ENVIRONMENT CANADA

CONSERVATION AND PROTECTION

A QUADRATIC PROGRAMMING MODEL OF THE SOUTH SASKATCHEWAN RIVER BASIN

USER'S MANUAL

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ABSTRACT

A prototype water-use optimization model for the South Saskatchewan River Basin was developed by staff of Pacific and Yukon Region. Quadratic programming was used and solved by the non-linear programming software called MINOS at the University of British Columbia. Access to the model is through the commercial account of Water Planning and Mangement Branch at the university. The model can be changed and solved from remote locations using dial-up ports or DATAPAC lines. The model allocates water use in the Basin with the objective of maximizing economic returns over a given year. The Basin is broken down into five sub-basins, with five final use activities over a time period of 12 individual months. The detailed equational structure of the model and methods of accessing it and editing the relevant files are presented. Many of the relationships are based on preliminary data or rough estimates. However, the basic structure of the model will not have to be significantly changed once better data have been obtained.

RESUME

Un modèle prototype d'optimization de l'utilisation d'eau pour le bassin de la rivière Saskatchewan Sud fut développé par le personnel des Eaux Intérieures et Terres de la région du Pacifique et du Yukon. Le modèle emploie une méthode de programmation quadratique qui est résoulue par le logiciel de programmation non-linéaire MINOS de l'université de la Columbie-Britannique. Ce modèle est accessible à travers un compte de la direction de planification et gestion des eaux à l'université. Le modèle peut être modifié et résoulu à partir d'un endroit eloigné en utilisant des lignes téléphoniques ou par DATAPAC. Le modèle alloue l'utilisation d'eaux dans le bassin afin d'atteindre le maximum de débit économique annuel. Le bassin est divisé en cinq sous-bassins et chacun comprend cinq catégories d'utilisation d'eau pour douze mois. Les équations du modèle sont présentées en détails ainsi que les façons d'aborder it de rédiger un fichier. Plusieurs rapports du modèle sont basés sur des données préliminaires ou des estimations brutes. Cependant, quand de meilleures données seront obtenues il ne sera pas nécessaire de changer de manière significative la base du modèle.

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I. INTRODUCTION

Multiple use of the water resource is an important issue in the South Saskatchewan River Basin. Managing the available water and allocating it among various users will continue to be a challenge for the agencies involved, especially as demands for water increase. The operation of Lake Diefenbaker is critical since it is the major reservoir in the system providing storage for consumptive uses while maintaining lake levels for power generation and recreation. In this study an optimization model is developed with the object of providing a tool for managers of the system to aid in determining the allocation of water and storage management in the Basin.

The model developed is a prototype model and relies heavily on secondary data and in some cases rough estimates of economic and physical parameters. Considerable effort would be required to improve the data and estimates which are used in the model. However, the structure of the model itself has proved to be logically consistent and is flexible in terms of incorporating new data or changing its geographical configuration or resolution. It is not anticipated that any major structural changes to the model would have to be made in order for it to be a useful tool for water management and planning in the Basin.

A. The Optimization Approach

The approach used in the development of the model is to attempt to maximize economic benefits from the allocation and management of the water in the Basin. Although it is not possible to quantify all the benefits from water use in dollar terms, reasonable estimates for the major water users (both consumptive and non-consumptive) can be obtained. Constraints can be imposed on the model to ensure that the solution meets environmental and social criteria that cannot be quantified in dollar values. It is important to note that the model should only be used as an aid to management and planning of the system. The final allocation of water in the system should depend not only on the quantifiable economic benefits, but also on the non-quantifiable environmental and social factors.

Economic benefits are defined as in traditional benefit-cost analysis. This implies that water is valued based on the wilingness-to-pay for it by the people or industries who use it. Depending on the situation, there are many ways to obtain an estimate of the willingness-to-pay and this study uses whatever method is most appropriate or feasible for the particular situation.

B. Quadratic Programming

In this study a quadratic programming model is constructed which represents the allocation of water within the Basin. A quadratic programming model consists of a quadratic objective function to be maximized subject to a number of linear constraint equations. For example, the following equations form a quadratic program.

$$\text{Maximize } Z = 2A + 3A^2 + 2AB - 4B + B^2$$

subject to: $A < 10$

$2A + 3B > 20$

$B > 5$

where Z = the function to be maximized

$A \& B$ = non-negative variables

This model is solved when we find the values of the A and B variables which result in the maximum value of function Z while satisfying the three constraints. There are several computerized algorithms which can solve a quadratic program quite efficiently. It is therefore feasible to solve a very large model (i.e. a model with a thousand variables and a thousand constraints) in a few seconds of mainframe computer time.

When applying quadratic programming to modeling the allocation of water in a river basin, the objective function would be used to represent the economic benefits associated with the use of water by various activities. For example the variable A in the above problem might represent the amount of water used by the domestic sector while the variable B could represent the water use for hydro-power generation. The objective function is simply a mathematical expression of the benefits from using the water in these sectors. It so happens that quadratic functions are usually quite appropriate forms for representing economic benefits associated with use of a commodity.

The linear constraints can be used to model the physical supplies and distribution of water in the system. Factors such as storage, maximum/minimum flows, evaporation, return flows, and diversions can be readily modeled as linear equations. Logical constraints such as storage balance equations and supply-demand relationships can also be modeled as linear equation in a straightforward manner.

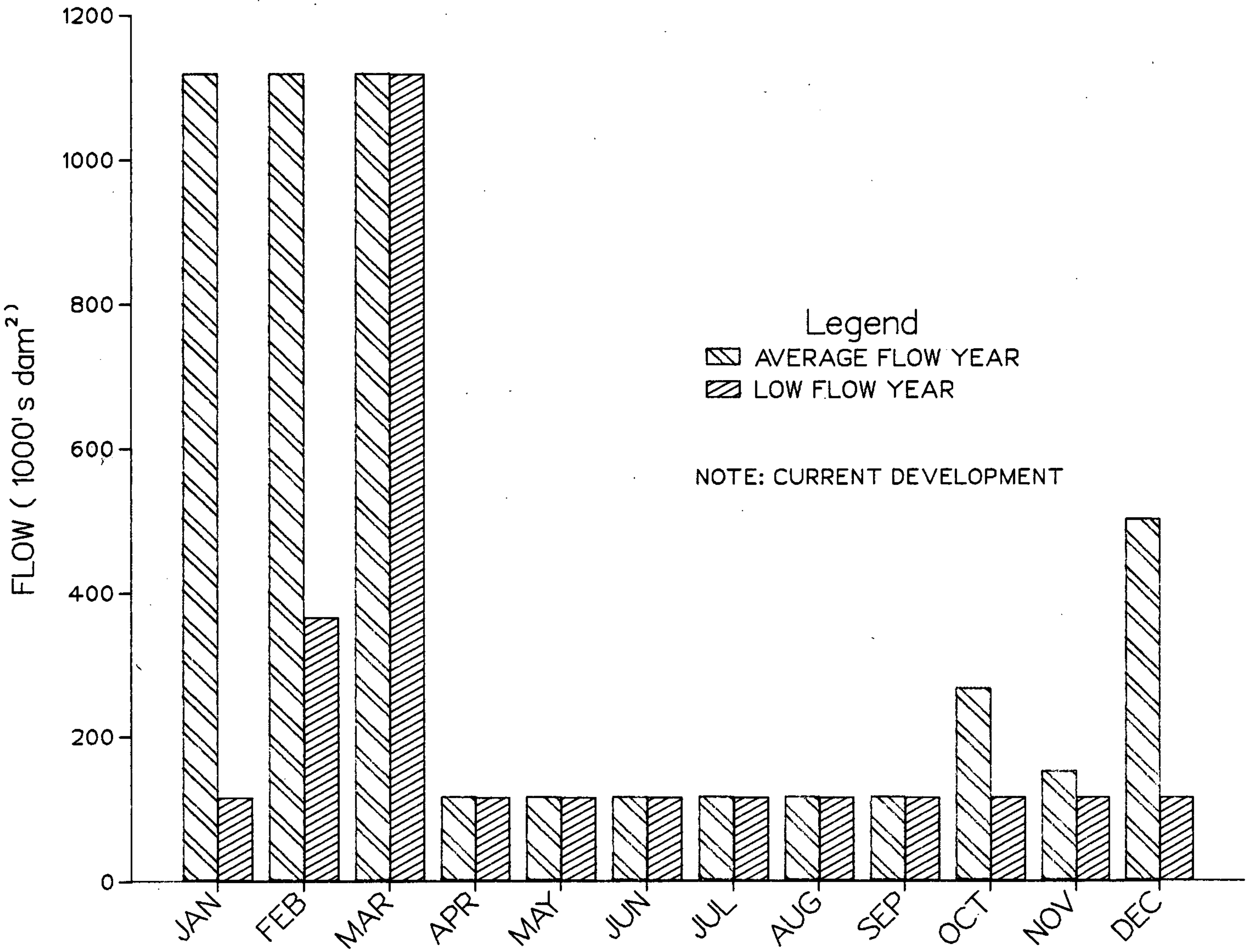
C. Applications of the Model

This section gives some examples of the capabilities and possible applications of the model based on some initial solutions. In general the model is intended as a tool to aid in long term planning in the Basin and mid-to-long term operations of the system. It is particularly useful for assessing the sensitivity of economic benefits to parameters such as prices, flows and storage capabilities. It can be run over a number of run-off and growth scenarios. Various constraints on the model can be removed or lessened in order to analyze the effect on economic benefits from water use.

1. Monthly Allocation of Water

For each water using activity, the model solution gives the optimal amount of water during each time period and the optimal activity level. For example, the model solution will give the optimum area of irrigated land and the associated water used for irrigation in each month. Likewise it will give the optimum power production and flow through turbines in each month. Figure 1 shows the optimal monthly flows of water through the

Figure 1
OPTIMAL FLOW THROUGH TURBINES
COTEAU CREEK



turbines for dry and average years based on an assumed price structure for power.

2. Operation of Lake Diefenbaker

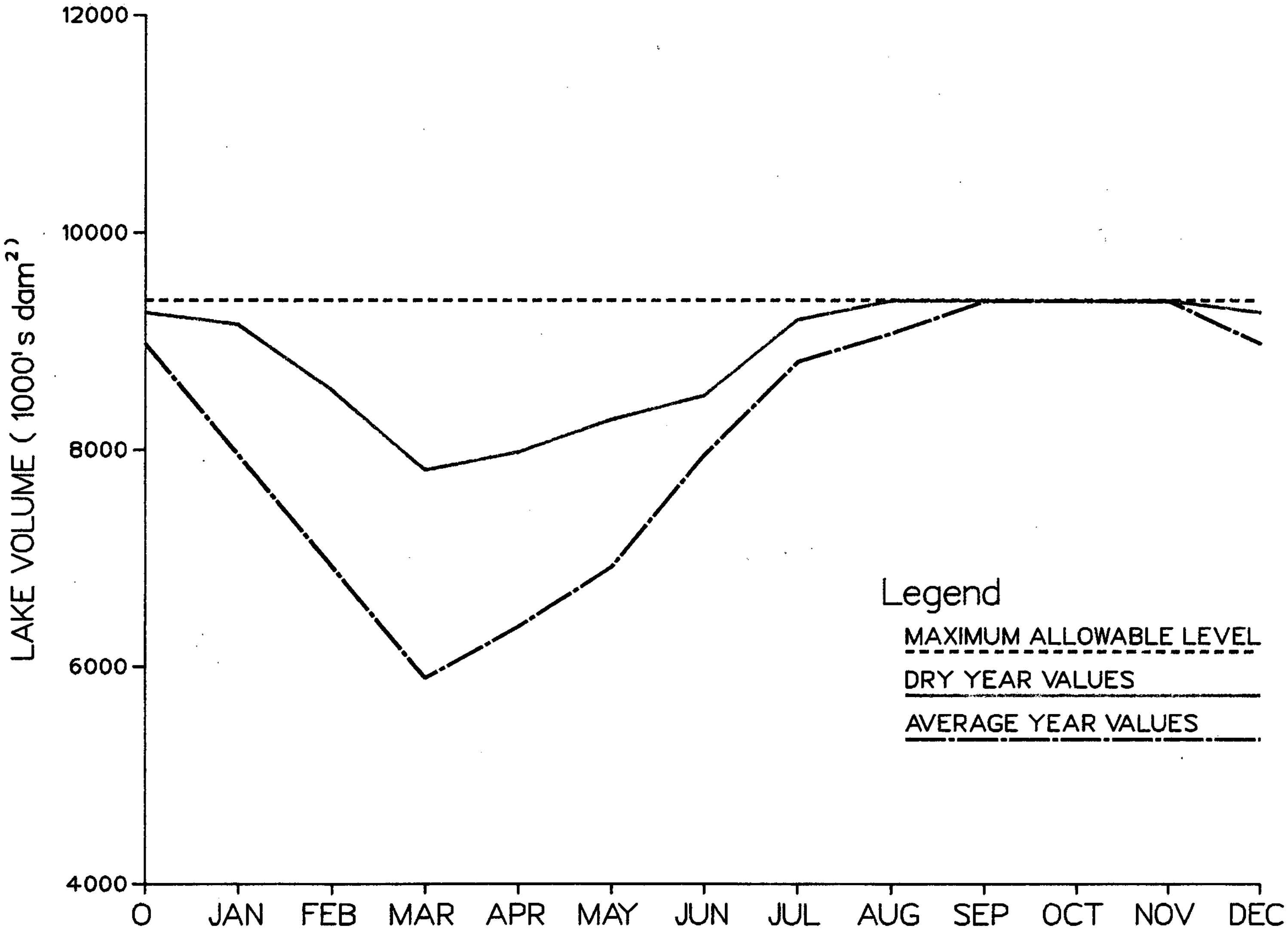
The optimal lake level regime is a function of hydropower generation, recreational needs, storage for consumptive uses and maximum and minimum elevation restrictions. The model determines the optimum lake level and release from storage in each time period. Figure 2 shows the optimal lake level in each month of dry and average run-off years.

3. Assessing Physical Changes

The model can be used as a benefit calculator to assess the economic benefits of changes in physical parameters such as storage capacity or irrigation efficiency. For example, to determine the benefits of increasing the storage capacity on Lake Diefenbaker, the model could be run with and without the increased storage, and the benefits could be determined by comparing the objective function values for the two solutions.

A test run was carried out which increased the storage capacity of Lake Diefenbaker by 10%. This resulted in an increase in the objective function of $9.9 million. Most of the increase (98%) resulted from increased power generation while a small proportion (2%) resulted from increased recreational values. Similar tests could be carried out for increasing storage on the tributaries or downstream of Lake Diefenbaker.

Figure 2
OPTIMAL STORAGE CURVE
LAKE DIEFENBAKER



D. Accessing the Model

The model is currently installed on the University of British Columbia mainframe computer and is accessed via the commercial account of Water Planning and Management in Vancouver. The account can be accessed through a datapac line or through a modem connection from remote sites. Full details on how to run the model are given in chapter three.

The model is solved using a software package called MINOS which is a FORTRAN based set of routines for solving linear and non-linear programming programs. This software and the data files for the model can be transferred to other systems which have FORTRAN compilers. Because of the large size of the model, personal computers may not be suitable for running the model. However, the model is easily solved on a mainframe and solutions would probably be feasible on a super-micro or mini-computer.

II. SPECIFICATION OF THE EQUATIONS

This section presents the constraint equations and objective function coefficients for the model. The model is composed of five sub-basins shown in Table 1. The sub-basins are represented by distinct modules which are linked to form the model for the entire Basin. The modules are fairly similar in structure except for the Lake Diefenbaker sub-basin which includes storage, recreation and hydro-power activities not found in the other reaches. Figure 3 is a schematic representation of the Basin showing the five sub-basins and the water supply and demand points. A brief explanation of the logic behind the equations and the source and method of deriving the coefficients are also given.

A. Variable Names

Some conventions are followed so that each variable and constraint can be identified by its sub-basin and month. Variable names are usually similar between different sub-basins except for the first and last characters. The first character of any variable or constraint name represents its sub-basin module. The final one or two characters of the name represent the period from 1 to 12, as shown in Table 1. The same variable names and conventions are used in the computer files which contain the MINOS code for the model (see appendix B).

Figure 3

SOUTH SASKATCHEWAN RIVER BASIN SCHEMATIC

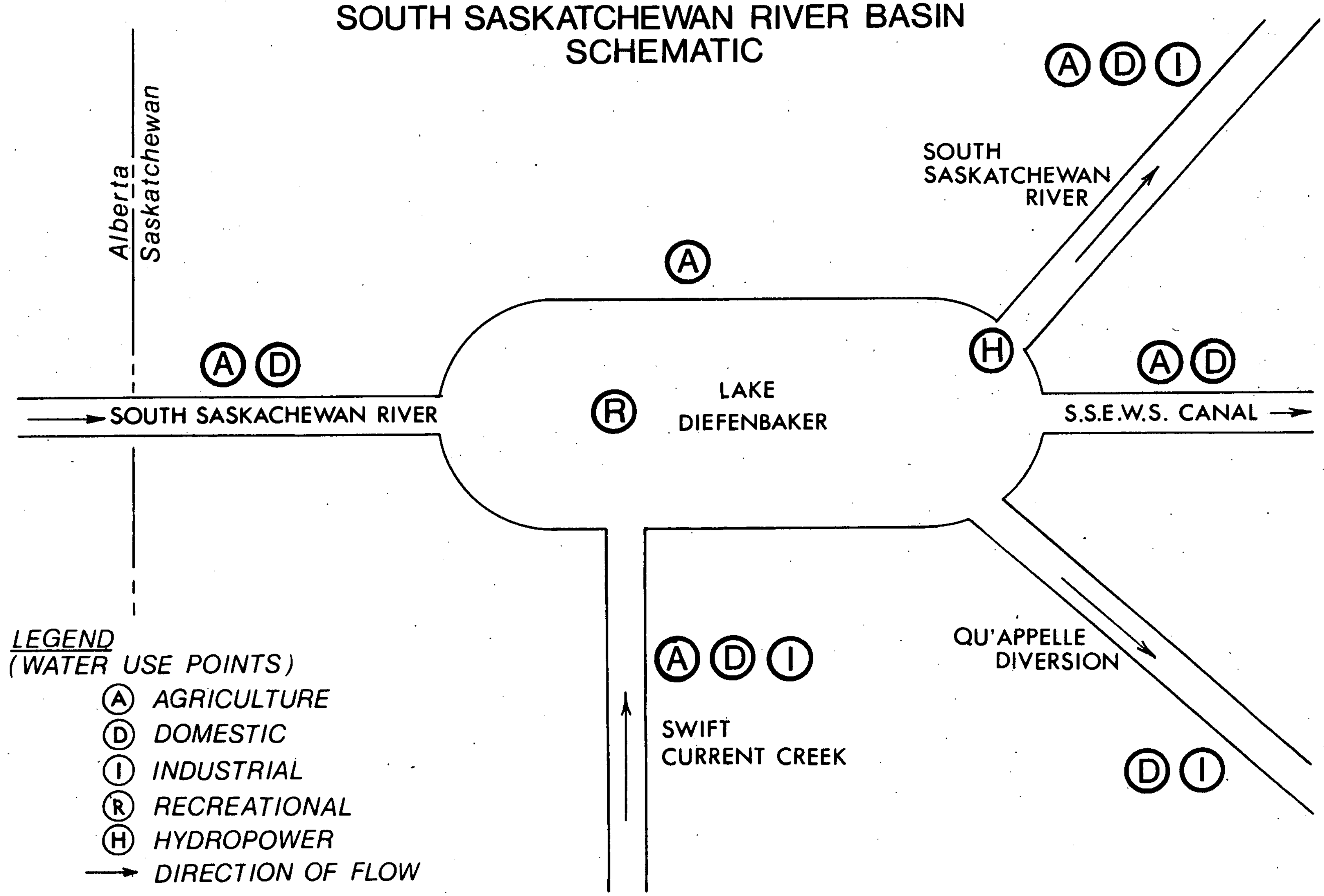


TABLE 1

Conventions Used in Variable and Equation Names

SUBBASINS	CODE (first character)
South Sask. River upstream of Lake Diefenbaker	R
Swift Current Creek	S
Lake Diefenbaker	L
Lake Diefenbaker (hydropower generation)	H
SSEWS Canal	C
South Sask. River downstream of Lake Diefenbaker	D
PERIOD	**CODE (last character)**
January	1
February	2
March	3
April	4
May	5
June	6
July	7
August	8
September	9
October	10
November	11
December	12

Each constraint equation in the model is required to have a name in the MINOS computer package. The same conventions to identify sub-basins and periods are used for these equations. However, the equation names are appended with the letter 'C' in order to distinguish them from variable names.

B. Equations

In this section the constraint equations and the objective function coefficients are presented for each sub-basin. Where required a brief explanation of the logic behind the equations and the data sources are given.

1. South Saskatchewan River Upstream Sub-basin

This portion of the mainstem is fairly simple to model since there is no storage and few water use activities. The most important feature of this sub-basin is the transboundary flows from Alberta into the Basin. These flows are the single most important source of water in the Basin.

a. Water Supply Activities

The first set of equations define the total amount of water available in the sub-basin for each period. Total supply consists of the transboundary flow from Alberta, the natural run-off in the sub-basin and any return flows from water use. Equations RSUP1C to RSUP12C define the monthly water supplies.

(RSUP1C) AREL1 + RROA1 + RRET1 - RGSUP1 = 0

(RSUP2C) AREL2 + RROA2 + RRET2 - RGSUP2 = 0

(RSUP3C) AREL3 + RROA3 + RRET3 - RGSUP3 = 0

(RSUP4C) AREL4 + RROA4 + RRET4 - RGSUP4 = 0

(RSUP5C) AREL5 + RROA5 + RRET5 - RGSUP5 = 0

(RUSP6C) AREL6 + RROA6 + RRET6 - RGSUP6 = 0

(RSUP7C) AREL7 + RROA7 + RRET7 - RGSUP7 = 0

(RSUP8C) AREL8 + RROA8 + RRET8 - RGSUP8 = 0

(RSUP9C) AREL9 + RROA9 + RRET9 - RGSUP9 = 0

(RSUP10C) AREL10 + RROA10 + RRET10 - RGSUP10 = 0

(RSUP11C) AREL11 + RROA11 + RRET11 - RGSUP11 = 0

(RSUP12C) AREL12 + RROA12 + RRET12 - RGSUP12 = 0

where:

AREL1 to AREL12 = transboundary flow from Alberta

RROA1 to RROA12 = natural run-off within the sub-basin

RRET1 to RRET12 = return flows within the sub-basin

RGSUP1 to RGSUP12 = gross water supply available

Not all of the gross monthly water supply will be available for use when reuqired the month. During peak flow periods, some of the water will be wasted unless the peaks can be captured by off-stream storage. A figure of 20% wastage was used to define net supply available. This figure was based on a similar optimization study of the Okanagan River Basin (McNeill, 1987). However, at this stage it is not known how appropriate it is for the South Saskatchewan River Basin. Equations (RWAS1C) to (RWAS12C) define the available water supply after wastage.

(RWAS1C) RNSUP1 - .8 RGSUP1 = 0

(RWAS2C) RNSUP2 - .8 RGUSP2 = 0

(RWAS3C) RNSUP3 - .8 RGSUP3 = 0

(RWAS4C) RNSUP4 - .8 RGSUP4 = 0

(RWAS5C) RNSUP5 - .8 RGSUP5 = 0

(RWAS6C) RNSUP6 - .8 RGSUP6 = 0

(RWAS7C) RNSUP7 - .8 RGSUP7 = 0

(RWAS8C) RNSUP8 - .8 RGSUP8 = 0

(RWAS9C) RNSUP9 - .8 RGSUP9 = 0

(RWAS10C) RNSUP10 - .8 RGSUP10 = 0

(RWAS11C) RNSUP11 - .8 RGSUP11 = 0

(RWAS12C) RNSUP12 - .8 RGSUP12 = 0

where:

RNSUP1 to RNSUP12 = monthly supply available after wastage

The next set of equations are straightforward definitions of the amount of water crossing the Alberta-Saskatchewan border. Because of apportionment agreements between the provinces, Saskatchewan is only guaranteed 50% of the natural flow from Alberta. For this reason the amounts designated in the model represent 50% of the longterm (56 year) average transborder flow. The data used to obtain this figure are from

Acres International (1986) which developed a water use forecasting model for the Saskatchewan Nelson Basin. The units are cubic decameters (dam^3).

(AREL1C)	AREL1	=	77 127	dam^3
(AREL2C)	AREL2	=	68 562	
(AREL3C)	AREL3	=	168 882	
(AREL4C)	AREL4	=	404 581	
(AREL5C)	AREL5	=	724 193	
(AREL6C)	AREL6	=	1 244 057	
(AREL7C)	AREL7	=	848 429	
(AREL8C)	AREL8	=	436 419	
(AREL9C)	AREL9	=	300 169	
(AREL10C)	AREL10	=	249 041	
(AREL11C)	AREL11	=	145 993	
(AREL12C)	AREL12	=	98 047	

The fifty-six-year average natural run-off in the sub-basin is defined in a similar manner in equations (RNAT1C) to (RNAT12C). The run-off data was again obtained from Acres International (1986). However, the basin configuration used in their study was somewhat more aggregated than the configuration used in this project. In the Acres model, the South Saskatchewan River and Lake Diefenbaker were considered as a single node (sub-basin) ending at Saskatoon. In the current study it was assumed that 30% of the naturalized flow for this node occurred in the upstream river sub-basin. Although the 30% figure is only a first guess, the solution will probably not change if the relative distribution of local natural run-off is different.

(RNAT1C)	RROA1	=	2 683	dam^3
(RNAT2C)	RROA2	=	720	
(RNAT3C)	RROA3	=	154	
(RNAT4C)	RROA4	=	64 607	
(RNAT5C)	RROA5	=	5 162	
(RNAT6C)	RROA6	=	16 669	
(RNAT7C)	RROA7	=	63 814	
(RNAT8C)	RROA8	=	25 310	
(RNAT9C)	RROA9	=	23 694	
(RNAT10C)	RROA10	=	11 597	
(RNAT11C)	RROA11	=	8 346	
(RNAT12C)	RROA12	=	2 456	

Return flows are defined in equations (RRET1C) to (RRET12C). These are a function of the amount and kinds of water using activities in the sub-basin. The only two significant users and sources of return flows are irrigation and domestic users. The return flows from irrigation occur in the heavy irrigation periods from May to September, while the return flows from domestic use are more evenly distributed throughout the year.

(RRET1C) RRET1 - .0625RDODO = 0

(RRET2C) RRET2 - .0625RDODO = 0

(RRET3C) RRET3 - .0625RDODO = 0

(RRET4C) RRET4 - .0625RDODO = 0

(RRET5C) RRET5 - .0625RDODO - .229RHEC = 0

(RRET6C) RRET6 - .0625RDODO - .438RHEC = 0

(RRET7C) RRET7 - .0625RDODO - .789RHEC = 0

(RRET8C) RRET8 - .0625RDODO - .546RHEC = 0

(RRET9C) RRET9 - .0625RDODO - .492RHEC = 0

(RRET10C) RRET10 - .0625RDODO = 0

(RRET11C) RRET11 - .0625RDODO = 0

(RRET12C) RRET12 - .0625RDODO = 0

where:

RDODO = gross annual water withdrawn for domestic use

RHEC = number of hectares irrigated

The coefficients in the return flow equations are based on estimates made in Acres International (1986). The model developed in this study estimated a 36 percent return flow from irrigation in the Lake Diefenbaker sub-basin. The distribution of return flows throughout the months of the year was in direct proportion to the amount of water applied in each month. The coefficients on RHEC in the above equations are obtained by multiplying:

36% x (annual water applied per hectare) x

(percent of annual total applied in each month)

The return flows from domestic use are based on 75% return. The return flow is considered to be a constant percentage of domestic use on a month by month basis. The coefficients in the above equations were obtained simply by dividing 75% by twelve.

b. Water Demand Activities

Total water demands (gross withdrawal) are defined by equations (RTOD1C) to (RTOD12C). These equations are fairly straightforward since irrigation and domestic use are the only water users in the sub-basin.

(RTOD1C)	RAGD1	+ RDOD1	- RTOD1	= 0
(RTOD2C)	RAGD2	+ RDOD2	- RTOD2	= 0
(RTOD3C)	RAGD3	+ RDOD3	- RTOD3	= 0
(RTOD4C)	RAGD4	+ RDOD4	- RTOD4	= 0
(RTOD5C)	RAGD5	+ RDOD5	- RTOD5	= 0
(RTOD6C)	RAGD6	+ RDOD6	- RTOD6	= 0
(RTOD7C)	RAGD7	+ RDOD7	- RTOD7	= 0
(RTOD8C)	RAGD8	+ RDOD8	- RTOD8	= 0
(RTOD9C)	RAGD9	+ RDOD9	- RTOD9	= 0
(RTOD10C)	RAGD10	+ RDOD10	- RTOD10	= 0
(RTOD11C)	RAGD11	+ RDOD11	- RTOD11	= 0
(RTOD12C)	RAGD12	+ RDOD12	- RTOD12	= 0

where:

RAGD1 to RAGD12 = water withdrawn for irrigation in each period

RDOD1 to RDOD12 = water withdrawn for domestic use in each period

RTOD1 to RTOD12 = total water withdrawn in each period

The annual amount of water withdrawn for irrigation is expressed as a function of the number of irrigated hectares in the sub-basin as shown in equation (RAGDOC). The per hectare water application is based on the average year irrigation requirement from Acres International (1986).

(RAGDOC) 6.741RHEC - RAGDO = 0

where:

RHEC = number of irrigated hectares

RAGDO = annual amount withdrawn for irrigation

The monthly withdrawals for irrigation are then expressed as percentages of the annual withdrawal as shown in equations (RAGD5C) to RAGD9C). These monthly percentages are the same as used in Acres International (1986).

(RAGD5C) RAGD5 - .091 RAGDO = 0

(RAGD6C) RAGD6 - .177 RAGDO = 0

(RAGD7C) RAGD7 - .317 RAGDO = 0

(RAGD8C) RAGD8 - .218 RAGDO = 0

(RAGD9C) RAGD9 - .187 RAGDO = 0

where:

RAGD5 to RAGD9 = amount withdrawn for irrigation in each period.

The next equation sets out an upper limit on the amount of land available for irrigation. This limit is set at the current level of irrigated hectares in the sub-basin, but could be increased when evaluating future levels of development. Some problems were encountered in determining the amount of presently irrigated land in each sub-basin. As mentioned, Acres International (1986) used a different sub-basin configuration so their data could not be used without some modification. The approach taken was to examine the irrigated area for each irrigation district and attempt to place it in the appropriate sub-basin. It is recommended that these estimates be re-calculated based on the latest field estimates.

(RHECC) RHEC < 300 hectares

The variable RHEC has a value of $350 in the objective function. An initial value of $350 per hectare was chosen based on the study by O'Grady et.al. (1983). This figure does not account for the off-farm capital and maintenance costs of the delivery system.

(VALUE) $350 x RHEC

Domestic demands are fixed in the model as shown in equations (RDOD1C) to (RDOD12C). Because the amount of water used by households was relatively small, it was not worth building domestic use into the objecive function. By fixing the amount of domestic water use, we are constraining the model to supply households a certain amount of water before allocating water to non-fixed uses.

