North Platte River Model

EIS Model Update 2006

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North Platte River Water Utilization Model Operations

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3.0 OPERATION OF THE NPREIS

The North Platte River EIS (NPREIS) Model is a computer simulation of a complicated river system. In order to simulate many of the nuances that make the North Platte so complicated, many flags, options, and user defined values were included in the NPREIS and its corresponding input files. The intent of this Section is to aid the user in understanding these items as well as the structure of the NPREIS and its associated data files. Section 3.0 also describes the system requirements for operating the NPREIS and what to expect during model operation.

3.1 Description of the Model

The NPREIS is based on the OPSTUDY program developed by Fred Otradovsky (1986) of the Bureau of Reclamation. The model is written in FORTRAN and contains several thousand lines of code. The code includes intricate comment statements that document the model algorithms. The NPREIS was developed using the Compaz™ Fortran. The model's source code was developed using the basic features of the Fortran language and should be portable to various compilers on other computer systems provided the memory limitations of the compiler used are not prohibitive.

The NPREIS is a monthly water balance model developed to simulate the operation of Reclamation's projects on the North Platte River. The model has been developed exclusively for the North Platte River Basin and cannot be adapted to model other river basins. The NPREIS uses only the inflows, the irrigation demands, and the options set by the model user to simulate the operation of Reclamation's facilities on the North Platte River. The major irrigation deliveries below Guernsey Reservoir associated with these facilities are also modeled. The terminus point of the model is Lewellen, Nebraska (the estimated flow in the river is the last item determined). The NPREIS requires four (4) input files to define the hydrologic and power generation characteristics of a model scenario and produces thirteen (13) output files that contain the results (Figure 3.1.1). The maximum study period that can be simulated using the NPREIS is 60 water years.

3.1.1 Model Structure

The NPREIS is organized into four subroutines (OPRES, OPNFLOW, OPSOA, and OPIRR) called by the main body of the program (OPMAIN). Each of these four subroutine calls additional subroutines to complete the operation of one phase of the system. The four phases are the physical reservoir operations, natural flow accounting, storage ownership accounting, and operation of the North Platte River between Guernsey and Lewellen. All the subroutines called by the model and their flow charts are found in Appendix E.

The subroutines that read the data from the input files and write the results to the output files are also controlled by OPMAIN.

OPRES controls the physical operation of the reservoirs. The reservoirs are operated in an upstream manner beginning with Guernsey Reservoir and ending with Seminoe Reservoir. This subroutine determines the inflow, outflow, power generation (for existing powerplants), evaporation, and EOM contents associated with each reservoir, including the Idealized Inland Lake. Minimum flows in the Miracle Mile, below Pathfinder Dam, and below Gray Reef Dam are also maintained.

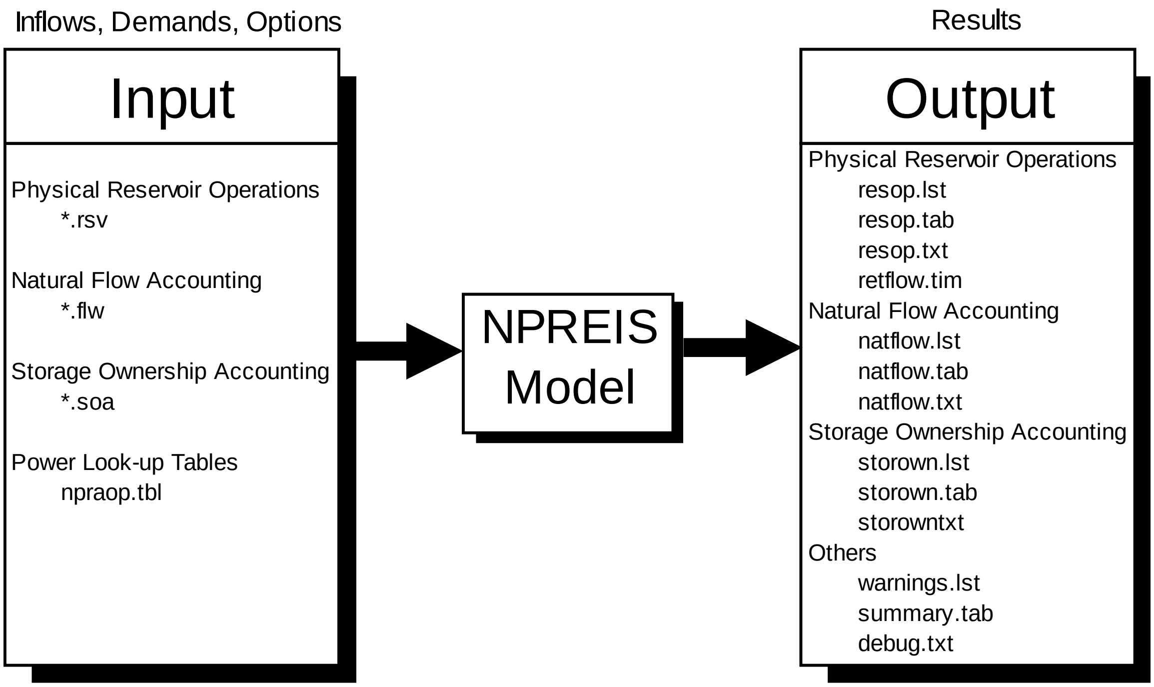


Figure 13.1.1 NPREIS - Input / Output Flow Diagram

OPNFLOW controls the natural flow accounting, which is only done in May through September. OPNFLOW takes the physical inflows that occur during the irrigation season (May-September) and calculates the total natural flow available to meet irrigation demands. The total available natural flow is distributed among the demands in order of priority. Any portion of a demand not fully satisfied from the natural flow is assigned as storage delivery, according to existing storage contracts.

OPSOA controls the storage ownership accounting. OPSOA determines the water available for accrual, EOM content, evaporation, storage deliveries from each ownership account, and balances the total physical and ownership storage in the system. Available water for accrual in the non-irrigation season (October-April) is equal to the total physical inflows above Guernsey Reservoir and is accrued to the ownerships in priority according to their storage rights and physical location on the river. During the irrigation season, the water available for accrual is equal to the unused portion of the natural flow. The storage deliveries assigned in OPNFLOW are passed to OPSOA, where they are delivered from the appropriate ownership account. Once the ownership accounting has concluded, the total physical and ownership storage in the system are balanced. When the physical system storage is greater than the ownership storage, the difference of the physical storage and ownership storage is assigned as a spill to balance the system. The balance spill is added to the Guernsey Reservoir outflow to release the water from the physical system. If the ownership storage is greater than the physical storage, the ownership(s) are reduced. When this situation occurs, the NPREIS determines whether a balance spill has already occurred from an earlier iteration for the month. If there was a balance spill, it is reduced. If the ownership storage is still greater than the physical storage, the NPREIS continues to try to balances the system by reducing the accruals. The remaining difference is first taken from the available water in ETO account, provided the ETO option is on and water exists in the ETO account. Any of the difference not met by reducing the ETO account is taken from the ownership accounts by assigning a negative accrual to the ownership that is in priority. The negative accruals are assigned by reach: Alcova to Glendo, Guernsey to Glendo, and above Alcova. If the Alcova to Glendo reach gain is negative, the NPREIS assigns a negative accrual to the ownership in priority in that reach to reduce the ownership storage and continues to the above Alcova reach, if necessary, to balance the system. If the Glendo to Guernsey reach gain is negative, the NPREIS assigns a negative accrual to the ownership in priority in that reach to reduce the ownership storage and continues to the above reaches, if necessary, to balance the system. Otherwise, the NPREIS assigns a negative accrual to the ownership in priority in the above Alcova reach to reduce the ownership storage to balance the system. If these efforts to balance the system fail, the “alternate method of distribution” is done. This method removes the remaining difference from the ownerships beginning with the North Platte Pathfinder ownership, North

Platte Guernsey ownership, Glendo Evaporation Pool ownership, Glendo Irrigation Pool ownership, Excess-to-Ownership account, Kendrick Seminoe ownership, and ending with the Kendrick Alcova ownership until the system balance is satisfied.

OPIRR controls the operation of the North Platte River between Guernsey, Wyoming, and Lewellen, Nebraska. OPIRR takes the Guernsey Reservoir outflow, accounts for reach gains, models irrigation deliveries from the river, and compute the flow at various points on the river. It also determines the return flows associated with these irrigation deliveries and adjusts the reach gains if the modeled return flows vary from historic.

3.2 Input Files

The input data files have been modified from the original OPSTUDY model developed by the Bureau of Reclamation (Otradovsky, 1986). The data from the input data files are read by the READ subroutine (called from the OPMAIN subroutine of the OPSTUDY program) and the general format of each file is the same. The first twenty-four lines in a data file consist of input file control information. The input file control information is followed by cdata, section headings and model output line item descriptions for model output files, table headings, adata, and hdata. The input and output arrays are:

cdata(x)	single item input;
adata(x,J)	12 item input;
hdata(x,I,J)	hydrologic data input;
flow(x,J)	yearly output; and
table(x,I,J)	summary table output.

The cdata(x) array is used to read and store single item constants such as reservoir size, canal capacity, option flags, etc. It may also be used to input the starting value of a variable such as the initial content of a reservoir. A cdata’s identifier is represented by the value of 'x' and corresponds to the sequential order of the cdata items in the input file. The maximum number of cdata items allowed in the input files are 125. Cdata items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPREIS as cdata(x), cdata1(x), and cdata2(x).

The adata(x,J) array is provided to read and store monthly constants consisting of 12 values, which may vary from one month to the next but not from water year to water year. An example would be the EOM reservoir target contents for Alcova Reservoir. An adata’s identifier is represented by the values of 'x' and 'J'. The value 'x' corresponds to the sequential order of the adata items in the input file and 'J' is the month number. The maximum number of adata items allowed in the input files are 50. Adata items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPREIS as adata(x,J), adata1(x,J), and adata2(x,J).

The hdata(x,I,J) array is provided to read and store hydrologic data or similar records where the record includes several years of monthly data such as historic stream flow records. The record identifier is represented by the value of 'x', 'I' is the year number, and 'J' is the month number. The maximum number of hdata items allowed in the input files are 90. Hdata items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPREIS as hdata(x,I,J), hdata1(x,I,J), and hdata2(x,I,J).

The flow(x,J) array provides the yearly output from the study where 'x' is the line number and 'J' is the month number. The maximum number of flow items allowed in the input files are 315. Flow items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPREIS as flow(x,J), flow1(x,J), and flow2(x,J).

The table(x,I,J) array provides for storage and output of summary tables to be printed at the end of the study where 'x' is the table number, 'I' is the year number, and 'J' is the month number. The maximum number of table items allowed in the input files are 50. Table items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPREIS as table(x,I,J), table1(x,I,J), and table2(x,I,J).

3.2.1 Input File Control Information

The input file control information consists of instructions on how the READ subroutine is to read the information in the input data file, which information will be used by the model, and how the results from the model will be written to the output files. The file format for the reservoir operations, natural flow accounting, and storage ownership accounting input files is shown below.

INPUT

Line	**Parameter card**
1	Model title and input file name
2	Run title and run description
3	ISTUDY - study number (alpha-numeric)
4	ISTART - the first water year of the study
5	IEND - the last water year of the study
6	NG - number of line group headings
7	NL - number of line headings
8	NT - number of summary tables
9	NC - number of constants and initializing 'cdata' values.
10	NA - number of average monthly 'adata' constants
11	NH - number of monthly input 'hdata' arrays
12	IFRST - first water year of input data
13	NYI - number of years of input 'hdata' to be read
14	NCL - number of comment lines to be read
15-NCL	Description of run, purpose, data used, and assumptions. Include any information that will assist in interpreting the results of the run. This information will be printed on a separate page at the start of the output listing.

Cdata input variables
No. of lines = 'NC'
Read format(F10.0, 4A10)

Col. 1-10	CDATA - constant or initial value
Col. 11-50	CNAME - description of constant or initial value

Line and group headings

No. of lines = 'NL'	number of line groups
Read format (10A4)	
Col. 1-40	AGHEAD - line group heading

Line headings

No. of lines = 'NL'	number of line headings
Read format (8A4)	
Col. 1-27	ALHEAD - line heading or description

Table headings
No. of lines = 'NT' number of tables
Read format (8A10)

Col. 1-80 ATHEAD - table heading or description. Center the table heading on the card.

Table output format control
No. of lines = 'NT' number of tables
Read format (I2)

Col. 1 SUMHEAD – determines whether the table output is summed or averaged.

Adata headings
No. of lines = 'NA' number of adata arrays
Read format (8A10)

Col. 1-80 ANAME - name or description of data
**NOTE: Each 'adata heading' must be followed by an 'adata' value.

