.5	12.0	41.5	52.0	53.2	6.5	8.4	8.4	21.3	31.5	34.7	1.7	3.7	4.5	17.1	28.7	33.2	2.5	4.2	5.0
U60F	27208	968.3	198.2	177.9	162.9	26.4	21.9	18.4	51.1	68.7	72.7	8.2	11.8	12.2	26.4	40.6	43.9	2.7	5.2	5.8	21.8	38.1	43.7	3.8	5.8	6.5
U70A	11447	1043.6	250.3	230.9	215.9	29.9	26.5	23.8	125.3	142.3	145.3	15.3	17.3	17.4	91.2	108.4	114.1	7.4	10.3	11.3	86.0	104.7	111.3	9.9	11.9	12.4
U70B	27211	859.9	120.1	105.2	93.4	15.7	13.0	10.8	69.1	73.2	68.7	10.1	10.6	9.8	49.5	57.4	56.9	5.8	7.4	7.5	47.0	56.1	56.7	6.6	7.7	7.8
U70C	35014	861.1	128.4	114.5	102.6	16.9	14.1	11.7	59.8	65.8	62.8	9.2	10.1	9.5	44.2	52.6	51.3	5.5	7.2	7.1	40.1	49.9	49.3	5.9	7.5	7.1
U70D	20822	944.4	162.2	143.8	130.4	20.1	16.7	14.1	48.4	58.8	59.2	7.2	9.0	9.2	24.3	36.1	37.8	2.0	4.2	4.7	20.7	33.9	36.6	3.0	5.0	5.4
U70E	8653	992.3	210.2	188.8	173.5	29.7	25.2	21.7	54.0	74.2	78.6	8.4	12.7	13.2	27.2	41.7	46.8	2.6	5.7	6.4	22.3	38.5	45.5	3.1	6.1	7.1
U70F	5940	1000.1	227.6	204.6	189.5	30.0	25.2	21.9	60.1	77.6	79.2	9.3	13.2	13.4	28.3	42.3	47.1	2.8	5.6	6.7	26.2	42.8	48.8	3.8	6.8	7.7
U80A	15783	1036.2	255.5	232.4	215.0	36.5	32.5	29.5	61.0	80.7	85.4	10.3	13.2	13.5	32.4	48.8	54.7	4.7	7.2	8.2	26.4	44.3	51.9	6.1	8.4	9.1

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
U80B	33894	799.7	151.0	134.3	122.5	19.6	16.5	14.0	35.4	47.1	47.1	5.6	7.7	7.4	19.9	30.4	34.6	1.6	3.8	4.6	15.6	27.4	32.6	2.3	4.3	5.0
U80C	20225	962.0	232.7	211.4	195.1	29.5	25.5	22.5	52.2	68.1	72.5	7.9	10.6	11.3	26.9	41.9	46.4	2.0	4.6	5.6	21.7	37.5	43.5	3.3	5.3	6.2
U80D	12012	1046.7	273.0	248.0	230.1	41.4	36.3	32.8	63.5	83.0	87.8	12.3	15.6	16.0	33.3	49.7	54.5	5.0	8.3	9.1	27.8	45.9	52.8	6.0	9.1	10.1
U80E	41502	831.2	171.3	153.4	141.7	22.7	19.0	16.7	41.3	51.4	51.7	7.3	8.9	8.6	22.6	33.2	36.8	2.8	4.8	5.7	18.6	30.7	35.1	3.2	5.5	6.1
U80F	13738	935.2	208.4	187.4	172.5	30.9	26.7	23.8	49.7	65.9	67.9	9.0	11.9	11.9	26.5	40.6	43.8	3.6	6.3	7.0	21.8	37.5	42.0	4.2	7.1	7.7
U80G	26120	940.0	175.4	156.3	142.8	21.5	17.6	15.1	49.1	59.4	59.2	8.3	9.3	9.1	25.7	37.2	39.3	2.6	4.6	5.0	21.2	34.0	37.2	3.8	5.3	5.4
U80H	24325	1011.3	234.2	210.3	194.2	31.7	27.0	24.0	59.1	74.5	77.2	10.2	12.9	13.4	31.3	45.7	49.9	3.7	6.7	7.8	25.2	41.0	47.6	4.1	7.0	8.4
U80J	37143	839.6	166.1	150.8	138.3	18.7	15.9	13.4	59.5	67.7	64.3	8.8	10.2	9.2	44.6	55.6	54.6	5.2	7.4	7.2	40.8	52.5	52.5	6.0	7.7	7.4
U80K	18355	946.8	201.0	178.6	162.9	28.2	23.5	20.1	53.8	68.7	66.6	8.9	11.9	11.7	26.7	41.5	43.2	3.6	5.9	6.3	23.7	40.2	43.6	4.6	6.4	6.8
U80L	10742	981.9	225.3	202.9	186.8	33.7	28.9	25.5	58.2	74.4	74.3	10.3	13.3	13.3	29.9	44.3	47.4	4.9	7.0	7.6	27.4	43.0	48.1	5.7	7.9	8.3
V11A	20692	1298.5	448.5	430.3	416.4	43.8	41.8	40.3	163.3	191.3	207.3	19.0	22.7	23.8	127.5	148.8	161.6	10.1	13.9	15.4	109.4	130.9	145.8	14.6	17.4	19.2
V11B	25263	1344.9	545.3	528.7	516.6	56.2	54.8	53.6	173.6	203.1	223.8	23.8	27.0	28.1	138.2	161.7	176.6	13.4	16.6	17.8	116.5	140.1	156.0	19.1	22.4	23.2
V11C	25245	1034.4	229.7	211.4	196.7	22.9	20.8	18.9	105.9	117.4	119.2	11.3	12.1	11.5	84.4	95.9	97.9	6.1	7.7	7.6	76.7	88.9	92.2	8.6	9.7	9.4
V11D	26593	895.6	194.4	177.0	163.9	16.7	13.6	11.3	92.9	105.0	104.8	7.3	8.4	7.9	68.2	81.7	85.6	2.4	3.8	4.4	66.9	81.9	86.5	4.7	5.4	5.5
V11E	19263	1072.0	280.1	260.9	245.7	31.5	28.7	26.8	122.6	136.8	143.5	16.6	16.6	16.6	93.7	108.3	113.4	9.9	11.0	11.2	83.7	99.9	106.0	13.2	13.6	13.5
V11F	16069	820.2	150.7	135.4	124.0	12.3	9.6	7.4	77.5	84.3	83.8	5.7	6.0	5.5	58.1	68.5	69.1	1.7	2.9	2.8	57.4	68.7	69.4	3.4	4.0	3.4
V11G	31348	1297.9	502.7	490.7	482.2	51.5	50.1	49.5	156.1	188.4	212.0	21.5	24.4	25.9	121.5	148.2	166.2	11.3	14.4	16.0	99.8	126.9	145.8	16.9	19.9	21.2
V11H	13293	991.5	244.9	226.8	212.9	23.8	21.2	19.2	112.0	131.5	138.2	12.0	13.1	13.1	82.3	97.4	106.1	5.7	7.1	7.8	75.9	93.1	103.1	8.5	9.1	9.4
V11J	14404	830.3	155.9	140.3	128.6	13.0	10.1	7.8	79.5	86.9	86.3	6.0	6.3	5.7	59.2	70.1	71.1	1.9	3.0	2.9	58.5	70.2	71.4	3.7	4.1	3.6
V11K	24676	912.3	201.4	183.2	170.0	18.5	15.5	12.9	98.8	111.6	113.6	9.2	9.8	9.6	72.3	84.0	88.4	3.9	5.0	4.8	69.7	82.5	88.0	6.4	6.7	6.0
V11L	31168	738.9	108.7	96.5	88.8	8.2	5.8	4.5	60.2	64.6	63.6	3.7	3.7	3.4	47.2	53.4	54.5	1.0	1.7	1.9	47.2	53.4	54.7	2.3	2.3	2.3
V11M	15432	740.8	92.3	80.1	72.3	7.1	5.0	3.6	49.1	52.9	50.6	3.6	3.7	3.2	33.4	41.3	42.1	0.7	1.8	1.9	33.5	41.6	42.4	1.9	2.4	2.1
V12A	30706	923.0	208.7	190.2	176.5	19.2	16.2	13.7	100.9	114.4	116.6	9.5	10.1	10.2	73.8	85.9	90.2	3.9	5.2	5.2	70.9	84.2	89.6	6.7	6.9	6.4
V12B	29327	884.8	186.2	168.5	156.4	17.0	13.9	11.6	93.9	105.0	106.9	8.6	9.1	9.0	68.6	79.1	83.9	3.6	4.4	4.6	66.4	78.0	83.5	6.0	5.9	5.5
V12C	15479	799.5	131.2	117.5	107.5	11.2	8.5	6.7	73.4	80.9	80.0	6.0	6.1	5.7	54.4	63.3	65.7	2.3	2.8	3.1	53.3	62.7	65.9	4.0	3.7	3.8
V12D	23596	1004.6	270.5	249.9	234.8	26.1	23.1	20.7	118.3	135.7	143.3	12.6	13.6	14.2	86.2	102.1	107.8	5.6	7.5	7.8	82.6	99.5	106.5	9.3	10.2	9.8
V12E	32435	787.1	119.1	105.8	96.2	10.1	7.7	6.1	64.9	71.3	69.8	5.3	5.2	4.7	50.2	57.6	59.0	2.2	2.7	2.7	47.2	55.7	57.7	3.4	3.3	3.2
V12F	33243	733.7	97.4	85.5	77.5	8.0	5.8	4.5	56.1	59.8	57.9	4.4	4.1	3.5	44.0	49.6	50.4	1.9	2.0	2.3	41.5	48.0	49.4	2.8	2.5	2.5
V12G	50589	739.1	73.4	62.4	54.6	7.0	5.0	3.7	42.5	46.9	43.7	3.8	4.2	3.6	29.3	37.0	37.8	1.3	2.5	2.6	27.3	35.6	37.4	1.9	2.6	2.7