The amount of water required for domestic purposes was calculated as follows. First the population of the sub-basin was estimated at 5,500 based on the populations of Kindersly and Leader. A per capita use figure of 350 liters per day was assumed which is the same figure used in the Acres International model (1986) for the Saskatoon area. Monthly totals were then calculated on this basis.

(RDOD1C) RDOD1 = 41 dam^3

(RDOD2C) RDOD2 = 41

(RDOD3C) RDOD3 = 41

(RDOD4C) RDOD4 = 59

(RDOD5C) RDOD5 = 76

(RDOD6C) RDOD6 = 76

(RODO7C) RDOD7 = 76

(RDOD8C) RDOD8 = 76

(RDOD9C) RDOD9 = 76

(RDOD10C) RDOD10 = 59

(RDOD11C) RDOD11 = 41

(RDOD12C) RDOD12 = 41

The annual total of domestic water use is also fixed as shown in equation (RDODOC).

(RDODOC) RDODO = 863 dam^3

where:

RDODO = annual water withdrawn for domestic use

c. Supply Demand Balance

This set of constraints set out the condition that in each period the total water withdrawn must be less than the supply available after wastage. Equations (RBAL1C) to (RBAL12C) define the supply demand balance.

(RBAL1C) RTOD1 - RNSUP1 < 0

(RBAL2C) RTOD2 - RNSUP2 < 0

(RBAL3C) RTOD3 - RNSUP3 < 0

(RBAL4C) RTOD4 - RNSUP4 < 0

(RBAL5C) RTOD5 - RNSUP5 < 0

(RBAL6C) RTOD6 - RNSUP6 < 0

(RBAL7C) RTOD7 - RNSUP7 < 0

(RBAL8C) RTOD8 - RNSUP8 < 0

(RBAL9C) RTOD9 - RNSUP9 < 0

(RBAL10C) RTOD10 - RNSUP10 < 0

(RBAL11C) RTOD11 - RNSUP10 < 0

(RBAL12C) RTOD12 - RNSUP12 < 0

where:

RTOD1 to RTOD12 = total water demand in each period

RNSUP1 to RNSUP12 = net supply available after wastage

The final set of equations for this sub-basin define the remaining flows which will pass to the next reach. Remaining flows are equal to the gross supply minus the total demands as shown in equations (RREM1C) to (RREM12C).

(RREM1CO RREM1 - RGSUP1 + RTOD1 = 0

(RREM2C) RREM2 - RGSUP2 + RTOD2 = 0

(RREM3C) RREM3 - RGSUP3 + RTOD3 = 0

(RREM4C) RREM4 - RGSUP4 + RTOD4 = 0

(RREM5C) RREM5 - RGSUP5 + RTOD5 = 0

(RREM6C) RREM6 - RGSUP6 + RTOD6 = 0

(RREM7C) RREM7 - RGSUP7 + RTOD7 = 0

(RREM8C) RREM8 - RGSUP8 + RTOD8 = 0

(RREM9C) RREM9 - RGSUP9 + RTOD9 = 0

(RREM10C) RREM10 - RGSUP10 + RTOD10 = 0

(RREM11C) RREM11 - RGSUP11 + RTOD11 = 0

(RREM12C) RREM12 - RGSUP12 + RTOD12 = 0

where:

RREM1 to RREM12 = remaining flow passing to next reach

The remaining flows pass into Lake Diefenbaker where they form part of the gross supply to the Lake Diefenbaker sub-basin. Thus the remaining flow constraints are the means by which the sub-basin module is linked to the downstream reaches.

2. Swift Current Creek Sub-basin

This sub-basin is modeled in a similar manner to the river sub-basin. The only difference in model structure is that all water is supplied locally from the sub-basin by natural run-off, with no water entering from upstream.

a. Water Supply Activities

The first set of equations define the total amount of water available in the sub-basin for each period. Total supply consists of the natural run-off in the sub-basin and any return flows from water use. Equations SSUP1C to SSUP12C define the monthly water supplies.

(SSUP1C) SROA1 + SRET1 - SGSUP1 = 0

(SSUP2C) SROA2 + SRET2 - SGSUP2 = 0

(SSUP3C) SROA3 + SRET3 - SGSUP3 = 0

(SSUP4C) SROA4 + SRET4 - SGSUP4 = 0

(SSUP5C) SROA5 + SRET5 - SGSUP5 = 0

(SUSP6C) SROA6 + SRET6 - SGSUP6 = 0

(SSUP7C) SROA7 + SRET7 - SGSUP7 = 0

(SSUP8C) SROA8 + SRET8 - SGSUP8 = 0

(SSUP9C) SROA9 + SRET9 - SGSUP9 = 0

(SSUP10C) SROA10 + SRET10 - SGSUP10 = 0

(SSUP11C) SROA11 + SRET11 - SGSUP11 = 0

(SSUP12C) SROA12 + SRET12 - SGSUP12 = 0

where:

SROA1 to SROA12 = natural run-off within the sub-basin

SRET1 to SRET12 = return flows within the sub-basin

SGSUP1 to SGSUP12 = gross water supply available

As in the previous sub-basin, a figure of 20% wastage was used to define net supply available. Equations (SWAS1C) to (SWAS12C) define the available water supply after wastage.

(SWAS1C) SNSUP1 - .8 SGSUP1 = 0

(SWAS2C) SNSUP2 - .8 SGUSP2 = 0

(SWAS3C) SNSUP3 - .8 SGSUP3 = 0

(SWAS4C) SNSUP4 - .8 SGSUP4 = 0

(SWAS5C) SNSUP5 - .8 SGSUP5 = 0

(SWAS6C) SNSUP6 - .8 SGSUP6 = 0

(SWAS7C) SNSUP7 - .8 SGSUP7 = 0

(SWAS8C) SNSUP8 - .8 SGSUP8 = 0

(SWAS9C) SNSUP9 - .8 SGSUP9 = 0

(SWAS10C) SNSUP10 - .8 SGSUP10 = 0

(SWAS11C) SNSUP11 - .8 SGSUP11 = 0

(SWAS12C) SNSUP12 - .8 SGSUP12 = 0

where:

SNSUP1 to SNSUP12 = monthly supply available after wastage

The fifty-six-year average natural run-off in the sub-basin is defined in equations (SNAT1C) to (SNAT12C). The run-off data used to calculate these averages were taken from the computerized files of the forecasting model developed in Acres International (1986).

(SNAT1C) SROA1 = 1 213 dam^3

(SNAT2C) SROA2 = 342

(SNAT3C) SROA3 = 606

(SNAT4C) SROA4 = 15 928

(SNAT5C) SROA5 = 2 198

(SNAT6C) SROA6 = 5 799

(SNAT7C) SROA7 = 25 323

(SNAT8C) SROA8 = 12 734

(SNAT9C) SROA9 = 10 056

(SNAT10C) SROA10 = 5 154

(SNAT11C) SROA11 = 2 642

(SNAT12C) SROA12 = 1 516

Return flows are defined in equations (SRET1C) to (SRET12C). These are specified in a similar manner to the upstream South Saskatchewan River sub-basin except that there is also a small amount of return flow from industry in the sub-basin. Return flows from irrigation are slightly higher at about 38%. Return flows from industry are set at 92.4% from industrial water use and 87.6% from domestic water use. These figures are taken directly from Acres International (1986).

(SRET1C) SRET1 - .073 SDODO - .077 SINDO = 0

(SRET2C) SRET2 - .073 SDODO - .077 SINDO = 0

(SRET3C) SRET3 - .073 SDODO - .077 SINDO = 0

(SRET4C) SRET4 - .073 SDODO - .077 SINDO = 0

(SRET5C) SRET5 - .073 SDODO - .077 SINDO - .362 SHEC = 0

(SRET6C) SRET6 - .073 SDODO - .077 SINDO - .581 SHEC = 0

(SRET7C) SRET7 - .073 SDODO - .077 SINDO - .806 SHEC = 0

(SRET8C) SRET8 - .073 SDODO - .077 SINDO - .637 SHEC = 0

(SRET9C) SRET9 - .073 SDODO - .077 SINDO - .678 SHEC = 0

(SRET10C) SRET10 - .073 SDODO - .077 SINDO = 0

(SRET11C) SRET11 - .073 SDODO - .077 SINDO = 0

(SRET12C) SRET12 - .073 SDODO - .077 SINDO = 0

where:

SDODO = gross annual water withdrawn for domestic use

SINDO = gross annual water withdrawn for industrial use

SHEC = number of hectares irrigated in the sub-basin

b. Water Demand Activities

Total water demands (gross withdrawal) are defined by equations (STOD1C) to (STOD12C). Agriculture, domestic and industry are the three water using sectors in the sub-basin.

(STOD1C) SAGD1 + SDOD1 + SIND1 - STOD1 = 0

(STOD2C) SAGD2 + SDOD2 + SIND2 - STOD2 = 0

(STOD3C) SAGD3 + SDOD3 + SIND3 - STOD3 = 0

(STOD4C) SAGD4 + SDOD4 + SIND4 - STOD4 = 0

(STOD5C) SAGD5 + SDOD5 + SIND5 - STOD5 = 0

(STOD6C) SAGD6 + SDOD6 + SIND6 - STOD6 = 0

(STOD7C) SAGD7 + SDOD7 + SIND7 - STOD7 = 0

(STOD8C) SAGD8 + SDOD8 + SIND8 - STOD8 = 0

(STOD9C) SAGD9 + SDOD9 + SIND9 - STOD9 = 0

(STOD10C) SAGD10 + SDOD10 + SIND10 - STOD10 = 0

(STOD11C) SAGD11 + SDOD11 + SIND11 - STOD11 = 0

(STOD12C) SAGD12 + SDOD12 + SIND12 - STOD12 = 0

where:

SAGD1 to SAGD12 = water withdrawn for irrigation in each period

SDOD1 to SDOD12 = water withdrawn for domestic use in each period

SIND1 to SIND12 = water withdrawn for industry in each period

STOD1 to STOD12 = total water withdrawn in each period

The annual amount of water withdrawn for irrigation is expressed as a function of the number of irrigated hectares in the sub-basin as shown in equation (SAGD0C). The figure of 7.98 dam^3 per hectare is the application rate used in Acres International (1986).

(SAGD0C) 7.98 SHEC - SAGD0 = 0

where:

SHEC = number of irrigated hectares

SAGD0 = annual amount withdrawn for irrigation

The monthly withdrawals for irrigation are then expressed as percentages of the annual withdrawal as shown in equations (SAGD5C) TO SAGD9C).

(SAGD5C) SAGD5 - .116 SAGD0 = 0

(SAGD6C) SAGD6 - .184 SAGD0 = 0

(SAGD7C) SAGD7 - .259 SAGD0 = 0

(SAGD8C) SAGD8 - .222 SAGD0 = 0

(SAGD9C) SAGD9 - .219 SAGD0 = 0

where:

SAGD5 to SAGD9 = amount withdrawn for irrigation in each time period.

The next equation sets out an upper limit on the amount of land available for irrigation. This limit is set at the current level of irrigated hectares in the sub-basin, but could be increased when evaluating future levels of development. The current level is taken from Acres International (1986).

(SHECC) SHEC $<$ 8000 hectares

The variable SHEC representing the number of irrigated hectares in the sub-basin also appears in the objective function. For every hectare irrigated, the value of the objective function increases by $350. This is a very rough figure based on the study by O'Grady et.al. (1983). This figure does not account for the off-farm capital and maintenance costs of the delivery system.

(VALUE) $350 x SHEC

There is a small amount of industrial water use in the sub-basin as reported in Acres International (1986). The model constrains the solution to supply water to industry at current levels. Total annual water use is defined in equation (SINDOC).

(SINDOC) SINDO = 329 dam^3

where:

SINDO = annual water withdrawn for industry in the sub-basin.

The monthly water supplied to industry is expressed as a percentage of annual industrial water use as shown in equations (SIND1C) to (SIND12C).

(SIND1C) SIND1 - .0833 SIND0 = 0

(SIND2C) SIND2 - .0833 SIND0 = 0

(SIND3C) SIND3 - .0833 SIND0 = 0

(SIND4C) SIND4 - .0833 SIND0 = 0

(SIND5C) SIND5 - .0833 SIND0 = 0

(SIND6C) SIND6 - .0833 SIND0 = 0

(SIND7C) SIND7 - .0833 SIND0 = 0

(SIND8C) SIND8 - .0833 SIND0 = 0

(SIND9C) SIND9 - .0833 SIND0 = 0

(SIND10C) SIND10 - .0833 SIND0 = 0

(SIND11C) SIND11 - .0833 SIND0 = 0

(SIND12C) SIND12 - .0833 SIND0 = 0

where:

SIND1 to SIND2 = monthly withdrawals for industry

Domestic demands are fixed in the model as shown in equations (SDOD1C) to (SDOD12C). Domestic requirements are based on a population of 21 518 with a per capita use of 524 liters per day as used in Acres International (1986).

(SDOD1C) SDOD1 = 240 dam^3

(SDOD2C) SDOD2 = 240

(SDOD3C) SDOD3 = 240

(SDOD4C) SDOD4 = 343

(SDOD5C) SDOD5 = 446

(SDOD6C) SDOD6 = 446

(SOD07C) SDOD7 = 446

(SDOD8C) SDOD8 = 446

(SDOD9C) SDOD9 = 446

(SDOD10C) SDOD10 = 343

(SDOD11C) SDOD11 = 240

(SDOD12C) SDOD12 = 240 .

The annual total of domestic water use is also fixed as shown in equation (SDODOC).

(SDODOC) SDODO = 4 116 dam^3

where:

SDODO = annual water withdrawn for domestic use

c. Supply Demand Balance

This set of constraints set out the condition that in each period the total water withdrawn must be less than the supply available after wastage. Equations (SBAL1C) to (SBAL12C) define the supply demand balance.

(SBAL1C) STOD1 - SNSUP1 < 0

(SBAL2C) STOD2 - SNSUP2 < 0

(SBAL3C) STOD3 - SNSUP3 < 0

(SBAL4C) STOD4 - SNSUP4 < 0

(SBAL5C) STOD5 - SNSUP5 < 0

(SBAL6C) STOD6 - SNSUP6 < 0

(SBAL7C) STOD7 - SNSUP7 < 0

(SBAL8C) STOD8 - SNSUP8 < 0

(SBAL9C) STOD9 - SNSUP9 < 0

(SBAL10C) STOD10 - SNSUP10 < 0

(SBAL11C) STOD11 - SNSUP10 < 0

(SBAL12C) STOD12 - SNSUP12 < 0

where:

STOD1 to STOD12 = total water demands in each period

SNSUP1 to SNSUP12 = net supply of water available after wastage

The final set of constraints for this sub-basin defines the remaining flows which will pass to the next reach which is the Lake Diefenbaker sub-basin. Remaining flows are equal to the gross supply minus the total demands as shown in equations (SREM1C) to (SREM12C).

(SREM1CO SREM1 - SGSUP1 + STOD1 = 0

(SREM2C) SREM2 - SGSUP2 + STOD2 = 0

(SREM3C) SREM3 - SGSUP3 + STOD3 = 0

(SREM4C) SREM4 - SGSUP4 + STOD4 = 0

(SREM5C) SREM5 - SGSUP5 + STOD5 = 0

(SREM6C) SREM6 - SGSUP6 + STOD6 = 0

(SREM7C) SREM7 - SGSUP7 + STOD7 = 0

(SREM8C) SREM8 - SGSUP8 + STOD8 = 0

(SREM9C) SREM9 - SGSUP9 + STOD9 = 0

(SREM10C) SREM10 - SGSUP10 + STOD10 = 0

(SREM11C) SREM11 - SGSUP11 + STOD11 = 0

(SREM12C) SREM12 - SGSUP12 + STOD12 = 0

where:

SREM1 to SREM12 = remaining flow passing to next reach

3. Lake Diefenbaker Sub-Basin

This sub-basin is more complex than the Swift Current Creek and the upstream river sub-basins. Many equations are necessary to model storage operations, hydroelectric generation and recreational values. Downstream flow requirements and the Qu'appelle diversion add further complexity to the model.

a. Water Supply Activities

The first set of equations defines the total amount of water available in the sub-basin for each period. Total supply consists of the natural run-off in the sub-basin, any return flows from water use and the remaining flows from the upstream river and Swift Current Creek sub-basins. Equations LSUP1C to LSUP12C define the monthly water supplies.

(LSUP1C)	LROA1	+	LRET1	+	SREM1	+	RREM1	-	LGSUP1	=	0
(LSUP2C)	LROA2	+	LRET2	+	SREM2	+	RREM2	-	LGSUP2	=	0
(LSUP3C)	LROA3	+	LRET3	+	SREM3	+	RREM3	-	LGSUP3	=	0
(LSUP4C)	LROA4	+	LRET4	+	SREM4	+	RREM4	-	LGSUP4	=	0
(LSUP5C)	LROA5	+	LRET5	+	SREM5	+	RREM5	-	LGSUP5	=	0
(LUSP6C)	LROA6	+	LRET6	+	SREM6	+	RREM6	-	LGSUP6	=	0
(LSUP7C)	LROA7	+	LRET7	+	SREM7	+	RREM7	-	LGSUP7	=	0
(LSUP8C)	LROA8	+	LRET8	+	SREM8	+	RREM8	-	LGSUP8	=	0
(LSUP9C)	LROA9	+	LRET9	+	SREM9	+	RREM9	-	LGSUP9	=	0
(LSUP10C)	LROA10	+	LRET10	+	SREM10	+	RREM10	-	LGSUP10	=	0
(LSUP11C)	LROA11	+	LRET11	+	SREM11	+	RREM11	-	LGSUP11	=	0
(LSUP12C)	LROA12	+	LRET12	+	SREM12	+	RREM12	-	LGSUP12	=	0

where:

LROA1 to LROA12 = natural run-off within the sub-basin

LRET1 to LRET12 = return flows within the sub-basin

SREM1 to SREM12 = remaining flow from Swift Current sub-basin

RREM1 to RREM12 = remaining flow from upstream river sub-basin

LGSUP1 to LGSUP12 = gross water supply available

No wastage is assumed in this sub-basin because of the large amount of storage available. Evaporation losses are significant and are included in the lake level balance equations in a later section.

The fifty-six-year average natural run-off in the sub-basin is defined in equations (LNAT1C) to (LNAT12C). These run-off figures are based on the data given in Acres International (1986) for the Saskatoon area (node) of their model. However, the Saskatoon node of the Acres model included the South Saskatchewan River as well as Lake Diefenbaker. It was assumed that 40% of the reported local run-off from this node occurred in the Lake Diefenbaker sub-basin.

(LNAT1C)	LROA1	= 3 577	dam^3
(LNAT2C)	LROA2	= 960	
(LNAT3C)	LROA3	= 205	
(LNAT4C)	LROA4	= 86 143	
(LNAT5C)	LROA5	= 6 883	
(LNAT6C)	LROA6	= 22 226	
(LNAT7C)	LROA7	= 85 085	
(LNAT8C)	LROA8	= 33 747	
(LNAT9C)	LROA9	= 31 592	
(LNAT10C)	LROA10	= 15 463	
(LNAT11C)	LROA11	= 11 128	
(LNAT12C)	LROA12	= 3 275	

Return flows are defined in equations (LRET1C) to (LRET12C). These are specified in a similar manner to the Swift Current Creek sub-basin although the coefficients are somewhat lower. Based on Acres International (1986), return flows are estimated to be 75% from domestic use, 24% from industrial use and 36% from irrigation.

(LRET1C) LRET1 - .063 LDODO - .02 LINDO = 0

(LRET2C) LRET2 - .063 LDODO - .02 LINDO = 0

(LRET3C) LRET3 - .063 LDODO - .02 LINDO = 0

(LRET4C) LRET4 - .063 LDODO - .02 LINDO = 0

(LRET5C) LRET5 - .063 LDODO - .02 LINDO - .362 LHEC = 0

(LRET6C) LRET6 - .063 LDODO - .02 LINDO - .581 LHEC = 0

(LRET7C) LRET7 - .063 LDODO - .02 LINDO - .806 LHEC = 0

(LRET8C) LRET8 - .063 LDODO - .02 LINDO - .637 LHEC = 0

(LRET9C) LRET9 - .063 LDODO - .02 LINDO - .678 LHEC = 0

(LRET10C) LRET10 - .063 LDODO - .02 LINDO = 0

(LRET11C) LRET11 - .063 LDODO - .02 LINDO = 0

(LRET12C) LRET12 - .063 LDODO - .02 LINDO = 0

where:

LDODO = gross annual water withdrawn for domestic use

LINDO = gross annual water withdrawn for industrial use

LHEC = number of hectares irrigated

b. Water Demand Activities

Total water demands (gross withdrawal) are defined by equations (LTOD1C) to (LTOD12C). Agriculture, domestic and industry are the three consumptive users of water in the sub-basin. Non-consumptive uses including recreation and power generation are dealt with separately.

(LTOD1C) LAGD1 + LDOD1 + LIND1 - LTOD1 = 0

(LTOD2C) LAGD2 + LDOD2 + LIND2 - LTOD2 = 0

(LTOD3C) LAGD3 + LDOD3 + LIND3 - LTOD3 = 0

(LTOD4C) LAGD4 + LDOD4 + LIND4 - LTOD4 = 0

(LTOD5C) LAGD5 + LDOD5 + LIND5 - LTOD5 = 0

(LTOD6C) LAGD6 + LDOD6 + LIND6 - LTOD6 = 0

(LTOD7C) LAGD7 + LDOD7 + LIND7 - LTOD7 = 0

(LTOD8C) LAGD8 + LDOD8 + LIND8 - LTOD8 = 0

(LTOD9C) LAGD9 + LDOD9 + LIND9 - LTOD9 = 0

(LTOD10C) LAGD10 + LDOD10 + LIND10 - LTOD10 = 0

(LTOD11C) LAGD11 + LDOD11 + LIND11 - LTOD11 = 0

(LTOD12C) LAGD12 + LDOD12 + LIND12 - LTOD12 = 0

where:

LAGD1 to LAGD12 = water withdrawn for irrigation in each period

LDOD1 to LDOD12 = water withdrawn for domestic use in each period

LIND1 to LIND12 = water withdrawn for industry in each period

LTOD1 to LTOD12 = total water withdrawn in each period

The annual amount of water withdrawn for irrigation is expressed as a function of the number of irrigated hectares in the sub-basin as shown in equation (LAGDOC). The application rate of 6.74 dam^3 per hectare is taken from Acres International (1986).

(LAGDOC) 6.74 LHEC - LAGDO = 0

where:

LHEC = number of irrigated hectares

LAGDO = annual amount withdrawn for irrigation

The monthly withdrawals for irrigation are then expressed as percentages of the annual withdrawal as shown in equations (LAGD5C) to (LAGD9C).

(LAGD5C) LAGD5 - .091 LAGDO = 0

(LAGD6C) LAGD6 - .177 LAGDO = 0

(LAGD7C) LAGD7 - .317 LAGDO = 0

(LAGD8C) LAGD8 - .218 LAGDO = 0

(LAGD9C) LAGD9 - .197 LAGDO = 0

where:

LAGD5 to LAGD9 = amount withdrawn for irrigation in each period.

The next equation sets out an upper limit on the amount of land available for irrigation. This limit is set at the current level of irrigated hectares in the sub-basin, but could be increased when evaluating future levels of development. The irrigated area is estimated from information on irrigation districts and totals for the Saskatoon node in the forecasting model developed by Acres International (1986).

(LHECC) LHEC $<$ 8800 hectares

The variable LHEC representing the number of irrigated hectares in the sub-basin appears in the objective function with a value of $350 per hectare, based on the study by O'Grady et.al. (1983). This figure does not account for the off-farm capital and maintenance costs of the delivery system.

(VALUE) $350 x RHEC

There is no significant industrial water use in the sub-basin. However, with the expectations of some future development in industry, the equations have been provided using right hand side values of zero as shown in equation (LINDOC).

(LINDOC) LINDO = 0

where:

LINDO = annual water withdrawn for industry in the sub-basin.

The monthly water supplied to industry is expressed as a percentage of annual industrial water use as shown in equations (LIND1C) to (LIND12C).

(LIND1C) LIND1 - .0833 LINDO = 0

(LIND2C) LIND2 - .0833 LINDO = 0

(LIND3C) LIND3 - .0833 LINDO = 0

(LIND4C) LIND4 - .0833 LINDO = 0

(LIND5C) LIND5 - .0833 LINDO = 0

(LIND6C) LIND6 - .0833 LINDO = 0

(LIND7C) LIND7 - .0833 LINDO = 0

(LIND8C) LIND8 - .0833 LINDO = 0

(LIND9C) LIND9 - .0833 LINDO = 0

(LIND10C) LIND10 - .0833 LINDO = 0

(LIND11C) LIND11 - .0833 LINDO = 0

(LIND12C) LIND12 - .0833 LINDO = 0

where:

LIND1 to LIND12 = monthly withdrawals for industry

Domestic demands are fixed in the model as shown in equations (LDOD1C) to (LDOD12C). They are based on a population of 4 500 and a per capita daily consumption of 575 liters.

(LDOD1C) LDOD1 = 34 dam^3

(LDOD2C) LDOD2 = 34

(LDOD3C) LDOD3 = 34

(LDOD4C) LDOD4 = 48

(LDOD5C) LDOD5 = 62

(LDOD6C) LDOD6 = 62

(LOD07C) LDOD7 = 62

(LDOD8C) LDOD8 = 62

(LDOD9C) LDOD9 = 62

(LDOD10C) LDOD10 = 48

(LDOD11C) LDOD11 = 34

(LDOD12C) LDOD12 = 34

where:

LDOD1 to LDOD12 = monthly domestic water use

The amount of water diverted to the Qu'Appelle system is shown in equations (LQAP1C) to (LQAP12C). The monthly diversion of 15 608 dam^3 was obtained by dividing the annual diversion of 187 300 dam^3 as reported in Acres International (1986) by twelve.

(LQAP1C) LQAP1 = 15 608 dam^3

(LQAP2C) LQAP2 = 15 608

(LQAP3C) LQAP3 = 15 608

(LQAP4C) LQAP4 = 15 608

(LQAP5C) LQAP5 = 15 608

(LQAP6C) LQAP6 = 15 608

(LQAP7C) LQAP7 = 15 608

(LQAP8C) LQAP8 = 15 608

(LQAP9C) LQAP9 = 15 608

(LQAP10C) LQAP10 = 15 608

(LQAP11C) LQAP11 = 15 608

(LQAP12C) LQAP12 = 15 608

Net evaporation from Lake Diefenbaker is considered as a water use activity and is shown in equations (LEVAP1C) to (LEVAP12C).

(LEVAP1C) LEVAP1 = 0 dam^3

(LEVAP2C) LEVAP2 = 0

(LEVAP3C) LEVAP3 = 0

(LEVAP4C) LEVAP4 = 0

(LEVAP5C) LEVAP5 = 6 992

(LEVAP6C) LEVAP6 = 15 808

(LOD07C) LEVAP7 = 35 568

(LEVAP8C) LEVAP8 = 39 824

(LEVAP9C) LEVAP9 = 33 744

(LEVAP10C)LEVAP10 = 23 104

(LEVAP11C)LEVAP11 = 2 128

(LEVAP12C)LEVAP12 = 0

where:

LEVAP1 to LEVAP12 = net evaporation from Lake Diefenbaker

c. <u>Lake Level Equations</u>

The lake level equations are the key constraints for this sub-basin. They define the lake level in each period as a function of the previous period's level and inflows and outflows to the lake. They implicitly balance out supply and demand in each time period so no supply-demand balance equations are required. Equations (LLAK1) to (LLAK12) define lake levels in each period. Note that the lake level is actually expressed in terms of volume of Lake Diefenbaker in dam^3.

(LLAK1) - LLAK1 + LLAK0 + LGSUP1 - LTOD1
- LEVAP1 - LREL1 - LCREL1 - LQAP1 = 0

(LLAK2) - LLAK2 + LLAK1 + LGSUP2 - LTOD2
- LEVAP2 - LREL2 - LCREL2 - LQAP2 = 0

(LLAK3) - LLAK3 + LLAK2 + LGSUP3 - LTOD3
- LEVAP3 - LREL3 - LCREL3 - LQAP3 = 0

(LLAK4) - LLAK4 + LLAK3 + LGSUP4 - LTOD4
- LEVAP4 - LREL4 - LCREL4 - LQAP4 = 0

(LLAK5) - LLAK5 + LLAK4 + LGSUP5 - LTOD5
- LEVAP5 - LREL5 - LCREL5 - LQAP5 = 0

(LLAK6)	- LLAK6	+ LLAK5	+ LGSUP6	- LTOD6	
	- LEVAP6	- LREL6	- LCREL6	- LQAP6	= 0
(LLAK7)	- LLAK7	+ LLAK6	+ LGSUP7	- LTOD7	
	- LEVAP7	- LREL7	- LCREL7	- LQAP7	= 0
(LLAK8)	- LLAK8	+ LLAK7	+ LGSUP8	- LTOD8	
	- LEVAP8	- LREL8	- LCREL8	- LQAP8	= 0
(LLAK9)	- LLAK9	+ LLAK8	+ LGSUP9	- LTOD9	
	- LEVAP9	- LREL9	- LCREL9	- LQAP9	= 0
(LLAK10)	- LLAK10	+ LLAK9	+ LGSUP10	- LTOD10	
	- LEVAP10	- LREL10	- LCREL10	- LQAP10	= 0
(LLAK11)	- LLAK11	+ LLAK10	+ LGSUP11	- LTOD11	
	- LEVAP11	- LREL11	- LCREL11	- LQAP11	= 0
(LLAK12)	- LLAK12	+ LLAK11	+ LGSUP12	- LTOD12	
	- LEVAP12	- LREL12	- LCREL12	- LQAP12	= 0

where:

LLAK0 = lake level at the start of first period

LLAK1 TO LLAK12 = lake level at the end of each period

LREL1 TO LREL12 = release to river downstream

LCREL1 to LCREL12 = release to canal

LQAP1 to LQAP12 = release to Qu'Appelle diversion

Because the model works on a sustained water yield basis the storage in the lake cannot be mined. This condition is imposed by equation (LLAK0C) which states that the end-of-year storage must be equal to the beginning-of-year storage.

(LLAK0C) LLAK0 - LLAK12 = 0

There are also some restrictions on maximum and minimum lake levels. The maximum lake levels are based on maximum no-flood levels from the operating rule curve for Lake Diefenbaker. Equations (LMAX1C) to (LMAX12C) define the maximum lake level expressed in volume of water contained in Lake Diefenbaker.

(LMAX1C) LLAK1 $<$ 9 372 800 dam^3

(LMAX2C) LLAK2 $<$ 9 372 800

(LMAX3C) LLAK3 $<$ 9 372 800

(LMAX4C) LLAK4 $<$ 9 372 800

(LMAX5C) LLAK5 $<$ 9 372 800

(LMAX6C) LLAK6 $<$ 9 372 800

(LMAX7C) LLAK7 $<$ 9 372 800

(LMAX8C) LLAK8 $<$ 9 372 800

(LMAX9C) LLAK9 $<$ 9 372 800

(LMAX10C) LLAK10 $<$ 9 372 800

(LMAX11C) LLAK11 $<$ 9 372 800

(LMAX12C) LLAK12 $<$ 9 372 800

The minimum lake levels as set out in the Lake Diefenbaker rule curve are shown in equations (LMIN1C) to (LMIN12C).