Adatas
No. of lines ='NA' number of adata arrays
Read format (12F6.0)

Col. 1-6 ADATA(x,1) - January constant
Col. 7-12 ADATA(x,2) - February constant
. . .
. . .
. . .
Col. 67-72 ADATA(x,12) - December constant

NOTE: Use the ADATA array to read and store monthly constants such as monthly reservoir targets where the reservoir target requirement for all January's is the same and all February's is the same, etc.
**** NOTE: AHEAD and ADATA are entered as pairs.

Hdata headings
No. of lines = 'NH' number of hdata arrays
Read format (8A10)

Col. 1-80 ALIST - name or description of data
**NOTE: Each 'hdata heading' must be followed by a series of 'hdata' values.

Hdatas
No. of lines = 'NYI x NH' number of years times number of hdata items
Read format (I5, 12F6.0 or free-field) All hdata items use the free-field format.

Col. 1-5 year or other identification (integer only)
Col. 6-11 HDATA(x,i,1) - January data
Col. 12-17 HDATA(x,i,2) - February data
. . .
. . .
. . .
Col. 72-77 HDATA(x,i,12) - December data
Note: Data are listed one year (12 months of record) per line. HDATA may be sorted by files (INPT=0) or by years (INPT=1). Each series of hdata values must be preceded by a 'hdata heading'.

3.3 Output Files

The NPREIS produces three output files each for the physical operations, natural flow, and storage ownership, a *.LST, *.TXT and *.TAB output file. The output files associated with the physical reservoir operations are RESOP.LST, RESOP.TXT and RESOP.TAB. The output files associated with the natural flow are NATFLOW.LST, NATFLOW.TXT, and NATFLOW.TAB. The output files associated with the storage ownership are STOROWN.LST, STOROWN.TXT, and STOROWN.TAB. In addition to these output files, the NPREIS reports any run time warning message to the MESSAGE.LST file and the return flow timing patterns to the RETFLOW.TIM file.

3.3.1 __.LST Output Files

The *.LST files contain the yearly output of a model run listed by station name followed by the station's monthly values, repeated for the total number of defined stations. Each accounting point is assigned a station name and the monthly output data for each station is assigned to a corresponding two-dimensional flow array in the NPREIS. The first number identifies the station and the second number (J) is the month of the year (i.e., the first output item in the RESOP.LST file would be flow(1,J), the second flow(2,J), etc. ...).

The *.LST files are organized into 14 columns across the page. Column one (1) contains a brief description of the output item or station name. Columns two (2) through thirteen (13) are the monthly values reported in a water year format (October through September). The last column (14) is the average or sum of monthly values in columns 2 through 13. The program always uses column 14 to display the average or sum of the monthly values. The averages are reported when the EOM reservoir contents, Year-to-Date (YTD) ownership accruals, or similar items are reported. After the last year of the study, the NPREIS creates a summary of the yearly output data. This summary section reports the average of the monthly values over the period of the study at the end of the *.LST output file. These monthly averages include the zero, negative, and positive values contained in columns 2 through 13 for a station and caution is required when using these averages.

3.3.2 __.TAB Output Files

The *.TAB files contain a listing of selected stations and their monthly values organized into tabular format from the beginning of the study to the end. A three-dimensional table array provides for the storage and output of summary tables as identified in the input files. The first number identifies the station and the second number (I) is the year and the third number (J) is the month of the year (i.e., the first output item in the RESOP.TAB file would be table(1,I,J), the second flow(2,I,J), etc. ...). When additional tables are added to the input files, the model user must make modifications to the source code by assigning the desired output item to the appropriate table array item.

3.3.3 __.TXT Output Files

The *.TXT files contain the same information as the *.TAB files in a format that is easier to import into a spreadsheet such as Excel.

3.3.4 RETFLOW.TIM Output File

The RETFLOW.TIM output file contains the return flow timing patterns calculated by the GLOVER Subroutine and used for Reaches No. 2 and No. 3 below Guernsey and the Alcova to Glenrock Reach. This output file also lists the parameters used to generate the given return flow timing patterns.

3.3.5 MESSAGE.LST Output File

The MESSAGE.LST output file contains a listing of warning messages produced by the NPREIS during execution. The model user should examine this file after each run and note the warning messages contained therein.

These messages provide a general commentary of what condition were encountered during the model's execution and its response. A listing of the possible warning messages produced by the model is shown in Table 3.3.1.

Warning Message	Explanation
GLENDO RESERVOIR OUTFLOW EXCEEDS MAXIMUM FOR MONTH xx OF YEAR xxxx	Glendo Reservoir has no vacant space remaining in the flood pool to attenuate high inflows. If high flows cannot be held in upstream reservoirs, the model will allow the Glendo outflow to exceed its maximum capacity and will pass the inflow that is unable to be held in the flood pool.
FLOW IN THE NORTH PLATTE AT GLENROCK EXCEEDS xxxxx CFS FOR MONTH xxx OF xxxx	The flow in the river exceeds the value set by the model user in cdata(49) (5000 cfs). Minor flooding along the river's banks begins to occur near 5000 cfs. The model does not attempt to reduce the flow in this situation, it only provides this warning message.
FLOW IN THE NORTH PLATTE AT GLENROCK IS LESS THAN xxxx CFS FOR MONTH xxx OF xxxx	The flow in the river is less than the value set by the model user in cdata(39) (330 cfs). This indicates that there is not enough ownership water available above Alcova to satisfy the 330 cfs. The model allows the minimum flow set by the model user to be violated in this situation.
YEAR = xxxx MONTH = xx SEMINOE RESERVOIR BELOW RECOMMENDED LEVEL, SEVERE OPERATIONAL PROBLEMS EXIST	The model is unable to operate the North Platte River System with the current hydrologic configuration in the input files (inflows, demands, and options). The model processes each reservoir one at a time, beginning with Seminoe Reservoir, storing only the portion of the inflows needed to maintain the reservoir's minimum storage level and passes the remainder downstream to the next reservoir. This process is repeated until the operational problem overcome.
SEVERE OPERATIONAL PROBLEMS CORRECTED BY REDUCING KORTES OUTFLOW & ALL FLOWS ABOVE	Severe operational problems were corrected by reducing the outflow of Seminoe and Kortes Reservoirs to maintain minimum storage levels.
SEVERE OPERATIONAL PROBLEMS CORRECTED BY ADJUSTING OUTFLOWS ABOVE GLENDO RESERVOIR	Severe operational problems were corrected by reducing the outflows of all Reservoirs above Glendo Reservoir.
SEVERE OPERATIONAL PROBLEMS CORRECTED BY REDUCING GUERNSEY OUTFLOW & ALL FLOWS ABOVE	Severe operational problems were corrected only after all outflows of the reservoirs were adjusted to get a new Guernsey Reservoir outflow.
GLENDO TARGET IS SUSPENDED FOR MONTH xxx OF xxxx, PATHFINDER OUTFLOW EXCEEDED	The targeted Glendo Reservoir inflow computed by the model to reach the desired EOM content has been suspended for this month because it would require a spill situation at Pathfinder Reservoir.
PATHFINDER RESERVOIR OUTFLOW EXCEEDS THE TURBINE CAPACITY FOR MONTH xxx OF xxxx	After making every attempt to adjust the Pathfinder Reservoir outflow, the Pathfinder release still exceeds the combined capacity of the turbine outflow. The release is made and the model continues.
OPERATIONAL PROBLEMS MAY EXIST FOR ALCOVA RESERVOIR	The physical content of Alcova Reservoir is below the elevation required to make releases to the Casper Canal.

EOM STORAGE BELOW THAT REQUIRED TO MAKE CASPER CANAL DELIVERIES	The physical content of Alcova Reservoir is below the elevation required to make the requested Casper Canal Delivery. However, the delivery was met because the water in the Kendrick ownership exceeded the request.
YEAR = xxxx MONTH = xx TRI-STATE CANAL DIVERSION EXCEEDS CANAL CAPACITY ADJUSTED FARMERS, NORTHPORT, AND RAMSHORN DIVERSIONS PROPORTIONATELY	The requested deliveries exceed the canal's capacity. The deliveries are reduced proportionately and the model continues.
YEAR = xxxx MONTH = xx GRATTAN DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx NORTH PLATTE DITCH DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx ROCK RANCH DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx PRATT-FERRIS DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx BURBANK DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx TORRINGTON DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx LUCERNE DIVERSION EXCEEDS CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx NARROWS DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx MITCHELL-GERING DIVERSION EXCEEDED DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested deliveries exceed the canal's capacity. The deliveries are reduced proportionately and the model continues.
YEAR = xxxx MONTH= xx FORT LARAMIE CANAL DIVERSION EXCEEDS CANAL CAPACITY. ADJUSTED WRIGHT-MURPHY FT LARAMIE (GOSHEN), AND GERING-FT LARAMIE DIVERSIONS PROPORTIONATELY	The requested deliveries exceed the canal's capacity. The deliveries are reduced proportionately and the model continues.
YEAR = xxxx MONTH= xx INTERSTATE CANAL DIVERSION EXCEEDS CANAL CAPACITY, DIVERSION ADJUSTED ACCORDINGLY	The requested deliveries exceed the canal's capacity. The deliveries are reduced proportionately and the model continues.
YEAR = xxxx MONTH= xx KENDRICK DIVERSION EXCEEDS CANAL CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx ROCK RANCH STORAGE DIVERSION EXCEEDS WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx LINGLE STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx HILL STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.

YEAR = xxxx MONTH= xx FARMERS STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx GERING STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx GRATTAN STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN GRATTAN ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx BURBANK STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN BURBANK ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx TORRINGTON STORAGE DIVERSION EXCEEDS GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN TORRINGTON ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx LUCERNE STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN LUCERNE ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= WRIGHT AND MURPHY STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN WRIGHT & MURPHY ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= CORN CREEK STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN CORN CREEK ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx MITCHELL STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN MITCHELL ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx BRIDGEPORT STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN BRIDGEPORT ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.

YEAR = xxxx MONTH= xx ENTERPRISE STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN ENTERPRISE ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx CENTRAL NEBRASKA POWER DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN CENTRAL NEBRASKA POWER ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx CENTRAL STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx CHIMNEY ROCK STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx BROWNS CREEK STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx BEERLINE STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
INITIAL TOTAL RESERVOIR CONTENT DOES NOT EQUAL INITIAL TOTAL OWNERSHIP	The sum of the initial physical reservoir contents in the reservoir operations input file does not equal the sum of the initial ownership contents in the storage ownership accounting input file. The initial reservoir contents and initial ownerships must be adjusted until their sums are equal.
NO OWNERSHIP WAS IN PRIORITY BELOW ALCOVA, MOVING TO UPPER RESERVOIRS FOR DISTRIBUTION	When the ownership storage is greater then the physical storage in the system, the accrual for the ownership in priority is reduced by the difference. The model first reduces the accrual to ownerships in priority below Alcova, then reduces the accrual to ownerships in priority above Alcova.
NO OWNERSHIP WAS IN PRIORITY BELOW GLENDO, MOVING TO UPPER RESERVOIRS FOR DISTRIBUTION	The model attempted to balance Physical and Ownership storage from Guernsey Ownership, but Guernsey was not in priority and the model moved to above Alcova to try to balance the system.
NO OWNERSHIP WAS IN PRIORITY, MOVING TO ALTERNATE METHOD OF DISTRIBUTION	When the ownership storage is greater then the physical storage in the system and no ownership was in priority, the system is balanced by the reducing the ownerships beginning with the North Platte Pathfinder, North Platte Guernsey, Glendo, ETO, Kendrick Seminoe, and ending with Kendrick Alcova.
REDUCING GLENDO TARGET BECAUSE OF KENDRICK OWN. BELOW ALCOVA	If the model is not allowed to use Kendrick ownership to meet the minimum flow below Gray Reef when the Pathfinder ownership is deficient, reduce the Glendo target inflow to ensure that no Kendrick water is moved to Glendo.
MINIMUM FLOW PAST CASPER VIOLATED BECAUSE NO PATHFINDER OWNERSHIP IS AVAILABLE ABOVE ALCOVA.	If the model is not allowed to use Kendrick ownership to meet the minimum flow below Gray Reef when the Pathfinder ownership is deficient, reduce the minimum flow.

REDUCING GRAY REEF OUTFLOW BECAUSE OF KENDRICK OWN BELOW ALCOVA	If the model is not allowed to use Kendrick ownership to meet the minimum flow below Gray Reef when the Pathfinder ownership is deficient, reduce the Gray Reef outflow to ensure that no Kendrick water is moved to Glendo.
KENDRICK OWN EXISTS BELOW ALCOVA BY xxxx KAF	If the model is allowed to use Kendrick ownership to meet the minimum flow below Gray Reef when the Pathfinder ownership is deficient, the quantity of Kendrick water moved is reported.
EFFICIENCY (x.xx) TO HIGH, REDUCING TO 0.95	If an efficiency is greater than 95%, the model reduces it to 95%.
WARNING TABLE name INPUT PARAMETER parm NOT IN TABLE OUTPUT VALUE RETURNED VALUE FOR YEAR: xxxx MONTH: xxx	The given reservoir content is above or below the values in the reservoir's power look-up table (content vs. Max turbine release). When the content is below the lowest value in the table, the model uses the lowest maximum turbine release on the table and reports the value used. When the content is above the highest value in the table, the model uses the highest maximum turbine release on the table and reports the value used.