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
V13A	23169	1280.9	466.0	452.0	440.8	52.0	50.6	49.6	176.3	203.8	222.5	21.9	25.2	27.0	144.7	168.8	182.7	12.2	16.0	18.1	115.9	139.6	154.2	17.0	19.3	21.4
V13B	29378	985.9	244.2	226.2	212.1	23.8	21.1	19.0	111.7	131.2	137.8	12.0	13.1	13.0	82.0	97.3	105.8	5.7	7.0	7.6	75.6	92.9	102.7	8.5	9.0	9.2
V13C	25565	820.4	133.9	118.6	107.3	12.5	10.2	8.7	77.5	84.2	82.1	7.4	7.4	7.0	57.6	67.0	68.7	3.8	4.7	4.8	55.0	64.7	67.5	5.1	5.4	5.3
V13D	28337	818.4	148.9	133.6	122.3	12.3	9.5	7.4	76.8	83.4	82.9	5.7	5.9	5.5	57.3	67.6	68.4	1.8	2.8	2.8	56.7	67.8	68.6	3.5	3.9	3.6
V13E	28088	706.3	81.6	71.0	63.5	8.2	6.3	4.9	48.3	48.9	46.7	5.0	4.6	3.9	38.3	41.1	41.0	3.2	3.1	2.9	37.0	40.2	40.0	3.7	3.5	3.0
V14A	22389	732.3	102.4	90.3	82.3	7.2	5.1	3.7	60.5	64.0	61.4	3.9	3.8	3.3	45.1	52.7	53.1	1.1	2.0	2.1	45.1	53.1	53.5	2.1	2.5	2.4
V14B	17014	714.5	73.8	64.2	57.1	6.5	4.7	3.4	40.5	44.5	40.4	3.1	3.9	3.3	26.6	34.2	34.3	0.7	1.8	2.0	27.1	34.9	35.0	1.6	2.2	2.3
V14C	19519	784.2	104.3	89.5	79.7	8.9	6.5	4.6	66.3	66.7	62.0	5.5	5.3	4.2	48.2	54.4	53.6	2.0	3.2	2.8	47.1	54.4	53.5	3.1	3.7	3.1
V14D	63178	713.1	57.4	47.8	42.6	4.4	2.8	1.9	36.2	34.7	31.8	2.8	2.4	1.9	25.5	29.1	28.4	0.8	1.4	1.4	25.4	29.0	28.2	1.4	1.7	1.5
V14E	28656	760.9	90.8	80.2	72.2	8.2	6.3	4.9	46.5	54.2	50.6	3.8	4.9	4.6	30.6	39.0	41.5	1.0	2.0	2.6	30.8	39.8	42.5	2.1	2.6	3.0
V20A	26709	1024.4	264.6	250.6	238.8	28.8	27.0	25.6	122.9	139.5	147.8	15.6	17.0	17.1	95.1	110.9	119.2	9.6	11.8	12.3	82.4	99.2	108.3	12.0	14.0	14.1
V20B	19026	971.0	212.0	197.7	186.7	23.6	21.6	20.2	106.2	118.3	124.7	13.3	13.9	14.0	81.5	94.7	101.0	8.6	9.9	10.3	72.1	86.2	93.4	10.3	11.4	11.5
V20C	18787	954.0	221.7	208.7	197.8	22.9	21.4	20.2	102.4	114.3	120.7	11.3	11.8	11.8	81.3	93.0	99.1	6.6	7.7	8.0	70.1	82.4	88.6	9.1	9.7	9.7
V20D	29924	856.5	122.8	107.9	96.8	14.7	12.4	10.5	75.0	79.5	77.0	9.9	10.3	9.6	56.6	63.5	64.3	6.4	7.6	7.6	51.1	59.5	61.4	7.0	7.8	7.6
V20E	59867	756.8	102.5	88.9	79.2	9.5	7.6	6.1	65.4	68.1	63.0	6.1	6.4	5.5	46.6	54.0	54.0	2.5	3.7	3.9	45.6	53.8	53.8	3.5	4.3	4.2
V20F	15386	872.2	140.6	125.6	113.8	17.1	14.7	12.9	83.2	90.5	89.2	11.2	11.9	11.6	62.9	71.7	73.9	7.4	8.6	9.0	56.3	66.7	70.0	8.2	9.0	9.2
V20G	25365	756.7	70.2	59.4	52.7	7.7	5.7	4.4	46.7	47.6	43.0	5.6	5.3	4.4	36.4	39.7	39.0	3.8	4.1	3.8	33.8	37.9	38.3	3.8	4.1	3.7
V20H	60337	683.6	122.5	113.9	108.3	5.6	4.1	3.2	37.6	42.1	41.2	1.9	2.4	2.1	27.5	33.6	35.1	-0.3	0.6	0.9	26.8	33.0	34.8	0.7	1.3	1.5
V20J	31398	667.1	116.7	108.6	103.1	5.3	3.8	2.9	35.9	40.0	38.8	1.8	2.2	1.9	26.3	32.2	33.2	-0.3	0.5	0.7	25.7	31.6	33.0	0.6	1.2	1.3
V31A	62170	915.0	208.3	191.9	178.8	18.0	16.0	14.3	104.6	118.6	121.0	8.8	9.9	9.8	75.9	91.2	97.3	3.7	5.2	6.1	71.7	88.3	96.0	5.8	6.7	7.3
V31B	50531	857.8	159.6	143.1	131.2	15.4	12.8	11.0	86.5	97.9	98.2	7.9	9.2	9.2	64.7	75.3	79.3	3.7	5.1	6.0	62.2	73.6	79.0	5.1	6.1	6.5
V31C	39589	809.2	115.9	101.8	91.5	11.6	9.6	7.8	66.7	71.2	68.5	5.9	6.7	6.2	51.3	59.2	59.2	3.0	4.5	4.6	49.5	58.2	58.6	4.0	5.0	4.8
V31D	46712	787.9	104.9	91.1	82.0	9.6	7.2	5.7	65.3	67.5	64.0	5.6	5.6	4.9	51.4	56.3	56.2	2.9	3.7	3.7	50.0	55.5	55.8	3.7	4.0	3.8
V31E	83388	853.4	149.7	134.5	122.8	12.0	9.9	8.0	78.2	84.9	83.9	6.7	6.7	5.9	58.7	66.0	66.7	3.0	3.7	3.3	56.3	64.7	65.9	4.8	4.9	4.2
V31F	15559	912.6	178.9	162.0	149.2	14.6	12.2	10.3	89.8	98.8	99.2	8.0	8.2	7.6	66.7	76.4	77.4	3.4	4.6	4.4	63.3	74.4	76.4	5.5	6.1	5.5
V31G	25472	788.5	116.3	101.8	91.4	10.3	8.3	6.8	73.4	77.2	73.9	6.1	6.5	6.2	54.4	62.0	62.1	2.8	4.3	4.2	53.2	61.7	62.0	4.1	4.7	4.4
V31H	12848	981.5	237.9	219.0	204.8	20.2	17.9	15.8	109.4	125.4	128.5	10.6	11.7	11.3	79.4	93.7	97.9	4.4	6.3	6.6	74.1	90.4	95.9	7.2	8.6	8.3
V31J	35794	873.0	161.4	145.2	132.3	15.2	12.7	10.5	85.3	97.8	98.3	7.5	9.0	8.5	63.7	76.9	80.5	3.0	5.2	5.6	60.0	74.5	79.1	4.7	6.2	6.2
V31K	22665	796.1	116.4	101.8	91.7	10.3	8.3	6.6	73.3	76.9	73.7	6.1	6.5	6.0	54.5	62.0	62.2	2.9	4.3	4.0	53.5	61.7	62.2	4.1	4.8	4.2

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
V32A	19470	932.6	242.7	222.5	206.2	21.3	18.3	16.0	111.1	130.6	136.0	10.0	11.8	12.5	79.6	95.8	102.1	3.8	6.0	7.0	77.8	95.5	103.0	6.5	7.8	8.5
V32B	55695	797.0	143.1	127.4	115.7	11.8	9.4	7.8	78.0	85.8	81.8	6.2	7.1	6.9	58.5	69.6	71.4	2.7	4.6	5.0	58.0	70.0	72.2	4.0	5.3	5.5
V32C	62992	729.3	96.9	84.4	76.6	8.7	6.1	4.6	59.1	61.7	58.9	4.7	4.6	4.3	46.6	51.2	52.8	2.7	2.8	3.1	46.1	51.5	53.4	3.2	3.1	3.5
V32D	58992	743.8	86.5	73.9	65.9	7.5	5.6	4.1	52.6	54.1	50.8	4.2	4.5	3.8	40.8	45.1	45.5	2.3	2.9	2.9	39.3	44.2	45.3	2.9	3.1	3.0
V32E	78328	775.1	137.5	123.0	113.0	10.2	7.7	6.1	74.4	82.2	79.1	5.1	5.6	5.0	54.6	65.5	66.7	1.7	3.0	3.3	55.4	66.6	68.1	3.2	3.8	3.7
V32F	20143	736.4	86.3	73.7	65.5	7.5	5.6	4.2	52.7	54.2	50.8	4.2	4.5	3.9	40.7	45.1	45.4	2.2	2.8	3.0	39.2	44.2	45.2	2.9	3.1	3.1
V32G	54434	855.0	169.9	151.6	137.7	16.5	13.7	11.5	92.8	100.0	99.0	8.7	9.4	9.4	69.0	79.8	81.2	4.6	6.0	6.4	67.7	79.2	81.8	6.1	6.8	6.9
V32H	51742	723.1	95.3	83.5	75.2	8.2	6.4	5.1	54.5	58.2	54.9	4.6	4.8	4.4	43.1	48.3	49.1	2.5	3.2	3.3	41.6	47.7	48.7	3.2	3.6	3.6
V33A	57686	743.9	119.4	104.6	95.4	9.8	7.5	6.0	68.1	73.3	71.8	5.2	5.6	5.6	50.5	58.9	61.4	1.6	3.0	3.6	50.1	58.3	61.5	3.0	3.6	3.8
V33B	40664	736.3	113.9	100.1	91.3	8.9	6.7	5.4	65.2	70.5	68.9	4.5	5.0	5.0	48.6	57.3	59.6	1.1	2.5	3.2	48.0	56.6	59.6	2.5	2.9	3.4
V33C	39805	771.4	119.7	106.7	97.2	10.5	8.2	6.7	65.8	70.7	67.6	5.7	6.2	5.6	49.6	58.4	57.9	2.6	4.0	4.0	48.0	57.7	57.6	3.6	4.5	4.3
V33D	45519	746.6	91.7	79.8	72.4	7.5	5.2	4.1	48.9	52.8	50.4	3.9	3.7	3.2	32.7	40.4	41.8	0.6	1.8	2.1	32.5	40.4	42.3	1.9	2.3	2.4
V40A	37222	901.6	108.6	95.2	85.4	11.6	9.5	7.9	56.0	61.6	61.4	5.8	6.3	6.1	37.9	45.5	48.0	2.6	3.4	3.6	36.2	44.1	47.4	3.6	4.0	4.0
V40B	29231	764.0	75.4	65.4	58.4	6.6	4.8	3.6	37.0	41.7	40.2	3.2	3.4	3.2	26.8	32.9	34.6	0.7	1.8	2.1	24.9	31.8	34.1	1.4	2.1	2.1
V40C	45486	845.3	130.1	115.9	105.2	15.9	13.4	11.5	69.2	75.7	72.7	9.2	10.1	9.6	48.7	56.4	58.4	5.4	6.7	7.0	49.2	57.7	60.1	6.4	7.3	7.4
V40D	33329	801.1	103.9	92.0	82.1	12.5	10.3	8.5	58.7	62.3	57.0	7.6	8.2	7.4	42.4	49.1	49.0	4.8	5.8	5.9	42.6	49.9	49.8	5.4	6.1	6.1
V40E	30091	727.2	62.3	53.6	47.6	5.2	3.7	2.5	31.1	34.8	32.4	2.4	2.8	2.3	23.1	28.5	29.2	0.6	1.5	1.7	21.4	27.5	28.8	1.2	1.8	1.7
V50A	40892	758.5	79.3	68.8	61.4	7.5	5.5	4.3	39.7	44.0	42.4	3.9	3.9	3.8	27.9	34.1	34.9	1.4	2.3	2.5	25.4	33.0	34.4	1.9	2.5	2.5
V50B	38378	835.6	114.3	101.0	91.9	11.7	9.2	7.6	51.8	59.7	60.6	5.7	6.1	5.7	36.7	44.4	47.2	2.2	3.3	3.8	33.3	42.4	46.2	3.2	3.9	4.0
V50C	40909	982.2	208.2	191.8	177.9	23.4	20.4	17.8	82.2	96.3	94.5	11.9	14.4	13.4	60.5	74.0	76.5	6.7	9.6	10.2	57.6	72.5	76.0	8.0	10.6	10.9
V50D	14680	1019.9	193.1	172.2	157.2	25.1	21.0	17.9	53.4	67.8	68.7	8.9	11.7	11.8	28.6	41.7	43.9	3.1	5.8	6.2	24.6	39.5	42.8	3.9	6.4	7.0
V60A	10682	892.1	195.3	177.6	164.7	18.6	16.1	13.6	96.4	108.8	111.1	9.6	10.4	10.4	70.3	81.6	86.2	4.4	5.8	5.7	67.8	80.0	85.6	7.0	7.4	6.9
V60B	55165	854.9	143.8	127.9	116.6	12.7	10.3	8.3	82.9	88.7	84.6	7.3	7.5	6.7	58.9	70.1	70.1	3.3	4.5	4.1	57.8	69.2	69.9	5.0	5.2	4.5
V60C	36064	728.3	90.7	78.9	71.5	7.8	5.7	4.2	46.3	50.9	48.8	3.9	4.0	3.5	31.4	38.6	39.3	1.3	1.9	1.7	30.7	38.5	39.8	2.4	2.3	2.1
V60D	30789	846.8	173.5	157.5	145.9	13.3	10.5	8.4	86.5	99.1	98.6	6.2	7.1	6.5	63.5	76.8	80.6	2.3	3.3	3.9	64.2	77.6	82.0	4.0	4.5	4.6
V60E	74718	718.1	102.6	91.2	83.5	7.0	5.0	3.5	64.8	67.8	62.2	4.1	4.4	3.3	45.8	53.9	54.3	1.2	2.2	2.3	47.0	55.7	56.0	2.1	2.7	2.5
V60F	40601	769.2	96.7	83.5	74.9	8.6	6.3	4.8	49.3	54.8	52.3	4.1	4.4	3.8	33.9	42.2	43.3	1.4	2.2	2.3	32.1	41.5	43.0	2.4	2.6	2.6
V60G	46139	679.5	117.7	109.9	105.0	5.1	3.6	2.8	36.1	40.1	39.3	1.7	2.0	1.8	27.1	32.7	34.0	-0.2	0.5	0.7	26.5	32.1	33.8	0.7	1.1	1.2
V60H	35494	700.9	72.1	62.6	56.7	5.5	3.8	2.7	40.2	42.7	40.4	2.8	2.8	2.1	28.0	34.0	34.7	0.6	1.4	1.4	27.7	34.0	34.8	1.4	1.7	1.5