(LMIN1C) LLAK1 $>$ 5 424 000 dam^3

(LMIN2C) LLAK2 $>$ 5 424 000

(LMIN3C) LLAK3 $>$ 5 424 000

(LMIN4C) LLAK4 > 5 424 000

(LMIN5C) LLAK5 > 5 424 000

(LMIN6C) LLAK6 > 5 424 000

(LMIN7C) LLAK7 > 5 424 000

(LMIN8C) LLAK8 > 5 424 000

(LMIN9C) LLAK9 > 5 424 000

(LMIN10C) LLAK10 > 5 424 000

(LMIN11C) LLAK11 > 5 424 000

(LMIN12C) LLAK12 > 5 424 000

Minimum flow requirements for the river downstream are imposed on the model. These are based on a minimum flow of 1500 cubic feet per second required for the city of Saskatoon. Equations (LINS1C) to (LINS12C) define the minimum flows expressed as total monthly release in dam^3.

(LINS1C) LREL1 > 113 382 dam^3

(LINS2C) LREL2 > 102 816

(LINS3C) LREL3 > 113 382

(LINS4C) LREL4 > 110 160

(LINS5C) LREL5 > 113 382

(LINS6C) LREL6 > 110 160

(LINS7C) LREL7 > 113 382

(LINS8C) LREL8 > 113 382

(LINS9C) LREL9 > 110 160

(LINS10C) LREL10 > 113 382

(LINS11C) LREL11 > 110 106

(LINS12C) LREL12 > 113 382

Maximum downstream flows are also imposed. Flows above these levels are considered to cause flood damages. These constraints are shown in equations (LFLD1C) to (LFLD12C).

(LFLD1C) LREL1 < 1 607 040 dam^3

(LFLD2C) LREL2 < 1 451 520

(LFLD3C) LREL3 < 1 607 040

(LFLD4C) LREL4 < 1 555 200

(LFLD5C) LREL5 < 1 607 040

(LFLD6C) LREL6 < 1 555 520

(LFLD7C) LREL7 < 1 607 040

(LFLD8C) LREL8 < 1 607 040

(LFLD9C) LREL9 < 1 555 520

(LFLD10C) LREL10 < 1 607 040

(LFLD11C) LREL11 < 1 555 520

(LFLD12C) LREL12 < 1 607 040

d. Hydropower Generation

Hydropower generation is a non-linear function of head and flows. Modeling this relationship requires a number of equations to represent maximum turbine capacity, flows through the turbines and reservoir head. Some scaling adjustments were also made to keep objective function coefficients from becoming too small relative to the coefficients in the constraints.

The first set of constraints define the amount of flow through turbines and limit this flow to being less than or equal to the actual flow released from the reservoir as shown in equations (HCTF1C) to (HCTF12C). For scaling purposes the reservoir release is expressed in thousands of dam^3 in these equations. This change in units is accounted for by multiplying the objective function value for hydropower by 1000 in a later set of equations.

(HCTF1C) HREL1 - .001 LREL1 < 0

(HCTF2C) HREL2 - .001 LREL2 < 0

(HCTF3C) HREL3 - .001 LREL3 < 0

(HCTF4C) HREL4 - .001 LREL4 < 0

(HCTF5C) HREL5 - .001 LREL5 < 0

(HCTF6C) HREL6 - .001 LREL6 < 0

(HCTF7C) HREL7 - .001 LREL7 < 0

(HCTF8C) HREL8 - .001 LREL8 < 0

(HCTF9C) HREL9 - .001 LREL9 < 0

(HCTF10C) HREL10 - .001 LREL10 < 0

(HCTF11C) HREL11 - .001 LREL11 < 0

(HCTF12C) HREL12 - .001 LREL12 < 0

where:

HREL1 to HREL12 = flow passing through turbines (thousands of dam^3)

The amount of water used for power generation is also limited by the capacity of the turbines. Equations (HCTF1C) to (HCTF12C) define monthly maximum flows for power generation based on turbine capacity. The monthly maximum flows are based on a maximum discharge total of 425 cubic meters per second for the Coteau Creek station as reported in the Saskatchewan Nelson Basin study by the Prairie Provinces Water Board (1986).

(HCTT1C) HREL1 $<$ 1116.9 thousands of dam^3

(HCTT2C) HREL2 $<$ 1116.9

(HCTT3C) HREL3 $<$ 1116.9

(HCTT4C) HREL4 $<$ 1116.9

(HCTT5C) HREL5 $<$ 1116.9

(HCTT6C) HREL6 $<$ 1116.9

(HCTT7C) HREL7 $<$ 1116.9

(HCTT8C) HREL8 $<$ 1116.9

(HCTT9C) HREL9 $<$ 1116.9

(HCTT10C) HREL10 $<$ 1116.9

(HCTT11C) HREL11 $<$ 1116.9

(HCTT12C) HREL12 $<$ 1116.9

A power generation formula was estimated from a graph of reservoir elevation versus generating capacity. The graph was used to determine the change in power generating capacity associated with a unit drop in reservoir elevation at various elevations (heads). Full details of the calculation are presented in appendix two. It is recommended that actual power generation formulae from Saskatchewan Power Corporation should be used in the model in place of the estimates made from the power capacity curve for Lake Diefenbaker.

The amount of power generated is a function of head as well as flow through the turbines. The head is stated as a function of the average lake level during the month as shown in equations (LHED1C) to (LHED12C). For scaling purposes the head is expressed in millimetres.

(LHED1C) $- HED1 + .00143\ LLAK0 + .00143\ LAK1 = 7\ 223$ millimetres

(LHED2C) $- HED2 + .00143\ LLAK1 + .00143\ LAK2 = 7\ 223$

(LHED3C) $- HED3 + .00143\ LLAK2 + .00143\ LAK3 = 7\ 223$

(LHED4C) $- HED4 + .00143\ LLAK3 + .00143\ LAK4 = 7\ 223$

(LHED5C) $- HED5 + .00143\ LLAK4 + .00143\ LAK5 = 7\ 223$

(LHED6C) $- HED6 + .00143\ LLAK5 + .00143\ LAK6 = 7\ 223$

(LHED7C) $- HED7 + .00143\ LLAK6 + .00143\ LAK7 = 7\ 223$

(LHED8C) $- HED8 + .00143\ LLAK7 + .00143\ LAK8 = 7\ 223$

(LHED9C) $- HED9 + .00143\ LLAK8 + .00143\ LAK9 = 7\ 223$

(LHED10C) $- HED10 + .00143\ LLAK9 + .00143\ LAK10 = 7\ 223$

(LHED11C) $- HED11 + .00143\ LLAK10 + .00143\ LAK11 = 7\ 223$

(LHED12C) $- HED12 + .00143\ LLAK11 + .00143\ LAK12 = 7\ 223$

where:

LHED1 to LHED12 = head for power generation (millimetres)

The production of power is based on the product of head and flow. The following formula gives power generation in megawatt hours for a given month (see appendix A).

power generation = .007403 LHED x HREL (MWH)

Multiplying by the price of hydro-power gives the value of power generation.

value of power = price x .007403 LHED x HREL generation

A two price system for hydropower is used. In the winter months, October to March, a price of $118 per megawatt-hour is used. In the remaining summer months a lesser price of $43 per megawatt-hour is used in the objective function. This price system is roughly based on B.C. Hydro costs of power production, with the high price being for thermo generated power and the low price being for hydro power. It is recommended that these prices be reviewed and revised in order to reflect power values for Saskatchewan. Using these prices the following objective function values are generated. This non-linear portion of the objective function will appear in a separate sub-routine (see Chapter 3).

(VALUE) .8764 LHED1 X HREL1

(VALUE) .8764 LHED2 X HREL2

(VALUE) .8764 LHED3 X HREL3

(VALUE) .31949 LHED4 X HREL4

(VALUE) .31949 LHED5 X HREL5

(VALUE) .31949 LHED6 X HREL6

(VALUE) .31949 LHED7 X HREL7

(VALUE) .31949 LHED8 X HREL8

(VALUE) .31949 LHED9 X HREL9

(VALUE) .8764 LHED10 X HREL10

(VALUE) .8764 LHED11 X HREL11

(VALUE) .8764 LHED12 X HREL12

e. <u>Recreational Activity</u>

Instead of maximizing recreational gains from lake level operations, the model is set out to minimize recreational losses, which has the same effect and is easier to model. A variable representing recreational lake levels is introduced in equations (LRLV5C) to (LRLV9C). Recreational activity in the other time periods is assumed to be insignificant. These equations state that the recreational lake level is less than or equal to the actual lake level.

(LRLV5C) LREC5 - LLAK5 < 0

(LRLV6C) LREC6 - LLAK6 < 0

(LRLV7C) LREC7 - LLAK7 < 0

(LRLV8C) LREC8 - LLAK8 < 0

(LRLV9C) LREC9 - LLAK9 < 0

where:

LREC5 to LREC9 = recreational lake levels

Maximum recreational values are reached when the lake level is at a height of 555.3 meters (8,682,000) dam^3 in volume). No additional recreational benefits are considered to occur if lake levels rise above this figure. This limit is modeled by specifying that the recreational lake levels LREC5 to LREC9 must be less than 8,682,000 dam^3 as shown in equations (LRMX5C) to (LRMX9C).

(LRMX5C) LREC5 < 8 682 000 dam^3

(LRMX6C) LREC6 < 8 682 000

(LRMX7C) LREC7 < 8 682 000

(LRMX8C) LREC8 < 8 682 000

(LRMX9C) LREC9 < 8 682 000

The next step is to define a lake level deficiency variable which is the amount by which the lake volume is below 8,682,000 dam^3. Recreational losses will be proportional to this variable. This is done in equations (LRLS5C) to (LRLS9C).

(LRLS5C) LREC5 + LRLS5 = 8 682 000 dam^3

(LRLS6C) LREC6 + LRLS6 = 8 682 000

(LRLS7C) LREC7 + LRLS7 = 8 682 000

(LRLS8C) LREC8 + LRLS8 = 8 682 000

(LRLS9C) LREC9 + LRLS9 = 8 682 000

where:

LRLS5 to LRLS9 = lake level difference from optimum recreational elevation

Finally an objective function value for the lake level deficiency variable must be determined. A study by Bjonback(1986) was used as the basis for determing the value associated with recreational losses. His study estimated a loss of $560,000 (1984 dollars) associated with a lake level 3.5 meters below optimal elevations for recreation. This figure did not reflect losses at Elbow Harbour and Paliser parks or by summer inhabitants of recreational cottages. Based on visitation rates to Elbow and Paliser parks, it was possible to calculate the losses in these areas from a similar drop in lake levels. Including these areas increased the total loss figure to $763,728. It was assumed that there were 150 cottages at 60% occupancy rate over three summer months. Applying the same loss rate to cottage inhabitants increased the total loss figure to $819,000. In 1986 dollars the total recreational loss figure is $884,000.

A drop of 3.5 meters in the elevation of Lake Diefenbaker is equivalent in a loss of volume of 1,233,500 dam^3. Dividing the total loss by 1,233,500 dam^3 gives an annual loss of $0.717 per dam^3. This figure was then weighted by the relative visitation rates in each month to give monthly values lost per dam^3. The monthly values lost are then entered in the objective function as coefficients on the LRLS variables.

(VALUE) - .0541 LRLS5

(VALUE) - .1446 LRLS6

(VALUE) - .2827 LRLS7

(VALUE) - .2203 LRLS8

(VALUE) - .0151 LRLS9

4. SSEWS Canal Sub-basin

The structure of the model for this sub-basin is similar to the river upstream and the Swift current sub-basins. There is no significant storage within the sub-basin with almost all of the water supply coming in the form of release from Lake Diefenbaker. Supply-demand balance equations are the key constraints in the model.

a. Water Supply Activities

Water supply consists of release from Lake Diefenbaker, natural run-off within the sub-basin and return flows. The gross water supply is defined in equations (KSUP1C) to (KSUP12C).

(KSUP1C)	LCREL1	+ KROA1	+ KRET1	- KGSUP1	=	0
(KSUP2C)	LCREL2	+ KROA2	+ KRET2	- KGSUP2	=	0
(KSUP3C)	LCREL3	+ KROA3	+ KRET3	- KGSUP3	=	0
(KSUP4C)	LCREL4	+ KROA4	+ KRET4	- KGSUP4	=	0
(KSUP5C)	LCREL5	+ KROA5	+ KRET5	- KGSUP5	=	0
(KUSP6C)	LCREL6	+ KROA6	+ KRET6	- KGSUP6	=	0
(KSUP7C)	LCREL7	+ KROA7	+ KRET7	- KGSUP7	=	0

(KSUP8C) LCREL8 + KROA8 + KRET8 - KGSUP8 = 0

(KSUP9C) LCREL9 + KROA9 + KRET9 - KGSUP9 = 0

(KSUP10C) LCREL10 + KROA10 + KRET10 - KGSUP10 = 0

(KSUP11C) LCREL11 + KROA11 + KRET11 - KGSUP11 = 0

(KSUP12C) LCREL12 + KROA12 + KRET12 - KGSUP12 = 0

where:

LCREL1 to LCREL12 = release of water to canal from lake

KROA1 to KROA12 = natural run-off within the sub-basin

KRET1 to KRET12 = return flows within the sub-basin

KGSUP1 to KGSUP12 = gross water supply available

As in other sub-basins, a figure of 20% wastage was used to define net supply available. Equations (KWAS1C) to (KWAS12C) define the available water supply after wastage.

(KWAS1C) KNSUP1 - .8 KGSUP1 = 0

(KWAS2C) KNSUP2 - .8 KGUKP2 = 0

(KWAS3C) KNSUP3 - .8 KGSUP3 = 0

(KWAS4C) KNSUP4 - .8 KGSUP4 = 0

(KWAS5C) KNSUP5 - .8 KGSUP5 = 0

(KWAS6C) KNSUP6 - .8 KGSUP6 = 0

(KWAS7C) KNSUP7 - .8 KGSUP7 = 0

(KWAS8C) KNSUP8 - .8 KGSUP8 = 0

(KWAS9C) KNSUP9 - .8 KGSUP9 = 0

(KWAS10C) KNSUP10 - .8 KGSUP10 = 0

(KWAS11C) KNSUP11 - .8 KGSUP11 = 0

(KWAS12C) KNSUP12 - .8 KGSUP12 = 0

where:

KNSUP1 to KNSUP12 = monthly supply available after wastage

At the time of writing it was not known if there was any significant natural run-off in the sub-basin. However, because of its small area, it was assumed that local supply was insignificant as shown in equations (KNAT1C) to (KNAT12C).

(KNAT1C) KROA1 = 0

(KNAT2C) KROA2 = 0

(KNAT3C) KROA3 = 0

(KNAT4C) KROA4 = 0

(KNAT5C) KROA5 = 0

(KNAT6C) KROA6 = 0

(KNAT7C) KROA7 = 0

(KNAT8C) KROA8 = 0

(KNAT9C) KROA9 = 0

(KNAT10C) KROA10 = 0

(KNAT11C) KROA11 = 0

(KNAT12C) KROA12 = 0

Return flows are defined in equations (KRET1C) to (KRET12C). Return flows from domestic, agricultural and industrial uses are shown in equations (KRET1C) to (KRET12C). Agricultural return flows are based on an annual return of 34.6%. Annual return flows from industry and domestic are 92% and 88% respectively. All of the above figures are taken from Acres International (1986).

(KRET1C) KRET1 - .073 KDODO - .077 KINDO = 0

(KRET2C) KRET2 - .073 KDODO - .077 KINDO = 0

(KRET3C) KRET3 - .073 KDODO - .077 KINDO = 0

(KRET4C) KRET4 - .073 KDODO - .077 KINDO = 0

(KRET5C) KRET5 - .073 KDODO - .077 KINDO - .117 KHEC = 0

(KRET6C) KRET6 - .073 KDODO - .077 KINDO - .361 KHEC = 0

(KRET7C) KRET7 - .073 KDODO - .077 KINDO - .769 KHEC = 0

(KRET8C) KRET8 - .073 KDODO - .077 KINDO - .385 KHEC = 0

(KRET9C) KRET9 - .073 KDODO - .077 KINDO - .361 KHEC = 0

(KRET10C) KRET10 - .073 KDODO - .077 KINDO = 0

(KRET11C) KRET11 - .073 KDODO - .077 KINDO = 0

(KRET12C) KRET12 - .073 KDODO - .077 KINDO = 0

where:

KDODO = gross annual water withdrawn for domestic use

KINDO = gross annual water withdrawn for industrial use

KHEC = number of hectares irrigated

b. <u>Water Demand Activities</u>

Total water demands (gross withdrawal) are defined by equations (KTOD1C) to (KTOD12C). Agriculture, domestic and industry are included in these equations, although there is no significant industrial water use in the sub-basin. A later set of equations fixes the industrial water use at zero.

(KTOD1C) KAGD1 + KDOD1 + KIND1 - KTOD1 = 0

(KTOD2C) KAGD2 + KDOD2 + KIND2 - KTOD2 = 0

(KTOD3C) KAGD3 + KDOD3 + KIND3 - KTOD3 = 0

(KTOD4C) KAGD4 + KDOD4 + KIND4 - KTOD4 = 0

(KTOD5C) KAGD5 + KDOD5 + KIND5 - KTOD5 = 0

(KTOD6C) KAGD6 + KDOD6 + KIND6 - KTOD6 = 0

(KTOD7C) KAGD7 + KDOD7 + KIND7 - KTOD7 = 0

(KTOD8C) KAGD8 + KDOD8 + KIND8 - KTOD8 = 0

(KTOD9C) KAGD9 + KDOD9 + KIND9 - KTOD9 = 0

(KTOD10C) KAGD10 + KDOD10 + KIND10 - KTOD10 = 0

(KTOD11C) KAGD11 + KDOD11 + KIND11 - KTOD11 = 0

(KTOD12C) KAGD12 + KDOD12 + KIND12 - KTOD12 = 0

where:

KAGD1 to KAGD12 = water withdrawn for irrigation in each period

KDOD1 to KDOD12 = water withdrawn for domestic use in each period

KIND1 to KIND12 = water withdrawn for industry in each period

KTOD1 to KTOD12 = total water withdrawn in each period

The annual amount of water withdrawn for irrigation is expressed as a function of the number of irrigated hectares in the sub-basin as shown in equation (KAGDOC). The annual application rate of 5.83 dam^3 per hectare is taken from Acres International (1986).

(KAGD0C) 5.83 KHEC - KAGD0 = 0

where:

KHEC = number of irrigated hectares

KAGD0 = annual amount withdrawn for irrigation

The monthly withdrawals for irrigation are then expressed as percentages of the annual withdrawal as shown in equations (KAGD5C) TO KAGD9C).

(KAGD5C) KAGD5 - .059 KAGD0 = 0

(KAGD6C) KAGD6 - .178 KAGD0 = 0

(KAGD7C) KAGD7 - .381 KAGD0 = 0

(KAGD8C) KAGD8 - .191 KAGD0 = 0

(KAGD9C) KAGD9 - .190 KAGD0 = 0

where:

KAGD5 to KAGD9 = amount withdrawn for irrigation in each period.

The next equation sets out an upper limit on the amount of land available for irrigation. This limit is set at the current level of irrigated hectares in the sub-basin, but could be increased when evaluating future levels of development. The figure of 20 950 hectares is an estimate based on data from Acres International (1986) and the estimated area of the South Saskatchewan River Irrigation District.

(KHECC) KHEC < 20 950 hectares

The variable KHEC representing the number of irrigated hectares in the sub-basin is an objective function activity with a value of $350 per hectare based on the study by O'Grady et.al. (1983). This figure does not account for the off-farm capital and maintenance costs of the delivery system.

(VALUE) $350 x KHEC

It is not known whether there is any significant industrial water use in the sub-basin. Initially the model sets industrial water use at nil as shown in equation (KINDOC).

(KINDOC) KINDO = 0

where:

KINDO = annual water withdrawn for industry in the sub-basin.

The monthly water supplied to industry is expressed as a percentage of annual industrial water use as shown in equations (KIND1C) to (KIND12C).

(KIND1C) KIND1 - .0833 KINDO = 0

(KIND2C) KIND2 - .0833 KINDO = 0

(KIND3C) KIND3 - .0833 KINDO = 0

(KIND4C) KIND4 - .0833 KINDO = 0

(KIND5C) KIND5 - .0833 KINDO = 0

(KIND6C) KIND6 - .0833 KINDO = 0

(KIND7C) KIND7 - .0833 KINDO = 0

(KIND8C) KIND8 - .0833 KINDO = 0

(KIND9C) KIND9 - .0833 KINDO = 0

(KIND10C) KIND10 - .0833 KINDO = 0

(KIND11C) KIND11 - .0833 KINDO = 0

(KIND12C) KIND12 - .0833 KINDO = 0

where:

KIND1 to KIND2 = monthly withdrawals for industry

Domestic demands are fixed in the model as shown in equations (KDOD1C) to (KDOD12C). These demands are based on a population of 20,150 with a per capita consumption of 350 liters per day. The population figure is an estimate derived by taking one half of the rural population of the Saskatoon node used in the forecasting model developed by Acres International (1986).

(KDOD1C) KDOD1 = 150 dam^3

(KDOD2C) KDOD2 = 150

(KDOD3C) KDOD3 = 150

(KDOD4C) KDOD4 = 215

(KDOD5C) KDOD5 = 279

(KDOD6C) KDOD6 = 279

(KODO7C) KDOD7 = 279

(KDOD8C) KDOD8 = 279

(KDOD9C) KDOD9 = 279

(KDOD10C) KDOD10 = 215

(KDOD11C) KDOD11 = 150

(KDOD12C) KDOD12 = 150

The annual total of domestic water use is also fixed as shown in equation (KDODOC).

(KDODOC) KDODO = 2 575 dam^3

where:

KDODO = annual water withdrawn for domestic use

c. Supply Demand Balance

This set of constraints set out the condition that in each period the total water withdrawn must be less than the supply available after wastage. Equations (KBAL1C) to (KBAL12C) define the supply demand balance.

(KBAL1C) KTOD1 - KNSUP1 $<$ 0

(KBAL2C) KTOD2 - KNSUP2 $<$ 0

(KBAL3C) KTOD3 - KNSUP3 $<$ 0

(KBAL4C) KTOD4 - KNSUP4 $<$ 0

(KBAL5C) KTOD5 - KNSUP5 $<$ 0

(KBAL6C) KTOD6 - KNSUP6 $<$ 0

(KBAL7C) KTOD7 - KNSUP7 $<$ 0

(KBAL8C) KTOD8 - KNSUP8 $<$ 0

(KBAL9C) KTOD9 - KNSUP9 $<$ 0

(KBAL10C) KTOD10 - KNSUP10 < 0

(KBAL11C) KTOD11 - KNSUP10 < 0

(KBAL12C) KTOD12 - KNSUP12 < 0

where:

KTOD1 to KTOD12 = total water demand in each period

KNSUP1 to KNSUP12 = water available after wastage

The final set of equations for this sub-basin define the remaining flows which will leave the South Saskatchewan River system. Remaining flows are equal to the gross supply minus the total demands as shown in equations (KREM1C) to (KREM12C).

(KREM1CO KREM1 - KGSUP1 + KTOD1 = 0

(KREM2C) KREM2 - KGSUP2 + KTOD2 = 0

(KREM3C) KREM3 - KGSUP3 + KTOD3 = 0

(KREM4C) KREM4 - KGSUP4 + KTOD4 = 0

(KREM5C) KREM5 - KGSUP5 + KTOD5 = 0

(KREM6C) KREM6 - KGSUP6 + KTOD6 = 0

(KREM7C) KREM7 - KGSUP7 + KTOD7 = 0

(KREM8C) KREM8 - KGSUP8 + KTOD8 = 0

(KREM9C) KREM9 - KGSUP9 + KTOD9 = 0

(KREM10C) KREM10 - KGSUP10 + KTOD10 = 0

(KREM11C) KREM11 - KGSUP11 + KTOD11 = 0

(KREM12C) KREM12 - KGSUP12 + KTOD12 = 0

where:

KREM1 to KREM12 = remaining flow passing out of the basin

5. Downstream River Sub-basin

This is the final sub-basin of the system. The model structure is similar to the Swift Current Creek and upstream river sub-basins. The major difference is that remaining flows from the downstream river sub-basin leave the Basin rather than acting as linkages with downstream sub-basins.

a. Water Supply Activities

The first set of equations define the total amount of water available in the sub-basin for each period. Total supply consists of water released from Lake Diefenbaker, the natural run-off in the sub-basin and any return flows from water use. Equations DSUP1C to DSUP12C define the monthly water supplies.

(DSUP1C) LREL1 + DROA1 + DRET1 - DGSUP1 = 0

(DSUP2C) LREL2 + DROA2 + DRET2 - DGSUP2 = 0

(DSUP3C) LREL3 + DROA3 + DRET3 - DGSUP3 = 0

(DSUP4C) LREL4 + DROA4 + DRET4 - DGSUP4 = 0

(DSUP5C) LREL5 + DROA5 + DRET5 - DGSUP5 = 0

(DUSP6C) LREL6 + DROA6 + DRET6 - DGSUP6 = 0

(DSUP7C) LREL7 + DROA7 + DRET7 - DGSUP7 = 0

(DSUP8C) LREL8 + DROA8 + DRET8 - DGSUP8 = 0

(DSUP9C) LREL9 + DROA9 + DRET9 - DGSUP9 = 0

(DSUP10C) LREL10 + DROA10 + DRET10 - DGSUP10 = 0

(DSUP11C) LREL11 + DROA11 + DRET11 - DGSUP11 = 0

(DSUP12C) LREL12 + DROA12 + DRET12 - DGSUP12 = 0

where:

DROA1 to DROA12 = natural run-off within the sub-basin

DRET1 to DRET12 = return flows within the sub-basin

DGSUP1 to DGSUP12 = gross water supply available

As in other sub-basins, a figure of 20% wastage was used to define net supply available. Equations (DWAS1C) to (DWAS12C) define the available water supply after wastage.

(DWAS1C) DNSUP1 - .8 DGSUP1 = 0

(DWAS2C) DNSUP2 - .8 DGUSP2 = 0

(DWAS3C) DNSUP3 - .8 DGSUP3 = 0

(DWAS4C) DNSUP4 - .8 DGSUP4 = 0

(DWAS5C) DNSUP5 - .8 DGSUP5 = 0

(DWAS6C) DNSUP6 - .8 DGSUP6 = 0

(DWAS7C) DNSUP7 - .8 DGSUP7 = 0

(DWAS8C) DNSUP8 - .8 DGSUP8 = 0

(DWAS9C) DNSUP9 - .8 DGSUP9 = 0

(DWAS10C) DNSUP10 - .8 DGSUP10 = 0

(DWAS11C) DNSUP11 - .8 DGSUP11 = 0

(DWAS12C) DNSUP12 - .8 DGSUP12 = 0

where:

DNSUP1 to DNSUP12 = monthly supply available after wastage

The fifty-six-year average natural run-off in the sub-basin is defined in equations (DNAT1C) to (DNAT12C). It was assumed that natural run-off in this sub-basin was equal to 30% of the local natural supply at the Saskatoon node of the forecasting model developed by Acres International (1986).

(DNAT1C) DROA1 = 2 683 dam^3

(DNAT2C) DROA2 = 720

(DNAT3C) DROA3 = 154

(DNAT4C) DROA4 = 64 607

(DNAT5C) DROA5 = 5 162

(DNAT6C) DROA6 = 16 669

(DNAT7C) DROA7 = 63 814

(DNAT8C) DROA8 = 25 310

(DNAT9C) DROA9 = 23 694

(DNAT10C) DROA10 = 11 597

(DNAT11C) DROA11 = 8 346

(DNAT12C) DROA12 = 2 456

Return flows are defined in equations (DRET1C) to (DRET12C). The coefficients are based on an annual return flow of 37% from agriculture, 88% from domestic and 73% from industry.

(DRET1C) DRET1 - .073 DDODO - .061 DINDO = 0

(DRET2C) DRET2 - .073 DDODO - .061 DINDO = 0

(DRET3C)	DRET3	- .073 DDODO - .061 DINDO = 0
(DRET4C)	DRET4	- .073 DDODO - .061 DINDO = 0
(DRET5C)	DRET5	- .073 DDODO - .061 DINDO - .362 DHEC = 0
(DRET6C)	DRET6	- .073 DDODO - .061 DINDO - .581 DHEC = 0
(DRET7C)	DRET7	- .073 DDODO - .061 DINDO - .806 DHEC = 0
(DRET8C)	DRET8	- .073 DDODO - .061 DINDO - .637 DHEC = 0
(DRET9C)	DRET9	- .073 DDODO - .061 DINDO - .678 DHEC = 0
(DRET10C)	DRET10	- .073 DDODO - .061 DINDO = 0
(DRET11C)	DRET11	- .073 DDODO - .061 DINDO = 0
(DRET12C)	DRET12	- .073 DDODO - .061 DINDO = 0

where:

DDODO = gross water withdrawn for domestic use

DINDO = gross water withdrawn for industrial use

DHEC = number of hectares irrigated

b. Water Demand Activities

Total water demands (gross withdrawal) are defined by equations (DTOD1C) to (DTOD12C). Agriculture, domestic and industry are the three water using sectors in the sub-basin.

(DTOD1C)	DAGD1 + DDOD1 + DIND1 - DTOD1 = 0
(DTOD2C)	DAGD2 + DDOD2 + DIND2 - DTOD2 = 0
(DTOD3C)	DAGD3 + DDOD3 + DIND3 - DTOD3 = 0
(DTOD4C)	DAGD4 + DDOD4 + DIND4 - DTOD4 = 0
(DTOD5C)	DAGD5 + DDOD5 + DIND5 - DTOD5 = 0

(DTOD6C) DAGD6 + DDOD6 + DIND6 - DTOD6 = 0

(DTOD7C) DAGD7 + DDOD7 + DIND7 - DTOD7 = 0

(DTOD8C) DAGD8 + DDOD8 + DIND8 - DTOD8 = 0

(DTOD9C) DAGD9 + DDOD9 + DIND9 - DTOD9 = 0

(DTOD10C) DAGD10 + DDOD10 + DIND10 - DTOD10 = 0

(DTOD11C) DAGD11 + DDOD11 + DIND11 - DTOD11 = 0

(DTOD12C) DAGD12 + DDOD12 + DIND12 - DTOD12 = 0

where:

DAGD1 to DAGD12 = water withdrawn for irrigation in each period

DDOD1 to DDOD12 = water withdrawn for domestic use in each period

DIND1 to DIND12 = water withdrawn for industry in each period

DTOD1 to DTOD12 = total water withdrawn in each period

The annual amount of water withdrawn for irrigation is expressed as a function of the number of irrigated hectares in the sub-basin as shown in equation (DAGDOC). The annual application of 6.86 dam^3 per hectare is taken from Acres International (1986).

(DAGDOC) 6.86 DHEC - DAGDO = 0

where:

DHEC = number of irrigated hectares

DAGDO = annual amount withdrawn for irrigation

The monthly withdrawals for irrigation are then expressed as percentages of the annual withdrawal as shown in equations (DAGD5C) to (DAGD9C).