3.4 System Requirements for the NPREIS

The NPREIS included on the diskette in Appendix H was compiled with the Compaq™ Visual Fortran Compiler. The compiled version, NPREIS.EXE, is a stand alone executable file that is operable on IBM™-compatible Personal Computers (PC) with an 80486 processor or better. The model requires at least one gigabyte available hard disk space.

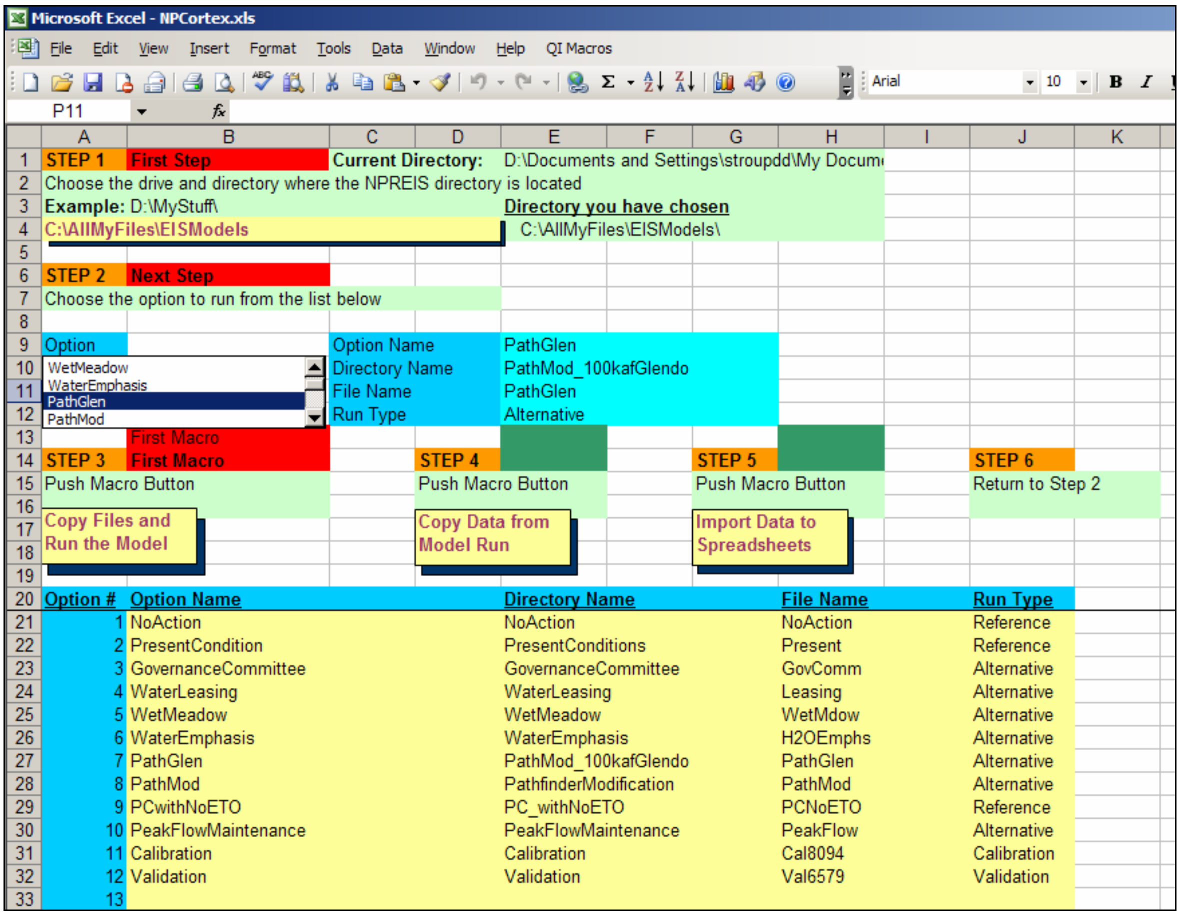
3.4.1 Running the Model

Once the files are loaded on the hard drive, the model is ready to run. The model was compiled using the Compaq™ Visual Fortran Compiler. To run the NPREIS, open the NPCortex.xls spreadsheet in the Tools directory. The NPCortex.xls spreadsheet is a user interface for the North Platte Model that automatically establishes spreadsheet links and displays a "Control Page" that walks the user through a number of individual steps for executing the model.

1. Step 1. Select the alternative for the model run (e.g., "Present Condition" vs. "Governance Committee").
2. Step 2. Step 2 operates a macro which runs the North Platte Model for the selected alternative.
3. Step 3. Step 3 operates several post-processor programs, written in Quick Basic, that extract data from the *.tab and *.lst output files produced by the North Platte model.
4. Step 4. At this step, the *.TXT and *.OUT files generated in Steps 2 and 3 are imported into Excel and saved as a sort of "hydrologic summary spreadsheet" for the alternative (Tables47_94.xls). The output analysis spreadsheets are also opened and data from the model run is placed in the spreadsheets and compared to a reference run. There are 50 analysis spreadsheets operated at this step.

The mechanical actions needed to run the North Platte model and process the output begin with typing the correct path to the location of the NPREIS directory in cell A5 (i.e. C:\EISModels) and press enter. Select the simulation you would like to run from the drop down menu in cells A10:B12. The NPREIS Decision Support System (DSS) is operated by three macros programmed using Visual Basic for Applications in Excel. Activate the first macro by selecting the **Copy Files and Run the Model** button. This macro creates the output directory if it does not already exist, copies the input files (npraop.tbl, *.flw, *.rsv, and *.soa) to the output directory, and simulates the alternative with the

NPREIS model. Acivate the second macro by selecting the [Copy Data from Model Run] button. This macro runs several post-processing programs that exctract data from the NPREIS model output files. The final macro is activated by pressing the [Import Data to Spreadsheets] button. This macro opens spreadsheets, copies model output into spreadsheets, and post-processes the model output using Excel spreadsheets. The model automatically assigns the reservoir operation output file, message file, natural flow output file, and storage ownership output file to RESOP.LST, MESSAGE.LST, NATFLOW.LST, and STOROWN.LST, respectively. The following example demonstrates the user interface that has been developed in the NPCortex.xls spreadsheet.



When the model has finished execution, check to verify that the RESOP.LST, RESOP.TAB, MESSAGE.LST, NATFLOW.LST, NATLOW.TAB, STOROWN.LST, and STOROWN.TAB files have been created on your hard drive. Each time the model is run, any existing ".LST" or ".TAB" files listed above will be over written and replaced by the data from the current run. The ".LST" files contain the yearly output of a model run listed by station name preceded by the station's monthly values, repeated for the total number of defined stations. The ".TAB" files contain a listing of selected stations and their monthly values organized into tabular format from the beginning of the study to the end.

During execution, the model will check to ensure that certain input data items are consistent. If inconsistencies in the input data exist, the model will write a message to the screen identifying the problem and stop execution. These messages are shown in Table 3.4.1. Warnings generated by the model are discussed in Section 3.3.3, Table 3.3.1.

NPREIS Error Message	Explanation/Action
“Initial total Reservoir content does not equal initial total Ownership”	The sum of the initial physical reservoir contents in the reservoir operations input file does not equal the sum of the initial ownership contents in the storage ownership accounting input file. The initial reservoir contents and initial ownerships must be adjust until their sums are equal.
“The model was unable to balance ownership and physical storage due to limited ownership”	After all attempts to balance the system were exhausted, there was not enough ownership available to balance the system. The model’s execution is stop, keeping it from generating errant numbers. Input data may be unrealistic.
“TSLLGNA prorated incorrectly-fctrs must sum to 1" “TSLLCHK=xxxx TSLLGNA=xxxx”	The factors (hdata1(46-59,I,J)) used to prorate the Tri-State to Lewellen gain (TSLLGNA) do not sum to one. Adjust these factors until the sum equals 1.
“Main Canal Delivery exceeds Pathfinder Diversion - Reduce Main Canal Delivery, try with IPMFLAG=1 (cdata(59))"	The Pathfinder Delivery has been reduced and cannot meet the historic deliveries to land above the Idealized Inland Lakes. The Main Canal Delivery (hdata(19,I,J)) must be reduced or the IPMFLAG flag set to 1. This flag calculates the Main Canal Delivery as a percentage of the Pathfinder Diversion. The percentage are found in adata(23,J).

3.5 Description of Model Options

Information that a user can modify to model different scenarios is contained in the three input data files. The three data files correspond to the three functions performed by the NPREIS: physical reservoir operations, storage and natural flow accounting, and storage ownership accounting. The various options and input parameters are described in the following sections to help the model user understand how the parameters can be adjusted and what happens when different options are chosen.

3.5.1 Reservoir Operation Input File

The physical reservoir operations input file contains the data to operate the North Platte system based on physical parameters (i.e., inflows, reservoir capacities, storage moved between reservoirs, etc. ...).

3.5.1.1 Reservoir Parameters

Reservoir input parameters such as initial EOM content (cdata(3-10)), maximum and minimum storage contents (cdata(11-26)), evaporation factors (adata(13-16,J)), bank storage (cdata(27-31)) and seepage factors (hdata(7-11,I,J)), and EOM targets (cdata(40, 51-58) - adata(11-12,J)) can be changed by replacing the current values in this input file with values chosen by the model user. For example, if the starting year of a study changes, the initial EOM contents should be changed to the September EOM contents from the water year pervious to the new starting water year. Increasing or decreasing the evaporation factors will cause the reservoirs’ evaporation losses to increase or decrease. If the bank storage factor for a reservoir is increased, more of a change in reservoir content will go to bank storage (positive change in storage) or will be released from bank storage (negative change in storage). The bank storage function in the NPREIS can be turned off by setting the bank storage flag (cdata(92)) to zero (0). When IBNKFLAG is set to zero (0), a reservoir’s gain/loss is equal to the reservoir’s seepage as entered in hdata items’ hdata(7-11,I,J) and no bank storage is accounted for. A positive reservoir seepage value indicates that the reservoir is losing water due to seepage, while a negative seepage value indicates that a reservoir is gaining water (side inflow is greater than reservoir seepage). Adjusting the reservoir targets and maximum and minimum storage contents allow the model user to change the operating regime of the reservoirs.

3.5.1.2 Delivery/Irrigation Parameters

Irrigation related factors such as the efficiency (see Section 3.5.3.4), non-beneficial use (cdata(60)), and surface runoff factors (adata(25,J)) control the amount of a diversion that contributes to surface runoff or deep percolation. The irrigation deliveries (hdata(20-71,I,J), including water orders for storage) in this file can also be adjusted to simulate changed conditions.

3.5.1.3 Return Flow Timing Parameters

The timing of the return flows from irrigation can be increased or decreased by changing parameters for the GLOVER subroutine: transmissivities (cdata(64-66)), reach widths (cdata(70-72)), and storage coefficient (cdata(69,73)). If the return flow timing increases, water available for return flow takes longer to return. The return flow timing will increase if the transmissivities are decreased, reach widths increased, or storage coefficient increased, while the reverse is also true. The initial condition recharge parameters (cdata(88-90)) act to prime the initial return flow conditions. If these values are increased, the return flow occurring in the initial years of the study will also increase.

3.5.1.4 Gray Reef Winter Outflow Option

The Gray Reef winter outflow option (cdata(48)) controls the method used to move water between Gray Reef Reservoir and Glendo Reservoir in the winter months. When cdata(48) is equal to zero (0), the outflow is based on the size of the Glendo restorage space cdata(40). When the option is set to one (1), the outflow is based on the total physical storage above Alcova Reservoir as of October 1. Section 2.4.5.2 provides further details on this option.

3.5.1.5 Pathfinder Main Canal Option

The Pathfinder Main Canal deliveries occurring above the Idealized Inland Lakes can be a function of the historic Main Canal deliveries or a percentage of the total Pathfinder delivery. When the option (cdata(59)) is equal to zero (0), the Pathfinder Main Canal deliveries are equal to the historic deliveries reported by the Pathfinder Irrigation District (hdata(19,I,J)). When this option is set to one (1), the Main Canal delivery is computed by the model as a percentage (adata(23,J)) of the total Pathfinder delivery (hdata(33,I,J)).