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
V60J	18594	811.0	179.3	166.6	158.5	9.0	6.8	5.4	52.7	61.2	61.4	3.1	3.9	3.7	38.3	46.9	49.7	-0.2	1.2	1.5	37.3	46.2	49.7	1.3	2.1	2.3
V60K	22802	684.2	126.1	117.3	111.3	5.9	4.4	3.3	38.5	43.5	42.5	2.0	2.6	2.1	28.0	34.5	36.0	-0.2	0.7	0.8	27.3	33.9	35.7	0.8	1.5	1.4
V70A	28025	1171.2	392.2	378.2	366.6	43.6	42.1	40.6	164.1	188.6	204.8	21.5	24.5	25.3	127.3	149.2	162.4	13.0	17.2	18.3	109.1	131.5	144.8	17.2	20.0	21.1
V70B	12123	1101.2	319.3	303.8	291.6	36.7	34.5	32.8	145.2	165.7	178.4	19.2	21.2	21.7	112.1	130.3	141.4	12.7	15.2	15.7	97.8	116.4	128.5	15.4	17.4	17.6
V70C	34152	879.6	192.1	175.9	163.4	19.1	17.0	15.3	97.0	110.8	114.9	10.4	11.4	11.3	70.4	83.8	90.7	5.5	7.0	7.7	65.0	80.1	87.9	7.7	8.4	8.8
V70D	19837	817.3	130.3	113.5	101.7	11.9	9.2	7.2	77.5	82.2	77.9	6.9	7.3	6.3	55.6	64.0	65.0	2.4	3.9	4.1	54.0	63.5	65.1	4.0	4.7	4.6
V70E	10528	773.5	110.4	95.0	84.7	10.0	7.4	5.5	69.2	70.8	66.5	6.2	6.0	4.9	49.7	56.5	56.6	2.4	3.4	3.3	48.5	56.4	56.7	3.5	4.0	3.7
V70F	36446	693.1	55.3	45.7	40.0	4.6	3.1	2.0	35.7	34.2	30.1	3.0	2.7	1.9	25.6	29.0	27.3	1.0	1.8	1.5	25.3	28.6	27.4	1.6	1.9	1.5
V70G	50447	666.8	44.8	36.9	32.8	3.6	2.1	1.3	29.7	27.8	25.0	2.6	1.8	1.2	22.3	24.4	22.9	1.1	1.3	1.0	22.0	24.2	22.9	1.5	1.4	1.0
W11A	44514	1059.1	228.5	212.7	198.7	25.1	22.7	20.7	92.1	107.9	110.7	12.2	14.8	15.3	63.6	78.5	82.9	6.1	8.6	9.8	59.8	75.7	81.0	7.9	10.0	10.9
W11B	12682	1052.3	221.3	200.9	186.6	28.3	24.1	21.3	53.0	68.8	72.8	8.4	11.4	12.0	28.5	43.8	47.1	3.3	6.1	6.8	25.1	40.9	45.3	4.0	6.4	7.0
W11C	38222	1103.6	251.2	228.9	213.3	34.1	29.9	26.8	67.6	83.1	86.3	11.1	14.1	14.8	31.4	46.7	50.5	4.0	6.9	7.8	15.9	34.1	40.2	3.2	6.2	7.0
W12A	62329	877.8	149.3	134.5	122.1	18.4	15.8	13.5	76.5	85.1	82.7	10.3	11.4	10.9	53.0	62.7	64.1	5.6	7.5	7.5	53.7	63.9	65.9	7.4	8.3	8.1
W12B	65632	935.2	165.6	152.1	140.9	20.3	18.2	16.2	70.0	80.2	81.2	10.1	11.5	11.4	49.8	60.8	63.2	5.3	7.4	7.7	46.9	59.6	62.6	6.8	8.4	8.5
W12C	57006	850.1	118.4	104.6	95.7	12.3	10.0	8.3	47.7	53.4	54.2	5.4	6.5	6.3	32.7	39.5	41.9	2.6	4.0	4.3	30.2	38.0	40.8	3.0	4.3	4.5
W12D	56893	846.7	144.9	129.5	119.4	19.9	16.2	13.5	52.4	59.7	58.9	8.1	9.1	8.2	35.9	44.8	46.1	4.3	5.9	5.7	32.9	42.9	44.7	4.6	6.2	5.8
W12E	24858	1051.1	257.1	236.1	220.6	37.8	32.7	29.2	84.4	102.3	104.9	14.2	17.1	17.0	55.9	72.6	76.2	8.1	11.1	11.5	52.0	70.4	75.7	8.4	11.4	12.2
W12F	39900	1282.6	313.8	287.3	269.6	52.4	46.4	42.3	84.9	104.3	112.2	17.4	21.6	23.2	39.5	56.0	61.4	7.0	10.8	11.8	21.5	42.0	50.2	4.7	9.1	10.7
W12G	32635	834.4	170.7	154.6	143.7	19.4	15.6	12.9	49.2	60.2	61.1	5.4	7.4	7.6	33.8	44.7	46.5	1.5	3.6	4.0	29.9	42.7	45.2	1.7	3.7	4.2
W12H	48456	1042.7	235.3	212.7	196.7	35.8	30.8	26.9	60.9	77.2	78.6	11.5	15.3	14.9	30.0	43.9	47.5	4.9	8.1	8.6	16.0	33.1	39.1	3.1	6.7	7.7
W12J	33212	1286.8	363.9	336.5	315.3	62.5	56.6	52.2	93.7	122.0	129.9	20.7	25.6	26.3	46.0	66.8	73.9	9.6	13.6	15.0	26.0	50.8	61.1	7.5	12.5	14.2
W13A	27583	1139.0	238.8	217.6	202.8	28.4	24.9	22.6	68.3	83.8	90.1	10.5	12.3	12.8	34.7	48.5	53.3	3.0	5.0	5.7	31.0	45.8	51.5	5.4	6.9	7.4
W13B	22244	1296.2	424.3	394.9	374.5	60.3	54.3	50.1	105.0	133.1	141.6	18.5	23.1	24.3	43.3	64.9	72.1	5.9	10.2	11.1	31.3	56.7	66.9	7.2	11.4	12.3
W21A	34014	880.4	165.1	146.4	132.8	14.2	11.5	9.5	88.5	97.2	96.3	7.8	8.3	7.8	64.7	75.9	77.1	3.3	4.6	4.8	62.0	74.1	76.6	5.0	5.6	5.4
W21B	58038	813.5	145.6	129.1	118.0	12.3	9.3	7.1	76.8	83.7	80.1	6.5	7.4	6.5	56.9	66.4	68.1	3.0	4.0	4.3	55.6	66.1	68.2	4.3	4.6	4.6
W21C	36963	728.2	93.7	82.0	73.9	8.0	6.2	4.9	53.6	57.1	53.8	4.5	4.7	4.2	42.5	47.5	48.2	2.4	3.1	3.2	41.0	46.8	47.8	3.1	3.5	3.4
W21D	46869	719.9	92.3	80.7	72.5	7.9	6.1	4.9	53.0	56.4	52.9	4.5	4.7	4.2	41.9	46.9	47.5	2.3	3.1	3.3	40.5	46.3	47.1	3.1	3.5	3.4
W21E	41598	731.6	129.2	115.9	106.3	11.9	9.1	7.3	65.5	71.9	72.4	6.1	6.1	6.0	51.7	60.0	62.0	3.4	3.8	4.0	50.2	59.3	61.3	4.4	4.3	4.3
W21F	24275	703.6	111.2	99.2	90.4	9.7	7.3	5.6	58.0	62.9	62.6	4.9	4.9	4.6	46.3	53.2	54.5	2.6	3.1	3.2	45.0	52.4	54.1	3.4	3.5	3.4