(DAGD5C) DAGD5 - .094 DAGD0 = 0

(DAGD6C) DAGD6 - .178 DAGD0 = 0

(DAGD7C) DAGD7 - .308 DAGD0 = 0

(DAGD8C) DAGD8 - .223 DAGD0 = 0

(DAGD9C) DAGD9 - .196 DAGD0 = 0

where:

DAGD5 to DAGD9 = amount withdrawn for irrigation in each period.

The next equation sets out an upper limit on the amount of land available for irrigation. This limit is set at the current level of irrigated hectares in the sub-basin, but could be increased when evaluating future levels of development. The current total of 10,070 hectares was arived at by subtracting the sum of the irrigated area in the Lake Diefenbaker, upstream river and Canal sub-basins from the Saskatoon node total of 40,810 hectares in the Acres International (1986) forecasting model.

(DHECC) DHEC < 10 070 hectares

The variable DHEC representing the number of irrigated hectares in the sub-basin has a value in the objective function of $350 per hectare based on the study by O'Grady et.al. (1983). This figure does not account for the off-farm capital and maintenance costs of the delivery system.

(VALUE) $200 x RHEC

There is some industrial water use in the sub-basin. The amount of water withdrawn for industry was calculated from the Acres International (1986) model by adding the figures for the Saskatoon and St. Louis nodes. The model constrains the solution to supply water to industry at current levels. Total annual water use is defined in equation (DINDOC).

(DINDOC) DINDO = 7933 dam^3

where:

DINDO = annual water withdrawn for industry in the sub-basin.

The monthly water supplied to industry is expressed as a percentage of annual industrial water use as shown in equations (DIND1C) to (DIND12C).

(DIND1C) DIND1 - .0833 DINDO = 0

(DIND2C) DIND2 - .0833 DINDO = 0

(DIND3C) DIND3 - .0833 DINDO = 0

(DIND4C) DIND4 - .0833 DINDO = 0

(DIND5C) DIND5 - .0833 DINDO = 0

(DIND6C) DIND6 - .0833 DINDO = 0

(DIND7C) DIND7 - .0833 DINDO = 0

(DIND8C) DIND8 - .0833 DINDO = 0

(DIND9C) DIND9 - .0833 DINDO = 0

(DIND10C) DIND10 - .0833 DINDO = 0

(DIND11C) DIND11 - .0833 DINDO = 0

(DIND12C) DIND12 - .0833 DINDO = 0

where:

DIND1 to DIND12 = monthly withdrawals for industry

Domestic demands are fixed in the model as shown in equations (DDOD1C) to (DDOD12C). The consumption figures are based on a population of 205,932 which is the sum of the urban populations of the St. Louis and Saskatoon nodes plus one half of the rural population of the Saskatoon node in Acres International (1986). Per capita daily consumption was estimated at 350 liters per day.

(DDOD1C) DDOD1 = 1534 dam^3

(DDOD2C) DDOD2 = 1534

(DDOD3C) DDOD3 = 1534

(DDOD4C) DDOD4 = 2191

(DDOD5C) DDOD5 = 2850

(DDOD6C) DDOD6 = 2850

(DOD07C) DDOD7 = 2850

(DDOD8C) DDOD8 = 2850

(DDOD9C) DDOD9 = 2850

(DDOD10C) DDOD10 = 2191

(DDOD11C) DDOD11 = 1534

(DDOD12C) DDOD12 = 1534

The annual total of domestic water use is also fixed as shown in equation (DDODOC).

(DDODOC) DDODO = 26 302

where:

DDODO = annual water withdrawn for domestic use

c. Supply Demand Balance

This set of constraints set out the condition that in each period the total water withdrawn must be less than the supply available after wastage. Equations (DBAL1C) to (DBAL12C) define the supply demand balance.

(DBAL1C) DTOD1 - DNSUP1 < 0

(DBAL2C) DTOD2 - DNSUP2 < 0

(DBAL3C) DTOD3 - DNSUP3 < 0

(DBAL4C) DTOD4 - DNSUP4 < 0

(DBAL5C) DTOD5 - DNSUP5 < 0

(DBAL6C) DTOD6 - DNSUP6 < 0

(DBAL7C) DTOD7 - DNSUP7 < 0

(DBAL8C) DTOD8 - DNSUP8 < 0

(DBAL9C) DTOD9 - DNSUP9 < 0

(DBAL10C) DTOD10 - DNSUP10 < 0

(DBAL11C) DTOD11 - DNSUP10 < 0

(DBAL12C) DTOD12 - DNSUP12 < 0

The final set of equations for this sub-basin define the remaining flows which will leave the Basin. Remaining flows are equal to the gross supply minus the total demands as shown in equations (DREM1C) to (DREM12C).

(DREM1CO DREM1 - DGSUP1 + DTOD1 = 0

(DREM2C) DREM2 - DGSUP2 + DTOD2 = 0

(DREM3C) DREM3 - DGSUP3 + DTOD3 = 0

(DREM4C) DREM4 - DGSUP4 + DTOD4 = 0

(DREM5C) DREM5 - DGSUP5 + DTOD5 = 0

(DREM6C) DREM6 - DGSUP6 + DTOD6 = 0

(DREM7C) DREM7 - DGSUP7 + DTOD7 = 0

(DREM8C) DREM8 - DGSUP8 + DTOD8 = 0

(DREM9C) DREM9 - DGSUP9 + DTOD9 = 0

(DREM10C) DREM10 - DGSUP10 + DTOD10 = 0

(DREM11C) DREM11 - DGSUP11 + DTOD11 = 0

(DREM12C) DREM12 - DGSUP12 + DTOD12 = 0

where:

DREM1 to DREM12 = remaining flow leaving the Basin.

III. HOW TO RUN THE MODEL

This chapter describes how the model can be accessed on the University of British Columbia mainframe computer. A brief description of some basic MTS editor commands is given in order that the user can make changes to the model or test the sensitivity of the solution to certain parameters. Procedures for transferring the model to another installation are also discussed.

A. Signing on to the U.B.C. System

From a remote terminal the U.B.C. system can be accessed either through a modem connection or through DATAPAC. If you have a modem the 2400 baud port can be reached by dialing (604) 222-2400. If you are using DATAPAC the U.B.C. address number is 67200900. Once a connection is established the following identification line should appear on the terminal:

University of B.C. -- General MTS.

Further information may appear on the same line identifying the device and task number. To sign on to the system enter the following command:

$SIGNON EDPR

The system will print out any messages from the computing centre then will respond with:

Enter user password:

?

Type the password after the questionmark. Note that it will not appear on the screen as you type it. For security reasons, the password is not stated in this report but can be obtained from the author. The EDPR on the signon command is the Computer ID for a commercial account belonging to Water Planning and Management Branch in Pacific and Yukon Region.

If you have signed on correctly the system will respond with a few lines telling you the time of the sign-on, the remaining funds in the account and the disk usage. When you see the prompt symbol # at the beginning of a blank line you are ready to enter commands to the system.

The University of B.C. mainframe computer uses the MTS operating system. Basic MTS commands necessary to run the model or edit the data files are discussed in this write-up. For further information on using MTS, a basic MTS manual should be consulted. In particular, information on using the editor will likely be valuable if extensive changes to the model are planned.

When you have finished using the system you can sign off with the following command.

```
$SIGNOFF
```

The system will respond by giving you a breakdown of the time you were signed on and the charges that were applied.

B. Running the Quadratic Programming Model

The model can be run by entering the following command:

$RUN R.OBJMOD+NA:MINOS 5=R.CONMOD 6=-OUT 9=R.BASIS

As a result of this command the solution is written into a file named -OUT. It may take a few seconds for the solution to be obtained; possibly longer if the system is very busy. To see the solution, the following command will list the contents of -OUT on the screen:

$COPY -OUT

The solution is about 30 pages long and gives values of the objective function and of each variable and constraint in the model. The file -OUT is a temporary file which is only maintained during the current signon. A different name for this file can be specified on the run command if so desired. The only requirement is that the file name begin with a '-' (minus sign) which signifies that it is a temporary file and that it be attached to unit 6 on the run command.

If you want to keep the solution on a disk file that is saved for future reference, then leave off the minus sign from the file name. In this case the file you use for the solution output should first be created before you enter the run command. For example, to put the output in a file called 'SOLUTION', enter the following commands:

$CREATE SOLUTION

$RUN R.OBJMOD+NA:MINOS 5=R.CONMOD 6=SOLUTION 9=R.BASIS

The unit specification 9=R.BASIS is not always required but is recommended in most cases. It is used when a starting basis for the model solution is provided by the user, and can save considerable computing time. Currently a starting basis is provided in the file called R.BASIS.

C. File Structure of the Model

The four files which drive the model are a MINOS command file, a file containing the linear constraint and objective function equations, and FORTRAN source and object files which contain the non-linear portion of the objective function. The names of these files are given below.

Filename	Function
R.SPECSMOD	MINOS command file
R.MOD.DAT	Contains the linear constraints and linear portion of the objective function in MPSX code
R.SUBMOD	Contains the fortran source code for the non-linear portion of the objective function.
R.OBJMOD	Contains the FORTRAN object code for the non-linear portion of the objective function

1. MINOS Command File (R.SPECSMOD)

This file contains commands that control the MINOS routines that solve the quadratic programming problem. The commands specify the size of the problem, the degree of precision required, whether or not there is a starting basis and a number of other parameters. It is not recommended that any changes be made to this file at this time. The commands contained in it will be appropriate for most changes that might be made to the data files for the model. However, if more non-linear terms are added to the objective function it will be necessary to change the R.SPECSMOD file. If it becomes necessary to make any changes to the MINOS commands, it is recommended that you consult the author and the MINOS manuals. A listing of the R.SPECSMOD file can be obtained with an MTS command as follows:

$LIST R.SPECSMOD

2. Linear Portion of the Model (R.MOD.DAT)

The constraints (which are all linear) and the linear elements of the objective function are contained in this file. Standard MPSX format is used for coding the problem. MPSX format is a widely used method of coding linear programs. The file is divided into several sections each divided by a header line as shown below.

NAME		(name of run provided by user)
ROWS	-	section showing the kind and name of each row one row per line
COLUMNS	-	section showing identifiers for each variable in each equation including row name, variable name and coefficient
RHS	-	section showing the right hand side value for each constraint - one line for each right hand side value
ENDATA	-	(last line signifying end of data)

The NAME line must be first in the file, containing the word NAME in columns 1 to 4 and a name for the problem in columns 15-22.

a. The ROWS Section

Each row in the model represents a single equation and is classified as either a less than constraint, greater than constraint, equality constraint or a free (objective) row. Each line in the ROWS section specifies the name of the row and the type of row. The row type is represented by a one letter symbol in column 2 or 3 and a user supplied name for the row is shown in columns 5 to 12. The row type symbols are as follows:

E	equality constraint
L	less-than constraint
G	greater-than constraint
N	objective function

The objective function in the model is given the name "VALUE". The constraint names are as shown in chapter II.

b. The COLUMNS Section

The columns section contains one line for each occurrence of a variable in the model. There are usually several lines for each variable because variables often occur in more than one equation. Lines containing the same variable must occur consecutively. Each line in this section contains the variable name in columns 5-12, the name of the row in which it occurs in columns 15-22 and the coefficient on the variable in columns 25-36.

This is a somewhat cumbersome and non-intuitive method of representing the equations in the model although it is the standard method for many mathematical programming prackages. In a sense, the COLUMNS section is expressing the model column by column instead of row by row (equation by equation). However, once you have worked with the model and studied the listing provided, the method of coding the equations should become more clear.

c. The RHS Section

The RHS section contains the the right-hand-side value for each constraint in the model. There is an option to include more than one set of right-hand-side variables for the model, and then specify which set is to be used with the MINOS control commands. Only one set of right-hand-side variables is included in the model in its current form. A name identifying which set the values belong to is placed in columns 5-12. In the model provided, the name given to the set is "RHS1". Therefore this name appears first on every line in the RHS section. The name of the constraint (row name) appears in columns 15-22, and the actual right-hand-side value appears in columns 25-36.

3. The Non-linear Portion of the Model
(R.SUBMOD and R.OBJMOD)

The non-linear portion of the model refers to the section of the objective function which contains the quadratic terms, either cross terms or square terms. Two files are necessary to represent these non-linearities. The first file, R.SUBMOD, contains a fortran subroutine representing the non-linear portion of the objective function. The second file, R.OBJMOD, is the compiled version (executable code) of the subroutine. To make changes to the non-linear portion of the objective function, R.SUBMOD must be edited then recompiled with the recompiled version going into R.OBJMOD.

A listing of R.SUBMOD is provided in Table 2. It can be seen that there are two vectors X(i) and G(i) represented in this file, both with 24 elements. The X(i) vector is composed of all variables which occur in the non-linear portion of the objective function. The subscript number occurs to the order in which these variables occur in the COLUMNS section of the R.MOD.DAT file. For example X(1) to X(12) are the variables LHED1 to LHED12 while X(13) to X(24) represent the variables HREL1 to HREL12. Lines 12-24 specify the power generation function which is composed of LHED multiplied by HREL in each time period (as discussed in Chapter 2). The price of power is represented by the two variables PHIGH and PLOW which are defined in lines 10 and 11. This is the two tiered price system discussed in chapter 2, where PHIGH represents the high value of power in the winter and PLOW represents the lower power values in the summer months.

The G(i) vector is a vector of partial derivatives of the objective function in corresponding order with the X(i) variables. For example, the element G(1) is the partial derivative of the non-linear objective function with respect to X(1). It is necessary to supply this vector of partial derivatives for use in the MINOS search procedures.

TABLE 2

FORTRAN Program for Non-Linear Portion of Objective Function

LIST R.SUBMOD

```
      SUBROUTINE CALCFG (MODE,N,X,F,G,NSTATE,NPROB)
      IMPLICIT   REAL*8(A-H,O-Z)
      REAL*8     X(N),G(N)
C
C  SUBROUTINE FOR NON-LINEAR OBJECTIVE FUNCTION IN MINOS
C
      IF (NPROB.GT.1) GO TO 999
      IF (NSTATE.EQ.1) WRITE (6,101)NPROB
 101  FORMAT ('0','FIRST CALL TO CALCFG. PROBLEM # -',I3/)
      PHIGH=.31949
      PLOW=0.31949
      AA=X(1)*X(13)*PHIGH
      BB=X(2)*X(14)*PHIGH
      CC=X(3)*X(15)*PHIGH
      DD=X(4)*X(16)*PLOW
      EE=X(5)*X(17)*PLOW
      FF=X(6)*X(18)*PLOW
      GG=X(7)*X(19)*PLOW
      HH=X(8)*X(20)*PLOW
      OO=X(9)*X(21)*PLOW
      PP=X(10)*X(22)*PHIGH
      QQ=X(11)*X(23)*PHIGH
      RR=X(12)*X(24)*PHIGH
      F = AA+BB+CC+DD+EE+FF+GG+HH+OO+PP+QQ+RR
      G(1) = X(13)*PHIGH
      G(2) = X(14)*PHIGH
      G(3) = X(15)*PHIGH
      G(4) = X(16)*PLOW
      G(5) = X(17)*PLOW
      G(6) = X(18)*PLOW
      G(7) = X(19)*PLOW
      G(8) = X(20)*PLOW
      G(9) = X(21)*PLOW
      G(10) = X(22)*PHIGH
      G(11) = X(23)*PHIGH
      G(12) = X(24)*PHIGH
      G(13) = X(1)*PHIGH
      G(14) = X(2)*PHIGH
      G(15) = X(3)*PHIGH
      G(16) = X(4)*PLOW
      G(17) = X(5)*PLOW
      G(18) = X(6)*PLOW
      G(19) = X(7)*PLOW
      G(20) = X(8)*PLOW
      G(21) = X(9)*PLOW
      G(22) = X(10)*PHIGH
      G(23) = X(11)*PHIGH
      G(24) = X(12)*PHIGH
 999  CONTINUE
      RETURN
      END
```

Lines 1 to 11 and 49 to 51 are standard and will remain unchanged even if changes to the X(i) and G(i) vectors are made.The compiled version of the FORTRAN program is contained in R.OBJMOD. Any changes made to the source code will necessitate a recompiling of the source program with the output copied to R.OBJMOD. This is described in section E-2 below.

D. Using the MTS Editor

It is necessary to use the editor to make any changes to the model. It is also very useful for reading portions of the output file without displaying the complete contents of the file after a run. To invoke the editor use the following command:

```
$EDIT FILENAME
```

where FILENAME is the name of the file to be edited. Once you are in edit mode the prompt character changes to a ':' instead of the "#" which signifies MTS command mode.

A few of the basic commands used in the editor are discussed below. Note that these commands to not begin with a $ sign as do MTS commands.

To print a portion or all of the file use the command:

```
PRINT (range)
```

where range is a line number range specified by the user. For example to print lines 5 to 15 of the file use:

```
PRINT 5 15
```

To print the whole file use the /FILE range specifier:

```
PRINT /FILE
```

If you wish to change the contents of a line of the file there are a couple of ways of doing this. The simplest way is to use the replace command which replaces a specified line of text. For example to replace line six use:

REPLACE 6

The editor will then type the current line 6 and then cue you for the replacement. Type in the new line and press return. If you just want to change a part of the line without replacing the whole line then the ALTER command can be used. For example if the string "IWD" is contained in line 6 and we want to change it to "IWL" then following command will accomplish this:

ALTER 6 'IWD'IWL'

If we want to change every occurrence of IWD to IWL from lines 10 to 20 then the following command would be used:

ALTER@A 10 20 'IWD'IWL'

The modifier @A has been added to the ALTER command to specify that the change is to apply to all occurrences of IWD. Without this modifier, only the first occurrence would be changed. To delete lines from a file use the DELETE command. The following example deletes lines 70 to 100.

DELETE 70 100

After you enter a delete command which deleted five or more lines, the editor will ask you if this is okay. Type in yes or no if you do not really mean to delete the lines. To move lines around in a file use the MOVE command. This command takes a specified range of line numbers and inserts them at a specified location in the file. For example the following command takes lines 30 to 40 and inserts them at line 10.

MOVE 30 40 to 10

The COPY command is used when you want to copy a range of lines to another location in the file without removing them from their original location. For example the following command copies lines 5 to 10 to a location starting immediately after line 20.

COPY 5 10 to 20

To insert new lines into the file or to tack new lines on to the end of the file it is necessary to go into insert mode. The following command puts you in insert mode ready to insert after line 10. It is important to specify a line number on the INSERT command or else it will assume that you want to insert after the last line that you have accessed.

INSERT 10

After typing the above command you can insert as many lines as you like by just typing them in. When you have finished typing them in hit the break key to get out of insert mode. This places you back in the standard edit mode. A useful function of the editor when examining large files is the SCAN function. This command searches for occurrences of a particular string and prints out all lines containing the string. For example the following command will search the file for all occurrences of "objective function" and print out the lines containing this string.

SCAN@A /FILE 'objective function'

When you have finished your edit session, use the STOP command to put you back into the MTS operating system. For example the following command puts you back into MTS.

STOP

You can tell when you are back in MTS because the prompt character becomes a "#". It is recommended that you create a practice file before you try to edit any of the model files. Use the $CREATE command in MTS, then use the $EDIT command on the created file. Begin by using the INSERT edit command to enter some lines. Get out of insert mode by pressing the break key, and then try some of the other edit commands. The attached sample shows a printout of an example edit session.

E. Making Changes to the Model

Before making changes to any of the model files it is recommended that back-up copies be made. A backup copy of a file can be made using the $CREATE and $COPY commands in MTS. The following sequence will back-up an existing file which is called MODEL by creating a copy of it called MODEL.BAK.

```
$CREATE MODEL.BAK
$COPY MODEL MODEL.BAK
```

1. Making Changes to the Linear Portion of the Model

These changes are done simply by editing the R.MOD.DAT file and making the required changes. There are some hints that can facilitate this process which are illustrated by some of the examples below.

Most changes will be fairly simple and will not change the structure of the model. For example if the upper limit on irrigable area were to be changed in the Swift-Current sub-basin one could search for the row identifier 'SHECC'which is the name of the constraint which specifies the upper bound on irrigated hectares. Go into edit mode and then enter the following command:

SCAN@A /f 'SHECC'

The editor will then print all lines in the file that contain the string 'SHECC'. Note that SHECC appears three places in the file. First it appears in the ROWS section, identified as a less-than row, then it appears in the column section where the variable SHEC is given a coefficient of 1, and finally it appears in the right hand side section where the value of xxxx is given. The search command should print all of these occurrences along with their line numbers. Suppose that the RHS line number containing the value for SHECC is line 2350, then to change the upper limit on irrigated area from 8000 hectares to 10000 hectares use the ALTER command as follows.

ALTER 2350 '8000'10000'

Often the only change desired is to alter a coefficient in one of the equations of the model. For example, suppose we wanted to increase the return flow coefficient from the domestic sector in the Swift Current Basin from .077 to .085 for the sixth period. The name of the constraint function which specifies this relationship is SRET6C. The name of the variable whose coefficient we want to change is SDOMO. First of all use the scan command as above to find all occurrences of SRET6C, then find which occurrence contained the column entry for SDOMO. Say for example that this turns out to be line 1266, then the following ALTER command would be used.

ALTER 1266 '.077'.085'

Sometimes it might be necessary to add another constraint to the model. To do this it will be necessary to insert lines in the ROWS, COLUMNS and RHS sections. For example say we want to add a constraint that specifies that the remaining flow from the Swift Current Basin is not to exceed 5000 Dam^3 in the fourth period. If we give this constraint the name SRMAX4, it would be expressed in equational form as:

(SRMAX4) SREM4 < 5000

To enter this relatively simple constraint in the model requires three edit additions to the R.MOD.DAT file. First the new row name must be entered in the ROWS section. It can be inserted at any point in the ROWS section - but say you have decided to insert it at line 88. Use the following sequence.

```
INSERT 80
 L   SRMAX4
< press break key to get out of insert >
```

Second, the RHS value for the row should be entered in the RHS section. Again it does not matter exactly where this is inserted as long as it is in the RHS section - say for example you want to insert it at line 3049. Then use the following sequence:

```
INSERT 3049
RHS1        SRMAX4      5000
```

< press break key to get out of insert >

Finally you will have to enter the value for the coefficient on the SREM4 variable in the new constraint in the COLUMNS section. In this case it **does** matter where this line is inserted. Recall that entries for the same variable in the COLUMNS section must appear consecutively. Therefore you must use the SCAN command to find out where the SREM4 variables occur in the COLUMNS section. Suppose that the last entry for the SREM4 variable in the COLUMNS section is line 1311, then insert the new entry immediately after this line:

```
INSERT 1311
SREM4     SRMAX4         1
```

< press break key to get out of insert >

Note that the coefficient on SRMAX has the value of 1. This completes the entry of the new constraint SRMAX4.

If you wish to completely delete a constraint from the model, the procedure is straightforward. First use the SCAN function to search for all lines containing the constraint name. Then simply delete these lines one by one using a series of DELETE commands.

It may become necessary at some point to add more sub-basins to the model. Using the editor COPY commands you can take advantage of the similar structure for most of the sub-basins. For example if you want to add another sub-basin which has a similar equational structure as the Swift Current Sub-basin, you could simply copy all the lines pertaining to Swift

Current to another section of the file and then use some global alter commands to change the name of the constraints and variables to the correct names for the new sub-basin. As an example, consider adding a new sub-basin for Queen's Creek. All variable and constraint names for this sub-basin are to begin with the letter Q. Suppose that the row names for the Swift Current sub-basin are contained in lines 150 to 300 in the ROWS section, and that the last line of the ROWS section is line 1200. The following command would make a copy of all the Swift Current row names and insert them just after line 1200:

COPY 150 300 to 1200

Because all these lines are being inserted between lines 1200 and the next line, the new line numbers will be represented by decimal fractions such as 1200.001 or 1200.023 etc. You might want to renumber the file at this point using only integer line numbers by entering the following command:

RENUMBER

Note that all Swift Current entries begin with the letter S. Identify the first and last line numbers of the new block you have created (if you have renumbered the file the block will be contained in lines 1201 to 1350) and do a global ALTER command on this block, to change the S's to Q's.

ALTER@A 1201 1350 ' S' Q'

Note that we have identified the string as ' S' instead of 'S' to avoid altering all occurrences of the letter S. The ' S' ensures that S will be changed to Q only when it is the first letter of a constraint or variable name. The same procedure can be followed for the RHS and COLUMNS section to create new blocks starting with the letter Q. Then the only changes to be made will be to alter the coefficients in the new Q blocks to their correct values for the QUEENS sub-basin.

2. Making Changes to the Non-Linear Portion of the Model

Again the use of the editor will also be required to change the file R.SUBMOD. However, an additional complication is that the changed file will have to be recompiled with the resulting object code being placed in the file R.OBJMOD. Some example edits and re-compiling are given below.

For example, say we want to change the low summer price from .33 to .66. First, edit the R.SUBMOD file:

```
EDIT R.SUBMOD
```

Then make the line alteration:

```
ALTER 6 '.33'.66'
```

Get back into MTS mode by typing:

```
STOP
```

Now that you are back in MTS it is necessary to recompile the FORTRAN program in R.SUBMOD. Do this with the following command:

```
$RUN *FTN SCARDS=R.SUBMOD
```

You should then receive a message on the screen saying that there are no errors in the subroutine. If you do get an error message, go back and check the changes you have made to the R.SUBMOD file. The object (executable code) is automatically placed in a temporary file called -LOAD. The next step is to copy the -LOAD file into the R.OBJMOD file.

This is done with the following MTS command.

```
$COPY -LOAD R.OBJMOD
```

You are now ready to re-run the model with the changes.

F. Transferring the Model to Another Computer

Both the MINOS software and the model files would have to be transferred before the model could be run on another computer system. Environment Canada has a licence to use MINOS and the software can legally be transferred to other computers within the department. A copy of the tape containing the MINOS software and user's manuals is available at the Pacific and Yukon Regional Office. If the host computer has tape reading facilities, the tape probably could be read directly. The software is FORTRAN based, and the host computer must have a FORTRAN compiler in order to implement MINOS. According to our discussions with the software distribution center at Stanford University, the MINOS software is flexible and can be adapted to numerous different computer systems. However, the services of a computer specialist with some experience in FORTRAN is recommended.

There are several options for transfer of the model files. It is possible to arrange a direct connection between the U.B.C. computer and the receiving computer system through a modem or through DATAPAC. File transfer programs such as KERMIT could then be used. If the receiving computer has a tape reading facility, the model files could be copied to tape and the tape transferred to the new installation. Probably the easiest option from the point of view of Pacific and Yukon region is to copy the model files to IBM PC floppy disks and send the disks to the Western and Northern office. The files could then be transferred from the floppy disks to the receiving computer system either through a modem or DATAPAC line.

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APPENDIX A

DERIVATION OF HYDROPOWER EQUATIONS

The general form of a power generation function is shown in equation (A1).

$$\text{Power} = C \times \text{Head} \times \text{Flow} \qquad (A1)$$

where:

C = a constant
Head = operating head
Flow = flow through the turbines

Equation (A1) is applicable to power generation in any specified time period. In the model, the formula is applied on a monthly basis, using average head during the month and total flow through the turbines in the month.

The specific power generation formula for Lake Diefenbaker (Coteau Rapids station) was estimated indirectly from a graph of reservoir elevation versus potential generating capacity. More accurate and direct estimates might be made available from Saskatchewan Power Corporation and should eventually be incorporated into the model if possible. The graph of potential generating capacity from Lake Diefenbaker, reproduced from Prairie Provinces Water Board (1982), is shown in Figure A1.

The basic procedure was to read-off the drop in power potential at various lake elevations for a unit release from Lake Diefenbaker. This data was then used to estimate an equation which expressed power generation for a unit flow as a function of elevation. This equation could then be transformed into a standard power generation formula as a function of head and flow.

Table A1 shows the basic data used to estimate the power-head relationship. The first column represents power in MWH and is equal to the loss in pontential generating capacity for a one meter drop in elevation of Lake Diefenbaker. The second column represents the average head in meters at which the corresponding power loss in column one was derived. The head is derived by subtracting the base elevation of 545.6 meters. Note that a one meter drop in elevation represents an approximate flow of 404,691 dam^3 through the turbines.

Figure A1
POTENTIAL GENERATING CAPACITY
FOR LAKE DIEFENBAKER

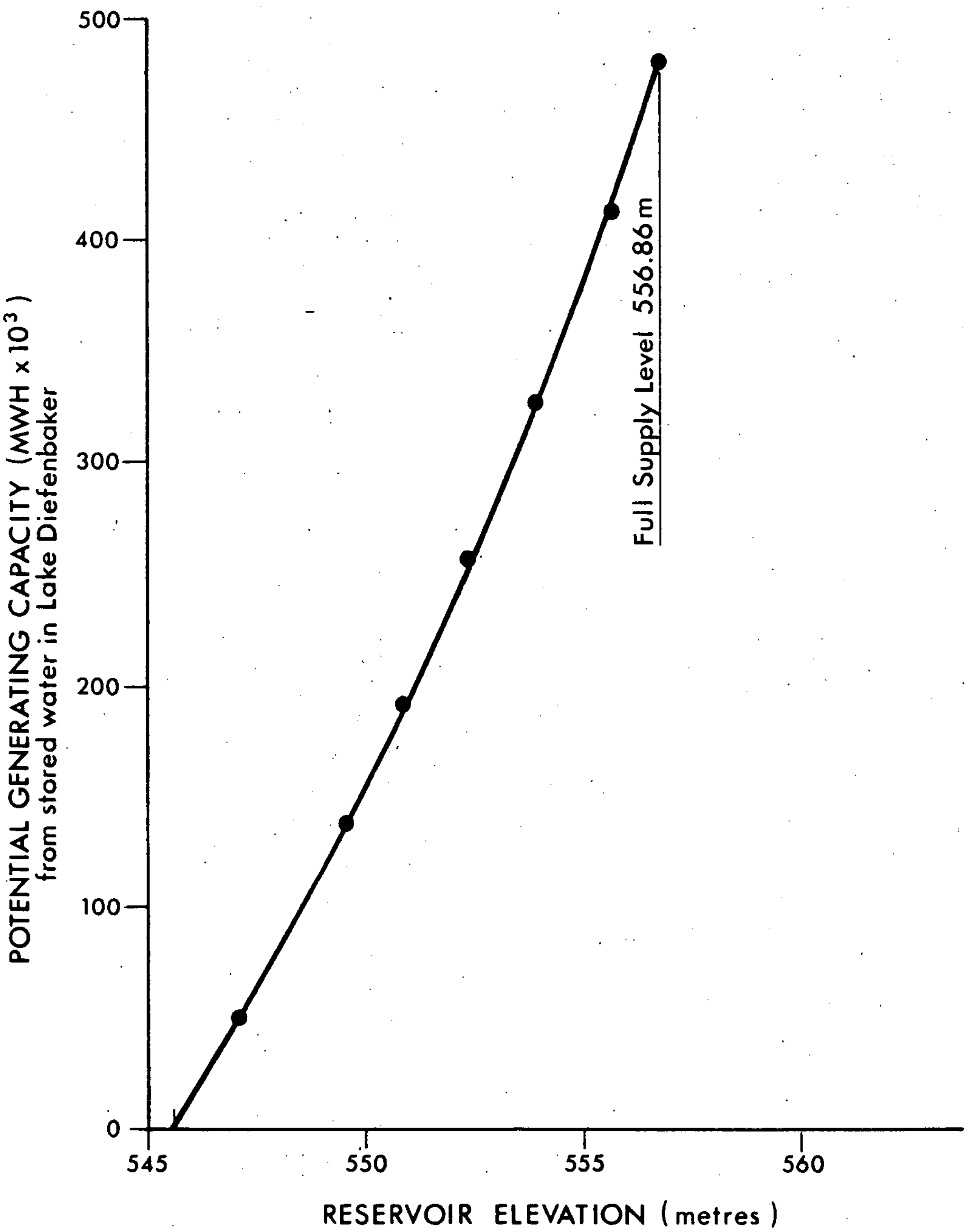


Table A1

Data Used to Estimate Power-Head Relationship

Power (MWH)	Head (Meters)
53 000	10.3
51 000	8.9
50 000	7.9
44 000	6.9
40 000	5.9
38 000	4.9
36 000	2.9
33 000	1.9
31 000	0.9
20 000	0.3

Based on the above data, the following regression equation was estimated.