3.5.1.6 Seminoe-Pathfinder Water Movement Rule

The Seminoe to Pathfinder water movement rule consists of adjusting the Seminoe Reservoir outflow (adata1(6-8,J)) based on the storage in Seminoe Reservoir (October through June; cdata(33,34)) and of maintaining a balance (adata1(9,J)) between the storage in Seminoe and Pathfinder Reservoir (July through September; cdata(35)). These rules are followed as long as the minimum flow out of Kortes Dam is not violated (cdata(32)) and that the maximum Kortes turbine capacity is not exceeded (cdata(36)).

3.5.1.7 Gain Utilization Parameters

The use of the Guernsey to Whalen and Whalen to Tri-State gains to satisfy diversions in these reaches can be controlled by adjusting the utilization factors (adata(1-2,J)). A utilization factor of one (1.0) makes 100% of the gain occurring in the reach available to satisfy diversion demands, while a value between 0.0 and 1.0 reduces the amount of the gain available to satisfy diversion demands. These factors simulate rain storm events in the lower reaches for which the system cannot be perfectly operated and used completely to meet the diversions.

3.5.1.8 Glendo Low Flow

The Glendo Low Flow values (adata(10,J)) are used to control the year around releases from the Glendo Dam. These values can be varied by the model user and must be between 25 and 45 cubic feet per second.

3.5.1.9 Pathfinder-Fremont Canyon Bypass

The Pathfinder-Fremont Canyon bypass (adata(9,J)) can be used to release water directly below the Pathfinder Dam instead of releasing it through the Fremont Canyon Powerplant.

3.5.1.10 Powerplant Availability Parameters

The powerplant availability factors (adata(17-22,J)) control the availability of the turbines at the powerplants for generation. A factor of 1.0 indicates that the turbines at the given powerplant were available and ready for generation 100% of the time during the month. A value less than 1.0 can be used to model the turbine down time for maintenance.

3.5.1.11 Natural Flow and Ownership Accounting Flags

The natural flow and Ownership accounting subroutines of the NPREIS can be skipped by setting the flags for cdata(1-2) to zero (0). Both flags must be set to zero (0). When both flags are set to zero (0), only the physical operation of the reservoirs will be performed by the model.

3.5.2 Natural Flow Input File

The storage and natural flow accounting input file contains the data to calculate natural flow available at Tri-State Diversion Dam and to segregate storage and natural flow demands.

3.5.2.1 Natural Flow Rights and Storage Contracts

The natural flow rights and storage contracts in the NPREIS are items cdata1(1) through cdata1(68). These values can be updated by the model user as needed.

3.5.2.2 Appropriate Natural Flow below Tri-State Dam Option

The option (cdata1(69)) to appropriate the natural flow below Tri-State Dam is used to tell the NPREIS to appropriate the natural flow in the river between Tri-State Dam and Lewellen every month. When this option is equal to one (1), the model will appropriate the natural flow in this reach. When this option is set to zero (0), the model will only appropriate the natural flow in this reach if a shortage of water is identified.

3.5.2.3 Natural Flow Section Gains and Losses

The section gains and losses (adata1(1-5,J)) for the natural flow accounting can be adjusted by the model user. These values are currently set to the values in the SONFAP.

3.5.2.4 Historic Irrigation Deliveries

Historic irrigation deliveries (hdata1(2-45,I,J)) are included in the natural flow accounting input file. These items are used by the model to establish the background return flow condition that the model uses to adjust the reach gain and should not be changed.

3.5.2.5 Tri-State to Lewellen Subreach Factors

These are the factors used by the NPREIS to prorate the Tri-State to Lewellen reach gain to the subreaches in Reach No. 3. The sum of the subreach factors in any given month must equal one (1). The model user can change the distribution of the Tri-State to Lewellen reach gain to the subreaches by adjusting these factors.

3.5.2.6 Irrigation Reuse

The irrigation reuse option allows the model to simulate irrigation reuse in Reaches No. 2 and No. 3. The amount of reuse is controlled by the model user via hdata items hdata1(60-63,i,j). For example, if the model user wanted to implement 20% reuse in a reach, they would use a factor of 0.20. The NPREIS then takes 20% of all water available for return and reuses it by means of a phantom diversion. The phantom diversion functions identically to a canal diversion by reducing the diverted amount by evaporation and consumptive use with the remaining portion being assign as water available for return. The phantom reuse diversion occurs after all other diversions in a reach have been processed and is assumed to take place at the bottom of the reach. A reuse factor for both the historic and modeled condition exists for Reaches No. 2 and No. 3. The historic reuse factors are used by the model to establish the historic return flow condition that the model uses to adjust reach gain and should not be changed. The modeled (adjustable) reuse factors are used by the model to simulate the response of a change in reuse.

3.5.2.7 Well Irrigation Parameters

The net recharge from well irrigation option is controlled though hdata items' hdata1(64-67,i,j). The model user must enter their estimate of monthly net recharge from well irrigation in the given hdata items. The monthly net recharge is the net change in ground water content due to pumping and is entered as a negative value to indicate it is a depletion. The model adds the net recharge from well irrigation to the water available for return in the reach just before calling the GLOVER subroutine to determine the return flow. This option allows the model user to investigate other than historic ground water use in periods of surface water shortages. However, the use of this option will require the model user to make a judgement of how ground water usage will increase if surface water shortages occur. A net recharge from well irrigation data set for both the historic and modeled condition exists for Reaches No. 2 and No. 3. The historic net recharge from well irrigation values are used by the model to establish the historic return flow condition that the model uses to adjust the reach gain and should not be changed. The modeled (adjustable) net recharge from well irrigation values are used by the model to simulate the response of a change in well irrigation.

3.5.3 Storage Ownership Input File

The storage ownership accounting input file contains the data necessary to track water accrued to and delivered from the ownership accounts.

3.5.3.1 Ownership Parameters

Ownership input parameters such as initial contents, accrual flags, and maximum accruals and ownership contents are cdata2(1-21, 23-26) items. The initial ownership contents should be equal to the September EOM ownership contents from the water year prior to the beginning of the study. The sum of the initial ownership contents must equal the sum of the initial physical contents of the reservoirs. If necessary, the model user should adjust the initial ownership contents to satisfy this condition. The initial contents for the individual Glendo contractors accounts are calculated by the NPREIS from the initial Glendo Irrigation Pool ownership content (cdata2(8)) proportionally. The accrual flags indicate whether an ownership is allow to accrue water. A value of one (1) enables an ownership to accrue, while a value of zero (0) disables the accrual option. The Inland Lakes ownership account in the main stem is allowed to accrue water only in the months of October, November, and April (adata2(1,J)). These accrual limits are set in accordance with the SONFAP. The maximum ownership contents for the Kendrick Seminoe, Kendrick Alcova, North Platte Guernsey, and North Platte Pathfinder ownerships are the maximum capacity values used for the Seminoe, Alcova, Guernsey, and Pathfinder Reservoirs, respectively.

3.5.3.2 ETO Options

The ETO options allow the model user to decide to accrue ETO from in Glendo and Guernsey (cdata2(26)), to accrue ETO in Seminoe and Pathfinder (cdata2(27)), replace evaporation from Glendo and Guernsey ownerships (cdata2(28)), replace evaporation from Kendrick and Pathfinder ownerships (cdata2(29)), augment natural flow with ETO (cdata2(30)), augment storage flow with ETO (cdata2(31)), and limit ETO storage to the space available in Glendo Reservoir (cdata2(32)).

3.5.3.3 Kendrick Water below Alcova Option

Cdata2(22) is a flag that allows (1=YES) or does not allow (0=NO) Kendrick ownership to be moved below Alcova Reservoir (Kendrick point of diversion). If Kendrick water is not allowed below Alcova, there exists a possibility of violating the minimum flow past Casper, Wyoming. However, allowing water below its point of diversion is not an acceptable practice.

3.5.3.4 Irrigation Efficiencies

Irrigation efficiencies (hdata2(1-78,I,J)) control the amount of a diversion that is consumptively use. As efficiency factors are increased, a greater portion of the delivery is consumptively used and the water available for return flow is decreased. An efficiency factor data set for both the historic and modeled condition exists for all modeled diversions. The historic efficiency factors are used by the model to establish the historic return flow condition that the model uses to adjust the reach gain and should not be changed. The modeled (adjustable) efficiency factors are used by the model to simulate the response of a change in efficiency.

3.5.3.5 Pathfinder Ownership Options

The NPREIS can simulate two additional ownership accounts in the Pathfinder Reservoir. These two accounts, Pathfinder enlargement #1 ownership and Pathfinder enlargement #2 ownership, are controlled via cdata2(33) through cdata2(39). These ownerships accrue water under the same priority date (12/06/04) as the North Platte Pathfinder storage right. The original North Platte Pathfinder storage right of 1,070,000 acre-feet has been reduced to 1,016,507 acre-feet due to sedimentation over its life time. The combined capacity of the Pathfinder enlargement #1 and #2 accounts should not be greater than the amount lost to sedimentation (53,493 acre-feet). Water available for accrual under the 12/06/04 priority date is accrued to these ownerships on a proportional share basis. The deliveries from the Pathfinder enlargement #1 and #2 accounts are controlled by adata(31) and adata(32), respectively.

3.5.3.6 ETO Account Option

Glendo Reservoir has a reregulation space of 334,240 acre-feet that is used to restore North Platte Pathfinder water released from Pathfinder Reservoir to generate power in the winter months. This reregulation space has also been used to capture large inflows and hold them in the Excess-to-Ownership (ETO) account, which is later used to replace ownership evaporation and augment the flow of the North Platte River. The model user controls the operation of the ETO account via cdata2(25) through cdata2(27). Cdata2(28) and cdata2(29) control the use of the ETO account to replace ownership evaporation. Cdata2(30) and cdata2(31) control the use of the ETO account to augment the flow of the North Platte River.

3.5.3.7 Glendo Reregulation Space Options

The NPREIS can use a portion of the reregulation space as an additional storage account. This additional account is controlled by the model user via cdata2(15) through cdata2(17). The NPREIS assigns this account the most junior storage right on the system and it accrues water after all other rights have been satisfied with respect to river reaches. The deliveries from this account are controlled by adata(30).

3.5.3.8 Pathfinder Alternative Account Options

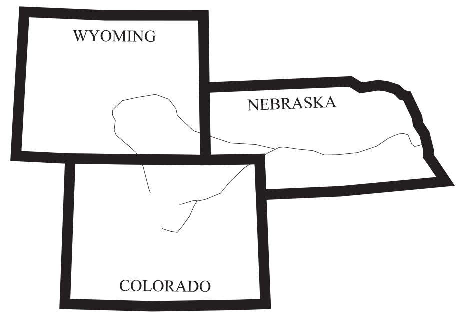
This option allows the model user to create and simulate an alternative account of a specified maximum content (cdata2(35)) in the North Platte Pathfinder ownership. This account is activated when cdata2(36) is set to one (1) in the storage ownership input file (_.SOA). When active, this account proportionally shares the accruals and evaporation credited to the North Platte Pathfinder ownership. Releases from this account are controlled via adata(34,J). This account can be used by the model user to explore the possibility of dedicating a portion of the Pathfinder ownership to an environmental account.

3.5.3.9 Kendrick Seminoe Alternative Account Options

This option allows the model user to create and simulate an alternative account of a specified maximum content (cdata2(64)) in the Kendrick Seminoe ownership. This account is activated when cdata2(65) is set to one (1) in the storage ownership input file (_.SOA). When active, this account proportionally shares the accruals and evaporation credited to the Kendrick Seminoe ownership. Releases from this account are controlled via adata(37,J). This account can be used by the model user to explore the possibility of dedicating a portion of the Kendrick Seminoe ownership to an environmental account.

3.5.3.10 Glendo Irrigation Pool Alternative Account Options

This option allows the model user to create and simulate an alternative account of a specified maximum percentage (cdata2(61)) of the Glendo Irrigation Pool ownership. This account is activated when cdata2(61) is set to a number between zero (0) and one (1) in the storage ownership input file (_.SOA). A value of 0.05 dedicates 5 % of the Glendo Irrigation ownership to the alternative account. The account is inactive only when cdata2(61) is set to zero (0). When active, this account proportionally shares the accruals and evaporation (if the Glendo Evaporation Pool has been depleted) is credited to the Glendo Irrigation ownership. The alternative account is further proportionally subdivided into a Wyoming and Nebraska alternative account (0.375 and 0.625, respectively). Releases from the Wyoming and Nebraska alternative accounts are controlled via adata(35,J) and adata(36,J), respectively. These accounts can be used by the model user to explore the possibility of dedicating a portion of the Glendo Irrigation ownership to an environmental account.