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
W21G	56284	731.5	127.4	114.3	104.9	11.6	8.9	7.0	63.7	70.3	71.0	5.8	5.9	5.7	49.9	58.3	60.6	3.1	3.6	3.7	48.4	57.6	59.9	4.1	4.1	4.0
W21H	43281	780.8	110.8	97.8	89.4	9.8	7.0	5.3	57.3	60.3	57.2	5.0	5.0	4.3	44.9	51.0	49.9	2.5	3.1	3.0	43.5	50.3	49.3	3.1	3.3	3.1
W21J	53004	802.9	129.9	116.5	106.4	11.4	9.2	7.3	69.7	76.2	73.2	6.1	6.9	5.9	52.0	61.9	62.1	2.6	4.2	4.2	50.4	61.3	61.9	3.8	4.9	4.5
W21K	79744	759.4	129.9	116.9	108.6	10.5	8.2	6.6	48.8	54.8	52.6	3.7	4.9	4.2	33.8	42.5	43.1	0.6	2.4	2.6	33.0	42.5	43.4	1.5	2.9	3.0
W21L	53280	733.6	97.9	87.3	79.3	12.1	9.6	7.6	33.3	39.6	38.5	5.0	6.1	5.4	25.0	31.4	31.6	3.3	4.6	4.3	22.1	29.7	30.6	3.0	4.5	4.3
W22A	23871	910.4	183.0	164.4	150.9	17.7	14.8	12.3	78.2	92.7	93.6	8.8	10.7	10.5	52.6	66.8	70.9	4.0	5.7	6.2	50.2	65.6	70.4	5.9	6.8	7.0
W22B	33168	812.3	141.6	125.4	114.3	11.6	8.5	6.5	74.8	81.1	76.9	5.9	6.8	5.9	55.8	65.1	66.1	2.7	3.7	4.1	54.7	64.8	66.2	3.8	4.3	4.4
W22C	18561	874.5	150.0	132.4	119.9	12.9	9.6	7.1	65.9	76.0	72.9	5.9	7.0	6.2	44.6	56.2	58.1	2.1	3.4	3.6	43.0	55.6	58.2	3.4	4.0	3.9
W22D	19748	781.3	108.5	95.8	87.7	9.3	6.7	5.1	56.0	58.8	55.7	4.7	4.8	4.2	44.3	50.1	49.0	2.1	3.0	2.9	42.9	49.3	48.4	2.9	3.3	3.0
W22E	38542	1055.4	192.3	174.8	161.3	21.5	19.1	17.0	92.3	104.4	104.1	10.9	12.2	12.0	61.9	75.9	78.0	5.6	7.3	7.4	59.0	74.2	77.3	7.4	8.7	8.6
W22F	31203	797.6	108.6	96.3	88.6	11.1	8.6	7.1	45.1	49.8	49.4	4.1	4.5	4.5	32.5	40.6	41.3	1.2	2.6	2.8	31.0	39.3	40.4	2.0	2.9	2.9
W22G	24935	775.6	101.2	89.4	82.1	10.4	8.1	6.7	42.3	46.6	46.2	3.9	4.3	4.4	30.6	37.9	38.7	1.2	2.5	2.8	29.0	36.6	37.9	2.0	2.8	2.7
W22H	30611	741.8	120.2	108.2	101.0	9.5	7.4	5.8	45.4	50.4	48.7	3.4	4.4	3.5	32.0	40.0	40.9	0.5	2.3	2.3	31.0	39.9	41.2	1.3	2.7	2.7
W22J	60494	720.6	108.6	97.9	91.9	8.5	6.2	5.2	41.3	45.5	44.3	3.2	3.6	3.3	29.7	36.9	38.1	0.4	1.9	2.4	28.8	36.7	38.2	1.2	2.3	2.6
W22K	47552	753.9	94.1	83.0	76.2	9.6	7.4	6.1	38.5	42.9	42.7	3.5	3.9	3.9	27.4	34.5	35.6	0.9	2.1	2.4	25.9	33.2	34.8	1.6	2.4	2.4
W22L	27929	730.5	126.6	114.4	105.9	12.5	9.5	7.4	43.9	51.7	50.2	4.1	5.8	5.3	32.3	41.3	41.8	1.3	3.6	3.6	28.9	39.5	40.6	1.2	3.3	3.6
W23A	41372	834.4	136.7	123.3	113.8	17.9	14.7	12.5	48.4	56.6	56.2	7.6	9.2	8.8	32.4	41.3	44.0	4.3	6.3	6.7	21.0	32.7	37.4	2.7	5.0	5.9
W23B	19279	923.8	199.6	181.0	167.1	29.1	24.9	21.7	49.4	64.2	65.1	8.6	11.5	11.7	25.1	37.7	41.2	3.6	6.5	7.0	11.7	27.2	32.8	2.0	5.1	6.1
W23C	31256	1143.4	276.2	250.6	232.1	46.7	41.2	37.5	77.7	97.4	102.8	16.7	19.9	20.3	38.5	55.7	61.4	7.5	11.2	12.1	21.4	42.1	50.4	5.9	10.0	11.2
W23D	24793	1040.7	245.8	221.7	204.6	41.8	36.4	32.4	68.7	84.7	85.7	13.9	17.9	18.0	34.4	50.1	53.4	6.6	10.4	11.3	21.6	40.2	45.4	4.7	8.9	10.0
W31A	36971	811.1	135.3	122.4	112.9	9.3	7.3	5.6	71.5	77.5	77.2	5.3	5.4	4.8	53.0	61.1	63.3	2.0	2.7	2.7	52.4	60.9	63.6	3.4	3.5	3.3
W31B	30427	794.9	124.9	113.2	104.5	10.3	8.2	6.4	60.4	65.9	63.5	5.2	5.4	4.9	46.0	53.0	54.8	2.8	3.5	3.4	46.1	53.2	55.1	3.7	3.9	3.6
W31C	17155	896.3	124.3	110.2	100.3	12.8	10.7	9.2	73.1	75.4	73.3	7.3	7.5	7.3	54.1	60.4	60.7	3.8	4.9	5.0	52.4	59.4	59.9	4.7	5.4	5.4
W31D	29456	785.4	120.0	108.7	100.4	9.7	7.7	6.0	58.2	63.5	60.9	4.9	5.1	4.7	44.6	51.4	53.0	2.5	3.3	3.2	44.7	51.4	53.2	3.5	3.6	3.5
W31E	33418	714.8	116.0	102.4	93.5	8.8	6.6	5.1	46.4	53.6	52.7	3.6	4.1	4.2	33.2	41.9	42.9	0.9	2.2	2.3	31.8	41.0	42.7	1.9	2.6	2.4
W31F	58333	692.7	129.7	115.0	105.4	10.5	7.8	6.5	49.7	59.5	57.5	3.5	4.3	4.3	37.5	48.4	48.7	1.2	2.5	2.8	35.0	47.3	48.1	1.8	2.9	3.0
W31J	55259	653.9	96.3	83.9	76.4	9.1	6.6	5.1	28.3	34.2	32.8	3.5	3.9	3.6	16.6	24.2	25.4	0.9	2.4	2.4	8.8	18.1	20.3	0.7	2.1	2.0
W31L	32138	661.7	99.4	86.8	79.0	9.4	6.9	5.4	29.0	35.4	33.9	3.5	4.1	3.8	16.9	24.9	26.1	0.9	2.5	2.5	8.8	18.5	20.9	0.7	2.1	2.1
W32A	41739	702.0	119.3	105.2	97.2	10.9	8.3	6.9	30.3	36.1	34.6	4.5	4.9	4.5	16.7	24.5	25.8	1.8	3.1	3.3	9.3	18.3	20.9	1.5	2.8	2.8

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
W32B	93412	901.0	199.7	180.7	167.6	25.1	21.1	18.4	46.4	59.7	59.1	8.1	10.2	9.9	24.2	36.7	39.8	3.0	5.5	6.3	13.7	28.8	33.5	2.2	4.9	5.6
W32C	72822	688.2	143.2	130.7	121.5	15.5	12.6	10.4	45.1	56.1	56.2	4.3	6.9	6.9	30.5	40.4	41.8	0.7	2.8	3.4	21.3	33.3	35.8	0.3	2.1	2.8
W32D	26722	785.0	114.0	101.6	93.9	12.9	10.1	8.3	42.4	47.6	46.9	4.5	5.6	5.3	28.6	35.7	36.9	1.1	2.8	3.3	27.1	35.2	37.0	1.2	2.9	3.4
W32E	45591	771.1	111.5	99.8	92.2	11.3	8.7	6.9	42.6	48.6	48.7	4.3	5.3	5.2	28.6	36.3	38.0	1.0	2.5	3.0	20.5	29.5	32.4	1.1	1.9	2.5
W32F	18734	783.6	145.4	130.3	121.4	16.6	13.1	10.9	52.3	58.9	56.9	6.6	7.3	6.9	34.5	43.1	44.8	3.3	4.2	4.4	24.7	35.8	38.8	2.7	3.6	3.7
W32G	64749	845.4	147.3	130.8	119.6	21.0	17.5	15.1	42.4	52.7	53.3	7.4	9.3	9.8	23.3	33.3	35.6	3.2	5.4	6.0	11.2	23.9	27.9	2.2	4.5	5.2
W32H	127506	959.2	200.7	178.7	163.0	28.8	24.3	20.8	57.9	71.1	70.7	9.9	12.3	11.9	29.7	44.1	45.5	3.8	7.1	7.5	14.6	33.0	36.8	2.3	6.0	6.8
W41A	18761	1019.4	271.7	250.7	234.1	24.0	21.2	19.1	127.8	147.7	151.8	12.2	13.6	13.6	90.9	110.2	118.2	5.0	7.0	7.9	86.3	107.3	116.8	8.2	9.3	9.7
W41B	30561	938.1	199.5	179.2	164.5	17.5	14.7	12.7	101.4	113.8	114.1	9.3	10.2	9.9	72.7	86.7	90.4	3.8	5.4	6.0	69.5	84.9	89.6	6.0	7.0	7.0
W41C	21731	927.8	193.6	173.6	158.9	16.8	14.1	12.0	99.2	111.0	110.9	9.0	9.8	9.4	71.3	85.0	88.1	3.5	5.2	5.7	68.2	83.1	87.3	5.8	6.6	6.7
W41D	23801	880.5	158.6	140.4	127.2	13.4	10.7	8.8	85.7	94.1	93.0	7.4	7.6	7.3	63.4	74.2	74.8	3.0	4.3	4.5	60.9	72.6	74.4	4.7	5.2	5.0
W41E	30317	837.5	120.1	104.8	95.0	10.6	8.2	6.7	66.6	73.3	73.1	6.0	6.2	6.1	52.8	60.2	61.8	3.2	4.1	4.3	49.3	57.7	60.3	4.1	4.4	4.3
W41F	34345	826.3	138.8	125.8	116.4	9.4	7.3	5.8	72.8	79.1	78.9	5.2	5.4	5.0	54.3	62.6	64.9	2.0	2.6	2.8	53.7	62.3	65.2	3.4	3.5	3.5
W41G	9579	778.3	98.7	88.3	81.0	7.9	6.1	4.5	41.4	46.1	43.7	3.4	3.9	3.2	29.8	36.0	37.2	1.5	2.2	2.2	29.6	36.0	37.4	2.2	2.4	2.4
W42A	39736	1058.3	291.2	269.3	252.1	25.7	22.7	20.4	132.9	155.0	159.9	12.7	14.3	14.4	94.3	115.1	123.7	5.2	7.6	8.1	89.7	112.2	122.3	8.6	10.0	10.2
W42B	41655	937.7	196.1	176.2	161.8	16.8	14.0	12.1	102.2	113.9	114.0	8.9	9.8	9.6	74.6	88.4	91.6	3.6	5.3	6.0	71.6	86.6	90.9	5.8	6.6	6.9
W42C	37656	1021.4	259.6	237.7	221.3	23.0	19.9	17.8	120.6	139.5	143.1	11.5	12.7	13.0	85.0	103.5	110.9	4.7	6.6	7.3	80.7	100.8	109.9	7.6	8.7	9.1
W42D	48940	885.8	172.5	156.4	145.7	13.2	10.7	8.9	83.3	92.6	95.3	6.8	7.3	7.0	63.6	74.3	77.5	3.5	4.2	4.3	61.6	72.9	76.8	4.8	5.3	5.0
W42E	23174	833.5	143.7	130.4	120.7	10.4	8.3	6.9	71.7	79.5	81.1	5.4	5.7	5.8	55.7	65.0	67.2	2.7	3.5	3.6	53.7	63.9	66.6	3.6	4.1	4.1
W42F	30553	830.6	144.7	131.5	121.8	10.6	8.5	6.9	72.1	80.2	82.0	5.6	5.9	5.8	55.8	65.4	67.7	2.8	3.6	3.4	53.8	64.2	67.2	3.8	4.2	4.0
W42G	24816	811.6	153.0	137.9	128.3	9.9	7.7	6.2	72.2	77.1	75.2	4.9	5.3	4.8	56.3	65.1	66.6	2.2	3.4	3.6	55.0	64.5	66.2	3.3	3.9	3.8
W42H	27290	774.0	112.1	101.5	93.4	8.9	6.9	5.3	54.9	59.6	56.6	4.4	4.6	4.0	42.6	48.9	49.8	2.3	2.8	2.8	42.5	49.0	49.9	3.1	3.2	3.1
W42J	29046	761.9	94.4	84.3	77.2	7.5	5.8	4.3	39.9	44.4	41.9	3.2	3.8	3.1	28.6	34.7	35.8	1.4	2.0	2.1	28.4	34.7	35.8	2.1	2.4	2.3
W42K	41597	803.3	133.6	118.8	108.3	12.1	9.7	7.7	71.4	76.6	72.2	6.3	6.7	6.0	55.1	63.4	63.7	3.6	4.7	4.5	54.6	63.1	64.2	4.6	5.1	4.7
W42L	25065	763.9	129.3	116.6	108.3	7.9	5.9	4.8	62.3	66.1	63.8	3.9	4.0	3.8	49.7	57.1	57.1	1.6	2.6	2.9	48.7	56.6	56.8	2.5	3.0	3.0
W42M	39157	747.2	125.9	112.4	102.9	12.5	10.0	8.1	57.2	62.8	59.4	4.8	5.4	4.8	43.9	52.0	51.9	2.7	3.4	3.4	42.2	51.0	51.6	3.3	3.4	3.5
W43A	24821	779.0	106.2	92.8	83.5	9.5	7.3	5.8	49.4	54.5	50.7	4.2	4.6	4.4	34.4	42.8	43.2	1.7	2.8	3.0	33.9	42.5	43.5	2.6	3.1	3.2
W43B	33170	783.2	103.1	90.0	81.0	9.1	7.0	5.4	47.9	52.3	48.5	3.9	4.3	4.0	33.7	41.6	41.8	1.6	2.8	2.8	33.4	41.4	42.0	2.5	3.0	2.9
W43C	39507	737.4	104.6	91.6	82.8	8.1	5.8	4.2	45.9	51.8	50.0	3.9	4.0	3.4	32.5	40.3	42.3	1.5	2.0	2.3	31.0	39.5	41.8	2.4	2.5	2.5