Power (in MWH) = 24 864 + 2 996 x Head (in meters) (A2)

Equation (A2) represents power generation for a flow of 404,691 dam^3, which is equivalent to a one meter drop in elevation of Lake Diefenbaker. The equation can be transformed to represent power for a flow of one dam^3 by dividing the right-hand-side by 404,691 as shown in equation (A3).

Power (in MWH) = .0614 + .007403 x Head (in meters) per dam^3 flow (A3)

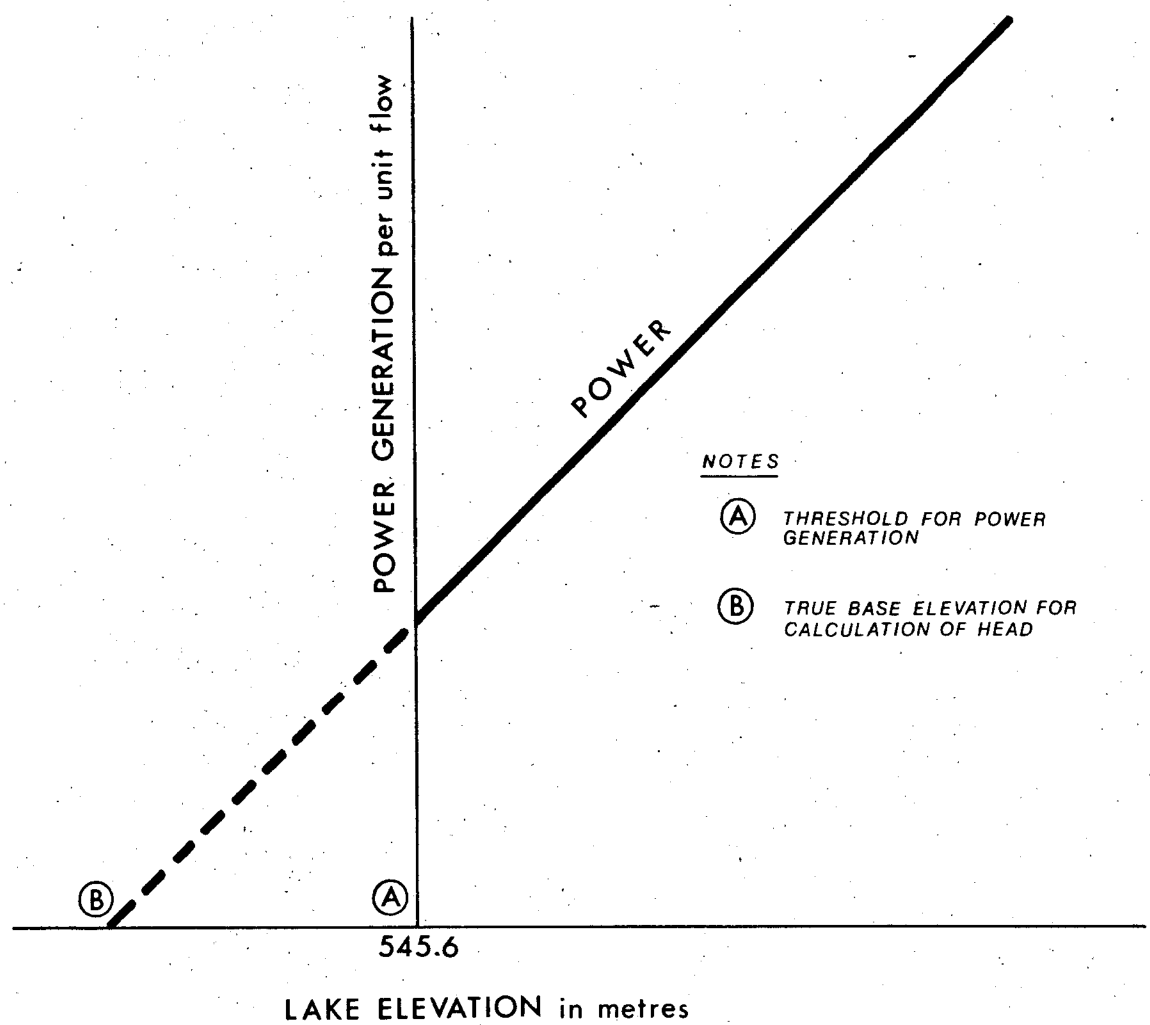
The next step is to derive a more general function which expresses power as a function of any given flow. This is done by simply multiplying equation (A3) by flow as shown in equation (A4).

Power (in MWH) = (.0614 + .007403 x Head) x Flow (in dam^3) (A4)

Equation (A4) is slightly different from the form of the standard power generation formula in that it has a separate constant term which has a value of .0614. This constant term originally occured in the regression equation (A2). It suggests that a lower base elevation lower than 545.6 meters should have been used to calulate head. However, the elevation of 545.6 meters would still be considered as a threshhold below which no power could be generated. This relationship is shown in Figure A2.

The power function in Figure A1 can be expressed as a function of head and flow without a separate constant term if the base elevation is measured from point B on the horizontal axis. However, if the lake elevation is below 545.6 meters, power generation would not be possible. Thus the

Figure A2
POWER – HEAD RELATIONSHIP



separate constant term which appears in equation (A4) can be dropped if the extra distance from point B to 545.6 meters is added to the value of Head. This extra distance is equal to 8.29 meters (calulated by dividing the slope of equation (A2) by the separate constant term). If this distance is added to the head (in effect recalculating Head from a base elevation of 537.31 meters), then the constant term can be dropped from equation (A4) giving equation (A5) which has the standard power generation format.

$$\text{Power (MWH)} = .007403 \times \text{Head (meters)} \times \text{Flow } (\text{dam}^3) \qquad \text{(A5)}$$

Equation (A5) is the basic power generation formula used in the objective function described in chapter two. Some changes in units are made for scaling purposes, expressing Head in millimeters and Flow in thousands of dam^3.

Now that the power generation formula has been derived, the next problem is to derive equations that define the Head variables in each of the twelve time periods. In general, operating head can be defined as in equation (A6).

$$\text{Head (meters)} = \text{lake elevation (meters)} - 537.31 \text{ meters} \qquad \text{(A6)}$$

where:

537.31 meters = base elevation for calculating head

The problem with the above equation is that it is based on lake elevation expressed in meters. However, the only variables in the model related to lake elevation are the variables LLAK1 to LLAK12 which are measures of the volume of Lake Diefenbaker expressed in dam^3. These variables can be converted to lake elevation in meters using Figure A3 which is a graph of elevation versus volume of Lake Diefenbaker. The capacity curve in figure A3 is non-linear, which causes some difficulty in transforming volume into elevation. However, in the normal operating range between 545.6 meters and 556.9 meters, the capacity curve can be approximated by a linear segment. Based on the slope of this segment the following equation will convert the lake volume into elevation in meters.

$$\text{Elevation (meters)} = 545.6 + .00000286 \times (\text{Lake Volume} - 5\ 424\ 000) \qquad \text{(A7)}$$

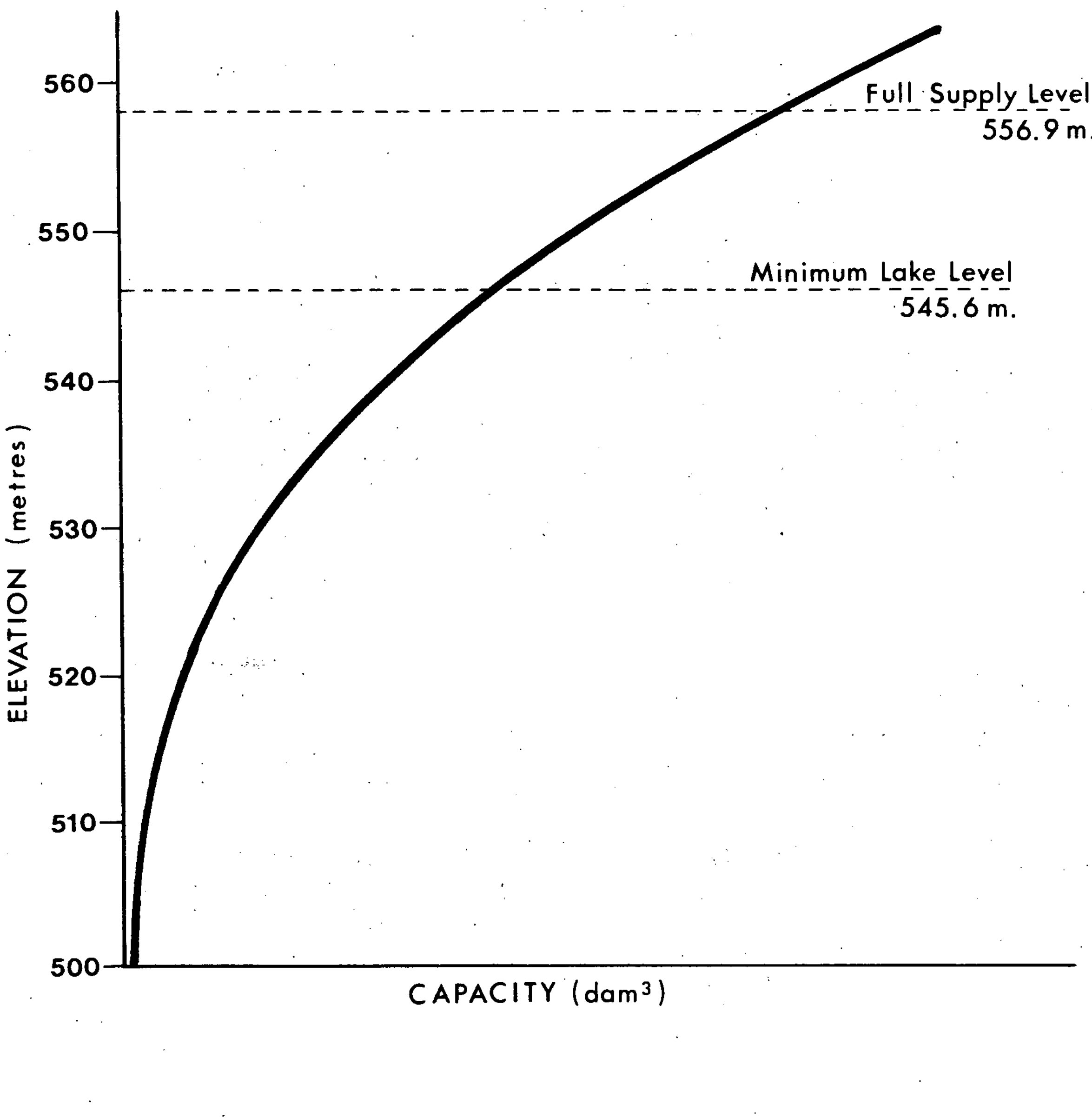
where:

545.6 = minimum lake level in meters
.00000286 = slope of the capacity curve in figure 1.
5 424 000 = volume equivalent in dam^3 of 545.6 meters.

This equation can be simplified and restated in millimeters as shown in equation (A8).

$$\text{Elevation (mm)} = 530\ 087 + .00286 \times \text{Lake Volume } (\text{dam}^3) \qquad \text{(A8)}$$

Figure A3
CAPACITY AND ELEVATION OF LAKE DIEFENBAKER



Average Head during any of the time periods is expressed in equation (A9).

Average Head = .5 x (Lake Elevation at beginning of period (A9)
(meters) + Lake Elevation at end of period) 537.31

where:

537.31 = base elevation for calculating operating head

By substituting equation (A8) for beginning and end of period elevations, we can restate average head as a function of lake volume rather than lake elevation as shown in equation (A10).

Average Head = .00143 x (lake volume at beginning of period (A10)
(mm) + lake volume at end of period) - 7 223

Equation (A10) is then used as the basis of the LHED1C to LHED12C constraints shown in chapter two which define average head in each period.

APPENDIX B

LISTING OF R.MOD.DAT

This appendix lists the file R.MOD.DAT which contains the MPSX standard code for the constraint equations and linear portion of the objective function. The first line of the file identifies the name of the run, while lines 2 to 100 form the ROWS section which gives the name and type of each row. Lines 701 to 2291 represent the COLUMNS section which gives the coefficients for each variable for whatever equation it occurs in. Lines 2292 to 2989 represent the RHS section which gives the right-hand side values of each constraint equation. Each line of the RHS section begins with the identifier TRY1. An identifier is required because it is possilbe to incorporate more than one set of right hand side values in the file and solve the model for each set.

Full details on the formatting and structure of this file are given in Chapter III, section C.2.

#list r.mod.dat

```
NAME                NONLINEAR COMPLETE
ROWS
 N  VALUE
 E  AREL1C
 E  AREL10C
 E  AREL11C
 E  AREL12C
 E  AREL2C
 E  AREL3C
 E  AREL4C
 E  AREL5C
 E  AREL6C
 E  AREL7C
 E  AREL8C
 E  AREL9C
 E  DAGD0C
 E  DAGD5C
 E  DAGD6C
 E  DAGD7C
 E  DAGD8C
 E  DAGD9C
 E  DDOD0C
 E  DDOD1C
 E  DDOD10C
 E  DDOD11C
 E  DDOD12C
 E  DDOD2C
 E  DDOD3C
 E  DDOD4C
 E  DDOD5C
 E  DDOD6C
 E  DDOD7C
 E  DDOD8C
 E  DDOD9C
 E  DIND0C
 E  DIND1C
 E  DIND10C
 E  DIND11C
 E  DIND12C
 E  DIND2C
 E  DIND3C
 E  DIND4C
 E  DIND5C
 E  DIND6C
 E  DIND7C
 E  DIND8C
 E  DIND9C
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 E  DNAT10C
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 E  DNAT2C
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 E  DNAT4C
 E  DNAT5C
 E  DNAT6C
 E  DNAT7C
 E  DNAT8C
 E  DNAT9C
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 E  DREM2C
 E  DREM3C
 E  DREM4C
 E  DREM5C
 E  DREM6C
 E  DREM7C
 E  DREM8C
 E  DREM9C
```

72	E	DRET1C
73	E	DRET10C
74	E	DRET11C
75	E	DRET12C
76	E	DRET2C
77	E	DRET3C
78	E	DRET4C
79	E	DRET5C
80	E	DRET6C
81	E	DRET7C
82	E	DRET8C
83	E	DRET9C
84	E	DSUP1C
85	E	DSUP10C
86	E	DSUP11C
87	E	DSUP12C
88	E	DSUP2C
89	E	DSUP3C
90	E	DSUP4C
91	E	DSUP5C
92	E	DSUP6C
93	E	DSUP7C
94	E	DSUP8C
95	E	DSUP9C
96	E	DTOD1C
97	E	DTOD10C
98	E	DTOD11C
99	E	DTOD12C
100	E	DTOD2C
101	E	DTOD3C
102	E	DTOD4C
103	E	DTOD5C
104	E	DTOD6C
105	E	DTOD7C
106	E	DTOD8C
107	E	DTOD9C
108	E	DWAS1C
109	E	DWAS10C
110	E	DWAS11C
111	E	DWAS12C
112	E	DWAS2C
113	E	DWAS3C
114	E	DWAS4C
115	E	DWAS5C
116	E	DWAS6C
117	E	DWAS7C
118	E	DWAS8C
119	E	DWAS9C
120	E	KAGD0C
121	E	KAGD5C
122	E	KAGD6C
123	E	KAGD7C
124	E	KAGD8C
125	E	KAGD9C
126	E	KDOD0C
127	E	KDOD1C
128	E	KDOD10C
129	E	KDOD11C
130	E	KDOD12C
131	E	KDOD2C
132	E	KDOD3C
133	E	KDOD4C
134	E	KDOD5C
135	E	KDOD6C
136	E	KDOD7C
137	E	KDOD8C
138	E	KDOD9C
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140	E	KIND1C
141	E	KIND10C
142	E	KIND11C
143	E	KIND12C
144	E	KIND2C
145	E	KIND3C
146	E	KIND4C

147	E	KIND5C
148	E	KIND6C
149	E	KIND7C
150	E	KIND8C
151	E	KIND9C
152	E	KNAT1C
153	E	KNAT10C
154	E	KNAT11C
155	E	KNAT12C
156	E	KNAT2C
157	E	KNAT3C
158	E	KNAT4C
159	E	KNAT5C
160	E	KNAT6C
161	E	KNAT7C
162	E	KNAT8C
163	E	KNAT9C
164	E	KREM1C
165	E	KREM10C
166	E	KREM11C
167	E	KREM12C
168	E	KREM2C
169	E	KREM3C
170	E	KREM4C
171	E	KREM5C
172	E	KREM6C
173	E	KREM7C
174	E	KREM8C
175	E	KREM9C
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177	E	KRET10C
178	E	KRET11C
179	E	KRET12C
180	E	KRET2C
181	E	KRET3C
182	E	KRET4C
183	E	KRET5C
184	E	KRET6C
185	E	KRET7C
186	E	KRET8C
187	E	KRET9C
188	E	KSUP1C
189	E	KSUP10C
190	E	KSUP11C
191	E	KSUP12C
192	E	KSUP2C
193	E	KSUP3C
194	E	KSUP4C
195	E	KSUP5C
196	E	KSUP6C
197	E	KSUP7C
198	E	KSUP8C
199	E	KSUP9C
200	E	KTOD1C
201	E	KTOD10C
202	E	KTOD11C
203	E	KTOD12C
204	E	KTOD2C
205	E	KTOD3C
206	E	KTOD4C
207	E	KTOD5C
208	E	KTOD6C
209	E	KTOD7C
210	E	KTOD8C
211	E	KTOD9C
212	E	KWAS1C
213	E	KWAS10C
214	E	KWAS11C
215	E	KWAS12C
216	E	KWAS2C
217	E	KWAS3C
218	E	KWAS4C
219	E	KWAS5C
220	E	KWAS6C
221	E	KWAS7C

222	E	KWAS8C
223	E	KWAS9C
224	E	LAGD0C
225	E	LAGD5C
226	E	LAGD6C
227	E	LAGD7C
228	E	LAGD8C
229	E	LAGD9C
230	E	LDOD0C
231	E	LDOD1C
232	E	LDOD10C
233	E	LDOD11C
234	E	LDOD12C
235	E	LDOD2C
236	E	LDOD3C
237	E	LDOD4C
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241	E	LDOD8C
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252	E	LEVAP7C
253	E	LEVAP8C
254	E	LEVAP9C
255	E	LHED1C
256	E	LHED10C
257	E	LHED11C
258	E	LHED12C
259	E	LHED2C
260	E	LHED3C
261	E	LHED4C
262	E	LHED5C
263	E	LHED6C
264	E	LHED7C
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266	E	LHED9C
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269	E	LIND10C
270	E	LIND11C
271	E	LIND12C
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273	E	LIND3C
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275	E	LIND5C
276	E	LIND6C
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290	E	LLAK7C
291	E	LLAK8C
292	E	LLAK9C
293	E	LNAT1C
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295	E	LNAT11C
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302	E	LNAT7C
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327	E	LRET8C
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331	E	LRLS7C
332	E	LRLS8C
333	E	LRLS9C
334	E	LSUP1C
335	E	LSUP10C
336	E	LSUP11C
337	E	LSUP12C
338	E	LSUP2C
339	E	LSUP3C
340	E	LSUP4C
341	E	LSUP5C
342	E	LSUP6C
343	E	LSUP7C
344	E	LSUP8C
345	E	LSUP9C
346	E	LTOD1C
347	E	LTOD10C
348	E	LTOD11C
349	E	LTOD12C
350	E	LTOD2C
351	E	LTOD3C
352	E	LTOD4C
353	E	LTOD5C
354	E	LTOD6C
355	E	LTOD7C
356	E	LTOD8C
357	E	LTOD9C
358	E	RAGD0C
359	E	RAGD5C
360	E	RAGD6C
361	E	RAGD7C
362	E	RAGD8C
363	E	RAGD9C
364	E	RDOD0C
365	E	RDOD1C
366	E	RDOD10C
367	E	RDOD11C
368	E	RDOD12C
369	E	RDOD2C
370	E	RDOD3C
371	E	RDOD4C

372	E	RDOD5C
373	E	RDOD6C
374	E	RDOD7C
375	E	RDOD8C
376	E	RDOD9C
377	E	RIND0C
378	E	RIND1C
379	E	RIND10C
380	E	RIND11C
381	E	RIND12C
382	E	RIND2C
383	E	RIND3C
384	E	RIND4C
385	E	RIND5C
386	E	RIND6C
387	E	RIND7C
388	E	RIND8C
389	E	RIND9C
390	E	RNAT1C
391	E	RNAT10C
392	E	RNAT11C
393	E	RNAT12C
394	E	RNAT2C
395	E	RNAT3C
396	E	RNAT4C
397	E	RNAT5C
398	E	RNAT6C
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407	E	RREM3C
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410	E	RREM6C
411	E	RREM7C
412	E	RREM8C
413	E	RREM9C
414	E	RRET1C
415	E	RRET10C
416	E	RRET11C
417	E	RRET12C
418	E	RRET2C
419	E	RRET3C
420	E	RRET4C
421	E	RRET5C
422	E	RRET6C
423	E	RRET7C
424	E	RRET8C
425	E	RRET9C
426	E	RSUP1C
427	E	RSUP10C
428	E	RSUP11C
429	E	RSUP12C
430	E	RSUP2C
431	E	RSUP3C
432	E	RSUP4C
433	E	RSUP5C
434	E	RSUP6C
435	E	RSUP7C
436	E	RSUP8C
437	E	RSUP9C
438	E	RTOD1C
439	E	RTOD10C
440	E	RTOD11C
441	E	RTOD12C
442	E	RTOD2C
443	E	RTOD3C
444	E	RTOD4C
445	E	RTOD5C
446	E	RTOD6C

447	E	RTOD7C
448	E	RTOD8C
449	E	RTOD9C
450	E	RWAS1C
451	E	RWAS10C
452	E	RWAS11C
453	E	RWAS12C
454	E	RWAS2C
455	E	RWAS3C
456	E	RWAS4C
457	E	RWAS5C
458	E	RWAS6C
459	E	RWAS7C
460	E	RWAS8C
461	E	RWAS9C
462	E	SAGD0C
463	E	SAGD5C
464	E	SAGD6C
465	E	SAGD7C
466	E	SAGD8C
467	E	SAGD9C
468	E	SDOD0C
469	E	SDOD1C
470	E	SDOD10C
471	E	SDOD11C
472	E	SDOD12C
473	E	SDOD2C
474	E	SDOD3C
475	E	SDOD4C
476	E	SDOD5C
477	E	SDOD6C
478	E	SDOD7C
479	E	SDOD8C
480	E	SDOD9C
481	E	SIND0C
482	E	SIND1C
483	E	SIND10C
484	E	SIND11C
485	E	SIND12C
486	E	SIND2C
487	E	SIND3C
488	E	SIND4C
489	E	SIND5C
490	E	SIND6C
491	E	SIND7C
492	E	SIND8C
493	E	SIND9C
494	E	SNAT1C
495	E	SNAT10C
496	E	SNAT11C
497	E	SNAT12C
498	E	SNAT2C
499	E	SNAT3C
500	E	SNAT4C
501	E	SNAT5C
502	E	SNAT6C
503	E	SNAT7C
504	E	SNAT8C
505	E	SNAT9C
506	E	SREM1C
507	E	SREM10C
508	E	SREM11C
509	E	SREM12C
510	E	SREM2C
511	E	SREM3C
512	E	SREM4C
513	E	SREM5C
514	E	SREM6C
515	E	SREM7C
516	E	SREM8C
517	E	SREM9C
518	E	SRET1C
519	E	SRET10C
520	E	SRET11C
521	E	SRET12C

522	E	SRET2C
523	E	SRET3C
524	E	SRET4C
525	E	SRET5C
526	E	SRET6C
527	E	SRET7C
528	E	SRET8C
529	E	SRET9C
530	E	SSUP1C
531	E	SSUP10C
532	E	SSUP11C
533	E	SSUP12C
534	E	SSUP2C
535	E	SSUP3C
536	E	SSUP4C
537	E	SSUP5C
538	E	SSUP6C
539	E	SSUP7C
540	E	SSUP8C
541	E	SSUP9C
542	E	STOD1C
543	E	STOD10C
544	E	STOD11C
545	E	STOD12C
546	E	STOD2C
547	E	STOD3C
548	E	STOD4C
549	E	STOD5C
550	E	STOD6C
551	E	STOD7C
552	E	STOD8C
553	E	STOD9C
554	E	SWAS1C
555	E	SWAS10C
556	E	SWAS11C
557	E	SWAS12C
558	E	SWAS2C
559	E	SWAS3C
560	E	SWAS4C
561	E	SWAS5C
562	E	SWAS6C
563	E	SWAS7C
564	E	SWAS8C
565	E	SWAS9C
566	G	LINS1C
567	G	LINS10C
568	G	LINS11C
569	G	LINS12C
570	G	LINS2C
571	G	LINS3C
572	G	LINS4C
573	G	LINS5C
574	G	LINS6C
575	G	LINS7C
576	G	LINS8C
577	G	LINS9C
578	G	LMIN1C
579	G	LMIN10C
580	G	LMIN11C
581	G	LMIN12C
582	G	LMIN2C
583	G	LMIN3C
584	G	LMIN4C
585	G	LMIN5C
586	G	LMIN6C
587	G	LMIN7C
588	G	LMIN8C
589	G	LMIN9C
590	L	DBAL1C
591	L	DBAL10C
592	L	DBAL11C
593	L	DBAL12C
594	L	DBAL2C
595	L	DBAL3C
596	L	DBAL4C

597	L	DBAL5C
598	L	DBAL6C
599	L	DBAL7C
600	L	DBAL8C
601	L	DBAL9C
602	L	DHECC
603	L	HCTF1C
604	L	HCTF10C
605	L	HCTF11C
606	L	HCTF12C
607	L	HCTF2C
608	L	HCTF3C
609	L	HCTF4C
610	L	HCTF5C
611	L	HCTF6C
612	L	HCTF7C
613	L	HCTF8C
614	L	HCTF9C
615	L	HCTT1C
616	L	HCTT10C
617	L	HCTT11C
618	L	HCTT12C
619	L	HCTT2C
620	L	HCTT3C
621	L	HCTT4C
622	L	HCTT5C
623	L	HCTT6C
624	L	HCTT7C
625	L	HCTT8C
626	L	HCTT9C
627	L	KBAL1C
628	L	KBAL10C
629	L	KBAL11C
630	L	KBAL12C
631	L	KBAL2C
632	L	KBAL3C
633	L	KBAL4C
634	L	KBAL5C
635	L	KBAL6C
636	L	KBAL7C
637	L	KBAL8C
638	L	KBAL9C
639	L	KHECC
640	L	LFLD1C
641	L	LFLD10C
642	L	LFLD11C
643	L	LFLD12C
644	L	LFLD2C
645	L	LFLD3C
646	L	LFLD4C
647	L	LFLD5C
648	L	LFLD6C
649	L	LFLD7C
650	L	LFLD8C
651	L	LFLD9C
652	L	LHECC
653	L	LMAX1C
654	L	LMAX10C
655	L	LMAX11C
656	L	LMAX12C
657	L	LMAX2C
658	L	LMAX3C
659	L	LMAX4C
660	L	LMAX5C
661	L	LMAX6C
662	L	LMAX7C
663	L	LMAX8C
664	L	LMAX9C
665	L	LRLV5C
666	L	LRLV6C
667	L	LRLV7C
668	L	LRLV8C
669	L	LRLV9C
670	L	LRMX5C
671	L	LRMX6C