North
Platte
River
Water
Utilization
Model

DOCUMENTATION

Wyoming Area Office
Mills, Wyoming
June 1997

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1.0 BACKGROUND

1.1 Introduction

Development of the North Platte River Water Utilization Model (NPRWUM) was initiated as part of an effort to evaluate existing Reclamation projects in the Platte River Basin for the potential to affect threatened and endangered species. The evaluation is one of the Reclamation's major environmental commitments as required by Section 7 of the Endangered Species Act. Section 7 requires Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of a listed species or to adversely modify or destroy critical habitat. It also requires agencies to carry out conservation programs for listed species. The threatened and endangered species affected by flow in the Platte River's big bend reach (Lexington to Chapman) have been identified as the Bald Eagle, Whooping Crane, Interior Least Tern, and Piping Plover. Reclamation projects located on the North and South Platte Rivers are being evaluated to assure they are operated in a manner that preserves and enhances environmental resources for these species while still meeting congressionally authorized, judicial, and contractual needs.

The NPRWUM has been developed by the United States Bureau of Reclamation (Reclamation), Wyoming Area Office (WYAO) in Mills, Wyoming in cooperation with the U.S. Fish and Wildlife Service to evaluate Reclamation projects on the North Platte River. In addition, a Hydrology Study Team was developed as part of Reclamation's public involvement effort for the evaluation study. This team provided interested parties the opportunity to give input into the hydrology work performed for this study. It also provided Reclamation the opportunity to get technical feedback on the hydrology work performed. The team's role has been to review and comment on completed hydrology work, provide technical support, and provide feedback to their consistency on the scope of the hydrology work performed for the evaluation study.

The NPRWUM has been programmed to simulate the reservoir operations, natural flow segregation, storage ownership accounting, and provide estimates of flow at various points on the North Platte River from Seminoe Reservoir to Lewellen, Nebraska. Required input parameters for the NPRWUM include inflows, diversions, initial reservoir end-of-month contents, etc. The NPRWUM is applicable only to the North Platte River Basin and is not intended for use to simulate other basins.

1.1.1 Limitations

The NPRWUM, like all models, is a simplification of the real world. These simplifications, necessary to describe a complex system such as the North Platte River, impose certain weaknesses on the model. The presence of a weakness in handling a certain condition does not necessarily mean that the model should not be used to examine these situations. However, the model user should be aware of the potential errors that might result from such uses and consider these weaknesses when drawing conclusions based on the model's output.

The NPRWUM employs a monthly time step to simulate the North Platte River System. The monthly time step smooths out the daily peak flows occurring during the month and only provides an estimate of the monthly volume of flow at any point. For example, the daily accrual limitation for the Inland Lakes Ownership account in the main stem of 910 cubic feet per second (cfs) equates to about 54,000 acre-feet (af) over a month and is meaningless using monthly data when the account can only accrue up to 46,000 af annually. Estimates of the flow become coarser at points located lower and lower in the system as any errors occurring compound. The travel time of the water from one point in the system to another is ignored within the monthly time step. Inferences of daily estimates from the model's monthly output could be possible using statistical methods, however, the model user must recognize the coarseness of the resultant estimates.

The details within NPRWUM are limited to Reclamation facilities and operations. The NPRWUM covers an areal extent from the inflows to Seminoe Reservoir, downstream to Lewellen, Nebraska. The model does not simulate the City of Cheyenne account or the Pacific Power and Light account, nor is the interaction between the ground water and surface water explicitly modeled. None of the diversions above Whalen Dam, apart from the Casper Canal, are explicitly represented in the NPRWUM. Rather, they are implicitly accounted for in the gains computed above Whalen Dam. The diversions explicitly modeled below Whalen Diversion Dam can be divided into three groups - those that divert directly from the North Platte River in the Whalen to Tri-State reach, those that divert directly from the North Platte River in the Tri-State to Lewellen reach, and those that divert from canals off the main reach (Interstate Canal, Fort Laramie Canal, and Tri-State Canal) of the North Platte River. Diversions in the first group are: Interstate Canal, Fort Laramie Canal, Burbank Ditch, Lucerne Ditch, Grattan Ditch, Rock Ranch Ditch, Torrington Ditch, North Platte Ditch, Narrows Ditch, Pratt-Ferris Ditch, Mitchell-Gering Canal, and Tri-State Canal. Diversions in the second group are: Enterprise Canal, Winters Creek Canal, Central Canal, Minatare Canal, Castle Rock Canal, Nine Mile Canal, Short Line Canal, Chimney Rock Canal, Belmont (Bridgeport) Canal, Empire Canal, Browns Creek Canal, Beerline Canal, Lisco Canal, and Midland-Overland Canal. Diversions in the third group are: Wyoming Laterals, Lingle, Hill, and Pathfinder Irrigation District from the Interstate Canal, Wright/Murphy, Goshen, and Gering-Fort Laramie from the Fort Laramie Canal, and Farmers, Northport, and Ramshorn from the Tri-State Canal. Diversions not associated with one of these groups and ground water depletions due to well irrigation are implicitly accounted for in the computed reach gains. The NPRWUM can simulate an overall depletion due to ground water pumping in the Whalen to Tri-State and Tri-State to Lewellen reaches, however, these depletions are not physically linked to actual well irrigation and must be entered into the input file by the model user.

The accuracy of the NPRWUM is largely dependent upon the level of confidence associated with the input parameters, primarily inflows. Major inflows to the system included the North Platte River above Seminoe Reservoir, Medicine Bow River, and the Sweetwater River. The U. S. Geological Survey classifies the accuracy of its streamflow data published in the Water Resources Data Reports as "excellent," "good," "fair," and "poor." "Excellent" means that about 95 percent of the daily discharges are within 5 percent of their true value; "good," within 10 percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned, are rated "poor." Typically, the accuracy of these major inflows varies depending on the season and has been reported as "good" except for those period's containing estimated daily discharges, which are "poor." Based on input data alone, the accuracy of the monthly values computed by the NPRWUM is at best within 10 percent of their true value (± 10 %). This means that a computed monthly flow of 50,000 acre-feet at Lewellen is at best within ± 5000 acre-feet (55,000 to 45,000 af). Input data items such as inflow, reach gains, and diversions have been rounded to the nearest 100 acre-feet (0.1 kaf).

The NPRWUM does not compute the flow in the river for intermediate points within the modeled reaches above the Tri-State Diversion Dam, it only computes the flow entering a reach and the flow leaving a reach. The model assumes that the volume of water entering the reach plus the reach gain, adjusted to reflect changes in the return flow, is sufficient to satisfy the requested irrigation deliveries within the reach. The Tri-State to Lewellen reach accounts for the flow in the North Platte River below each modeled diversion. The Tri-State to Lewellen reach was divided into subreaches comprising small segments of the river between two modeled diversion points. The Tri-State to Lewellen reach gain is prorated to these subreaches based on their physical location with respect to the Tri-State Dam and location of major creeks and drains. The model uses the subreach gains to satisfy the diversions and calculate the flow in the river below each modeled diversion. If the flow leaving any reach is less than zero, the model reiterates the reach assigning any shortages that cannot be met from storage to the diversions in order of priority. This simplified operation provides an indication of which diversion(s) will stand the shortage, if one occurs.

The NPRWUM has not been configured to assess impacts on individual irrigators within the modeled irrigation districts, nor has it been configured to assess management practices of these individual irrigators at the field level. However, it will show reduced flows in the river or shortages of water to those diversions modeled based on the lumped reach approached employed therein. While these reductions may not be explicitly identified with a specific location, the overall reduction in a reach should be discernable.

When storage in the North Platte River System is above normal and there is the possibility of large inflows from either precipitation or melting snow, Reclamation manages its system of reservoirs on the North Platte River in order to reduce spills and control flooding. This introduces additional operational criteria that must be considered in addition to the regular requirements set by water rights, decrees, and water delivery contracts. Some decisions made regarding the operation of the system during these wet periods are influenced or controlled by agencies outside of the Bureau of Reclamation. Agencies involved include the United States Corps of Engineers, the Wyoming State Engineers Office, and the Nebraska Department of Water Resources. With the number of agencies involved and the individual nature of events and circumstances associated with a given wet year, each wet year is managed differently from other wet years. Therefore, the NPRWUM continues to use operating rules associated with the regular requirements set by water rights, decrees, and water delivery contracts during a wet year rather than perform an operation that would require the agreement of one or more additional agencies. This results in a certain amount of error in the timing of peak flows leaving the North Platte River System, but is of little or no consequence due to the large amount of water available to all interests on the system.

Numerous management decisions related to irrigation, power, fisheries, recreation, and municipal needs are required in the operation of the North Platte River System in very dry conditions. The need that is deemed the most important and controls the operation of the North Platte River System at a particular time is influenced by the concerns of the public, the priorities of the managing entities, as well as such contracts, laws, agreements that govern the system. However, when reservoir levels have been depleted all interests in the system will be affected and will receive less water than is needed to satisfy their full demand. Irrigators will be shorted, minimum flows may not be maintained, power plants may be bypassed, and recreation will be limited. The results given by the NPRWUM during extreme drought conditions may differ from the results obtained under actual operation of the system due to the number of complex management decisions required. It should also be noted that these extreme levels of drought have not occurred in the hydrologic history recorded since the dams have been built on the North Platte River and it is pure conjecture as to how the system would be operated.

1.2 Explanation of the NPRWUM Documentation

This documentation has been written to document the Fortran source code of the NPRWUM and demonstrate its calibration. Future use of the NPRWUM by Reclamation will be documented in the associated reports. Likewise, other parties that use the NPRWUM for their own purposes should document their use of the model accordingly. Section 1.0 provides an introduction to the North Platte River System and its management. Section 2.0 discusses the development of the NPRWUM and operational criteria. Section 3.0 describes the application and use of the NPRWUM. Section 4.0 discusses the Calibration of the model. Section 5.0 contains a listing of selected references.

1.2.1 Objective

The objective of the NPRWUM documentation is to give the model operator enough information about the NPRWUM and the North Platte River to understand and use the model. To accomplish this objective, a general history of the North Plate River is presented. This history touches on legislation and court decisions that affect the operation of the structures on the river; the major participants who are involved in the operation the North Platte River; and control of the river for beneficial use. The operational criteria the NPRWUM uses to simulate the River are also discussed. The use and operation of the model are presented, and calibration of the model is addressed.

1.2.2 Intended audience

This manual is intended for people with a working knowledge of the North Platte River System. A knowledge of the North Platte Decree, water resources, reservoir operations, hydroelectric power generation, and computer programming is strongly recommended in understanding the terminology and concepts presented herein.

1.3 Description of the Reclamation’s Projects

The North Platte River, fed by many mountain streams rising in the Rocky Mountains of Colorado and Wyoming, is the most important river in southeastern Wyoming and western Nebraska. Its waters are stored and used for irrigation and power development for the North Platte Project, the Kendrick Project, and the Kortes and Glendo Units of the Pick-Sloan Missouri Basin Program. Storage structures for these projects are interspersed along the North Platte River and require close coordination of operations. Project operation is further complicated by agreements and laws governing water rights. The use and quantity of water are allocated for certain defined purposes - some on a priority basis, some on a proportionate share basis, and some on a geographical source basis. The following discussion of Reclamation’s projects located on the North Platte River is taken from the *Project Data* book (U.S. Department of Interior, 1981) and has been revised as necessary to reflect current information.

1.3.1 North Platte Project

The North Platte Project extends 111 miles along the North Platte River Valley from Guernsey, Wyoming, to Bridgeport, Nebraska. The project provides full service irrigation for about 226,000 acres that are divided into four irrigation districts; Gering-Fort Laramie, Goshen, Northport, and Pathfinder. A supplemental irrigation service is furnished to nine water-user associations serving a combined area of about 109,000 acres. The names of the water-user associations are Hill, Lingle, and Rock Ranch Districts in Wyoming, and Farmers, Gering, Central, Chimney Rock, Browns Creek, and Beerline Districts in Nebraska.

Project features include five storage dams, four diversion dams, one pumping plant, one powerplant, and about 2,000 miles of canals, laterals, and drains. Electric power is generated at Guernsey Powerplant and supplied to the project area by four substations and about 160 miles of transmission lines.

In 1895, Nebraska enacted an irrigation district law permitting the formation of districts with power to assess lands for irrigation improvements. Shortly after the Federal Reclamation Act was passed in 1902, the Reclamation Service began studying the North Platte Project. The project was authorized in 1903, and surveys were started to determine the location of irrigable lands. As the work proceeded, it became apparent that storage must be provided to reclaim any considerable area. Further investigations led to the selection of the Pathfinder Dam site as the most favorable storage location.

The project, originally called the Sweetwater Project, was authorized by the Secretary of the Interior on March 14, 1903. Guernsey Dam and Powerplant were approved by the President on April 30, 1925. Construction started in 1905 on Pathfinder Dam and the Interstate Canal. By 1915, work on the Interstate Canal and Reservoirs was completed and work had started on the Fort Laramie Canal. Lingle Powerplant and the Northport Canal system were started in 1918. All canal construction was completed by 1925. Guernsey Dam was started on June 1, 1925, and completed in July 1927. The operation of the Lingle Powerplant was discontinued after April 1956.