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
W43F	63143	654.7	103.5	93.3	86.4	8.5	6.6	5.4	36.8	42.9	42.8	3.5	3.9	3.8	27.0	33.7	34.9	1.3	2.1	2.2	20.8	28.4	30.4	1.5	2.2	2.3
W44A	25470	685.8	100.4	88.5	81.0	7.3	5.3	4.1	40.9	47.2	45.8	2.9	3.3	3.4	30.1	37.9	38.9	0.7	2.0	2.0	28.9	36.9	38.6	1.4	2.1	2.2
W44B	48608	660.1	67.9	59.1	54.1	4.7	3.2	2.2	30.1	32.6	31.3	1.8	2.1	1.8	23.1	28.3	27.8	0.5	1.5	1.3	21.5	27.5	27.0	0.8	1.5	1.2
W51A	62429	922.6	202.4	185.7	173.2	16.2	13.9	12.1	97.7	110.2	110.2	8.4	9.4	9.1	73.9	86.8	91.2	4.5	5.3	5.6	68.0	82.8	88.8	5.9	6.4	6.5
W51B	49644	864.3	172.0	154.9	142.9	12.8	10.2	8.4	97.0	106.2	104.9	7.3	7.7	7.0	71.3	83.5	85.2	3.6	4.6	4.3	71.8	84.0	87.0	5.2	5.7	5.3
W51C	67770	902.8	171.4	153.6	140.9	13.7	11.2	9.5	94.9	105.4	102.6	8.0	8.6	8.1	69.1	82.1	84.8	3.9	5.3	5.6	66.7	81.3	85.5	5.6	6.3	6.3
W51D	52741	901.1	158.2	142.4	130.7	13.1	10.7	9.0	89.7	96.7	95.4	8.1	8.2	7.9	66.4	75.7	79.0	4.6	5.2	5.5	64.5	74.0	78.2	5.8	6.0	5.9
W51E	27427	836.0	148.1	133.3	121.6	12.0	9.8	8.1	75.8	84.7	83.8	6.4	6.7	6.5	57.5	67.7	69.5	3.4	4.1	4.3	53.8	65.1	68.0	4.6	4.8	4.6
W51F	58934	872.8	157.5	141.3	128.9	12.7	10.3	8.4	89.8	96.3	91.4	7.4	7.7	7.0	65.5	75.8	76.8	4.3	4.9	4.8	64.1	75.4	77.5	5.3	5.6	5.2
W51G	42009	887.3	189.1	172.9	160.7	14.2	11.9	10.0	80.6	91.5	92.6	7.0	7.9	7.3	62.7	74.6	77.8	3.1	4.9	5.1	58.8	72.5	76.3	4.8	5.9	5.8
W51H	28644	865.0	158.7	144.1	133.7	10.3	8.0	6.2	58.5	69.4	71.1	3.6	4.5	3.8	42.4	54.2	58.2	0.3	1.8	1.9	39.0	52.1	56.7	1.7	2.7	2.6
W52A	28944	835.5	157.3	141.2	129.8	11.7	9.3	7.5	91.2	99.1	97.3	7.0	7.1	6.4	67.2	78.3	79.2	3.6	4.5	4.1	67.8	78.7	80.9	5.1	5.4	4.7
W52B	33618	860.8	154.6	136.6	124.3	11.5	9.2	7.7	91.3	95.8	91.4	7.0	7.2	6.4	67.3	77.4	78.2	3.5	4.6	4.7	66.0	76.7	78.1	4.9	5.2	5.3
W52C	17784	839.7	152.6	135.3	123.5	10.8	8.7	7.2	89.4	95.2	90.4	6.5	6.9	5.9	65.1	75.4	76.7	3.0	4.1	4.4	64.7	75.8	77.2	4.4	4.9	4.7
W52D	11929	854.0	161.3	143.5	131.3	11.5	9.2	7.8	92.6	99.8	95.4	6.8	7.1	6.5	67.3	78.3	80.3	3.1	4.3	4.6	66.6	78.7	80.9	4.6	5.1	5.3
W53A	54747	824.2	135.1	119.5	107.2	9.5	7.2	5.5	80.5	86.3	81.3	6.0	5.7	4.6	61.0	69.9	70.0	2.8	3.5	3.2	59.2	69.3	70.4	4.4	4.2	3.7
W53B	21854	857.0	155.6	138.8	125.6	11.3	9.0	7.2	89.1	97.8	94.2	7.1	7.0	6.0	66.9	77.1	79.0	3.3	4.2	4.1	64.7	76.3	79.3	5.2	5.3	4.8
W53C	31561	912.9	203.8	185.5	172.0	15.6	13.2	11.4	104.4	117.3	118.7	8.6	9.3	9.1	74.3	88.6	94.8	3.7	5.1	5.6	72.8	88.8	95.8	6.1	6.6	6.9
W53D	31471	866.5	169.2	152.0	140.1	12.7	10.4	8.9	93.7	102.6	101.2	7.5	7.9	7.6	66.7	79.2	83.1	3.2	4.5	5.0	66.1	79.6	83.9	5.1	5.6	5.8
W53E	42186	904.3	154.3	138.0	125.5	11.8	10.0	8.5	87.9	96.6	93.8	6.9	7.7	7.3	63.9	75.0	77.1	3.0	4.6	5.0	61.1	73.5	76.4	4.6	5.4	5.6
W53F	44733	903.9	200.1	180.8	166.4	15.9	13.0	10.7	100.5	113.6	114.6	8.9	9.4	9.1	74.3	88.7	92.5	3.6	5.7	5.8	71.1	87.1	92.1	5.9	6.8	6.5
W53G	38230	945.9	199.8	179.8	165.9	14.2	11.3	9.2	84.5	100.2	104.3	6.0	6.8	6.9	55.6	72.4	78.3	0.1	2.6	3.2	52.0	70.5	78.3	2.7	4.0	4.2
W54A	25108	784.6	116.4	104.2	95.4	6.9	5.5	4.4	64.0	69.6	67.4	3.9	3.8	3.4	49.2	57.0	57.5	1.7	2.3	2.0	46.9	55.4	56.9	2.6	2.9	2.5
W54B	28193	845.8	134.6	119.7	108.1	9.1	7.4	5.8	80.6	86.7	82.3	5.8	5.9	5.2	57.7	68.5	69.7	2.3	3.6	3.5	57.2	69.0	70.7	3.7	4.5	4.0
W54C	10745	867.3	149.1	133.3	121.4	10.5	8.4	7.1	87.3	95.1	92.0	6.6	6.6	6.3	61.8	73.6	76.3	2.8	3.9	4.2	60.9	73.7	77.3	4.4	4.8	4.8
W54D	13874	895.4	165.5	148.4	136.1	11.9	9.7	8.1	94.9	104.1	101.9	7.4	7.6	7.0	67.0	79.7	83.2	3.3	4.5	4.5	66.0	79.5	84.2	5.1	5.6	5.3
W54E	19412	962.5	205.2	186.9	172.6	16.0	13.6	11.7	110.0	125.3	128.5	9.8	10.4	10.3	78.7	93.9	99.0	3.9	5.9	6.3	74.8	91.4	98.3	6.8	7.5	7.3
W54F	26829	995.1	221.5	202.5	188.0	17.2	14.7	12.8	115.1	132.3	137.1	10.3	11.1	11.0	82.3	98.6	104.5	4.1	6.1	6.7	77.9	95.7	103.9	7.0	7.9	7.9
W54G	26532	948.9	153.5	136.5	124.6	11.6	9.1	7.4	67.2	78.3	80.2	5.3	5.3	5.0	45.9	58.0	62.9	1.2	2.1	2.5	42.1	55.2	60.8	3.0	3.2	3.3