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 L  LRMX7C
 L  LRMX8C
 L  LRMX9C
 L  RBAL1C
 L  RBAL10C
 L  RBAL11C
 L  RBAL12C
 L  RBAL2C
 L  RBAL3C
 L  RBAL4C
 L  RBAL5C
 L  RBAL6C
 L  RBAL7C
 L  RBAL8C
 L  RBAL9C
 L  RHECC
 L  SBAL1C
 L  SBAL10C
 L  SBAL11C
 L  SBAL12C
 L  SBAL2C
 L  SBAL3C
 L  SBAL4C
 L  SBAL5C
 L  SBAL6C
 L  SBAL7C
 L  SBAL8C
 L  SBAL9C
 L  SHECC
COLUMNS
    LHED1      LHED1C     -1.
    LHED2      LHED2C     -1.
    LHED3      LHED3C     -1.
    LHED4      LHED4C     -1.
    LHED5      LHED5C     -1.
    LHED6      LHED6C     -1.
    LHED7      LHED7C     -1.
    LHED8      LHED8C     -1.
    LHED9      LHED9C     -1.
    LHED10     LHED10C    -1.
    LHED11     LHED11C    -1.
    LHED12     LHED12C    -1.
    HREL1      HCTF1C      1.
    HREL1      HCTT1C      1.
    HREL2      HCTF2C      1.
    HREL2      HCTT2C      1.
    HREL3      HCTF3C      1.
    HREL3      HCTT3C      1.
    HREL4      HCTF4C      1.
    HREL4      HCTT4C      1.
    HREL5      HCTF5C      1.
    HREL5      HCTT5C      1.
    HREL6      HCTF6C      1.
    HREL6      HCTT6C      1.
    HREL7      HCTF7C      1.
    HREL7      HCTT7C      1.
    HREL8      HCTF8C      1.
    HREL8      HCTT8C      1.
    HREL9      HCTF9C      1.
    HREL9      HCTT9C      1.
    HREL10     HCTF10C     1.
    HREL10     HCTT10C     1.
    HREL11     HCTF11C     1.
    HREL11     HCTT11C     1.
    HREL12     HCTF12C     1.
    HREL12     HCTT12C     1.
    AREL1      AREL1C     1.
    AREL1      RSUP1C     1.
    AREL10     AREL10C    1.
    AREL10     RSUP10C    1.
    AREL11     AREL11C    1.
    AREL11     RSUP11C    1.
    AREL12     AREL12C    1.
    AREL12     RSUP12C    1.
    AREL2      AREL2C     1.
```

747	AREL2	RSUP2C	1.
748	AREL3	AREL3C	1.
749	AREL3	RSUP3C	1.
750	AREL4	AREL4C	1.
751	AREL4	RSUP4C	1.
752	AREL5	AREL5C	1.
753	AREL5	RSUP5C	1.
754	AREL6	AREL6C	1.
755	AREL6	RSUP6C	1.
756	AREL7	AREL7C	1.
757	AREL7	RSUP7C	1.
758	AREL8	AREL8C	1.
759	AREL8	RSUP8C	1.
760	AREL9	AREL9C	1.
761	AREL9	RSUP9C	1.
762	LCREL1	KSUP1C	1.
763	LCREL1	LLAK1C	-1.
764	LCREL10	KSUP10C	1.
765	LCREL10	LLAK10C	-1.
766	LCREL11	KSUP11C	1.
767	LCREL11	LLAK11C	-1.
768	LCREL12	KSUP12C	1.
769	LCREL12	LLAK12C	-1.
770	LCREL2	KSUP2C	1.
771	LCREL2	LLAK2C	-1.
772	LCREL3	KSUP3C	1.
773	LCREL3	LLAK3C	-1.
774	LCREL4	KSUP4C	1.
775	LCREL4	LLAK4C	-1.
776	LCREL5	KSUP5C	1.
777	LCREL5	LLAK5C	-1.
778	LCREL6	KSUP6C	1.
779	LCREL6	LLAK6C	-1.
780	LCREL7	KSUP7C	1.
781	LCREL7	LLAK7C	-1.
782	LCREL8	KSUP8C	1.
783	LCREL8	LLAK8C	-1.
784	LCREL9	KSUP9C	1.
785	LCREL9	LLAK9C	-1.
786	DAGD0	DAGD0C	-1.
787	DAGD0	DAGD5C	-0.094
788	DAGD0	DAGD6C	-0.178
789	DAGD0	DAGD7C	-0.308
790	DAGD0	DAGD8C	-0.223
791	DAGD0	DAGD9C	-0.196
792	DAGD5	DAGD5C	1.
793	DAGD5	DTOD5C	1.
794	DAGD6	DAGD6C	1.
795	DAGD6	DTOD6C	1.
796	DAGD7	DAGD7C	1.
797	DAGD7	DTOD7C	1.
798	DAGD8	DAGD8C	1.
799	DAGD8	DTOD8C	1.
800	DAGD9	DAGD9C	1.
801	DAGD9	DTOD9C	1.
802	DDOD0	DDOD0C	1.
803	DDOD0	DRET1C	-.073
804	DDOD0	DRET10C	-.073
805	DDOD0	DRET11C	-.073
806	DDOD0	DRET12C	-.073
807	DDOD0	DRET2C	-.073
808	DDOD0	DRET3C	-.073
809	DDOD0	DRET4C	-.073
810	DDOD0	DRET5C	-.073
811	DDOD0	DRET6C	-.073
812	DDOD0	DRET7C	-.073
813	DDOD0	DRET8C	-.073
814	DDOD0	DRET9C	-.073
815	DDOD1	DDOD1C	1.
816	DDOD1	DTOD1C	1.
817	DDOD10	DDOD10C	1.
818	DDOD10	DTOD10C	1.
819	DDOD11	DDOD11C	1.
820	DDOD11	DTOD11C	1.
821	DDOD12	DDOD12C	1.

822	DDOD12	DTOD12C	1.
823	DDOD2	DDOD2C	1.
824	DDOD2	DTOD2C	1.
825	DDOD3	DDOD3C	1.
826	DDOD3	DTOD3C	1.
827	DDOD4	DDOD4C	1.
828	DDOD4	DTOD4C	1.
829	DDOD5	DDOD5C	1.
830	DDOD5	DTOD5C	1.
831	DDOD6	DDOD6C	1.
832	DDOD6	DTOD6C	1.
833	DDOD7	DDOD7C	1.
834	DDOD7	DTOD7C	1.
835	DDOD8	DDOD8C	1.
836	DDOD8	DTOD8C	1.
837	DDOD9	DDOD9C	1.
838	DDOD9	DTOD9C	1.
839	DGSUP1	DREM1C	-1.
840	DGSUP1	DSUP1C	-1.
841	DGSUP1	DWAS1C	-.8
842	DGSUP10	DREM10C	-1.
843	DGSUP10	DSUP10C	-1.
844	DGSUP10	DWAS10C	-.8
845	DGSUP11	DREM11C	-1.
846	DGSUP11	DSUP11C	-1.
847	DGSUP11	DWAS11C	-.8
848	DGSUP12	DREM12C	-1.
849	DGSUP12	DSUP12C	-1.
850	DGSUP12	DWAS12C	-.8
851	DGSUP2	DREM2C	-1.
852	DGSUP2	DSUP2C	-1.
853	DGSUP2	DWAS2C	-.8
854	DGSUP3	DREM3C	-1.
855	DGSUP3	DSUP3C	-1.
856	DGSUP3	DWAS3C	-.8
857	DGSUP4	DREM4C	-1.
858	DGSUP4	DSUP4C	-1.
859	DGSUP4	DWAS4C	-.8
860	DGSUP5	DREM5C	-1.
861	DGSUP5	DSUP5C	-1.
862	DGSUP5	DWAS5C	-.8
863	DGSUP6	DREM6C	-1.
864	DGSUP6	DSUP6C	-1.
865	DGSUP6	DWAS6C	-.8
866	DGSUP7	DREM7C	-1.
867	DGSUP7	DSUP7C	-1.
868	DGSUP7	DWAS7C	-.8
869	DGSUP8	DREM8C	-1.
870	DGSUP8	DSUP8C	-1.
871	DGSUP8	DWAS8C	-.8
872	DGSUP9	DREM9C	-1.
873	DGSUP9	DSUP9C	-1.
874	DGSUP9	DWAS9C	-.8
875	DHEC	DAGD0C	6.86
876	DHEC	DHECC	1.
877	DHEC	DRET5C	-.034
878	DHEC	DRET6C	-.066
879	DHEC	DRET7C	-.114
880	DHEC	DRET8C	-.083
881	DHEC	DRET9C	-.0732
882	DHEC	VALUE	350.
883	DIND0	DIND0C	1.
884	DIND0	DIND1C	-0.0833
885	DIND0	DIND10C	-0.0833
886	DIND0	DIND11C	-0.0833
887	DIND0	DIND12C	-0.0833
888	DIND0	DIND2C	-0.0833
889	DIND0	DIND3C	-0.0833
890	DIND0	DIND4C	-0.0833
891	DIND0	DIND5C	-0.0833
892	DIND0	DIND6C	-0.0833
893	DIND0	DIND7C	-0.0833
894	DIND0	DIND8C	-0.0833
895	DIND0	DIND9C	-0.0833
896	DIND0	DRET1C	-0.061

897	DIND0	DRET10C	-0.061
898	DIND0	DRET11C	-0.061
899	DIND0	DRET12C	-0.061
900	DIND0	DRET2C	-0.061
901	DIND0	DRET3C	-0.061
902	DIND0	DRET4C	-0.061
903	DIND0	DRET5C	-0.061
904	DIND0	DRET6C	-0.061
905	DIND0	DRET7C	-0.061
906	DIND0	DRET8C	-0.061
907	DIND0	DRET9C	-0.061
908	DIND1	DIND1C	1.
909	DIND1	DTOD1C	1.
910	DIND10	DIND10C	1.
911	DIND10	DTOD10C	1.
912	DIND11	DIND11C	1.
913	DIND11	DTOD11C	1.
914	DIND12	DIND12C	1.
915	DIND12	DTOD12C	1.
916	DIND2	DIND2C	1.
917	DIND2	DTOD2C	1.
918	DIND3	DIND3C	1.
919	DIND3	DTOD3C	1.
920	DIND4	DIND4C	1.
921	DIND4	DTOD4C	1.
922	DIND5	DIND5C	1.
923	DIND5	DTOD5C	1.
924	DIND6	DIND6C	1.
925	DIND6	DTOD6C	1.
926	DIND7	DIND7C	1.
927	DIND7	DTOD7C	1.
928	DIND8	DIND8C	1.
929	DIND8	DTOD8C	1.
930	DIND9	DIND9C	1.
931	DIND9	DTOD9C	1.
932	DNSUP1	DBAL1C	-1.
933	DNSUP1	DWAS1C	1.
934	DNSUP10	DBAL10C	-1.
935	DNSUP10	DWAS10C	1.
936	DNSUP11	DBAL11C	-1.
937	DNSUP11	DWAS11C	1.
938	DNSUP12	DBAL12C	-1.
939	DNSUP12	DWAS12C	1.
940	DNSUP2	DBAL2C	-1.
941	DNSUP2	DWAS2C	1.
942	DNSUP3	DBAL3C	-1.
943	DNSUP3	DWAS3C	1.
944	DNSUP4	DBAL4C	-1.
945	DNSUP4	DWAS4C	1.
946	DNSUP5	DBAL5C	-1.
947	DNSUP5	DWAS5C	1.
948	DNSUP6	DBAL6C	-1.
949	DNSUP6	DWAS6C	1.
950	DNSUP7	DBAL7C	-1.
951	DNSUP7	DWAS7C	1.
952	DNSUP8	DBAL8C	-1.
953	DNSUP8	DWAS8C	1.
954	DNSUP9	DBAL9C	-1.
955	DNSUP9	DWAS9C	1.
956	DREM1	DREM1C	1.
957	DREM10	DREM10C	1.
958	DREM11	DREM11C	1.
959	DREM12	DREM12C	1.
960	DREM2	DREM2C	1.
961	DREM3	DREM3C	1.
962	DREM4	DREM4C	1.
963	DREM5	DREM5C	1.
964	DREM6	DREM6C	1.
965	DREM7	DREM7C	1.
966	DREM8	DREM8C	1.
967	DREM9	DREM9C	1.
968	DRET1	DRET1C	1.
969	DRET1	DSUP1C	1.
970	DRET10	DRET10C	1.
971	DRET10	DSUP10C	1.

972	DRET11	DRET11C	1.
973	DRET11	DSUP11C	1.
974	DRET12	DRET12C	1.
975	DRET12	DSUP12C	1.
976	DRET2	DRET2C	1.
977	DRET2	DSUP2C	1.
978	DRET3	DRET3C	1.
979	DRET3	DSUP3C	1.
980	DRET4	DRET4C	1.
981	DRET4	DSUP4C	1.
982	DRET5	DRET5C	1.
983	DRET5	DSUP5C	1.
984	DRET6	DRET6C	1.
985	DRET6	DSUP6C	1.
986	DRET7	DRET7C	1.
987	DRET7	DSUP7C	1.
988	DRET8	DRET8C	1.
989	DRET8	DSUP8C	1.
990	DRET9	DRET9C	1.
991	DRET9	DSUP9C	1.
992	DROA1	DNAT1C	1.
993	DROA1	DSUP1C	1.
994	DROA10	DNAT10C	1.
995	DROA10	DSUP10C	1.
996	DROA11	DNAT11C	1.
997	DROA11	DSUP11C	1.
998	DROA12	DNAT12C	1.
999	DROA12	DSUP12C	1.
1000	DROA2	DNAT2C	1.
1001	DROA2	DSUP2C	1.
1002	DROA3	DNAT3C	1.
1003	DROA3	DSUP3C	1.
1004	DROA4	DNAT4C	1.
1005	DROA4	DSUP4C	1.
1006	DROA5	DNAT5C	1.
1007	DROA5	DSUP5C	1.
1008	DROA6	DNAT6C	1.
1009	DROA6	DSUP6C	1.
1010	DROA7	DNAT7C	1.
1011	DROA7	DSUP7C	1.
1012	DROA8	DNAT8C	1.
1013	DROA8	DSUP8C	1.
1014	DROA9	DNAT9C	1.
1015	DROA9	DSUP9C	1.
1016	DTOD1	DBAL1C	1.
1017	DTOD1	DREM1C	1.
1018	DTOD1	DTOD1C	-1.
1019	DTOD10	DBAL10C	1.
1020	DTOD10	DREM10C	1.
1021	DTOD10	DTOD10C	-1.
1022	DTOD11	DBAL11C	1.
1023	DTOD11	DREM11C	1.
1024	DTOD11	DTOD11C	-1.
1025	DTOD12	DBAL12C	1.
1026	DTOD12	DREM12C	1.
1027	DTOD12	DTOD12C	-1.
1028	DTOD2	DBAL2C	1.
1029	DTOD2	DREM2C	1.
1030	DTOD2	DTOD2C	-1.
1031	DTOD3	DBAL3C	1.
1032	DTOD3	DREM3C	1.
1033	DTOD3	DTOD3C	-1.
1034	DTOD4	DBAL4C	1.
1035	DTOD4	DREM4C	1.
1036	DTOD4	DTOD4C	-1.
1037	DTOD5	DBAL5C	1.
1038	DTOD5	DREM5C	1.
1039	DTOD5	DTOD5C	-1.
1040	DTOD6	DBAL6C	1.
1041	DTOD6	DREM6C	1.
1042	DTOD6	DTOD6C	-1.
1043	DTOD7	DBAL7C	1.
1044	DTOD7	DREM7C	1.
1045	DTOD7	DTOD7C	-1.
1046	DTOD8	DBAL8C	1.

1047	DTOD8	DREM8C	1.
1048	DTOD8	DTOD8C	-1.
1049	DTOD9	DBAL9C	1.
1050	DTOD9	DREM9C	1.
1051	DTOD9	DTOD9C	-1.
1052	KAGD0	KAGD0C	-1.
1053	KAGD0	KAGD5C	-0.059
1054	KAGD0	KAGD6C	-0.178
1055	KAGD0	KAGD7C	-0.381
1056	KAGD0	KAGD8C	-0.191
1057	KAGD0	KAGD9C	-0.190
1058	KAGD5	KAGD5C	1.
1059	KAGD5	KTOD5C	1.
1060	KAGD6	KAGD6C	1.
1061	KAGD6	KTOD6C	1.
1062	KAGD7	KAGD7C	1.
1063	KAGD7	KTOD7C	1.
1064	KAGD8	KAGD8C	1.
1065	KAGD8	KTOD8C	1.
1066	KAGD9	KAGD9C	1.
1067	KAGD9	KTOD9C	1.
1068	KDOD0	KDOD0C	1.
1069	KDOD0	KRET1C	-.073
1070	KDOD0	KRET10C	-.073
1071	KDOD0	KRET11C	-.073
1072	KDOD0	KRET12C	-.073
1073	KDOD0	KRET2C	-.073
1074	KDOD0	KRET3C	-.073
1075	KDOD0	KRET4C	-.073
1076	KDOD0	KRET5C	-.073
1077	KDOD0	KRET6C	-.073
1078	KDOD0	KRET7C	-.073
1079	KDOD0	KRET8C	-.073
1080	KDOD0	KRET9C	-.073
1081	KDOD1	KDOD1C	1.
1082	KDOD1	KTOD1C	1.
1083	KDOD10	KDOD10C	1.
1084	KDOD10	KTOD10C	1.
1085	KDOD11	KDOD11C	1.
1086	KDOD11	KTOD11C	1.
1087	KDOD12	KDOD12C	1.
1088	KDOD12	KTOD12C	1.
1089	KDOD2	KDOD2C	1.
1090	KDOD2	KTOD2C	1.
1091	KDOD3	KDOD3C	1.
1092	KDOD3	KTOD3C	1.
1093	KDOD4	KDOD4C	1.
1094	KDOD4	KTOD4C	1.
1095	KDOD5	KDOD5C	1.
1096	KDOD5	KTOD5C	1.
1097	KDOD6	KDOD6C	1.
1098	KDOD6	KTOD6C	1.
1099	KDOD7	KDOD7C	1.
1100	KDOD7	KTOD7C	1.
1101	KDOD8	KDOD8C	1.
1102	KDOD8	KTOD8C	1.
1103	KDOD9	KDOD9C	1.
1104	KDOD9	KTOD9C	1.
1105	KGSUP1	KREM1C	-1.
1106	KGSUP1	KSUP1C	-1.
1107	KGSUP1	KWAS1C	-.9
1108	KGSUP10	KREM10C	-1.
1109	KGSUP10	KSUP10C	-1.
1110	KGSUP10	KWAS10C	-.9
1111	KGSUP11	KREM11C	-1.
1112	KGSUP11	KSUP11C	-1.
1113	KGSUP11	KWAS11C	-.9
1114	KGSUP12	KREM12C	-1.
1115	KGSUP12	KSUP12C	-1.
1116	KGSUP12	KWAS12C	-.9
1117	KGSUP2	KREM2C	-1.
1118	KGSUP2	KSUP2C	-1.
1119	KGSUP2	KWAS2C	-.9
1120	KGSUP3	KREM3C	-1.
1121	KGSUP3	KSUP3C	-1.

1122	KGSUP3	KWAS3C	-.9
1123	KGSUP4	KREM4C	-1.
1124	KGSUP4	KSUP4C	-1.
1125	KGSUP4	KWAS4C	-.9
1126	KGSUP5	KREM5C	-1.
1127	KGSUP5	KSUP5C	-1.
1128	KGSUP5	KWAS5C	-.9
1129	KGSUP6	KREM6C	-1.
1130	KGSUP6	KSUP6C	-1.
1131	KGSUP6	KWAS6C	-.9
1132	KGSUP7	KREM7C	-1.
1133	KGSUP7	KSUP7C	-1.
1134	KGSUP7	KWAS7C	-.9
1135	KGSUP8	KREM8C	-1.
1136	KGSUP8	KSUP8C	-1.
1137	KGSUP8	KWAS8C	-.9
1138	KGSUP9	KREM9C	-1.
1139	KGSUP9	KSUP9C	-1.
1140	KGSUP9	KWAS9C	-.9
1141	KHEC	KAGD0C	5.83
1142	KHEC	KHECC	1.
1143	KHEC	KRET5C	-.117
1144	KHEC	KRET6C	-.361
1145	KHEC	KRET7C	-.769
1146	KHEC	KRET8C	-.385
1147	KHEC	KRET9C	-.361
1148	KHEC	VALUE	350.
1149	KIND0	KIND0C	1.
1150	KIND0	KIND1C	-0.0833
1151	KIND0	KIND10C	-0.0833
1152	KIND0	KIND11C	-0.0833
1153	KIND0	KIND12C	-0.0833
1154	KIND0	KIND2C	-0.0833
1155	KIND0	KIND3C	-0.0833
1156	KIND0	KIND4C	-0.0833
1157	KIND0	KIND5C	-0.0833
1158	KIND0	KIND6C	-0.0833
1159	KIND0	KIND7C	-0.0833
1160	KIND0	KIND8C	-0.0833
1161	KIND0	KIND9C	-0.0833
1162	KIND0	KRET1C	-0.061
1163	KIND0	KRET10C	-0.061
1164	KIND0	KRET11C	-0.061
1165	KIND0	KRET12C	-0.061
1166	KIND0	KRET2C	-0.061
1167	KIND0	KRET3C	-0.061
1168	KIND0	KRET4C	-0.061
1169	KIND0	KRET5C	-0.061
1170	KIND0	KRET6C	-0.061
1171	KIND0	KRET7C	-0.061
1172	KIND0	KRET8C	-0.061
1173	KIND0	KRET9C	-0.061
1174	KIND1	KIND1C	1.
1175	KIND1	KTOD1C	1.
1176	KIND10	KIND10C	1.
1177	KIND10	KTOD10C	1.
1178	KIND11	KIND11C	1.
1179	KIND11	KTOD11C	1.
1180	KIND12	KIND12C	1.
1181	KIND12	KTOD12C	1.
1182	KIND2	KIND2C	1.
1183	KIND2	KTOD2C	1.
1184	KIND3	KIND3C	1.
1185	KIND3	KTOD3C	1.
1186	KIND4	KIND4C	1.
1187	KIND4	KTOD4C	1.
1188	KIND5	KIND5C	1.
1189	KIND5	KTOD5C	1.
1190	KIND6	KIND6C	1.
1191	KIND6	KTOD6C	1.
1192	KIND7	KIND7C	1.
1193	KIND7	KTOD7C	1.
1194	KIND8	KIND8C	1.
1195	KIND8	KTOD8C	1.
1196	KIND9	KIND9C	1.

1197	KIND9	KTOD9C	1.
1198	KNSUP1	KBAL1C	-1.
1199	KNSUP1	KWAS1C	1.
1200	KNSUP10	KBAL10C	-1.
1201	KNSUP10	KWAS10C	1.
1202	KNSUP11	KBAL11C	-1.
1203	KNSUP11	KWAS11C	1.
1204	KNSUP12	KBAL12C	-1.
1205	KNSUP12	KWAS12C	1.
1206	KNSUP2	KBAL2C	-1.
1207	KNSUP2	KWAS2C	1.
1208	KNSUP3	KBAL3C	-1.
1209	KNSUP3	KWAS3C	1.
1210	KNSUP4	KBAL4C	-1.
1211	KNSUP4	KWAS4C	1.
1212	KNSUP5	KBAL5C	-1.
1213	KNSUP5	KWAS5C	1.
1214	KNSUP6	KBAL6C	-1.
1215	KNSUP6	KWAS6C	1.
1216	KNSUP7	KBAL7C	-1.
1217	KNSUP7	KWAS7C	1.
1218	KNSUP8	KBAL8C	-1.
1219	KNSUP8	KWAS8C	1.
1220	KNSUP9	KBAL9C	-1.
1221	KNSUP9	KWAS9C	1.
1222	KREM1	KREM1C	1.
1223	KREM10	KREM10C	1.
1224	KREM11	KREM11C	1.
1225	KREM12	KREM12C	1.
1226	KREM2	KREM2C	1.
1227	KREM3	KREM3C	1.
1228	KREM4	KREM4C	1.
1229	KREM5	KREM5C	1.
1230	KREM6	KREM6C	1.
1231	KREM7	KREM7C	1.
1232	KREM8	KREM8C	1.
1233	KREM9	KREM9C	1.
1234	KRET1	KRET1C	1.
1235	KRET1	KSUP1C	1.
1236	KRET10	KRET10C	1.
1237	KRET10	KSUP10C	1.
1238	KRET11	KRET11C	1.
1239	KRET11	KSUP11C	1.
1240	KRET12	KRET12C	1.
1241	KRET12	KSUP12C	1.
1242	KRET2	KRET2C	1.
1243	KRET2	KSUP2C	1.
1244	KRET3	KRET3C	1.
1245	KRET3	KSUP3C	1.
1246	KRET4	KRET4C	1.
1247	KRET4	KSUP4C	1.
1248	KRET5	KRET5C	1.
1249	KRET5	KSUP5C	1.
1250	KRET6	KRET6C	1.
1251	KRET6	KSUP6C	1.
1252	KRET7	KRET7C	1.
1253	KRET7	KSUP7C	1.
1254	KRET8	KRET8C	1.
1255	KRET8	KSUP8C	1.
1256	KRET9	KRET9C	1.
1257	KRET9	KSUP9C	1.
1258	KROA1	KNAT1C	1.
1259	KROA1	KSUP1C	1.
1260	KROA10	KNAT10C	1.
1261	KROA10	KSUP10C	1.
1262	KROA11	KNAT11C	1.
1263	KROA11	KSUP11C	1.
1264	KROA12	KNAT12C	1.
1265	KROA12	KSUP12C	1.
1266	KROA2	KNAT2C	1.
1267	KROA2	KSUP2C	1.
1268	KROA3	KNAT3C	1.
1269	KROA3	KSUP3C	1.
1270	KROA4	KNAT4C	1.
1271	KROA4	KSUP4C	1.

1272	KROA5	KNAT5C	1.
1273	KROA5	KSUP5C	1.
1274	KROA6	KNAT6C	1.
1275	KROA6	KSUP6C	1.
1276	KROA7	KNAT7C	1.
1277	KROA7	KSUP7C	1.
1278	KROA8	KNAT8C	1.
1279	KROA8	KSUP8C	1.
1280	KROA9	KNAT9C	1.
1281	KROA9	KSUP9C	1.
1282	KTOD1	KBAL1C	1.
1283	KTOD1	KREM1C	1.
1284	KTOD1	KTOD1C	-1.
1285	KTOD10	KBAL10C	1.
1286	KTOD10	KREM10C	1.
1287	KTOD10	KTOD10C	-1.
1288	KTOD11	KBAL11C	1.
1289	KTOD11	KREM11C	1.
1290	KTOD11	KTOD11C	-1.
1291	KTOD12	KBAL12C	1.
1292	KTOD12	KREM12C	1.
1293	KTOD12	KTOD12C	-1.
1294	KTOD2	KBAL2C	1.
1295	KTOD2	KREM2C	1.
1296	KTOD2	KTOD2C	-1.
1297	KTOD3	KBAL3C	1.
1298	KTOD3	KREM3C	1.
1299	KTOD3	KTOD3C	-1.
1300	KTOD4	KBAL4C	1.
1301	KTOD4	KREM4C	1.
1302	KTOD4	KTOD4C	-1.
1303	KTOD5	KBAL5C	1.
1304	KTOD5	KREM5C	1.
1305	KTOD5	KTOD5C	-1.
1306	KTOD6	KBAL6C	1.
1307	KTOD6	KREM6C	1.
1308	KTOD6	KTOD6C	-1.
1309	KTOD7	KBAL7C	1.
1310	KTOD7	KREM7C	1.
1311	KTOD7	KTOD7C	-1.
1312	KTOD8	KBAL8C	1.
1313	KTOD8	KREM8C	1.
1314	KTOD8	KTOD8C	-1.
1315	KTOD9	KBAL9C	1.
1316	KTOD9	KREM9C	1.
1317	KTOD9	KTOD9C	-1.
1318	LAGD0	LAGD0C	-1.
1319	LAGD0	LAGD5C	-0.091
1320	LAGD0	LAGD6C	-0.177
1321	LAGD0	LAGD7C	-0.317
1322	LAGD0	LAGD8C	-0.218
1323	LAGD0	LAGD9C	-0.197
1324	LAGD5	LAGD5C	1.
1325	LAGD5	LTOD5C	1.
1326	LAGD6	LAGD6C	1.
1327	LAGD6	LTOD6C	1.
1328	LAGD7	LAGD7C	1.
1329	LAGD7	LTOD7C	1.
1330	LAGD8	LAGD8C	1.
1331	LAGD8	LTOD8C	1.
1332	LAGD9	LAGD9C	1.
1333	LAGD9	LTOD9C	1.
1334	LDOD0	LDOD0C	1.
1335	LDOD0	LRET1C	-.0265
1336	LDOD0	LRET10C	-.0265
1337	LDOD0	LRET11C	-.0265
1338	LDOD0	LRET12C	-.0265
1339	LDOD0	LRET2C	-.0265
1340	LDOD0	LRET3C	-.0265
1341	LDOD0	LRET4C	-.0265
1342	LDOD0	LRET5C	-.0265
1343	LDOD0	LRET6C	-.0265
1344	LDOD0	LRET7C	-.0265
1345	LDOD0	LRET8C	-.0265
1346	LDOD0	LRET9C	-.0265

1347	LDOD1	LDOD1C	1.
1348	LDOD1	LTOD1C	1.
1349	LDOD10	LDOD10C	1.
1350	LDOD10	LTOD10C	1.
1351	LDOD11	LDOD11C	1.
1352	LDOD11	LTOD11C	1.
1353	LDOD12	LDOD12C	1.
1354	LDOD12	LTOD12C	1.
1355	LDOD2	LDOD2C	1.
1356	LDOD2	LTOD2C	1.
1357	LDOD3	LDOD3C	1.
1358	LDOD3	LTOD3C	1.
1359	LDOD4	LDOD4C	1.
1360	LDOD4	LTOD4C	1.
1361	LDOD5	LDOD5C	1.
1362	LDOD5	LTOD5C	1.
1363	LDOD6	LDOD6C	1.
1364	LDOD6	LTOD6C	1.
1365	LDOD7	LDOD7C	1.
1366	LDOD7	LTOD7C	1.
1367	LDOD8	LDOD8C	1.
1368	LDOD8	LTOD8C	1.
1369	LDOD9	LDOD9C	1.
1370	LDOD9	LTOD9C	1.
1371	LEVAP1	LEVAP1C	1.
1372	LEVAP1	LLAK1C	-1.
1373	LEVAP10	LEVAP10C	1.
1374	LEVAP10	LLAK10C	-1.
1375	LEVAP11	LEVAP11C	1.
1376	LEVAP11	LLAK11C	-1.
1377	LEVAP12	LEVAP12C	1.
1378	LEVAP12	LLAK12C	-1.
1379	LEVAP2	LEVAP2C	1.
1380	LEVAP2	LLAK2C	-1.
1381	LEVAP3	LEVAP3C	1.
1382	LEVAP3	LLAK3C	-1.
1383	LEVAP4	LEVAP4C	1.
1384	LEVAP4	LLAK4C	-1.
1385	LEVAP5	LEVAP5C	1.
1386	LEVAP5	LLAK5C	-1.
1387	LEVAP6	LEVAP6C	1.
1388	LEVAP6	LLAK6C	-1.
1389	LEVAP7	LEVAP7C	1.
1390	LEVAP7	LLAK7C	-1.
1391	LEVAP8	LEVAP8C	1.
1392	LEVAP8	LLAK8C	-1.
1393	LEVAP9	LEVAP9C	1.
1394	LEVAP9	LLAK9C	-1.
1395	LGSUP1	LLAK1C	1.
1396	LGSUP1	LSUP1C	-1.
1397	LGSUP10	LLAK10C	1.
1398	LGSUP10	LSUP10C	-1.
1399	LGSUP11	LLAK11C	1.
1400	LGSUP11	LSUP11C	-1.
1401	LGSUP12	LLAK12C	1.
1402	LGSUP12	LSUP12C	-1.
1403	LGSUP2	LLAK2C	1.
1404	LGSUP2	LSUP2C	-1.
1405	LGSUP3	LLAK3C	1.
1406	LGSUP3	LSUP3C	-1.
1407	LGSUP4	LLAK4C	1.
1408	LGSUP4	LSUP4C	-1.
1409	LGSUP5	LLAK5C	1.
1410	LGSUP5	LSUP5C	-1.
1411	LGSUP6	LLAK6C	1.
1412	LGSUP6	LSUP6C	-1.
1413	LGSUP7	LLAK7C	1.
1414	LGSUP7	LSUP7C	-1.
1415	LGSUP8	LLAK8C	1.
1416	LGSUP8	LSUP8C	-1.
1417	LGSUP9	LLAK9C	1.
1418	LGSUP9	LSUP9C	-1.
1419	LHEC	LAGDOC	6.741
1420	LHEC	LHECC	1.
1421	LHEC	LRET5C	-.229

1422	LHEC	LRET6C	-.438
1423	LHEC	LRET7C	-.789