1.3.1.1 Pathfinder Dam and Reservoir

Waters of the North Platte River must pass the Seminoe and Kortes Dams before entering the reservoir at Pathfinder Dam, which impounds the flow from Sweetwater River. Pathfinder Reservoir has a storage capacity of 1,016,507 acre-feet and holds much of the North Platte Project water. During the non-irrigation season, a small amount of water is released to satisfy other water rights, enhance fish and wildlife, and operate powerplants downstream. During the irrigation season, water is released as required, including water flowing from Seminoe Reservoir to be diverted at Alcova Dam for irrigation on the Kendrick Project.

Pathfinder Dam was one of the first dams constructed by the Reclamation Service. The dam is in a granite canyon on the North Platte River about three (3) miles below its junction with the Sweetwater River and about 47 miles southwest of Casper, Wyoming. It is made of granite quarried from nearby hills and faced with large rectangular blocks laid in horizontal courses. It is an arch dam with a gravity-type section, and has a structural height of 214 feet. Pathfinder Dike fills a depression in the natural ground surface about 0.25 mile south of the dam. It is an earth fill structure, 38 feet high, with a concrete core wall.

1.3.1.2 Guernsey Dam and Powerplant

About 180 miles below Alcova Dam and 25 miles below Glendo Dam, the Guernsey Dam controls river flow. Water released from Pathfinder Reservoir can be stored at this dam and released to fit varying irrigation demands. Guernsey Dam is in a rocky canyon two (2) miles upstream from Guernsey, Wyoming. It is a diaphragm-type embankment of sluiced clay, sand, and gravel that forms an impervious core. Its slopes are protected by a thick layer of rock riprap. The structural height of the dam is 135 feet. The original capacity of the reservoir was 73,810 acre-feet, but this has been greatly reduced by silt deposits to about 45,612 acre-feet. The powerplant is on the right bank below the dam and originally had two 2,400-kilowatt generators. The two generators were rewound in 1993 resulting in a new rating of 3,200 kilowatts each. Power is transmitted to towns and industries down the valley over transmission lines.

1.3.1.3 Whalen Diversion Dam

Since 1909, water for the North Platte Project has been diverted from the river by the Whalen Diversion Dam. Water is diverted on the south side of the river into the Fort Laramie Canal and on the north side of the river into the Interstate Canal. The dam is a gravity, concrete ogee weir with an embankment wing which spans the river about eight (8) miles below Guernsey Dam.

1.3.1.4 Fort Laramie Canal

The Fort Laramie Canal has an initial capacity of 1,550 cubic feet per second and winds its way for 129 miles to an area south of Gering, Nebraska, delivering water to farms along its course. It also originally carried water for operating the Lingle Powerplant, which was retired in April 1956. The canal was constructed during 1915-24.

1.3.1.5 Interstate Canal and Reservoir System

The Interstate Canal has an initial capacity of 2,100 cubic feet per second. Constructed during 1905-15, it follows the contour of the land for 95 miles to Lake Alice and Lake Minatare Reservoirs northeast of Scottsbluff, Nebraska. The 35-mile long Highline Canal extends from Lake Alice to the southwest. The diversion capacity is 160 cubic feet per second. The Lowline Canal extends from Lake Minatare southwest. It is 43 miles long and has a diversion capacity of 430 cubic feet per second. Lake Alice, Lake Minatare, Lake Winters Creek, and Reservoir No. 2 (Little Lake Alice) are off stream equalizing reservoirs and are also known as the Inland Lakes. The reservoirs are fed from water diverted at Whalen Diversion Dam through the Interstate Canal (also called the Pathfinder Main Canal), which ends at Lake Alice. The Reservoir Supply Canal carries water from Lake Alice to the other reservoirs. The combined storage capacity of the Inland Lakes is about 74,111 acre-feet.

1.3.1.6 Northport Canal

Water for the Northport Canal is conveyed 80 miles through the Tri-State Canal of the Farmers Irrigation District. The Northport Canal, a continuation of the privately constructed Tri-State Canal, was designed to irrigate 16,170 acres in the Northport Division. The canal is 27 miles long and has a diversion capacity of 250 cubic feet per second.

1.3.1.7 Operation Agency

The Pathfinder and Guernsey Reservoirs and Guernsey Powerplant are operated and maintained by the Bureau of Reclamation. Whalen Diversion Dam is operated by the Goshen Irrigation District for the other districts on a cost-sharing basis. The distribution systems are operated by the districts which they serve.

1.3.1.8 Warren Act Contracts

The Warren Act contracts take their name from the Act of Congress of February 21, 1911, known as the "Warren Act". That Act authorizes the Secretary of the Interior to contract for the storage and delivery of any surplus water conserved by any reclamation project over and above the requirements of the project proper. In connection with the North Platte Project, nine such contracts were entered into by the United States, three with Wyoming, and six with Nebraska districts (P. 34, Doherty, 1944). The names of the districts are the Hill, Lingle, and Rock Ranch Districts in Wyoming, and the Farmers, Gering, Central, Chimney Rock, Browns Creek, and Beerline Districts in Nebraska. These contracts further extend the use and benefits of Pathfinder and Guernsey storage water.

1.3.2 Kendrick Project

The Kendrick Project (formerly Casper-Alcova) conserves the waters of the North Platte River for irrigation and electric power generation. Major features of the project are Seminoe Dam and Powerplant, Alcova Dam and Powerplant, the Casper Canal and laterals, and drainage and power distribution systems. The original project service area included two units totaling 66,000 acres. The first unit was constructed to deliver water to 35,000 acres. Construction of the second unit was initially postponed pending determinations of adequate water supply and land classification. The development of significant drainage related problems resulted in the partial development of the first unit and abandonment of the second unit (U.S. Department of Interior, 1955). The total reported irrigated lands in production during recent years are approximately 24,000 acres. The project is a multiple-purpose development that involves storage at Seminoe Reservoir and diversion at Alcova Dam to project lands. Operation of the reservoirs and powerplants is integrated with other river basin developments.

In 1904, the Reclamation Service first investigated lands now included in the Kendrick Project in connection with a plan to build the Casper Canal, one of several irrigation ditches along the North Platte River. In December 1904, application for a permit authorizing the desired water appropriation for this canal was made, but no further action was taken. Until 1933, the lands now included in the Kendrick Project remained part of the open range used by the sheep ranchers in the area. In that year, however, as a result of further investigations by the Bureau of Reclamation, the Public Works Administration allocated funds to develop irrigation and hydroelectric power facilities on the North Platte River in the vicinity of Casper, Wyoming.

The Kendrick Project was authorized by a finding of feasibility approved by the President on August 30, 1935. The Alcova Powerplant was authorized for construction on August 22, 1950, under the provisions of section 9(a) of the Reclamation Project Act of 1939. Originally known as Casper-Alcova, the project was renamed Kendrick in 1937.

Seminoe Dam was constructed during 1936-39, and first delivery of power from the powerplant was made on August 3, 1939. Construction of Alcova Dam was started in 1935 and completed in 1938. The first irrigation water was diverted into the Casper Canal on June 14, 1946. Alcova Powerplant started power production in July 1955.

1.3.2.1 Seminoe Dam and Powerplant

The Seminoe Dam and Powerplant are on the North Platte River about 72 miles southwest of Casper, Wyoming. Seminoe Reservoir, with a total capacity of 1,017,273 acre-feet, provides storage capacity for the water to irrigate the project lands. The powerplant generates electric power as the water is released for irrigation or stored in Pathfinder Reservoir for later release as required. The dam is a concrete-arch structure containing 210,000 cubic yards of concrete and rising 295 feet above the rock foundation. Water is released from the reservoir through penstocks to the Seminoe Powerplant, or over a controlled spillway and outlet tunnel. The powerplant is located at the base of the dam, and has a rated head of 166 feet. The plant contains three units, each composed of a 15,000-kilowatt generator driven by a 20,800-horse-power turbine.

1.3.2.2 Alcova Dam and Powerplant

Alcova Dam is on the North Platte River about 37 miles downstream from Seminoe Dam and 10 miles downstream from Pathfinder Dam of the North Platte Project. The dam forms a reservoir, with a total capacity of 184,405 acre-feet, from which water is diverted into Casper Canal for irrigation of lands in the Kendrick Project. The dam is a zoned earth fill structure rising 265 feet above its foundation and containing 1,635,000 cubic yards of material. Water is released for other irrigation rights downstream through the Alcova Powerplant or over a controlled spillway. Alcova Powerplant was authorized and built after completion of Alcova Dam. It is on the right bank of the river opposite the toe of the dam. The plant uses the 165-foot drop from the reservoir to the river for power generation. It consists of two units, each an 18,000-kilowatt vertical-shaft generator driven by a 26,500-horsepower turbine.

1.3.2.3 Casper Canal and Distribution System

The irrigation distribution system for the existing unit (unit 1) consists of the Casper Canal, 59 miles long; 190 miles of laterals and sublaterals; and 41 miles of drains. Principal structures include the headgates located on Alcova Reservoir about one (1) mile west of the drain; six (6) concrete-lined tunnels having a total length of 3.4 miles; several siphons, and highway and farm road bridges; and many measuring and control structures. The main canal had an original capacity of 1,200 cubic feet per second. Since the construction of the canal, a V-Notched weir has been installed to limit the flow into the Casper Canal to approximately 600 cubic feet per second.

1.3.3 Kortes Unit

The Kortes Unit of the Pick-Sloan Missouri Basin Program consisting of Kortes Dam, Reservoir, and Powerplant, is in central Wyoming in a narrow gorge of the North Platte River two (2) miles below Seminoe Dam of the Kendrick Project, and about 60 miles southwest of Casper, Wyoming. It was the first unit initiated by the Bureau of Reclamation under the Missouri River Basin Project. The powerplant has three (3) units with a total generating capacity of 40,000 kilowatts.

Water released from Seminoe Dam to Pathfinder Reservoir passes through the Kortes turbines to generate power, which is distributed by the Government-owned interconnected transmission system to localities in the intermountain and Great Plains areas. Maximum benefits are obtained when Kortes Reservoir remains full and the power releases are coordinated with those from the Seminoe plant to maintain a full reservoir.

Investigations for development of a dam and reservoir at the Kortes site were conducted intermittently after 1933. Based on information obtained during these investigations, the Kortes Unit was included in Senate Document 191.

Kortes power development was found feasible by the Secretary of the Interior as a supplement to the Kendrick Project on November 26, 1941, but it was authorized by the Flood Control Act of December 22, 1944, Public Law 534, which approved the general comprehensive plan set forth in Senate Documents 191 and 475, as revised and coordinated by Senate Document 247, 78th Congress, 2d session.

Construction of Kortes Dam was started in 1946 and completed in 1951. Because of the enormous increase in power demands in the area and power sales commitments, an accelerated power program was developed which consisted of erecting generating equipment and machinery concurrently with the dam and powerhouse construction, placing the generators into service before the powerhouse was completed, construction of temporary transmission facilities, and providing temporary protection for the operating equipment during the construction period. As a result of this program, two units were placed into service six (6) months before the completion of the powerhouse and the dam and six (6) months earlier than they would have been without this accelerated program.

1.3.3.1 Kortes Dam

Kortes Dam is constructed in the 1,000-foot gorge of the Black Canyon on the North Platte River. The level of water in Kortes Reservoir controls the tailwater elevation of Seminoe Powerplant. The dam is constructed at the optimum location to develop the most head between Seminoe tailwater and Pathfinder high water surface elevation. About 200 of the 300 feet available are used. The concrete gravity structure has a maximum height above foundation rock of 244 feet and contains 147,000 cubic yards of concrete.

The 83-acre Kortes Reservoir is confined to the narrow canyon and provides storage for only 4,765 acre-feet of water. Other principal features include a 50,000 cubic foot per second uncontrolled spillway through the right abutment, and a switchyard on the top of the dam. The reinforced-concrete powerhouse occupies the entire width of the canyon at the toe of the dam. The plant has three 18,500 horsepower Francis-type turbines and three 13,300-kilowatt generators.

1.3.4 Glendo Unit

The Glendo Unit of the Pick-Sloan Missouri Basin Program is a multiple-purpose natural resource development. It consists of Glendo Dam, Reservoir, and Powerplant; Fremont Canyon Powerplant; and Gray Reef Dam and its reregulating reservoir. Unit features are located on the North Platte River in eastern and central Wyoming and are adjacent to, and work in conjunction with, other units of the Pick-Sloan Missouri Basin Program and the Kendrick and North Platte Projects.