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
W55A	68869	766.5	105.1	91.5	81.5	7.4	5.8	4.4	67.8	71.5	66.4	4.9	5.0	4.2	51.8	59.5	59.7	2.5	3.2	3.2	49.7	58.4	59.4	3.3	3.5	3.4
W55B	21783	849.7	142.6	126.5	114.2	10.0	7.9	6.6	85.0	94.9	90.3	6.2	6.6	6.1	63.1	73.6	76.4	2.8	3.8	4.4	60.1	72.2	75.6	4.2	4.6	4.7
W55C	53219	904.9	184.1	166.0	152.3	13.4	11.1	9.5	102.6	116.9	115.3	8.1	8.8	8.1	75.1	88.0	93.1	3.5	4.7	5.2	70.8	85.2	91.9	5.6	5.9	6.1
W55D	27086	901.4	172.2	154.9	142.2	12.5	10.3	8.7	97.7	107.7	105.8	7.8	7.9	7.5	68.6	82.0	85.7	3.3	4.6	4.8	67.6	81.6	86.5	5.3	5.9	5.6
W55E	16123	934.3	190.8	173.2	159.3	14.9	12.6	10.7	105.0	119.0	120.6	9.2	9.9	9.3	75.3	89.4	94.3	3.9	5.7	5.9	71.6	87.2	93.7	6.4	7.0	6.8
W56A	35972	921.8	213.3	194.9	180.4	17.6	15.1	13.2	106.2	122.5	124.5	9.7	10.7	10.3	77.3	93.2	99.3	4.3	6.2	6.6	73.1	90.1	97.4	6.7	7.6	7.6
W56B	22465	981.2	256.5	237.0	222.0	21.5	18.7	16.7	118.6	139.9	146.1	11.3	12.8	12.6	85.8	103.6	112.8	4.9	6.9	7.6	80.2	99.6	110.7	8.0	8.9	9.2
W56C	25269	1161.7	317.1	297.1	280.8	29.0	26.8	25.1	117.5	142.8	153.4	14.3	16.5	17.0	80.6	102.1	111.9	6.2	8.9	10.0	71.1	94.6	106.7	10.1	12.1	13.0
W56D	16568	1033.1	245.1	225.7	210.7	21.3	18.8	16.8	113.9	131.2	136.6	11.7	12.4	12.4	84.4	100.4	107.3	5.8	7.4	7.7	78.0	96.0	104.4	8.4	9.5	9.4
W56E	.	1126.9	275.3	253.6	237.0	22.1	19.4	17.2	101.0	123.3	130.8	9.3	10.9	10.6	66.6	85.1	93.0	1.7	3.9	4.4	58.3	79.0	89.2	5.3	6.8	7.0
W56F	.	904.7	158.7	141.4	129.5	12.4	9.8	8.1	66.9	80.4	81.0	5.1	6.1	6.0	44.4	58.8	62.6	0.8	2.9	3.1	40.5	56.5	61.7	2.6	3.8	3.8
W57A	.	823.1	179.8	162.5	149.1	14.1	10.9	8.5	57.1	71.3	70.6	5.7	7.1	6.3	40.4	53.5	56.0	2.8	3.9	4.0	37.5	51.9	55.5	3.9	4.6	4.4
W57B	.	784.9	137.8	123.3	112.6	9.8	7.6	6.0	51.7	62.7	62.1	4.7	5.2	4.4	36.8	46.8	49.5	1.7	2.7	2.8	32.8	43.9	47.6	3.0	3.5	3.2
W57C	.	753.7	121.8	110.1	101.4	9.2	7.4	5.9	41.2	49.2	49.7	4.1	4.4	4.1	30.7	40.0	42.3	1.7	2.5	2.5	27.0	37.0	40.1	2.8	3.2	2.7
W57D	.	860.9	156.6	142.0	131.8	10.1	7.8	6.2	57.9	68.6	70.4	3.7	4.3	3.8	42.0	53.5	57.6	0.2	1.7	2.1	38.6	51.3	56.1	1.6	2.6	2.7
W57E	.	699.4	116.9	102.9	94.5	8.1	5.4	3.8	40.4	47.2	45.5	3.5	3.5	2.9	29.2	38.0	38.8	1.7	2.3	1.9	27.4	37.2	38.5	2.4	2.5	2.0
W57F	.	770.8	112.5	99.7	91.0	8.0	5.9	4.6	41.2	48.0	47.5	3.5	3.8	3.3	30.3	37.6	39.0	1.2	2.1	2.1	27.3	35.8	38.2	2.0	2.5	2.4
W57H	.	711.7	102.0	88.6	80.3	8.3	5.9	4.3	40.8	46.2	45.5	4.0	4.0	3.4	28.9	37.1	37.9	1.5	2.6	2.2	26.7	35.6	37.2	2.4	2.9	2.4
W60A	.	1154.2	358.3	337.9	322.3	32.2	30.0	28.3	121.9	146.6	157.5	15.2	17.2	17.6	85.6	106.1	115.9	7.8	10.3	11.0	75.2	97.1	108.4	11.6	13.6	14.1
W60B	.	1204.8	386.4	365.3	349.2	34.3	32.0	30.2	127.2	154.0	165.9	15.7	17.6	18.2	89.1	110.9	121.4	7.6	10.3	11.0	78.4	101.5	113.6	11.5	13.7	14.2
W60C	.	1154.1	316.1	295.3	279.3	24.7	22.3	20.3	105.0	127.8	135.4	9.1	10.8	11.0	69.9	90.2	98.2	2.3	4.7	5.2	61.5	83.1	92.3	5.7	7.6	7.7
W60D	.	942.4	214.9	196.4	183.9	16.8	14.1	12.3	78.2	93.6	99.4	6.0	6.8	6.4	51.9	67.7	74.8	0.7	2.5	3.1	47.9	65.3	73.6	3.0	4.2	4.4
W60E	.	807.3	140.6	127.4	118.0	10.2	8.3	6.8	59.2	70.8	72.2	3.9	4.2	3.9	41.1	53.4	57.8	0.5	1.9	1.9	38.8	52.2	57.7	1.8	2.7	2.4
W60F	41808	807.9	159.6	143.7	133.2	12.4	9.9	8.3	52.4	61.1	63.1	5.3	5.6	5.3	36.1	46.9	50.3	1.9	3.1	3.1	32.9	44.5	49.0	3.2	3.8	3.8
W60G	.	909.7	189.3	172.1	159.1	14.1	11.5	9.6	68.9	85.9	88.2	5.2	6.3	5.8	48.3	64.2	69.7	0.7	2.7	3.1	43.3	60.3	67.7	2.9	3.9	4.0
W60H	.	794.7	143.0	128.2	117.4	10.2	8.0	6.4	53.1	64.6	64.5	4.8	5.4	4.7	37.4	47.9	51.0	1.6	2.7	2.9	33.2	44.9	49.0	3.0	3.5	3.4
W60J	.	819.1	150.2	134.4	124.0	12.8	10.2	8.3	52.5	60.7	62.3	6.0	6.2	5.8	37.5	46.7	50.0	2.8	3.6	3.5	33.0	43.5	47.7	4.0	4.4	4.0
W60K	66479	822.7	160.3	144.4	134.2	12.8	10.3	8.7	53.1	62.8	65.4	5.8	6.0	5.9	37.8	47.7	51.6	2.2	3.2	3.4	33.3	44.4	49.1	3.7	4.3	4.0
W70A	258736	767.7	147.8	131.7	121.6	14.4	11.4	9.5	36.6	44.9	43.0	5.8	6.8	5.9	19.3	29.8	30.9	2.3	4.3	4.1	10.6	22.6	25.1	1.9	3.8	3.7

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
X11A	67182	687.7	73.9	63.5	56.6	4.1	2.9	1.9	48.5	49.0	44.0	2.6	2.4	1.8	38.0	42.8	40.7	1.2	1.7	1.3	39.6	43.5	41.3	1.8	2.0	1.4
X11B	59662	716.2	77.2	65.8	58.0	5.2	3.5	2.4	48.7	51.3	47.1	3.2	3.0	2.4	38.3	44.5	43.4	1.6	1.9	1.8	38.7	44.6	44.1	2.4	2.1	2.0
X11C	31880	715.1	86.2	74.1	66.3	5.3	3.9	2.9	53.5	56.1	51.8	3.1	3.1	2.6	38.7	46.1	46.7	1.0	1.8	1.9	40.8	48.1	47.8	1.9	2.3	2.2
X11D	59035	744.0	102.6	89.5	79.7	6.5	5.0	3.8	60.3	65.8	61.5	3.6	3.9	3.4	43.4	52.2	53.1	1.1	2.0	2.2	45.7	54.2	54.9	2.2	2.7	2.7
X11E	24140	760.8	110.8	97.3	86.8	7.2	5.6	4.3	70.0	74.1	68.2	4.5	4.7	3.9	50.1	58.6	59.0	1.7	2.6	2.6	49.7	58.7	59.5	2.8	3.2	3.0
X11F	18251	817.0	128.8	115.0	104.4	8.8	7.2	6.2	77.3	84.0	80.8	5.1	5.4	5.3	58.4	67.4	68.6	2.2	3.0	3.4	55.9	66.4	68.7	3.5	3.8	3.9
X11G	26373	864.4	162.8	147.9	136.0	12.1	10.5	9.0	89.8	104.5	105.7	6.8	7.8	7.8	65.3	79.0	84.5	2.9	4.2	4.8	62.4	77.1	84.0	4.5	5.2	5.5
X11H	26513	947.1	182.3	165.4	151.5	14.9	12.6	10.9	100.2	112.0	111.6	9.4	9.5	8.6	77.6	90.8	93.5	5.6	6.5	6.4	69.2	83.6	87.9	7.2	7.5	7.1
X11J	18620	1030.9	254.1	236.2	222.1	21.3	18.8	17.1	126.6	146.1	152.1	12.9	13.4	13.2	96.9	113.1	121.7	7.5	8.5	9.0	85.4	103.0	113.6	10.1	10.5	10.5
X11K	21070	891.3	143.2	127.3	115.7	11.4	9.3	7.8	84.2	91.3	90.1	7.3	7.2	6.5	66.1	75.9	76.9	4.5	5.2	4.9	59.4	70.5	72.8	5.6	5.9	5.3
X12A	24433	800.9	142.9	127.8	116.4	10.5	8.1	6.6	83.3	89.9	87.0	5.6	6.1	5.6	59.7	71.7	74.6	2.0	3.0	3.9	59.1	72.7	75.9	3.4	4.0	4.4
X12B	15477	832.8	165.2	149.0	137.0	12.7	10.1	8.4	91.7	102.3	100.5	6.6	7.5	6.9	65.1	78.1	83.7	2.6	3.4	4.3	63.9	78.7	85.3	4.3	4.5	5.3
X12C	18613	882.0	189.8	172.4	159.2	14.7	11.7	9.8	100.6	114.6	113.3	7.5	8.5	7.9	71.3	85.6	91.9	2.9	3.6	4.5	69.9	85.9	93.3	5.1	5.1	5.7
X12D	22295	862.4	172.6	155.3	142.8	13.0	10.2	8.3	95.0	105.3	103.3	6.8	7.5	6.7	68.1	80.9	86.1	2.5	3.5	4.1	67.0	81.6	87.7	4.5	4.7	5.1
X12E	33265	887.6	168.0	149.3	134.4	15.8	12.6	10.1	102.2	113.9	106.1	10.0	10.9	9.5	73.7	86.9	90.2	4.5	6.4	6.7	71.3	85.7	89.8	6.3	7.3	7.2
X12F	31271	880.8	192.2	174.2	160.7	15.1	11.9	10.0	102.0	115.6	114.3	7.8	8.7	8.1	72.3	86.1	92.4	3.2	3.6	4.5	70.9	86.4	93.7	5.4	5.3	5.7
X12G	23873	901.7	149.5	133.3	121.3	12.0	9.8	8.3	86.9	94.6	93.7	7.7	7.5	6.9	67.9	78.4	79.6	4.5	5.3	5.1	61.0	72.6	75.1	5.9	6.1	5.6
X12H	28568	916.1	193.6	175.5	160.9	15.7	13.2	11.2	99.3	113.0	112.0	8.7	9.6	8.9	72.6	87.7	91.9	4.1	5.8	5.9	69.1	85.6	90.7	5.9	6.9	6.7
X12J	29567	1156.4	360.0	341.9	327.6	31.0	28.7	27.1	147.2	170.9	182.6	16.8	18.2	18.3	108.9	129.2	140.0	9.2	10.9	11.6	96.7	118.5	130.3	12.9	14.3	14.8
X12K	28619	902.5	191.5	173.6	159.1	15.7	13.2	11.1	98.6	112.2	111.2	8.8	9.6	8.8	71.9	86.9	91.2	4.1	5.8	5.8	68.5	84.8	89.9	6.1	6.9	6.6
X13A	24480	1193.2	367.3	348.8	334.9	33.0	30.9	29.5	124.0	148.7	160.0	15.8	17.9	18.3	86.6	107.7	119.7	7.8	10.2	11.4	74.5	97.3	110.3	11.5	13.6	14.4
X13B	23673	1158.9	312.5	293.4	278.7	24.8	22.6	20.8	105.7	127.1	136.0	10.1	11.8	11.9	70.2	89.5	98.9	2.9	5.1	5.8	59.8	81.0	91.4	6.2	8.1	8.2
X13C	19521	1262.2	428.2	406.8	390.2	37.8	35.4	33.5	134.4	163.8	177.2	17.1	19.0	19.6	94.4	117.5	129.0	7.8	10.6	11.5	82.7	106.9	120.5	12.5	14.5	15.1
X13D	18066	1194.0	340.0	320.8	305.8	26.8	24.6	22.9	110.4	134.2	143.6	10.5	12.6	12.6	73.4	94.0	104.2	2.7	5.0	5.9	62.2	84.8	96.1	6.2	8.3	8.7
X13E	21153	1037.5	281.6	261.3	246.3	23.4	20.2	17.8	86.8	106.2	110.9	8.5	10.0	9.9	57.1	76.1	83.1	2.0	4.8	5.0	50.0	70.8	78.9	4.2	6.3	6.3
X13F	21686	1015.7	268.2	248.3	233.0	21.2	18.5	16.6	91.4	113.6	120.8	7.7	9.6	9.7	59.6	78.1	87.1	1.4	3.1	3.8	50.8	71.3	82.1	4.3	5.5	6.0
X13G	33471	833.3	144.3	128.3	117.6	11.1	8.9	7.3	63.9	73.4	73.0	5.0	5.6	5.0	43.1	53.9	57.0	1.2	2.5	2.4	38.3	50.5	55.2	2.8	3.4	3.2
X13H	30548	741.3	135.0	120.8	111.8	9.7	7.4	6.1	49.1	58.3	57.8	3.9	4.2	4.2	33.3	42.9	46.7	0.6	1.7	2.3	31.1	41.5	46.0	2.1	2.6	2.8
X13J	78930	680.7	100.0	89.6	82.4	7.2	5.6	4.5	34.3	41.3	41.7	3.3	3.7	3.3	25.4	32.9	34.2	1.5	2.2	2.2	22.2	30.8	33.0	2.0	2.6	2.4