1424	LHEC	LRET8C	-.546
1425	LHEC	LRET9C	-.492
1426	LHEC	VALUE	350.
1427	LINDO	LINDOC	1.
1428	LINDO	LIND1C	-0.0833
1429	LINDO	LIND10C	-0.0833
1430	LINDO	LIND11C	-0.0833
1431	LINDO	LIND12C	-0.0833
1432	LINDO	LIND2C	-0.0833
1433	LINDO	LIND3C	-0.0833
1434	LINDO	LIND4C	-0.0833
1435	LINDO	LIND5C	-0.0833
1436	LINDO	LIND6C	-0.0833
1437	LINDO	LIND7C	-0.0833
1438	LINDO	LIND8C	-0.0833
1439	LINDO	LIND9C	-0.0833
1440	LINDO	LRET1C	-0.02
1441	LINDO	LRET10C	-0.02
1442	LINDO	LRET11C	-0.02
1443	LINDO	LRET12C	-0.02
1444	LINDO	LRET2C	-0.02
1445	LINDO	LRET3C	-0.02
1446	LINDO	LRET4C	-0.02
1447	LINDO	LRET5C	-0.02
1448	LINDO	LRET6C	-0.02
1449	LINDO	LRET7C	-0.02
1450	LINDO	LRET8C	-0.02
1451	LINDO	LRET9C	-0.02
1452	LIND1	LIND1C	1.
1453	LIND1	LTOD1C	1.
1454	LIND10	LIND10C	1.
1455	LIND10	LTOD10C	1.
1456	LIND11	LIND11C	1.
1457	LIND11	LTOD11C	1.
1458	LIND12	LIND12C	1.
1459	LIND12	LTOD12C	1.
1460	LIND2	LIND2C	1.
1461	LIND2	LTOD2C	1.
1462	LIND3	LIND3C	1.
1463	LIND3	LTOD3C	1.
1464	LIND4	LIND4C	1.
1465	LIND4	LTOD4C	1.
1466	LIND5	LIND5C	1.
1467	LIND5	LTOD5C	1.
1468	LIND6	LIND6C	1.
1469	LIND6	LTOD6C	1.
1470	LIND7	LIND7C	1.
1471	LIND7	LTOD7C	1.
1472	LIND8	LIND8C	1.
1473	LIND8	LTOD8C	1.
1474	LIND9	LIND9C	1.
1475	LIND9	LTOD9C	1.
1476	LLAKO	LHED1C	0.00143
1477	LLAKO	LLAKOC	1.
1478	LLAKO	LLAK1C	1.
1479	LLAK1	LHED1C	0.00143
1480	LLAK1	LHED2C	0.00143
1481	LLAK1	LLAK1C	-1.
1482	LLAK1	LLAK2C	1.
1483	LLAK1	LMAX1C	1.
1484	LLAK1	LMIN1C	1.
1485	LLAK10	LHED10C	0.00143
1486	LLAK10	LHED11C	0.00143
1487	LLAK10	LLAK10C	-1.
1488	LLAK10	LLAK11C	1.
1489	LLAK10	LMAX10C	1.
1490	LLAK10	LMIN10C	1.
1491	LLAK11	LHED11C	0.00143
1492	LLAK11	LHED12C	0.00143
1493	LLAK11	LLAK11C	-1.
1494	LLAK11	LLAK12C	1.
1495	LLAK11	LMAX11C	1.
1496	LLAK11	LMIN11C	1.

1497	LLAK12	LHED12C	0.00143
1498	LLAK12	LLAK12C	-1.
1499	LLAK12	LMAX12C	1.
1500	LLAK12	LMIN12C	1.
1501	LLAK12	LLAK0C	-1.
1502	LLAK2	LHED2C	0.00143
1503	LLAK2	LHED3C	0.00143
1504	LLAK2	LLAK2C	-1.
1505	LLAK2	LLAK3C	1.
1506	LLAK2	LMAX2C	1.
1507	LLAK2	LMIN2C	1.
1508	LLAK3	LHED3C	0.00143
1509	LLAK3	LHED4C	0.00143
1510	LLAK3	LLAK3C	-1.
1511	LLAK3	LLAK4C	1.
1512	LLAK3	LMAX3C	1.
1513	LLAK3	LMIN3C	1.
1514	LLAK4	LHED4C	0.00143
1515	LLAK4	LHED5C	0.00143
1516	LLAK4	LLAK4C	-1.
1517	LLAK4	LLAK5C	1.
1518	LLAK4	LMAX4C	1.
1519	LLAK4	LMIN4C	1.
1520	LLAK5	LHED5C	0.00143
1521	LLAK5	LHED6C	0.00143
1522	LLAK5	LLAK5C	-1.
1523	LLAK5	LLAK6C	1.
1524	LLAK5	LMAX5C	1.
1525	LLAK5	LMIN5C	1.
1526	LLAK5	LRLV5C	-1.
1527	LLAK6	LHED6C	0.00143
1528	LLAK6	LHED7C	0.00143
1529	LLAK6	LLAK6C	-1.
1530	LLAK6	LLAK7C	1.
1531	LLAK6	LMAX6C	1.
1532	LLAK6	LMIN6C	1.
1533	LLAK6	LRLV6C	-1.
1534	LLAK7	LHED7C	0.00143
1535	LLAK7	LHED8C	0.00143
1536	LLAK7	LLAK7C	-1.
1537	LLAK7	LLAK8C	1.
1538	LLAK7	LMAX7C	1.
1539	LLAK7	LMIN7C	1.
1540	LLAK7	LRLV7C	-1.
1541	LLAK8	LHED8C	0.00143
1542	LLAK8	LHED9C	0.00143
1543	LLAK8	LLAK8C	-1.
1544	LLAK8	LLAK9C	1.
1545	LLAK8	LMAX8C	1.
1546	LLAK8	LMIN8C	1.
1547	LLAK8	LRLV8C	-1.
1548	LLAK9	LHED10C	0.00143
1549	LLAK9	LHED9C	0.00143
1550	LLAK9	LLAK10C	1.
1551	LLAK9	LLAK9C	-1.
1552	LLAK9	LMAX9C	1.
1553	LLAK9	LMIN9C	1.
1554	LLAK9	LRLV9C	-1.
1555	LQAP1	LLAK1C	-1.
1556	LQAP1	LQAP1C	1.
1557	LQAP10	LLAK10C	-1.
1558	LQAP10	LQAP10C	1.
1559	LQAP11	LLAK11C	-1.
1560	LQAP11	LQAP11C	1.
1561	LQAP12	LLAK12C	-1.
1562	LQAP12	LQAP12C	1.
1563	LQAP2	LLAK2C	-1.
1564	LQAP2	LQAP2C	1.
1565	LQAP3	LLAK3C	-1.
1566	LQAP3	LQAP3C	1.
1567	LQAP4	LLAK4C	-1.
1568	LQAP4	LQAP4C	1.
1569	LQAP5	LLAK5C	-1.
1570	LQAP5	LQAP5C	1.
1571	LQAP6	LLAK6C	-1.

1572	LQAP6	LQAP6C	1.
1573	LQAP7	LLAK7C	-1.
1574	LQAP7	LQAP7C	1.
1575	LQAP8	LLAK8C	-1.
1576	LQAP8	LQAP8C	1.
1577	LQAP9	LLAK9C	-1.
1578	LQAP9	LQAP9C	1.
1579	LREC5	LRLS5C	1.
1580	LREC5	LRLV5C	1.
1581	LREC5	LRMX5C	1.
1582	LREC6	LRLS6C	1.
1583	LREC6	LRLV6C	1.
1584	LREC6	LRMX6C	1.
1585	LREC7	LRLS7C	1.
1586	LREC7	LRLV7C	1.
1587	LREC7	LRMX7C	1.
1588	LREC8	LRLS8C	1.
1589	LREC8	LRLV8C	1.
1590	LREC8	LRMX8C	1.
1591	LREC9	LRLS9C	1.
1592	LREC9	LRLV9C	1.
1593	LREC9	LRMX9C	1.
1594	LREL1	DSUP1C	1.
1595	LREL1	HCTF1C	-0.001
1596	LREL1	LFLD1C	1.
1597	LREL1	LINS1C	1.
1598	LREL1	LLAK1C	-1.
1599	LREL10	DSUP10C	1.
1600	LREL10	HCTF10C	-0.001
1601	LREL10	LFLD10C	1.
1602	LREL10	LINS10C	1.
1603	LREL10	LLAK10C	-1.
1604	LREL11	DSUP11C	1.
1605	LREL11	HCTF11C	-0.001
1606	LREL11	LFLD11C	1.
1607	LREL11	LINS11C	1.
1608	LREL11	LLAK11C	-1.
1609	LREL12	DSUP12C	1.
1610	LREL12	HCTF12C	-0.001
1611	LREL12	LFLD12C	1.
1612	LREL12	LINS12C	1.
1613	LREL12	LLAK12C	-1.
1614	LREL2	DSUP2C	1.
1615	LREL2	HCTF2C	-0.001
1616	LREL2	LFLD2C	1.
1617	LREL2	LINS2C	1.
1618	LREL2	LLAK2C	-1.
1619	LREL3	DSUP3C	1.
1620	LREL3	HCTF3C	-0.001
1621	LREL3	LFLD3C	1.
1622	LREL3	LINS3C	1.
1623	LREL3	LLAK3C	-1.
1624	LREL4	DSUP4C	1.
1625	LREL4	HCTF4C	-0.001
1626	LREL4	LFLD4C	1.
1627	LREL4	LINS4C	1.
1628	LREL4	LLAK4C	-1.
1629	LREL5	DSUP5C	1.
1630	LREL5	HCTF5C	-0.001
1631	LREL5	LFLD5C	1.
1632	LREL5	LINS5C	1.
1633	LREL5	LLAK5C	-1.
1634	LREL6	DSUP6C	1.
1635	LREL6	HCTF6C	-0.001
1636	LREL6	LFLD6C	1.
1637	LREL6	LINS6C	1.
1638	LREL6	LLAK6C	-1.
1639	LREL7	DSUP7C	1.
1640	LREL7	HCTF7C	-0.001
1641	LREL7	LFLD7C	1.
1642	LREL7	LINS7C	1.
1643	LREL7	LLAK7C	-1.
1644	LREL8	DSUP8C	1.
1645	LREL8	HCTF8C	-0.001
1646	LREL8	LFLD8C	1.

1647	LREL8	LINS8C	1.
1648	LREL8	LLAK8C	-1.
1649	LREL9	DSUP9C	1.
1650	LREL9	HCTF9C	-0.001
1651	LREL9	LFLD9C	1.
1652	LREL9	LINS9C	1.
1653	LREL9	LLAK9C	-1.
1654	LRET1	LRET1C	1.
1655	LRET1	LSUP1C	1.
1656	LRET10	LRET10C	1.
1657	LRET10	LSUP10C	1.
1658	LRET11	LRET11C	1.
1659	LRET11	LSUP11C	1.
1660	LRET12	LRET12C	1.
1661	LRET12	LSUP12C	1.
1662	LRET2	LRET2C	1.
1663	LRET2	LSUP2C	1.
1664	LRET3	LRET3C	1.
1665	LRET3	LSUP3C	1.
1666	LRET4	LRET4C	1.
1667	LRET4	LSUP4C	1.
1668	LRET5	LRET5C	1.
1669	LRET5	LSUP5C	1.
1670	LRET6	LRET6C	1.
1671	LRET6	LSUP6C	1.
1672	LRET7	LRET7C	1.
1673	LRET7	LSUP7C	1.
1674	LRET8	LRET8C	1.
1675	LRET8	LSUP8C	1.
1676	LRET9	LRET9C	1.
1677	LRET9	LSUP9C	1.
1678	LRLS5	LRLS5C	1.
1679	LRLS5	VALUE	-.0541
1680	LRLS6	LRLS6C	1.
1681	LRLS6	VALUE	-.1446
1682	LRLS7	LRLS7C	1.
1683	LRLS7	VALUE	-.2827
1684	LRLS8	LRLS8C	1.
1685	LRLS8	VALUE	-.2203
1686	LRLS9	LRLS9C	1.
1687	LRLS9	VALUE	-.0151
1688	LROA1	LNAT1C	1.
1689	LROA1	LSUP1C	1.
1690	LROA10	LNAT10C	1.
1691	LROA10	LSUP10C	1.
1692	LROA11	LNAT11C	1.
1693	LROA11	LSUP11C	1.
1694	LROA12	LNAT12C	1.
1695	LROA12	LSUP12C	1.
1696	LROA2	LNAT2C	1.
1697	LROA2	LSUP2C	1.
1698	LROA3	LNAT3C	1.
1699	LROA3	LSUP3C	1.
1700	LROA4	LNAT4C	1.
1701	LROA4	LSUP4C	1.
1702	LROA5	LNAT5C	1.
1703	LROA5	LSUP5C	1.
1704	LROA6	LNAT6C	1.
1705	LROA6	LSUP6C	1.
1706	LROA7	LNAT7C	1.
1707	LROA7	LSUP7C	1.
1708	LROA8	LNAT8C	1.
1709	LROA8	LSUP8C	1.
1710	LROA9	LNAT9C	1.
1711	LROA9	LSUP9C	1.
1712	LTOD1	LLAK1C	-1.
1713	LTOD1	LTOD1C	-1.
1714	LTOD10	LLAK10C	-1.
1715	LTOD10	LTOD10C	-1.
1716	LTOD11	LLAK11C	-1.
1717	LTOD11	LTOD11C	-1.
1718	LTOD12	LLAK12C	-1.
1719	LTOD12	LTOD12C	-1.
1720	LTOD2	LLAK2C	-1.
1721	LTOD2	LTOD2C	-1.

1722	LTOD3	LLAK3C	-1.
1723	LTOD3	LTOD3C	-1.
1724	LTOD4	LLAK4C	-1.
1725	LTOD4	LTOD4C	-1.
1726	LTOD5	LLAK5C	-1.
1727	LTOD5	LTOD5C	-1.
1728	LTOD6	LLAK6C	-1.
1729	LTOD6	LTOD6C	-1.
1730	LTOD7	LLAK7C	-1.
1731	LTOD7	LTOD7C	-1.
1732	LTOD8	LLAK8C	-1.
1733	LTOD8	LTOD8C	-1.
1734	LTOD9	LLAK9C	-1.
1735	LTOD9	LTOD9C	-1.
1736	RAGD0	RAGD0C	-1.
1737	RAGD0	RAGD5C	-0.091
1738	RAGD0	RAGD6C	-0.177
1739	RAGD0	RAGD7C	-0.317
1740	RAGD0	RAGD8C	-0.218
1741	RAGD0	RAGD9C	-0.197
1742	RAGD5	RAGD5C	1.
1743	RAGD5	RTOD5C	1.
1744	RAGD6	RAGD6C	1.
1745	RAGD6	RTOD6C	1.
1746	RAGD7	RAGD7C	1.
1747	RAGD7	RTOD7C	1.
1748	RAGD8	RAGD8C	1.
1749	RAGD8	RTOD8C	1.
1750	RAGD9	RAGD9C	1.
1751	RAGD9	RTOD9C	1.
1752	RDOD0	RDOD0C	1.
1753	RDOD0	RRET1C	-.0265
1754	RDOD0	RRET10C	-.0265
1755	RDOD0	RRET11C	-.0265
1756	RDOD0	RRET12C	-.0265
1757	RDOD0	RRET2C	-.0265
1758	RDOD0	RRET3C	-.0265
1759	RDOD0	RRET4C	-.0265
1760	RDOD0	RRET5C	-.0265
1761	RDOD0	RRET6C	-.0265
1762	RDOD0	RRET7C	-.0265
1763	RDOD0	RRET8C	-.0265
1764	RDOD0	RRET9C	-.0265
1765	RDOD1	RDOD1C	1.
1766	RDOD1	RTOD1C	1.
1767	RDOD10	RDOD10C	1.
1768	RDOD10	RTOD10C	1.
1769	RDOD11	RDOD11C	1.
1770	RDOD11	RTOD11C	1.
1771	RDOD12	RDOD12C	1.
1772	RDOD12	RTOD12C	1.
1773	RDOD2	RDOD2C	1.
1774	RDOD2	RTOD2C	1.
1775	RDOD3	RDOD3C	1.
1776	RDOD3	RTOD3C	1.
1777	RDOD4	RDOD4C	1.
1778	RDOD4	RTOD4C	1.
1779	RDOD5	RDOD5C	1.
1780	RDOD5	RTOD5C	1.
1781	RDOD6	RDOD6C	1.
1782	RDOD6	RTOD6C	1.
1783	RDOD7	RDOD7C	1.
1784	RDOD7	RTOD7C	1.
1785	RDOD8	RDOD8C	1.
1786	RDOD8	RTOD8C	1.
1787	RDOD9	RDOD9C	1.
1788	RDOD9	RTOD9C	1.
1789	RGSUP1	RREM1C	-1.
1790	RGSUP1	RSUP1C	-1.
1791	RGSUP1	RWAS1C	-.8
1792	RGSUP10	RREM10C	-1.
1793	RGSUP10	RSUP10C	-1.
1794	RGSUP10	RWAS10C	-.8
1795	RGSUP11	RREM11C	-1.
1796	RGSUP11	RSUP11C	-1.

1797	RGSUP11	RWAS11C	-.8
1798	RGSUP12	RREM12C	-1.
1799	RGSUP12	RSUP12C	-1.
1800	RGSUP12	RWAS12C	-.8
1801	RGSUP2	RREM2C	-1.
1802	RGSUP2	RSUP2C	-1.
1803	RGSUP2	RWAS2C	-.8
1804	RGSUP3	RREM3C	-1.
1805	RGSUP3	RSUP3C	-1.
1806	RGSUP3	RWAS3C	-.8
1807	RGSUP4	RREM4C	-1.
1808	RGSUP4	RSUP4C	-1.
1809	RGSUP4	RWAS4C	-.8
1810	RGSUP5	RREM5C	-1.
1811	RGSUP5	RSUP5C	-1.
1812	RGSUP5	RWAS5C	-.8
1813	RGSUP6	RREM6C	-1.
1814	RGSUP6	RSUP6C	-1.
1815	RGSUP6	RWAS6C	-.8
1816	RGSUP7	RREM7C	-1.
1817	RGSUP7	RSUP7C	-1.
1818	RGSUP7	RWAS7C	-.8
1819	RGSUP8	RREM8C	-1.
1820	RGSUP8	RSUP8C	-1.
1821	RGSUP8	RWAS8C	-.8
1822	RGSUP9	RREM9C	-1.
1823	RGSUP9	RSUP9C	-1.
1824	RGSUP9	RWAS9C	-.8
1825	RHEC	RAGD0C	6.741
1826	RHEC	RHECC	1.
1827	RHEC	RRET5C	-.229
1828	RHEC	RRET6C	-.438
1829	RHEC	RRET7C	-.789
1830	RHEC	RRET8C	-.546
1831	RHEC	RRET9C	-.492
1832	RHEC	VALUE	350.
1833	RIND0	RIND0C	1.
1834	RIND0	RIND1C	-0.0833
1835	RIND0	RIND10C	-0.0833
1836	RIND0	RIND11C	-0.0833
1837	RIND0	RIND12C	-0.0833
1838	RIND0	RIND2C	-0.0833
1839	RIND0	RIND3C	-0.0833
1840	RIND0	RIND4C	-0.0833
1841	RIND0	RIND5C	-0.0833
1842	RIND0	RIND6C	-0.0833
1843	RIND0	RIND7C	-0.0833
1844	RIND0	RIND8C	-0.0833
1845	RIND0	RIND9C	-0.0833
1846	RIND0	RRET1C	-0.02
1847	RIND0	RRET10C	-0.02
1848	RIND0	RRET11C	-0.02
1849	RIND0	RRET12C	-0.02
1850	RIND0	RRET2C	-0.02
1851	RIND0	RRET3C	-0.02
1852	RIND0	RRET4C	-0.02
1853	RIND0	RRET5C	-0.02
1854	RIND0	RRET6C	-0.02
1855	RIND0	RRET7C	-0.02
1856	RIND0	RRET8C	-0.02
1857	RIND0	RRET9C	-0.02
1858	RIND1	RIND1C	1.
1859	RIND1	RTOD1C	1.
1860	RIND10	RIND10C	1.
1861	RIND10	RTOD10C	1.
1862	RIND11	RIND11C	1.
1863	RIND11	RTOD11C	1.
1864	RIND12	RIND12C	1.
1865	RIND12	RTOD12C	1.
1866	RIND2	RIND2C	1.
1867	RIND2	RTOD2C	1.
1868	RIND3	RIND3C	1.
1869	RIND3	RTOD3C	1.
1870	RIND4	RIND4C	1.
1871	RIND4	RTOD4C	1.

1872	RIND5	RIND5C	1.
1873	RIND5	RTOD5C	1.
1874	RIND6	RIND6C	1.
1875	RIND6	RTOD6C	1.
1876	RIND7	RIND7C	1.
1877	RIND7	RTOD7C	1.
1878	RIND8	RIND8C	1.
1879	RIND8	RTOD8C	1.
1880	RIND9	RIND9C	1.
1881	RIND9	RTOD9C	1.
1882	RNSUP1	RBAL1C	-1.
1883	RNSUP1	RWAS1C	1.
1884	RNSUP10	RBAL10C	-1.
1885	RNSUP10	RWAS10C	1.
1886	RNSUP11	RBAL11C	-1.
1887	RNSUP11	RWAS11C	1.
1888	RNSUP12	RBAL12C	-1.
1889	RNSUP12	RWAS12C	1.
1890	RNSUP2	RBAL2C	-1.
1891	RNSUP2	RWAS2C	1.
1892	RNSUP3	RBAL3C	-1.
1893	RNSUP3	RWAS3C	1.
1894	RNSUP4	RBAL4C	-1.
1895	RNSUP4	RWAS4C	1.
1896	RNSUP5	RBAL5C	-1.
1897	RNSUP5	RWAS5C	1.
1898	RNSUP6	RBAL6C	-1.
1899	RNSUP6	RWAS6C	1.
1900	RNSUP7	RBAL7C	-1.
1901	RNSUP7	RWAS7C	1.
1902	RNSUP8	RBAL8C	-1.
1903	RNSUP8	RWAS8C	1.
1904	RNSUP9	RBAL9C	-1.
1905	RNSUP9	RWAS9C	1.
1906	RREM1	LSUP1C	1.
1907	RREM1	RREM1C	1.
1908	RREM10	LSUP10C	1.
1909	RREM10	RREM10C	1.
1910	RREM11	LSUP11C	1.
1911	RREM11	RREM11C	1.
1912	RREM12	LSUP12C	1.
1913	RREM12	RREM12C	1.
1914	RREM2	LSUP2C	1.
1915	RREM2	RREM2C	1.
1916	RREM3	LSUP3C	1.
1917	RREM3	RREM3C	1.
1918	RREM4	LSUP4C	1.
1919	RREM4	RREM4C	1.
1920	RREM5	LSUP5C	1.
1921	RREM5	RREM5C	1.
1922	RREM6	LSUP6C	1.
1923	RREM6	RREM6C	1.
1924	RREM7	LSUP7C	1.
1925	RREM7	RREM7C	1.
1926	RREM8	LSUP8C	1.
1927	RREM8	RREM8C	1.
1928	RREM9	LSUP9C	1.
1929	RREM9	RREM9C	1.
1930	RRET1	RRET1C	1.
1931	RRET1	RSUP1C	1.
1932	RRET10	RRET10C	1.
1933	RRET10	RSUP10C	1.
1934	RRET11	RRET11C	1.
1935	RRET11	RSUP11C	1.
1936	RRET12	RRET12C	1.
1937	RRET12	RSUP12C	1.
1938	RRET2	RRET2C	1.
1939	RRET2	RSUP2C	1.
1940	RRET3	RRET3C	1.
1941	RRET3	RSUP3C	1.
1942	RRET4	RRET4C	1.
1943	RRET4	RSUP4C	1.
1944	RRET5	RRET5C	1.
1945	RRET5	RSUP5C	1.
1946	RRET6	RRET6C	1.

1947	RRET6	RSUP6C	1.
1948	RRET7	RRET7C	1.
1949	RRET7	RSUP7C	1.
1950	RRET8	RRET8C	1.
1951	RRET8	RSUP8C	1.
1952	RRET9	RRET9C	1.
1953	RRET9	RSUP9C	1.
1954	RROA1	RNAT1C	1.
1955	RROA1	RSUP1C	1.
1956	RROA10	RNAT10C	1.
1957	RROA10	RSUP10C	1.
1958	RROA11	RNAT11C	1.
1959	RROA11	RSUP11C	1.
1960	RROA12	RNAT12C	1.
1961	RROA12	RSUP12C	1.
1962	RROA2	RNAT2C	1.
1963	RROA2	RSUP2C	1.
1964	RROA3	RNAT3C	1.
1965	RROA3	RSUP3C	1.
1966	RROA4	RNAT4C	1.
1967	RROA4	RSUP4C	1.
1968	RROA5	RNAT5C	1.
1969	RROA5	RSUP5C	1.
1970	RROA6	RNAT6C	1.
1971	RROA6	RSUP6C	1.
1972	RROA7	RNAT7C	1.
1973	RROA7	RSUP7C	1.
1974	RROA8	RNAT8C	1.
1975	RROA8	RSUP8C	1.
1976	RROA9	RNAT9C	1.
1977	RROA9	RSUP9C	1.
1978	RTOD1	RBAL1C	1.
1979	RTOD1	RREM1C	1.
1980	RTOD1	RTOD1C	-1.
1981	RTOD10	RBAL10C	1.
1982	RTOD10	RREM10C	1.
1983	RTOD10	RTOD10C	-1.
1984	RTOD11	RBAL11C	1.
1985	RTOD11	RREM11C	1.
1986	RTOD11	RTOD11C	-1.
1987	RTOD12	RBAL12C	1.
1988	RTOD12	RREM12C	1.
1989	RTOD12	RTOD12C	-1.
1990	RTOD2	RBAL2C	1.
1991	RTOD2	RREM2C	1.
1992	RTOD2	RTOD2C	-1.
1993	RTOD3	RBAL3C	1.
1994	RTOD3	RREM3C	1.
1995	RTOD3	RTOD3C	-1.
1996	RTOD4	RBAL4C	1.
1997	RTOD4	RREM4C	1.
1998	RTOD4	RTOD4C	-1.
1999	RTOD5	RBAL5C	1.
2000	RTOD5	RREM5C	1.
2001	RTOD5	RTOD5C	-1.
2002	RTOD6	RBAL6C	1.
2003	RTOD6	RREM6C	1.
2004	RTOD6	RTOD6C	-1.
2005	RTOD7	RBAL7C	1.
2006	RTOD7	RREM7C	1.
2007	RTOD7	RTOD7C	-1.
2008	RTOD8	RBAL8C	1.
2009	RTOD8	RREM8C	1.
2010	RTOD8	RTOD8C	-1.
2011	RTOD9	RBAL9C	1.
2012	RTOD9	RREM9C	1.
2013	RTOD9	RTOD9C	-1.
2014	SAGD0	SAGD0C	-1.
2015	SAGD0	SAGD5C	-0.084
2016	SAGD0	SAGD6C	-0.259
2017	SAGD0	SAGD7C	-0.322
2018	SAGD0	SAGD8C	-0.219
2019	SAGD0	SAGD9C	-0.197
2020	SAGD5	SAGD5C	1.
2021	SAGD5	STOD5C	1.

2022	SAGD6	SAGD6C	1.
2023	SAGD6	STOD6C	1.
2024	SAGD7	SAGD7C	1.
2025	SAGD7	STOD7C	1.
2026	SAGD8	SAGD8C	1.
2027	SAGD8	STOD8C	1.
2028	SAGD9	SAGD9C	1.
2029	SAGD9	STOD9C	1.
2030	SDODO	SDODOC	1.
2031	SDODO	SRET1C	-.073
2032	SDODO	SRET10C	-.073
2033	SDODO	SRET11C	-.073
2034	SDODO	SRET12C	-.073
2035	SDODO	SRET2C	-.073
2036	SDODO	SRET3C	-.073
2037	SDODO	SRET4C	-.073
2038	SDODO	SRET5C	-.073
2039	SDODO	SRET6C	-.073
2040	SDODO	SRET7C	-.073
2041	SDODO	SRET8C	-.073
2042	SDODO	SRET9C	-.073
2043	SDOD1	SDOD1C	1.
2044	SDOD1	STOD1C	1.
2045	SDOD10	SDOD10C	1.
2046	SDOD10	STOD10C	1.
2047	SDOD11	SDOD11C	1.
2048	SDOD11	STOD11C	1.
2049	SDOD12	SDOD12C	1.
2050	SDOD12	STOD12C	1.
2051	SDOD2	SDOD2C	1.
2052	SDOD2	STOD2C	1.
2053	SDOD3	SDOD3C	1.
2054	SDOD3	STOD3C	1.
2055	SDOD4	SDOD4C	1.
2056	SDOD4	STOD4C	1.
2057	SDOD5	SDOD5C	1.
2058	SDOD5	STOD5C	1.
2059	SDOD6	SDOD6C	1.
2060	SDOD6	STOD6C	1.
2061	SDOD7	SDOD7C	1.
2062	SDOD7	STOD7C	1.
2063	SDOD8	SDOD8C	1.
2064	SDOD8	STOD8C	1.
2065	SDOD9	SDOD9C	1.
2066	SDOD9	STOD9C	1.
2067	SGSUP1	SREM1C	-1.
2068	SGSUP1	SSUP1C	-1.
2069	SGSUP1	SWAS1C	-.8
2070	SGSUP10	SREM10C	-1.
2071	SGSUP10	SSUP10C	-1.
2072	SGSUP10	SWAS10C	-.8
2073	SGSUP11	SREM11C	-1.
2074	SGSUP11	SSUP11C	-1.
2075	SGSUP11	SWAS11C	-.8
2076	SGSUP12	SREM12C	-1.
2077	SGSUP12	SSUP12C	-1.
2078	SGSUP12	SWAS12C	-.8
2079	SGSUP2	SREM2C	-1.
2080	SGSUP2	SSUP2C	-1.
2081	SGSUP2	SWAS2C	-.8
2082	SGSUP3	SREM3C	-1.
2083	SGSUP3	SSUP3C	-1.
2084	SGSUP3	SWAS3C	-.8
2085	SGSUP4	SREM4C	-1.
2086	SGSUP4	SSUP4C	-1.
2087	SGSUP4	SWAS4C	-.8
2088	SGSUP5	SREM5C	-1.
2089	SGSUP5	SSUP5C	-1.
2090	SGSUP5	SWAS5C	-.8
2091	SGSUP6	SREM6C	-1.
2092	SGSUP6	SSUP6C	-1.
2093	SGSUP6	SWAS6C	-.8
2094	SGSUP7	SREM7C	-1.
2095	SGSUP7	SSUP7C	-1.
2096	SGSUP7	SWAS7C	-.8

2097	SGSUP8	SREM8C	-1.
2098	SGSUP8	SSUP8C	-1.
2099	SGSUP8	SWAS8C	-.8
2100	SGSUP9	SREM9C	-1.
2101	SGSUP9	SSUP9C	-1.
2102	SGSUP9	SWAS9C	-.8
2103	SHEC	SAGD0C	7.98
2104	SHEC	SHECC	1.
2105	SHEC	SRET5C	-.362
2106	SHEC	SRET6C	-.581
2107	SHEC	SRET7C	-.806
2108	SHEC	SRET8C	-.637
2109	SHEC	SRET9C	-.678
2110	SHEC	VALUE	350.
2111	SIND0	SIND0C	1.
2112	SIND0	SIND1C	-0.0833
2113	SIND0	SIND10C	-0.0833
2114	SIND0	SIND11C	-0.0833
2115	SIND0	SIND12C	-0.0833
2116	SIND0	SIND2C	-0.0833
2117	SIND0	SIND3C	-0.0833
2118	SIND0	SIND4C	-0.0833
2119	SIND0	SIND5C	-0.0833
2120	SIND0	SIND6C	-0.0833
2121	SIND0	SIND7C	-0.0833
2122	SIND0	SIND8C	-0.0833
2123	SIND0	SIND9C	-0.0833
2124	SIND0	SRET1C	-0.077
2125	SIND0	SRET10C	-0.077
2126	SIND0	SRET11C	-0.077
2127	SIND0	SRET12C	-0.077
2128	SIND0	SRET2C	-0.077
2129	SIND0	SRET3C	-0.077
2130	SIND0	SRET4C	-0.077
2131	SIND0	SRET5C	-0.077
2132	SIND0	SRET6C	-0.077
2133	SIND0	SRET7C	-0.077
2134	SIND0	SRET8C	-0.077
2135	SIND0	SRET9C	-0.077
2136	SIND1	SIND1C	1.
2137	SIND1	STOD1C	1.
2138	SIND10	SIND10C	1.
2139	SIND10	STOD10C	1.
2140	SIND11	SIND11C	1.
2141	SIND11	STOD11C	1.
2142	SIND12	SIND12C	1.
2143	SIND12	STOD12C	1.
2144	SIND2	SIND2C	1.
2145	SIND2	STOD2C	1.
2146	SIND3	SIND3C	1.
2147	SIND3	STOD3C	1.
2148	SIND4	SIND4C	1.
2149	SIND4	STOD4C	1.
2150	SIND5	SIND5C	1.
2151	SIND5	STOD5C	1.
2152	SIND6	SIND6C	1.
2153	SIND6	STOD6C	1.
2154	SIND7	SIND7C	1.
2155	SIND7	STOD7C	1.
2156	SIND8	SIND8C	1.
2157	SIND8	STOD8C	1.
2158	SIND9	SIND9C	1.
2159	SIND9	STOD9C	1.
2160	SNSUP1	SBAL1C	-1.
2161	SNSUP1	SWAS1C	1.
2162	SNSUP10	SBAL10C	-1.
2163	SNSUP10	SWAS10C	1.
2164	SNSUP11	SBAL11C	-1.