The unit furnishes a maximum of 40,000 acre-feet of water annually from Glendo Reservoir for irrigation in Wyoming and Nebraska, and electrical power is supplied to Wyoming, Colorado, and Nebraska by Glendo and Fremont Canyon Powerplants, which have uprated capacities of 38,000 and 66,800 kilowatts, respectively,

Preliminary investigations for the Glendo Unit started in 1944. It was included in Senate Document 191 as part of the Missouri River Basin Project and authorized for construction under the Flood Control Act of 1944. The original authorization provided for a storage capacity of approximately 150,000 acre-feet in the Glendo Reservoir for additional sediment storage and replacement of capacity lost to sediment in Guernsey Reservoir; reregulation of return flows from upstream irrigation; and flood control and the development of power.

Subsequent investigations disclosed the necessity for increasing the capacity of Glendo Reservoir to provide for adequate control in the high developed reach of the North Platte River Valley in Wyoming and Nebraska below the Glendo Reservoir site and the reregulation of upstream power releases so river water could be utilized more effectively for hydroelectric power production. As a result of these investigations, the total storage capacity was increased to 795,196 acre-feet, exclusive of a flood surcharge capacity of an additional 329,251 acre-feet.

The Glendo Unit was authorized for construction under the Flood Control Act of December 22, 1944, Public Law 534, which approved the general plan set forth in Senate Documents 191 and 475 as revised and coordinated by Senate Document 247, 78th Congress, 2nd session. The project was reauthorized by Public Law 503, 83d Congress, on July 16, 1954. Construction of Gray Reef Dam and Reservoir was authorized separately by Public Law 885-695 (72 Stat. 687), approved August 20, 1958.

Construction began December 1954 on the Glendo Dam, Reservoir, and Powerplant and was completed in 1958. Construction of the Fremont Canyon Powerplant and power conduit began in 1956 and was completed in 1961. Construction of Gray Reef Dam and Reservoir was started in 1959 and completed in 1961.

The Glendo Unit is operated in conformity with the North Platte River Decree of 1945. It provides irrigation, power generation, flood control, fish and wildlife enhancement, recreation, sediment retention, pollution abatement, and improvement of the quality of municipal and industrial water supply in the North Platte River Valley between Gray Reef Dam and Glendo Reservoir.

An amendment to the North Platte River Decree was approved in 1953 by the States of Colorado, Wyoming, and Nebraska, and by the U.S. Supreme Court. It provides for retaining the existing regimen of the natural flow of the North Platte River below Pathfinder Dam, except that not more than 40,000 acre-feet of water plus space obtained by evaporation losses may be stored in Glendo Reservoir for irrigation during any water year, and the amount held in storage at any time for irrigation may not exceed 100,000 acre-feet. The amended decree permits the release from storage of 15,000 acre-feet of water annually to Wyoming and 25,000 acre-feet annually to Nebraska for irrigation. All water available to Nebraska has been contracted, while Wyoming currently still has 10,350 acre-feet of water available for contract. Wyoming's remaining share is utilized in part for municipal, industrial, and irrigation purposes in Wyoming via temporary contacts renewed yearly.

Within the limits of the amended decree, storage facilities of the North Platte River system provide considerable flexibility. Maximum capacity for regulation and storage is afforded through exchange of water between Glendo Reservoir and upstream reservoirs. Exchange water stored in Glendo is released by the close of the irrigation season. The proprietary and contractual interests in storage water are identifiable at all times regardless of location of the water in the system. Floodwater stored in Glendo Reservoir is released under regulations prescribed by the Secretary of the Army under authority of the Flood Control Act of 1944.

1.3.4.1 Glendo Dam, Reservoir, and Powerplant

Glendo Dam is a zoned earth fill structure on the North Platte River about four and one-half (4.5) miles southeast of Glendo. The embankment has a structural height of 190 feet and a length of 2,096 feet along the crest. About 2,800 feet of dikes are required across a low area on the south side of the reservoir one and one-half (1.5) miles west of the dam. The dam forms a reservoir 14 miles in length, having a total capacity of 795,196 acre-feet at water surface elevation 4653, the top of the flood control capacity. Space is provided in the reservoir for storing 115,000 acre-feet of sediment, an estimated 100-year accumulation. There are 454,337 acre-feet allotted for irrigation and power and 271,917 acre-feet for flood control. In addition, a surcharge capacity of 329,251 acre-feet is available. These capacities differ slightly from the original storage allocations because of sediment accumulation.

Glendo Dam's design did not have the capability of making low flow releases, and the cycle of operation resulted in nearly 20 miles of river below Glendo being dewatered from late September until early April. The lack of flow in the river was identified as a design deficiency of the project as the outlet works were not capable of providing low flows which could be restored downstream in Guernsey Reservoir. To remedy the situation, a 1,025 foot long three (3) foot diameter pipeline tunnel was constructed in 1992-93 through Glendo Dam's right abutment near the spillway. The low flow outlet enables Reclamation to make low volume releases of 25-40 cubic feet per second during the non-irrigation season, without adversely affecting existing water uses.

An uncontrolled concrete spillway 45 feet wide is located about 450 feet north of the right abutment of the dam. The Glendo Powerplant is joined to the Glendo Reservoir by a diversion tunnel 21 feet in diameter and 2,100 feet long. The plant contains two (2) units having a maximum rated head of 130 feet. Each unit has an installed capacity of 19,000 kilowatts.

1.3.4.2 Fremont Canyon Powerplant

The Fremont Canyon Powerplant, on the left bank of the North Platte River at the head of Alcova Reservoir, consists of two 32,000-kilowatt generators, driven by two 33,500-horsepower Francis-type hydraulic turbines. The turbines operate at a maximum head of 350 feet and an effective head of 300 feet. The powerplant generates power during releases of stored floodwater, irrigation water, and water to satisfy prior water rights from Pathfinder Reservoir of the North Platte Project. Water for power generation is conveyed to the powerplant by a three (3) mile long 18 foot diameter, concrete-lined pressure tunnel. The tunnel branches to two 10.75 foot diameter penstocks upstream of the powerplant. This conduit is controlled by a 14 by 18 foot fixed-wheel gate located 243 feet downstream from the inlet. Access to the powerplant is provided by a 1,692-foot-long unlined tunnel 16.5 feet high and continuing a 16-foot-wide roadway.

1.3.4.3 Gray Reef Dam and Reservoir

Gray Reef Dam is on the North Platte River about 27 miles southwest of Casper, and two (2) miles downstream from Alcova Dam. The earth fill structure has a structural height of 36 feet, a crest length of 650 feet and contains a volume of 40,000 cubic yards of material. The spillway consists of a concrete chute near the center of the dam controlled by two 35- by 20-foot radial gates. Capacity of the spillway is 20,000 cubic feet per second. There are no outlet works in the dam. The reservoir has a total capacity of 1,800 acre-feet, with a surface area of 182 acres. Gray Reef Reservoir is operated to reregulate widely fluctuating water releases from the Alcova Powerplant of the Kendrick Project.

1.3.5 The U.S. Supreme Court North Platte Decree

The following discussion outlining the history of litigation on the North Platte River is taken from Owen Olpin (1992), Special Master Second Interim Report on Motions for Summary Judgement and Renewed Motions for Intervention. Owen Olpin was appointed Special Master by the Court and has supervised pretrial proceeding and discovery since 1987, for matters currently before the Court.

1.3.5.1 Original Proceedings

The construction of Pathfinder Dam as a component of the Bureau of Reclamation's North Platte Project started a chain of development in the North Platte Basin that has continued ever since. As a result, by the 1930's the North Platte and many of its major tributaries were -- as they still are -- over-appropriated. Increased human consumption and the network of on-stream reservoirs regulating flows have greatly reduced average flows and significantly altered the river's channel in the important wildlife habitat areas in central Nebraska.

Traditionally, the North Platte River has been appropriated for agriculture uses and, to a much lesser extent, for municipal and industrial uses. Instream values -- aesthetic, recreation, ecological, environmental and historic -- have remained backstage until quite recently. Today, though, the traditional water-using interests face claims demanding that a share of the North Platte flows remain in the river to serve wildlife, recreational, and other instream values.

The Supreme Court first apportioned the waters of the North Platte River by decree in 1945, after eleven years of litigation involving the states of Colorado, Wyoming, and Nebraska as well as the United States (U.S. Supreme Court, 1945). The proposed construction of a new reservoir near Glendo, Wyoming, by Reclamation brought about modifications to the Decree in 1953 (U.S. Supreme Court, 1953). (This early litigation is referred to in this document as "the original proceedings.")

During the original proceedings, the Court examined whether upstream junior appropriators in Wyoming and Colorado wrongfully were depriving senior appropriators in Nebraska of North Platte waters. At that time the

Court referred the matter to Special Master Michael Doherty (1944), whose final report (the "Doherty Report") formed the basis for the Decree that emerged. The Decree's polestar is its allocation of natural flow waters in the "pivotal" reach of the North Platte mainstem, between Whalen Dam in Wyoming, forty miles upstream of the Wyoming-Nebraska state line, and Tri-State Diversion Dam in Nebraska, one mile downstream of the state line. The Decree apportioned natural flows in this section of the mainstem 75 percent to Nebraska and 25 percent to Wyoming during the May 1 through September 30 irrigation season. In so doing, the Decree recognized some priorities across state lines, and protected the pivotal reach against both certain further Colorado development, and certain further upstream Wyoming development.

1.3.5.2 Current Proceedings

Nebraska petitioned the Court to enforce the Decree and for injunctive relief on October 6, 1986, and Wyoming answered and counterclaimed on March 18, 1987. The current proceedings are before the Court pursuant to the "changed conditions" or "reopener" provision of the Decree. Since the Decree was entered, development has in no sense stood still on the North Platte River. Aside from the 1953 stipulated modifications to the Decree, however, more than forty years of interstate administration under the Decree went by before North Platte apportionment issues returned to the Court in 1986.

In her petition, Nebraska alleges that Wyoming unlawfully is depleting and threatening to deplete the flow of the North Platte River by her intended administration of Grayrocks Reservoir's operations and releases on the Laramie River, by her intended construction of the Corn Creek project diversion facility at the Laramie's confluence with the North Platte River, by her proposed construction of a storage reservoir on the Deer Creek stream, which enters the North Platte between Pathfinder and Guernsey Dams, and by her efforts to prevent the United States Bureau of Reclamation from continuing historic off-season storage in the Inland Lakes in Nebraska.

Wyoming counterclaims that Nebraska is circumventing the Decree by demanding natural flows for diversion by irrigation canals at and above the Tri-State Dam in excess of the irrigation requirements of lands entitled to water under the Decree, and by demanding both natural flow and storage water from sources above Tri-State Dam and diverting those waters to uses below the Tri-State Dam that are not recognized by the Decree.

On April 20, 1993, Justice O'Connor delivered the opinion of the Court with respect to the Special Master's recommended dispositions of several summary judgment motions, together with exceptions filed to the Special Master's reports (U.S. Supreme Court, 1993). Paragraph IV of the Court's opinion states:

> " For the foregoing reasons, all of the exceptions filed to the Special Master's reports are overruled. The summary judgment motions of Nebraska and the United States regarding the Inland Lakes' priority date are granted, as is Nebraska's partial summary judgment motion with respect to the issue of canal diversion limitations. All other summary judgment motions are denied."

Even with the Court's ruling on these summary judgement motions, the litigation continues as other unresolved issues remain.

1.3.6 The Operation and Accounting of the North Platte River

The modified North Platte Decree forms the basis for the operation and accounting procedures used on the North Platte River. Each year Reclamation, State of Wyoming, and State of Nebraska meet to agree on the accounting procedures for the natural flow and ownership storage accounting for the upcoming irrigation season. The criteria for administration and operation are to conform with Wyoming and Nebraska State Laws, the U.S. Reclamation Law, and the modified U.S. Supreme Court North Platte Decree, as appropriate. Items agreed upon include order of priority of the ownership accounts, accrual capacity of the storage accounts, the methodology for calculating storage ownership evaporation, and how the excess to ownership account will be handled. The natural flow accounting methodology is also agreed upon at this meeting. A copy of the 1994 agreement between Reclamation, the State of Wyoming, and the State of Nebraska, known as the "North Platte River Ownership and Natural Flow Accounting Procedures (SONFAP)", is included as Appendix B as an example.

The actual implementation of the procedures requires a coordinated effort among several agencies. This section briefly discusses the individual agencies that have direct involvement in the operation of the North Platte River. The agencies involved in the operation of the North Platte River System include the United States Bureau of Reclamation, State of Wyoming, State of Nebraska, and U.S. Army Corps of Engineers.