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
X14A	14080	1246.6	420.6	402.2	388.4	37.1	35.0	33.4	138.6	166.1	180.4	17.9	20.1	20.5	97.9	120.6	133.6	9.3	11.7	12.4	82.7	105.6	120.2	13.8	15.9	16.3
X14B	18523	1227.2	375.8	356.4	340.8	30.2	28.0	26.3	122.1	148.3	160.0	12.8	14.9	14.9	81.3	103.0	114.1	4.6	6.8	7.5	67.7	90.4	102.9	8.7	10.6	11.1
X14C	16577	1120.6	287.1	268.3	253.8	22.8	20.4	18.6	100.9	120.9	128.7	9.6	11.0	11.0	66.9	85.2	93.7	2.8	4.8	5.3	57.4	77.3	87.4	6.0	7.3	7.6
X14D	12858	1131.7	349.8	329.3	314.8	23.1	20.5	18.6	101.9	122.7	132.2	8.3	9.6	9.4	64.5	83.2	92.7	0.1	1.9	2.6	58.3	78.6	88.9	4.6	5.9	5.9
X14E	17731	980.8	240.5	224.2	212.3	15.4	13.1	11.5	80.8	100.0	108.2	6.1	6.7	6.8	52.3	67.9	75.8	-0.2	1.3	1.9	47.9	64.9	74.1	3.2	3.9	3.9
X14F	11747	1248.5	463.7	443.1	426.5	30.9	28.3	26.3	105.4	134.8	149.8	9.1	11.2	12.0	67.0	89.2	102.0	-0.3	1.8	2.9	52.8	75.9	90.6	5.0	6.1	6.8
X14G	20417	894.4	202.2	186.8	175.7	12.8	10.7	9.2	63.9	77.1	81.7	3.8	4.6	4.6	41.9	55.8	62.7	-0.3	0.8	1.1	35.4	51.3	59.6	1.9	2.5	2.7
X14H	35978	741.2	123.8	111.5	103.3	8.8	7.0	5.8	41.3	49.8	53.8	3.4	3.5	3.6	28.1	37.8	41.9	0.7	1.5	1.7	23.5	34.5	39.3	2.1	2.4	2.4
X21A	26493	764.4	129.3	115.2	104.0	8.9	7.1	6.0	74.3	82.4	80.7	5.0	5.2	4.7	54.6	64.5	68.9	2.5	2.8	3.1	58.9	67.8	71.4	4.2	3.9	3.9
X21B	37831	706.0	92.7	80.7	72.2	6.6	5.2	4.2	54.6	56.7	55.6	4.2	3.8	3.2	42.6	48.2	48.4	2.4	2.7	2.5	44.2	49.1	49.2	3.5	3.2	2.8
X21C	31103	758.7	92.3	81.0	73.0	6.4	4.8	3.7	49.8	55.1	53.9	3.3	3.3	3.0	34.2	42.7	44.3	1.0	1.6	1.6	32.5	41.6	44.1	2.1	2.1	1.9
X21D	21913	733.7	84.9	72.5	64.0	6.3	4.9	4.0	49.4	50.1	48.2	4.1	3.6	3.2	34.8	39.8	39.7	2.2	2.6	2.2	33.1	38.4	38.8	3.0	2.9	2.5
X21E	34510	870.7	126.1	110.6	98.7	11.4	9.5	8.0	67.3	74.0	71.0	6.8	6.9	6.3	46.8	54.8	56.2	3.7	4.2	4.1	42.4	52.3	55.0	5.1	5.1	4.7
X21F	39672	755.8	97.5	85.3	76.8	6.5	5.1	4.2	57.5	62.0	59.4	3.6	3.7	3.5	44.2	51.8	52.2	1.2	2.2	2.4	45.2	53.0	53.4	2.4	2.7	2.7
X21G	34733	796.5	110.6	96.3	85.6	7.7	5.9	4.7	53.2	65.1	64.3	3.2	3.9	3.9	36.1	47.1	50.2	0.6	1.4	1.9	38.2	49.0	52.1	2.2	2.4	2.6
X21H	22885	1067.3	246.6	226.4	211.1	21.1	18.4	16.7	104.1	123.3	130.1	11.7	12.3	12.2	72.6	87.6	96.0	6.0	6.8	7.4	60.3	76.8	87.2	8.9	9.0	9.1
X21J	35460	917.4	182.9	164.8	150.8	14.5	12.3	10.5	88.9	102.4	105.9	8.1	8.4	8.1	57.5	70.0	75.5	2.6	3.7	4.1	55.1	68.9	76.0	5.4	5.6	5.4
X21K	24513	1058.2	264.4	244.5	229.2	22.2	19.9	18.2	98.9	117.8	128.7	10.7	11.1	11.6	68.1	82.5	90.4	4.7	5.8	6.3	60.0	75.1	85.6	8.2	8.4	8.3
X22A	25136	985.1	227.8	209.7	196.2	21.3	19.2	17.8	96.0	112.3	120.7	10.9	11.6	12.3	66.9	79.9	86.6	5.8	6.5	7.1	60.5	74.3	82.3	8.8	8.8	8.8
X22B	22665	977.5	224.8	205.9	192.3	16.7	14.2	12.4	87.9	106.5	112.5	6.5	7.4	7.4	58.8	73.6	82.0	1.9	2.7	3.0	53.8	69.9	80.3	4.4	4.4	4.3
X22C	36619	942.3	203.1	184.8	171.0	16.2	13.9	12.1	81.7	94.1	95.3	7.8	8.4	8.1	55.1	67.9	72.2	3.1	3.9	4.1	50.2	64.2	69.9	5.3	5.8	5.5
X22D	27445	1174.9	378.7	359.8	345.0	31.2	29.1	27.7	127.6	152.0	166.0	15.1	15.9	16.4	89.1	109.8	121.6	7.1	8.6	9.4	77.6	99.3	113.3	11.9	12.9	13.2
X22E	15300	1121.9	311.9	292.4	277.9	22.5	20.1	18.4	103.8	124.0	133.2	10.1	10.7	10.5	69.3	87.1	95.8	3.3	4.6	5.0	61.9	81.5	91.3	7.3	8.1	7.9
X22F	21241	937.8	218.5	202.6	190.5	14.9	12.8	11.3	73.2	89.5	96.4	6.7	7.0	6.9	50.9	62.6	69.1	2.2	3.0	3.4	42.3	56.2	64.1	4.8	5.0	4.9
X22G	10744	1100.0	319.0	300.3	285.6	23.1	21.0	19.5	96.4	120.8	132.1	9.5	10.9	11.4	63.2	80.3	89.5	2.8	4.2	4.9	48.6	68.2	79.3	6.4	7.5	7.9
X22H	20017	923.0	210.3	193.4	180.5	15.4	13.1	11.5	69.7	84.4	90.0	7.5	7.5	7.3	47.9	58.1	63.5	3.2	3.7	3.9	39.5	52.0	58.8	5.6	5.5	5.3
X22J	23988	816.7	117.9	102.1	91.9	10.0	7.6	6.3	55.7	62.3	61.7	5.1	5.0	5.1	38.0	45.3	48.6	2.0	2.4	2.9	30.9	40.8	46.1	3.0	3.0	3.2
X22K	33490	866.7	173.0	155.1	141.9	13.4	11.0	9.3	69.5	83.3	83.5	6.1	7.2	7.4	45.6	57.5	62.5	1.3	2.7	3.6	39.0	53.7	61.2	3.4	4.0	4.6
X23A	12681	1114.2	286.2	267.8	252.6	23.1	20.9	19.1	104.9	126.0	134.1	11.8	12.9	12.4	74.4	91.2	98.0	5.4	6.8	6.9	61.9	79.7	88.7	8.9	9.9	9.6