2165	SNSUP11	SWAS11C	1.
2166	SNSUP12	SBAL12C	-1.
2167	SNSUP12	SWAS12C	1.
2168	SNSUP2	SBAL2C	-1.
2169	SNSUP2	SWAS2C	1.
2170	SNSUP3	SBAL3C	-1.
2171	SNSUP3	SWAS3C	1.

2172	SNSUP4	SBAL4C	-1.
2173	SNSUP4	SWAS4C	1.
2174	SNSUP5	SBAL5C	-1.
2175	SNSUP5	SWAS5C	1.
2176	SNSUP6	SBAL6C	-1.
2177	SNSUP6	SWAS6C	1.
2178	SNSUP7	SBAL7C	-1.
2179	SNSUP7	SWAS7C	1.
2180	SNSUP8	SBAL8C	-1.
2181	SNSUP8	SWAS8C	1.
2182	SNSUP9	SBAL9C	-1.
2183	SNSUP9	SWAS9C	1.
2184	SREM1	LSUP1C	1.
2185	SREM1	SREM1C	1.
2186	SREM10	LSUP10C	1.
2187	SREM10	SREM10C	1.
2188	SREM11	LSUP11C	1.
2189	SREM11	SREM11C	1.
2190	SREM12	LSUP12C	1.
2191	SREM12	SREM12C	1.
2192	SREM2	LSUP2C	1.
2193	SREM2	SREM2C	1.
2194	SREM3	LSUP3C	1.
2195	SREM3	SREM3C	1.
2196	SREM4	LSUP4C	1.
2197	SREM4	SREM4C	1.
2198	SREM5	LSUP5C	1.
2199	SREM5	SREM5C	1.
2200	SREM6	LSUP6C	1.
2201	SREM6	SREM6C	1.
2202	SREM7	LSUP7C	1.
2203	SREM7	SREM7C	1.
2204	SREM8	LSUP8C	1.
2205	SREM8	SREM8C	1.
2206	SREM9	LSUP9C	1.
2207	SREM9	SREM9C	1.
2208	SRET1	SRET1C	1.
2209	SRET1	SSUP1C	1.
2210	SRET10	SRET10C	1.
2211	SRET10	SSUP10C	1.
2212	SRET11	SRET11C	1.
2213	SRET11	SSUP11C	1.
2214	SRET12	SRET12C	1.
2215	SRET12	SSUP12C	1.
2216	SRET2	SRET2C	1.
2217	SRET2	SSUP2C	1.
2218	SRET3	SRET3C	1.
2219	SRET3	SSUP3C	1.
2220	SRET4	SRET4C	1.
2221	SRET4	SSUP4C	1.
2222	SRET5	SRET5C	1.
2223	SRET5	SSUP5C	1.
2224	SRET6	SRET6C	1.
2225	SRET6	SSUP6C	1.
2226	SRET7	SRET7C	1.
2227	SRET7	SSUP7C	1.
2228	SRET8	SRET8C	1.
2229	SRET8	SSUP8C	1.
2230	SRET9	SRET9C	1.
2231	SRET9	SSUP9C	1.
2232	SROA1	SNAT1C	1.
2233	SROA1	SSUP1C	1.
2234	SROA10	SNAT10C	1.
2235	SROA10	SSUP10C	1.
2236	SROA11	SNAT11C	1.
2237	SROA11	SSUP11C	1.
2238	SROA12	SNAT12C	1.
2239	SROA12	SSUP12C	1.
2240	SROA2	SNAT2C	1.
2241	SROA2	SSUP2C	1.
2242	SROA3	SNAT3C	1.
2243	SROA3	SSUP3C	1.
2244	SROA4	SNAT4C	1.
2245	SROA4	SSUP4C	1.
2246	SROA5	SNAT5C	1.

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         SROA5    SSUP5C    1.
         SROA6    SNAT6C    1.
         SROA6    SSUP6C    1.
         SROA7    SNAT7C    1.
         SROA7    SSUP7C    1.
         SROA8    SNAT8C    1.
         SROA8    SSUP8C    1.
         SROA9    SNAT9C    1.
         SROA9    SSUP9C    1.
         STOD1    SBAL1C    1.
         STOD1    SREM1C    1.
         STOD1    STOD1C    -1.
         STOD10   SBAL10C   1.
         STOD10   SREM10C   1.
         STOD10   STOD10C   -1.
         STOD11   SBAL11C   1.
         STOD11   SREM11C   1.
         STOD11   STOD11C   -1.
         STOD12   SBAL12C   1.
         STOD12   SREM12C   1.
         STOD12   STOD12C   -1.
         STOD2    SBAL2C    1.
         STOD2    SREM2C    1.
         STOD2    STOD2C    -1.
         STOD3    SBAL3C    1.
         STOD3    SREM3C    1.
         STOD3    STOD3C    -1.
         STOD4    SBAL4C    1.
         STOD4    SREM4C    1.
         STOD4    STOD4C    -1.
         STOD5    SBAL5C    1.
         STOD5    SREM5C    1.
         STOD5    STOD5C    -1.
         STOD6    SBAL6C    1.
         STOD6    SREM6C    1.
         STOD6    STOD6C    -1.
         STOD7    SBAL7C    1.
         STOD7    SREM7C    1.
         STOD7    STOD7C    -1.
         STOD8    SBAL8C    1.
         STOD8    SREM8C    1.
         STOD8    STOD8C    -1.
         STOD9    SBAL9C    1.
         STOD9    SREM9C    1.
         STOD9    STOD9C    -1.
     RHS
         TRY1     AREL1C    77127.
         TRY1     AREL10C   249041.
         TRY1     AREL11C   145993.
         TRY1     AREL12C   98047.
         TRY1     AREL2C    68562.
         TRY1     AREL3C    168882.
         TRY1     AREL4C    404581.
         TRY1     AREL5C    724193.
         TRY1     AREL6C    1244057.
         TRY1     AREL7C    848429.
         TRY1     AREL8C    436419.
         TRY1     AREL9C    300169.
         TRY1     DAGD0C    0
         TRY1     DAGD5C    0
         TRY1     DAGD6C    0
         TRY1     DAGD7C    0
         TRY1     DAGD8C    0
         TRY1     DAGD9C    0
         TRY1     DBAL1C    0
         TRY1     DBAL10C   0
         TRY1     DBAL11C   0
         TRY1     DBAL12C   0
         TRY1     DBAL2C    0
         TRY1     DBAL3C    0
         TRY1     DBAL4C    0
         TRY1     DBAL5C    0
         TRY1     DBAL6C    0
         TRY1     DBAL7C    0
         TRY1     DBAL8C    0
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2322	TRY1	DBAL9C	0
2323	TRY1	DDOD0C	26302.
2324	TRY1	DDOD1C	1534.
2325	TRY1	DDOD10C	2191.
2326	TRY1	DDOD11C	1534.
2327	TRY1	DDOD12C	1534.
2328	TRY1	DDOD2C	1534.
2329	TRY1	DDOD3C	1534.
2330	TRY1	DDOD4C	2191.
2331	TRY1	DDOD5C	2850.
2332	TRY1	DDOD6C	2850.
2333	TRY1	DDOD7C	2850.
2334	TRY1	DDOD8C	2850.
2335	TRY1	DDOD9C	2850.
2336	TRY1	DHECC	10070.
2337	TRY1	DIND0C	7933.
2338	TRY1	DIND1C	0
2339	TRY1	DIND10C	0
2340	TRY1	DIND11C	0
2341	TRY1	DIND12C	0
2342	TRY1	DIND2C	0
2343	TRY1	DIND3C	0
2344	TRY1	DIND4C	0
2345	TRY1	DIND5C	0
2346	TRY1	DIND6C	0
2347	TRY1	DIND7C	0
2348	TRY1	DIND8C	0
2349	TRY1	DIND9C	0
2350	TRY1	DNAT1C	2683.
2351	TRY1	DNAT10C	11597.
2352	TRY1	DNAT11C	8346.
2353	TRY1	DNAT12C	2456.
2354	TRY1	DNAT2C	720.
2355	TRY1	DNAT3C	154.
2356	TRY1	DNAT4C	64607.
2357	TRY1	DNAT5C	5162.
2358	TRY1	DNAT6C	16669.
2359	TRY1	DNAT7C	63814.
2360	TRY1	DNAT8C	25310.
2361	TRY1	DNAT9C	23694.
2362	TRY1	DREM1C	0
2363	TRY1	DREM10C	0
2364	TRY1	DREM11C	0
2365	TRY1	DREM12C	0
2366	TRY1	DREM2C	0
2367	TRY1	DREM3C	0
2368	TRY1	DREM4C	0
2369	TRY1	DREM5C	0
2370	TRY1	DREM6C	0
2371	TRY1	DREM7C	0
2372	TRY1	DREM8C	0
2373	TRY1	DREM9C	0
2374	TRY1	DRET1C	0
2375	TRY1	DRET10C	0
2376	TRY1	DRET11C	0
2377	TRY1	DRET12C	0
2378	TRY1	DRET2C	0
2379	TRY1	DRET3C	0
2380	TRY1	DRET4C	0
2381	TRY1	DRET5C	0
2382	TRY1	DRET6C	0
2383	TRY1	DRET7C	0
2384	TRY1	DRET8C	0
2385	TRY1	DRET9C	0
2386	TRY1	DSUP1C	0
2387	TRY1	DSUP10C	0
2388	TRY1	DSUP11C	0
2389	TRY1	DSUP12C	0
2390	TRY1	DSUP2C	0
2391	TRY1	DSUP3C	0
2392	TRY1	DSUP4C	0
2393	TRY1	DSUP5C	0
2394	TRY1	DSUP6C	0
2395	TRY1	DSUP7C	0
2396	TRY1	DSUP8C	0

2397	TRY1	DSUP9C	0
2398	TRY1	DTOD1C	0
2399	TRY1	DTOD10C	0
2400	TRY1	DTOD11C	0
2401	TRY1	DTOD12C	0
2402	TRY1	DTOD2C	0
2403	TRY1	DTOD3C	0
2404	TRY1	DTOD4C	0
2405	TRY1	DTOD5C	0
2406	TRY1	DTOD6C	0
2407	TRY1	DTOD7C	0
2408	TRY1	DTOD8C	0
2409	TRY1	DTOD9C	0
2410	TRY1	DWAS1C	0
2411	TRY1	DWAS10C	0
2412	TRY1	DWAS11C	0
2413	TRY1	DWAS12C	0
2414	TRY1	DWAS2C	0
2415	TRY1	DWAS3C	0
2416	TRY1	DWAS4C	0
2417	TRY1	DWAS5C	0
2418	TRY1	DWAS6C	0
2419	TRY1	DWAS7C	0
2420	TRY1	DWAS8C	0
2421	TRY1	DWAS9C	0
2422	TRY1	HCTF1C	0
2423	TRY1	HCTF10C	0
2424	TRY1	HCTF11C	0
2425	TRY1	HCTF12C	0
2426	TRY1	HCTF2C	0
2427	TRY1	HCTF3C	0
2428	TRY1	HCTF4C	0
2429	TRY1	HCTF5C	0
2430	TRY1	HCTF6C	0
2431	TRY1	HCTF7C	0
2432	TRY1	HCTF8C	0
2433	TRY1	HCTF9C	0
2434	TRY1	HCTT1C	1116.9
2435	TRY1	HCTT10C	1116.9
2436	TRY1	HCTT11C	1116.9
2437	TRY1	HCTT12C	1116.9
2438	TRY1	HCTT2C	1116.9
2439	TRY1	HCTT3C	1116.9
2440	TRY1	HCTT4C	1116.9
2441	TRY1	HCTT5C	1116.9
2442	TRY1	HCTT6C	1116.9
2443	TRY1	HCTT7C	1116.9
2444	TRY1	HCTT8C	1116.9
2445	TRY1	HCTT9C	1116.9
2446	TRY1	KAGD0C	0
2447	TRY1	KAGD5C	0
2448	TRY1	KAGD6C	0
2449	TRY1	KAGD7C	0
2450	TRY1	KAGD8C	0
2451	TRY1	KAGD9C	0
2452	TRY1	KBAL1C	0
2453	TRY1	KBAL10C	0
2454	TRY1	KBAL11C	0
2455	TRY1	KBAL12C	0
2456	TRY1	KBAL2C	0
2457	TRY1	KBAL3C	0
2458	TRY1	KBAL4C	0
2459	TRY1	KBAL5C	0
2460	TRY1	KBAL6C	0
2461	TRY1	KBAL7C	0
2462	TRY1	KBAL8C	0
2463	TRY1	KBAL9C	0
2464	TRY1	KDOD0C	26302.
2465	TRY1	KDOD1C	150.
2466	TRY1	KDOD10C	215.
2467	TRY1	KDOD11C	150.
2468	TRY1	KDOD12C	150.
2469	TRY1	KDOD2C	150.
2470	TRY1	KDOD3C	150.
2471	TRY1	KDOD4C	215.

2472	TRY1	KDOD5C	279.
2473	TRY1	KDOD6C	279.
2474	TRY1	KDOD7C	279.
2475	TRY1	KDOD8C	279.
2476	TRY1	KDOD9C	279.
2477	TRY1	KHECC	20950.
2478	TRY1	KIND0C	0
2479	TRY1	KIND1C	0
2480	TRY1	KIND10C	0
2481	TRY1	KIND11C	0
2482	TRY1	KIND12C	0
2483	TRY1	KIND2C	0
2484	TRY1	KIND3C	0
2485	TRY1	KIND4C	0
2486	TRY1	KIND5C	0
2487	TRY1	KIND6C	0
2488	TRY1	KIND7C	0
2489	TRY1	KIND8C	0
2490	TRY1	KIND9C	0
2491	TRY1	KNAT1C	0
2492	TRY1	KNAT10C	0
2493	TRY1	KNAT11C	0
2494	TRY1	KNAT12C	0
2495	TRY1	KNAT2C	0
2496	TRY1	KNAT3C	0
2497	TRY1	KNAT4C	0
2498	TRY1	KNAT5C	0
2499	TRY1	KNAT6C	0
2500	TRY1	KNAT7C	0
2501	TRY1	KNAT8C	0
2502	TRY1	KNAT9C	0
2503	TRY1	KREM1C	0
2504	TRY1	KREM10C	0
2505	TRY1	KREM11C	0
2506	TRY1	KREM12C	0
2507	TRY1	KREM2C	0
2508	TRY1	KREM3C	0
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2510	TRY1	KREM5C	0
2511	TRY1	KREM6C	0
2512	TRY1	KREM7C	0
2513	TRY1	KREM8C	0
2514	TRY1	KREM9C	0
2515	TRY1	KRET1C	0
2516	TRY1	KRET10C	0
2517	TRY1	KRET11C	0
2518	TRY1	KRET12C	0
2519	TRY1	KRET2C	0
2520	TRY1	KRET3C	0
2521	TRY1	KRET4C	0
2522	TRY1	KRET5C	0
2523	TRY1	KRET6C	0
2524	TRY1	KRET7C	0
2525	TRY1	KRET8C	0
2526	TRY1	KRET9C	0
2527	TRY1	KSUP1C	0
2528	TRY1	KSUP10C	0
2529	TRY1	KSUP11C	0
2530	TRY1	KSUP12C	0
2531	TRY1	KSUP2C	0
2532	TRY1	KSUP3C	0
2533	TRY1	KSUP4C	0
2534	TRY1	KSUP5C	0
2535	TRY1	KSUP6C	0
2536	TRY1	KSUP7C	0
2537	TRY1	KSUP8C	0
2538	TRY1	KSUP9C	0
2539	TRY1	KTOD1C	0
2540	TRY1	KTOD10C	0
2541	TRY1	KTOD11C	0
2542	TRY1	KTOD12C	0
2543	TRY1	KTOD2C	0
2544	TRY1	KTOD3C	0
2545	TRY1	KTOD4C	0
2546	TRY1	KTOD5C	0

2547	TRY1	KTOD6C	0
2548	TRY1	KTOD7C	0
2549	TRY1	KTOD8C	0
2550	TRY1	KTOD9C	0
2551	TRY1	KWAS1C	0
2552	TRY1	KWAS10C	0
2553	TRY1	KWAS11C	0
2554	TRY1	KWAS12C	0
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2556	TRY1	KWAS3C	0
2557	TRY1	KWAS4C	0
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2559	TRY1	KWAS6C	0
2560	TRY1	KWAS7C	0
2561	TRY1	KWAS8C	0
2562	TRY1	KWAS9C	0
2563	TRY1	LAGD0C	0
2564	TRY1	LAGD5C	0
2565	TRY1	LAGD6C	0
2566	TRY1	LAGD7C	0
2567	TRY1	LAGD8C	0
2568	TRY1	LAGD9C	0
2569	TRY1	LDOD0C	566.
2570	TRY1	LDOD1C	34.
2571	TRY1	LDOD10C	48.
2572	TRY1	LDOD11C	34.
2573	TRY1	LDOD12C	34.
2574	TRY1	LDOD2C	34.
2575	TRY1	LDOD3C	34.
2576	TRY1	LDOD4C	48.
2577	TRY1	LDOD5C	62.
2578	TRY1	LDOD6C	62.
2579	TRY1	LDOD7C	62.
2580	TRY1	LDOD8C	62.
2581	TRY1	LDOD9C	62.
2582	TRY1	LEVAP1C	0
2583	TRY1	LEVAP10C	23104.
2584	TRY1	LEVAP11C	2128.
2585	TRY1	LEVAP12C	0
2586	TRY1	LEVAP2C	0
2587	TRY1	LEVAP3C	0
2588	TRY1	LEVAP4C	0
2589	TRY1	LEVAP5C	6992.
2590	TRY1	LEVAP6C	15808.
2591	TRY1	LEVAP7C	35568.
2592	TRY1	LEVAP8C	39824.
2593	TRY1	LEVAP9C	33744.
2594	TRY1	LFLD1C	1607040.
2595	TRY1	LFLD10C	1607040.
2596	TRY1	LFLD11C	1555200.
2597	TRY1	LFLD12C	1607040.
2598	TRY1	LFLD2C	1451520.
2599	TRY1	LFLD3C	1607040.
2600	TRY1	LFLD4C	1555200.
2601	TRY1	LFLD5C	1607040.
2602	TRY1	LFLD6C	1555200.
2603	TRY1	LFLD7C	1607040.
2604	TRY1	LFLD8C	1607040.
2605	TRY1	LFLD9C	1555200.
2606	TRY1	LHECC	8800.
2607	TRY1	LHED1C	7223.
2608	TRY1	LHED10C	7223.
2609	TRY1	LHED11C	7223.
2610	TRY1	LHED12C	7223.
2611	TRY1	LHED2C	7223.
2612	TRY1	LHED3C	7223.
2613	TRY1	LHED4C	7223.
2614	TRY1	LHED5C	7223.
2615	TRY1	LHED6C	7223.
2616	TRY1	LHED7C	7223.
2617	TRY1	LHED8C	7223.
2618	TRY1	LHED9C	7223.
2619	TRY1	LIND0C	0
2620	TRY1	LIND1C	0
2621	TRY1	LIND10C	0

2622	TRY1	LIND11C	0
2623	TRY1	LIND12C	0
2624	TRY1	LIND2C	0
2625	TRY1	LIND3C	0
2626	TRY1	LIND4C	0
2627	TRY1	LIND5C	0
2628	TRY1	LIND6C	0
2629	TRY1	LIND7C	0
2630	TRY1	LIND8C	0
2631	TRY1	LIND9C	0
2632	TRY1	LINS1C	113830.
2633	TRY1	LINS10C	113830.
2634	TRY1	LINS11C	110160.
2635	TRY1	LINS12C	113830.
2636	TRY1	LINS2C	102816.
2637	TRY1	LINS3C	113830.
2638	TRY1	LINS4C	110160.
2639	TRY1	LINS5C	113830.
2640	TRY1	LINS6C	110160.
2641	TRY1	LINS7C	113830.
2642	TRY1	LINS8C	113830.
2643	TRY1	LINS9C	110160.
2644	TRY1	LLAK0C	0.
2645	TRY1	LLAK1C	0
2646	TRY1	LLAK10C	0
2647	TRY1	LLAK11C	0
2648	TRY1	LLAK12C	0
2649	TRY1	LLAK2C	0
2650	TRY1	LLAK3C	0
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2652	TRY1	LLAK5C	0
2653	TRY1	LLAK6C	0
2654	TRY1	LLAK7C	0
2655	TRY1	LLAK8C	0
2656	TRY1	LLAK9C	0
2657	TRY1	LMAX1C	9372800.
2658	TRY1	LMAX10C	9372800.
2659	TRY1	LMAX11C	9372800.
2660	TRY1	LMAX12C	9372800.0
2661	TRY1	LMAX2C	9372800.
2662	TRY1	LMAX3C	9372800.
2663	TRY1	LMAX4C	9372800.
2664	TRY1	LMAX5C	9372800.
2665	TRY1	LMAX6C	9372800.
2666	TRY1	LMAX7C	9372800.
2667	TRY1	LMAX8C	9372800.
2668	TRY1	LMAX9C	9372800.
2669	TRY1	LMIN1C	5424000.
2670	TRY1	LMIN10C	5424000.
2671	TRY1	LMIN11C	5424000.
2672	TRY1	LMIN12C	5424000.
2673	TRY1	LMIN2C	5424000.
2674	TRY1	LMIN3C	5424000.
2675	TRY1	LMIN4C	5424000.
2676	TRY1	LMIN5C	5424000.
2677	TRY1	LMIN6C	5424000.
2678	TRY1	LMIN7C	5424000.
2679	TRY1	LMIN8C	5424000.
2680	TRY1	LMIN9C	5424000.
2681	TRY1	LNAT1C	3577.
2682	TRY1	LNAT10C	15463.
2683	TRY1	LNAT11C	11128.
2684	TRY1	LNAT12C	3275.
2685	TRY1	LNAT2C	960.
2686	TRY1	LNAT3C	205.
2687	TRY1	LNAT4C	86143.
2688	TRY1	LNAT5C	6883.
2689	TRY1	LNAT6C	22226.
2690	TRY1	LNAT7C	85085.
2691	TRY1	LNAT8C	33747.
2692	TRY1	LNAT9C	31592.
2693	TRY1	LQAP1C	15608.
2694	TRY1	LQAP10C	15608.
2695	TRY1	LQAP11C	15608.
2696	TRY1	LQAP12C	15608.

2697	TRY1	LQAP2C	15608.
2698	TRY1	LQAP3C	15608.
2699	TRY1	LQAP4C	15608.
2700	TRY1	LQAP5C	15608.
2701	TRY1	LQAP6C	15608.
2702	TRY1	LQAP7C	15608.
2703	TRY1	LQAP8C	15608.
2704	TRY1	LQAP9C	15608.
2705	TRY1	LRET1C	0
2706	TRY1	LRET10C	0
2707	TRY1	LRET11C	0
2708	TRY1	LRET12C	0
2709	TRY1	LRET2C	0
2710	TRY1	LRET3C	0
2711	TRY1	LRET4C	0
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2715	TRY1	LRET8C	0
2716	TRY1	LRET9C	0
2717	TRY1	LRLS5C	8682000.
2718	TRY1	LRLS6C	8682000.
2719	TRY1	LRLS7C	8682000.
2720	TRY1	LRLS8C	8682000.
2721	TRY1	LRLS9C	8682000.
2722	TRY1	LRLV5C	0
2723	TRY1	LRLV6C	0
2724	TRY1	LRLV7C	0
2725	TRY1	LRLV8C	0
2726	TRY1	LRLV9C	0
2727	TRY1	LRMX5C	8682000.
2728	TRY1	LRMX6C	8682000.
2729	TRY1	LRMX7C	8682000.
2730	TRY1	LRMX8C	8682000.
2731	TRY1	LRMX9C	8682000.
2732	TRY1	LSUP1C	0
2733	TRY1	LSUP10C	0
2734	TRY1	LSUP11C	0
2735	TRY1	LSUP12C	0
2736	TRY1	LSUP2C	0
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2754	TRY1	LTOD8C	0
2755	TRY1	LTOD9C	0
2756	TRY1	RAGD0C	0
2757	TRY1	RAGD5C	0
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2760	TRY1	RAGD8C	0
2761	TRY1	RAGD9C	0
2762	TRY1	RBAL1C	0
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2765	TRY1	RBAL12C	0
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2769	TRY1	RBAL5C	0
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2771	TRY1	RBAL7C	0

2772	TRY1	RBAL8C	0
2773	TRY1	RBAL9C	0
2774	TRY1	RDOD0C	863.
2775	TRY1	RDOD1C	41.
2776	TRY1	RDOD10C	59.
2777	TRY1	RDOD11C	41.
2778	TRY1	RDOD12C	41.
2779	TRY1	RDOD2C	41.
2780	TRY1	RDOD3C	41.
2781	TRY1	RDOD4C	59.
2782	TRY1	RDOD5C	76.
2783	TRY1	RDOD6C	76.
2784	TRY1	RDOD7C	76.
2785	TRY1	RDOD8C	76.
2786	TRY1	RDOD9C	76.
2787	TRY1	RHECC	300.
2788	TRY1	RIND0C	0
2789	TRY1	RIND1C	0
2790	TRY1	RIND10C	0
2791	TRY1	RIND11C	0
2792	TRY1	RIND12C	0
2793	TRY1	RIND2C	0
2794	TRY1	RIND3C	0
2795	TRY1	RIND4C	0
2796	TRY1	RIND5C	0
2797	TRY1	RIND6C	0
2798	TRY1	RIND7C	0
2799	TRY1	RIND8C	0
2800	TRY1	RIND9C	0
2801	TRY1	RNAT1C	2683.
2802	TRY1	RNAT10C	11597.
2803	TRY1	RNAT11C	8346.
2804	TRY1	RNAT12C	2456.
2805	TRY1	RNAT2C	720.
2806	TRY1	RNAT3C	154.
2807	TRY1	RNAT4C	64607.
2808	TRY1	RNAT5C	5162.
2809	TRY1	RNAT6C	16669.
2810	TRY1	RNAT7C	63814.
2811	TRY1	RNAT8C	25310.
2812	TRY1	RNAT9C	23694.
2813	TRY1	RREM1C	0
2814	TRY1	RREM10C	0
2815	TRY1	RREM11C	0
2816	TRY1	RREM12C	0
2817	TRY1	RREM2C	0
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2834	TRY1	RRET7C	0
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2843	TRY1	RSUP4C	0
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2847	TRY1	RSUP8C	0
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2849	TRY1	RTOD1C	0
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2865	TRY1	RWAS2C	0
2866	TRY1	RWAS3C	0
2867	TRY1	RWAS4C	0
2868	TRY1	RWAS5C	0
2869	TRY1	RWAS6C	0
2870	TRY1	RWAS7C	0
2871	TRY1	RWAS8C	0
2872	TRY1	RWAS9C	0
2873	TRY1	SAGD0C	0
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2878	TRY1	SAGD9C	0
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2883	TRY1	SBAL2C	0
2884	TRY1	SBAL3C	0
2885	TRY1	SBAL4C	0
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2888	TRY1	SBAL7C	0
2889	TRY1	SBAL8C	0
2890	TRY1	SBAL9C	0
2891	TRY1	SDOD0C	863.
2892	TRY1	SDOD1C	240.
2893	TRY1	SDOD10C	343.
2894	TRY1	SDOD11C	240.
2895	TRY1	SDOD12C	240.
2896	TRY1	SDOD2C	240.
2897	TRY1	SDOD3C	240.
2898	TRY1	SDOD4C	343.
2899	TRY1	SDOD5C	446.
2900	TRY1	SDOD6C	446.
2901	TRY1	SDOD7C	446.
2902	TRY1	SDOD8C	446.
2903	TRY1	SDOD9C	446.
2904	TRY1	SHECC	8000.
2905	TRY1	SIND0C	329.
2906	TRY1	SIND1C	0
2907	TRY1	SIND10C	0
2908	TRY1	SIND11C	0
2909	TRY1	SIND12C	0
2910	TRY1	SIND2C	0
2911	TRY1	SIND3C	0
2912	TRY1	SIND4C	0
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2915	TRY1	SIND7C	0
2916	TRY1	SIND8C	0
2917	TRY1	SIND9C	0
2918	TRY1	SNAT1C	3423.
2919	TRY1	SNAT10C	26427.
2920	TRY1	SNAT11C	1516.
2921	TRY1	SNAT12C	2456.

2922	TRY1	SNAT2C	606.
2923	TRY1	SNAT3C	15928.
2924	TRY1	SNAT4C	21987.
2925	TRY1	SNAT5C	5799.
2926	TRY1	SNAT6C	25323.
2927	TRY1	SNAT7C	12734.
2928	TRY1	SNAT8C	10056.
2929	TRY1	SNAT9C	5154.
2930	TRY1	SREM1C	0
2931	TRY1	SREM10C	0
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2933	TRY1	SREM12C	0
2934	TRY1	SREM2C	0
2935	TRY1	SREM3C	0
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2940	TRY1	SREM8C	0
2941	TRY1	SREM9C	0
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2984	TRY1	SWAS4C	0
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2987	TRY1	SWAS7C	0
2988	TRY1	SWAS8C	0
2989	TRY1	SWAS9C	0
2992	ENDATA		