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
X23B	22913	838.6	155.5	140.0	128.3	9.9	7.8	6.3	67.7	80.9	81.3	4.2	5.0	4.8	45.3	59.6	63.7	-0.2	1.6	2.3	42.1	57.3	62.9	1.8	2.7	2.8
X23C	8129	1116.2	294.6	275.1	260.2	19.7	17.4	15.7	105.6	127.2	139.1	8.5	9.4	9.7	71.2	88.7	98.9	1.9	3.4	3.9	62.1	80.3	92.8	5.5	6.2	6.2
X23D	18187	818.1	140.9	124.9	112.9	10.1	8.0	6.5	61.8	72.1	70.2	5.0	5.5	5.3	41.1	53.3	55.4	1.0	2.7	3.1	38.3	51.4	54.8	2.8	3.5	3.6
X23E	18039	1018.4	228.3	210.4	196.1	15.2	13.0	11.4	90.4	110.2	115.9	7.1	7.5	7.5	61.1	76.5	85.0	1.9	3.1	3.6	54.0	70.4	81.4	4.8	5.0	5.2
X23F	30958	838.4	152.2	135.4	122.8	11.1	8.9	7.2	64.9	76.7	76.0	5.4	6.1	5.7	42.6	55.6	58.7	1.1	2.8	3.2	39.4	53.2	57.9	3.0	3.9	3.7
X23G	22509	896.4	157.6	138.7	124.6	13.2	10.4	8.5	71.7	82.7	83.0	7.2	7.3	7.1	47.5	59.2	61.6	2.4	3.6	3.8	42.6	56.0	60.0	4.3	4.8	4.6
X23H	30605	884.9	173.9	158.9	148.1	13.3	11.5	10.2	64.5	74.8	76.8	6.9	7.2	6.6	44.0	53.8	57.8	3.1	3.9	3.8	36.3	47.5	52.9	4.9	5.3	5.0
X24A	24851	729.2	115.1	100.4	90.5	10.1	7.7	5.8	47.0	53.5	52.4	4.7	4.7	4.2	33.0	41.3	41.9	2.0	2.4	1.9	28.5	38.3	40.5	3.1	3.1	2.5
X24B	33496	708.0	97.2	85.0	76.8	8.9	7.1	5.9	39.1	46.9	48.3	3.9	4.3	4.5	28.5	35.8	38.4	1.9	2.6	2.5	23.3	32.1	35.7	2.8	3.0	2.8
X24C	28570	739.0	100.7	87.7	78.8	7.1	5.3	3.6	46.0	50.3	47.4	3.4	3.9	3.0	31.8	39.2	39.6	0.6	1.9	1.7	28.7	37.7	38.7	1.7	2.4	2.1
X24D	30185	831.1	215.7	198.5	186.6	13.6	11.3	9.6	64.3	79.8	83.4	4.7	6.0	5.6	43.2	57.9	62.4	0.2	2.0	2.5	38.4	54.5	60.4	2.7	3.7	3.8
X24E	52598	650.2	126.0	113.6	104.8	7.8	6.0	4.7	43.2	53.1	54.3	3.1	3.6	3.8	29.3	39.9	42.6	0.9	1.6	1.9	26.7	38.1	41.9	2.0	2.2	2.3
X24F	26206	663.0	131.2	118.4	109.5	8.0	6.4	5.0	44.3	54.6	56.1	3.1	3.7	4.0	29.9	40.7	43.9	0.7	1.6	1.9	27.3	38.9	43.2	1.9	2.4	2.3
X31A	23007	1232.6	410.2	392.8	379.1	30.0	28.1	27.0	139.1	159.2	172.7	15.7	16.1	16.3	99.9	120.3	131.4	7.2	8.2	8.7	86.5	107.4	118.9	12.6	13.3	13.3
X31B	19517	1248.0	409.2	390.5	375.5	28.7	26.8	25.2	115.5	136.8	148.4	11.7	12.9	12.7	78.5	97.7	107.8	3.4	4.9	5.1	67.2	87.0	97.7	8.7	9.9	9.8
X31C	15397	1311.3	438.6	423.2	410.8	30.5	29.1	28.1	125.5	144.7	158.9	13.6	14.7	15.6	93.0	111.1	122.3	5.1	6.6	7.5	69.6	87.2	99.5	10.5	11.6	12.0
X31D	19199	937.0	190.5	177.0	167.2	11.4	10.0	9.0	68.0	80.3	86.0	5.2	5.5	5.5	47.4	58.4	64.4	0.9	2.0	2.4	38.3	50.9	58.3	3.3	3.7	3.8
X31E	21383	1254.2	413.6	395.5	380.7	29.6	27.7	26.2	109.4	130.3	139.2	11.7	13.1	13.1	74.8	94.0	103.1	3.1	5.0	5.6	54.0	74.4	84.5	8.0	9.6	9.8
X31F	9399	1334.1	494.1	475.4	460.2	32.4	30.4	29.1	111.5	137.4	153.1	12.2	13.6	13.9	75.6	96.1	108.1	3.1	4.6	5.5	55.5	77.3	90.6	8.8	10.0	10.3
X31G	16854	983.5	269.9	251.2	237.4	18.6	15.7	13.8	79.8	99.4	105.5	6.5	6.6	6.4	51.6	69.0	75.0	0.9	2.2	2.3	43.0	63.2	70.1	3.9	4.6	4.0
X31H	6042	1169.0	354.2	334.3	319.9	23.6	21.2	19.5	102.4	120.7	128.8	10.4	10.9	10.4	65.6	83.3	91.0	2.8	4.3	4.3	50.2	69.9	79.0	6.8	8.0	7.6
X31J	15429	896.7	215.9	199.1	188.2	14.5	12.0	10.5	70.1	85.5	91.8	5.1	5.1	5.3	46.0	60.5	67.1	0.6	1.6	1.8	39.0	55.4	63.2	3.1	3.3	3.1
X31K	48754	680.2	94.0	83.6	76.6	6.4	5.0	3.7	37.6	44.2	44.9	2.5	3.0	2.9	26.0	33.9	36.4	0.7	1.3	1.3	22.9	32.2	35.3	1.5	1.7	1.6
X31L	30384	743.5	145.0	130.7	121.2	10.1	7.9	6.2	51.7	62.0	63.0	3.7	4.3	4.2	34.9	45.6	49.0	0.7	1.4	1.4	31.4	43.9	48.1	2.0	2.4	2.3
X32A	11220	1048.6	270.3	253.5	240.6	17.3	15.5	14.4	76.5	93.8	102.6	7.2	7.7	8.0	49.6	63.5	71.4	1.2	2.2	3.0	38.5	53.7	62.6	4.9	5.1	5.4
X32B	5531	972.3	202.5	186.8	174.6	13.1	11.6	10.4	67.1	82.4	88.0	5.9	6.8	6.7	42.8	57.6	64.5	1.3	2.7	3.3	34.3	50.2	58.7	3.9	4.6	4.7
X32C	23334	759.0	158.4	143.3	133.6	9.5	7.4	6.1	52.2	62.0	64.5	3.8	4.0	4.1	34.4	44.0	47.2	1.1	1.5	1.6	30.7	42.3	46.7	2.5	2.4	2.3
X32D	9999	1126.7	410.1	388.4	372.6	33.6	30.8	29.0	101.3	124.6	134.8	10.8	12.2	13.0	65.0	83.3	93.2	3.2	4.7	5.7	55.6	75.6	87.2	7.7	8.4	9.0
X32E	7826	920.8	250.4	232.9	220.1	21.5	19.0	17.2	76.8	92.0	98.0	8.1	9.0	9.3	49.7	63.7	69.7	2.9	4.1	4.5	43.5	59.3	66.4	5.6	6.3	6.5

QC	AREA	MAP	ASTF	AMTF	ADTF	ASLF	AMLF	ADLF	ESTFR	EMTFR	EDTFR	ESLFR	EMLFR	EDLFR	PSTFR	PMTFR	PDTFR	PSLFR	PMLFR	PDLFR	WSTFR	WMTFR	WDTFR	WSLFR	WMLFR	WDLFR
X32F	15731	719.7	92.8	81.6	73.9	7.3	6.0	5.2	34.9	42.3	44.7	3.4	3.6	3.5	24.1	31.6	34.5	1.6	1.9	2.2	18.3	27.2	31.8	2.3	2.5	2.6
X32G	33554	662.8	112.6	100.9	93.2	7.6	5.5	4.1	40.2	47.8	48.3	3.0	3.1	2.9	28.1	37.0	38.8	0.4	1.2	1.1	25.4	35.6	38.3	1.6	1.9	1.7
All QC's	**AREA**	**MAP**	**ASTF**	**AMTF**	**ADTF**	**ASLF**	**AMLF**	**ADLF**	**ESTFR**	**EMTFR**	**EDTFR**	**ESLFR**	**EMLFR**	**EDLFR**	**PSTFR**	**PMTFR**	**PDTFR**	**PSLFR**	**PMLFR**	**PDLFR**	**WSTFR**	**WMTFR**	**WDTFR**	**WSLFR**	**WMLFR**	**WDLFR**
Max	258736.0	1812.8	1195.0	1181.6	1169.9	85.2	83.8	82.7	176.3	203.8	223.8	27.5	28.3	28.8	144.7	168.8	182.7	13.4	17.2	19.1	116.5	140.1	160.0	25.1	26.0	26.3
Min	5531.0	647.0	33.8	27.2	24.1	2.2	1.0	0.4	17.7	22.3	20.8	1.1	0.9	0.4	9.9	15.7	17.5	-0.5	0.3	0.1	8.8	15.5	17.5	0.1	0.5	0.2
Average	35399.9	840.2	165.9	151.9	141.7	16.4	14.2	12.6	63.6	73.2	74.7	7.3	8.2	8.0	46.6	56.9	60.2	3.5	4.9	5.2	43.8	54.6	58.5	5.0	6.0	6.1

7. DATA STORAGE AND AVAILABILITY

The following sets of data were generated during the course of the project and are stored on computer servers. These data are the property of the Water Research Commission and the Department of Water Affairs and Forestry and are available, with permission from these organizations, from Mr. MB Gush, CSIR (Environmentek), % Agrometeorology, UNP, P/Bag X01, Scottsville, 3209.

7.1 Verification study data

Input data for inclusion in the *ACRU Menubuilder* were assimilated for all the catchments utilised. This included all relevant soil, weather, land cover and catchment attribute data, as well as individual parameter data. These data were stored in their original menu format as well as in a readily accessible tabular format in an MS Word document. Additional files required by the *ACRU* model such as composite daily input files and dynamic land use change files were also stored. Daily and monthly streamflow outputs generated from the simulations for all catchments were stored in Excel spreadsheets with associated graphical displays. Daily and monthly comparative statistical outputs were also included in these spreadsheets.

7.2 National Quaternary Catchment streamflow reduction estimation data

ACRU-generated input menus and output files utilized in the Quaternary Catchment simulations were stored on the CCWR mainframe. Output data stored for each Quaternary Catchment with an MAP greater than 650 mm included mean, median, 10, 20, 80 and 90 percentile values for monthly and annual streamflow totals. These values were stored for Acocks baseline veld type, eucalypt, pine and wattle simulations. All mean and median values were also stored in Excel spreadsheets with graphical displays of streamflow reductions per Quaternary Catchment, tree genus and soil depth (see Appendix 6.1).