The reservoir system operation is planned and determined by the U.S. Bureau of Reclamation's Wyoming Area Office (WYAO) in Mills, Wyoming, which has physical control over the reservoirs on the North Platte River within the State of Wyoming. The WYAO performs an accounting of water usage on a daily basis. The daily accounting of water usage requires exchange of information with the states of Wyoming and Nebraska. This shared information consists of streamflow and diversion measurements. Both states also perform an accounting of their own. This accounting is performed by the State Engineer's Office (SEO) for Wyoming and the Department of Water Resources (DWR) for Nebraska. Various combinations of the Wyoming SEO, the Nebraska DWR, the U.S. Geological Survey (USGS), and the Bureau of Reclamation work cooperatively in operating and maintaining many of the river gages located on the North Platte River system.

The Western Area Power Administration's (Western) Loveland Area office, located in Loveland, Colorado, is responsible for the marketing and transmission of the power generated at Pick-Sloan Missouri Basin Program-Western Division hydroelectric facilities located in Colorado, and Wyoming including the facilities on the North Platte River. This power is marketed to wholesale customers, including municipal associations and generation and transmission associations which in turn, serve more than 140 rural electric associations and municipalities in eastern Colorado, Wyoming, western Nebraska, and most of Kansas. Revenue from the sale of this power goes to the United States Treasury to pay for operations and maintenance expenses, generation, transmission, multi-purpose dam facilities, investment with interest, and a portion of the irrigation facilities associated with the projects. The operation of Reclamation's powerplants on the North Platte River is coordinated with Western to generate power from water released in Reclamation's river operations, reservoir regulation, and to meet irrigation demands.

The U.S. Army Corps of Engineers is involved in the operation of Glendo Water when water enters the Glendo Reservoir exclusive flood pool. Reclamation advises the Corps of Engineers when flooding occurs due to storms that are in progress or when the reservoir's water surface has reached elevation 4,635 feet. The Corps of Engineers determines releases once the water surface reaches this elevation except for those releases needed for downstream irrigation demands or to protect the safety of the structure. If the reservoir elevation should exceed elevation 4,653 feet, the Corps of Engineers relinquishes its authority back to Reclamation. Releases would then be made by Reclamation to protect the structure until the water level drops below the surcharge pool (U.S. Department of Interior, 1987).

This discussion, while very general, gives the reader an idea of the interagency contact required to run the system. Further questions relating to the function of these individual agencies should be directed to them.

2.0 OPERATING CRITERIA

2.1 Introduction

The North Platte River operation and accounting practices are complex and include many interrelated features. For this reason, the North Platte River operations and accounting practices were broken down into logical individualized units. Each unit represents an individual operation or accounting practice that could be modeled separately from any of the other operation or accounting processes.

The model operates the North Platte River System as four separate units: the physical reservoir operations, the natural flow/storage flow segregation, storage ownership accounting, and the river below Guernsey Reservoir. The physical evaporation from the reservoirs, power generation, end-of-month reservoir contents, reservoir releases, and segregation of reservoir releases are calculated during the physical reservoir operations (Section 2.4). Irrigation demands are separated into components satisfied from natural flow, storage, and excess-to-ownership in the natural flow and storage flow accounting (Section 2.6). Ownership evaporation, deliveries from ownership, end-of-month ownership storage, and balancing the system are done during the storage ownership accounting section of the model (Section 2.7). The return flow calculations and distribution of flows below Tri-

State Diversion Dam are performed in the river below Guernsey Reservoir Section (Section 2.9). Each of the four major sections is linked to the others so that no section may operate alone; however, each section models and operates a separate aspect of the North Platte River System.

The model uses a monthly time step and determines system operation on a monthly basis. All calculations performed by the model are in thousands of acre-feet per month (kaf). Therefore, values input in cubic feet per second (cfs) are converted to kaf for use in the model. Values reported by the model are in kaf to one decimal.

Input data for the NPRWUM are divided into three categories; physical reservoir operations, natural flow, and ownership storage. Each category is further separated into three types of data; single, monthly, and month by water year.

Single data items are constants (i.e. maximum reservoir contents) or flags that direct the operation of the model (i.e. to allow excess-to-ownership storage). The single physical reservoir operations data are cdata items, the single natural flow data are cdata1 items, and the single ownership storage data are cdata2 items. Single items are read from the input data file in a one dimensional array and items are distinguished by a number following the item label (i.e. the first item in the physical operations data file would be cdata(1), the second cdata(2), etc ...).

Monthly data items change each month but are constant from year to year (i.e. Alcova Reservoir targets). The monthly physical reservoir operations data are adata items, the monthly natural flow data are adata1 items, and the monthly ownership storage data are adata2 items. Monthly items are read from the input data file in a two dimensional array and items are distinguished by two numbers following the item label. The first number is the order in which the item appears in the data set and the second number, denoted by the letter J, is the month of the water year (i.e. the first item in the physical operations data file would be adata(1,J), the second adata(2,J), etc ...).

Month by water year data items are different for every month of every water year (i.e. monthly diversion amounts). The month by water year physical reservoir operations data are hdata items, the month by water year natural flow data are hdata1 items, and the month by water year ownership storage data are hdata2 items. Month by water year items are read from the input data file in a three dimensional array and items are distinguished by three numbers following the item label. The first number is the order in which the item appears in the data set, the second number, denoted by the letter I, is the water year, and the third number, denoted by the letter J, is the month of the water year (i.e. the first item in the physical operations data file would be hdata(1,I,J), the second hdata(2,I,J), etc ...).

2.2 Operational Criteria

The NPRWUM was developed to simulate 1993 levels of operation on the North Platte River. This includes the operation of seven dams and reservoirs (Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo, and Guernsey); power generation at six generation units (Seminoe, Kortes, Fremont Canyon, Alcova, Glendo, and Guernsey); water rights and storage for the Inland Lakes; gaged inflows from the Medicine Bow River, North Platte River above Seminoe Reservoir, Sweetwater River, Deer Creek, Laramie River, and Blue Creek; reach gains defined by reservoir placement (Kortes-Pathfinder, Alcova-Glendo, Glendo-Guernsey, Guernsey-Whalen, Whalen-Tri-State, and Tri-State-Lewellen); and return flows determined from diversion amounts. In addition to current levels of operation, procedures were included that allow greater flexibility and analysis when modeling and comparing scenarios.

The model incorporates operational criteria that reflect the current (1993) operation of the river. These criteria do not exactly simulate the historic operation since no operating criteria exist to accurately describe the system over an extended period. These criteria illustrate how the system would function given present operations and management practices employed on the river.

2.3 Physical Reservoir and Storage Ownership Evaporation

Physical reservoir evaporation is modeled for Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo, and Guernsey reservoirs. Physical evaporation is also modeled for the Inland Lakes. The Inland Lakes (Lake Alice, Little Lake Alice, Lake Winters Creek, and Lake Minatare) are modeled as one consolidated lake by the

NPRWUM. The consolidated Lake is referred to as the Idealized Inland Lake in the NPRWUM Documentation. The Idealized Inland Lake was created to provide a simplified accounting procedure for water delivered to/from the Inland Lakes. The operation of the Idealized Inland Lake is discussed in detail in Section 2.9.5 of this document.

Physical evaporation is modeled with average evaporation factors (adata(13,J) - adata(16,J)) and the current area-capacity relationship for each reservoir. The average evaporation factors are calculated from historic evaporation factors. The average evaporation factors used in the NPRWUM are shown in Table 2.3.1.

Table 2.3.1 Average Evaporation Factors Used in the NPRWUM

Evaporation Station	Evaporation Factor											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Seminoe	0.29	0.15	0.10	0.09	0.09	0.17	0.30	0.38	0.52	0.61	0.55	0.39
Pathfinder	0.29	0.15	0.10	0.09	0.09	0.17	0.30	0.42	0.55	0.65	0.60	0.44
Glendo	0.24	0.12	0.11	0.12	0.11	0.19	0.31	0.45	0.56	0.67	0.62	0.44
Whalen	0.24	0.12	0.11	0.12	0.11	0.19	0.31	0.44	0.53	0.61	0.54	0.37

Storage ownership evaporation is also modeled using area-capacity relationships for individual reservoirs and average evaporation factors. Evaporation is modeled for North Platte Pathfinder, North Platte Guernsey, Kendrick Seminoe, Kendrick Alcova, Glendo Unit and Inland Lakes ownership accounts. Inland Lakes ownership evaporation is calculated for Inland Lakes ownership held in Glendo and Guernsey reservoirs on the main stem of the North Platte River.

2.3.1 Data

The data used in the reservoir evaporation subroutines is from the Reclamation's Wyoming Area Office in Mills, Wyoming. The data were obtained from Reclamation's HYDROMET database.

Reclamation is also the source of the area-capacity data used in this study. These area-capacity tables are those used by Reclamation to calculate reservoir content and evaporation as of 1993. Appendix A contains the published area-capacity tables and equations used by the model.

2.3.2 Physical Reservoir Evaporation

In the physical reservoir operation, evaporation factors are used to determine reservoir evaporation. Evaporation factors are determined by multiplying the pan evaporation times a reduction factor (0.7). Pan evaporation is the measured change in elevation in the pan minus precipitation. The pan evaporation is divided by 12 to convert from inches to feet of evaporation. The reduction factor is a correction for the additional evaporation that occurs in a small pan compared to a large body of water like a reservoir.

Table 2.3.2 shows which evaporation station the NPRWUM uses to calculate evaporation at each storage facility. The North Platte Decree states that the Pathfinder pan will be used to calculate the evaporation from Seminoe, Kortes, Pathfinder, Alcova, and Gray Reef reservoirs, and the Whalen pan will be used to calculate the evaporation from Glendo and Guernsey reservoirs. To increase the accuracy of evaporation calculated at Seminoe, Kortes, and Glendo Reservoirs, evaporation pans were installed at Seminoe and Glendo. During the summer, evaporation is calculated using these pans at these reservoirs.

Factors from the Whalen pan are used to calculate the physical evaporation for the Idealized Inland Lake. Although an evaporation pan exists at Lake Minatare, the period of record for the Lake Minatare pan is from water year 1991 to current. Such a short period of record is insufficient for the purpose of the NPRWUM.

The content used to calculate reservoir evaporation is the average of the previous month's and the current month's end-of-month storage. The average end-of-month content is used in the area-capacity relationships developed by Reclamation to determine the average water surface area for the month. The average water surface area is multiplied by the monthly evaporation factor for the assigned reservoir to obtain the evaporation for the month. After the evaporation is calculated, the end-of-month content for the current month is recalculated and evaporation is redetermined using the recalculated end-of-month content. This process is repeated until the evaporation remains constant between successive iterations.

The second degree polynomial equations which define the reservoir area-capacity curves are presented in Appendix A. The equations show that the independent variable in each equation is water surface elevation and the dependent variable is capacity. To use these equations in the model, the independent variable must be capacity and the dependent variable must be water surface elevation. Therefore, the second degree polynomial was solved for the independent variable (water surface elevation). The resulting quadratic equation, shown in Figure 2.3.1, was incorporated into the model. Once the water surface elevation is known, the water surface area can be calculated directly using the equations shown in Appendix A. Reservoir evaporation is determined by multiplying the average end-of-month water surface area by the average evaporation factor (pan evaporation times 0.7).

Table 2.3.2 Evaporation Pan Used to Calculate Evaporation

Storage Facility	Evaporation Pan Used to Calculate Evaporation	
	May - September	October - April
Seminoe Reservoir	Seminoe Pan	Pathfinder Pan
Kortes Reservoir	Seminoe Pan	Pathfinder Pan
Pathfinder Reservoir	Pathfinder Pan	Pathfinder Pan
Alcova Reservoir	Pathfinder Pan	Pathfinder Pan
Gray Reef Reservoir	Pathfinder Pan	Pathfinder Pan
Glendo Reservoir	Glendo Pan	Whalen Pan
Guernsey Reservoir	Whalen Pan	Whalen Pan
Idealized Inland Lake (not stored in the main stem)	Whalen Pan	Whalen Pan

Reclamation's Equation (see Appendix A)

$$\text{Capacity} = A_1 + (A_2 \times \text{Elevation}) + (A_3 \times \text{Elevation}^2)$$

where:

Elevation	=	water surface relative elevation (feet)
Capacity	=	capacity in acre-feet
A_1	=	constant coefficient
A_2	=	constant coefficient
A_3	=	constant coefficient

Quadratic Equation Used in Evaporation Routines.

$$\text{Elevation} = \frac{-A_2 + (A_2^2 - 4 \times A_3 \times (A_1 - \text{Capacity}))^{1/2}}{2 \times A_3}$$

Note: Only the positive root of the solution is used to determine the average water surface area.

Figure 2.3.1 Reclamation's Capacity Equation for Water Surface Elevation

2.3.2.1 Annual Guernsey Silt Run

The annual silt run at Guernsey has a significant effect on the calculation of the Guernsey Reservoir evaporation for July. The purpose of the silt run is to flush silt from Guernsey Reservoir into the irrigation supply canals downstream of Guernsey Reservoir. Much of the silt is deposited in the canals where it acts to reduce seepage losses. The current Guernsey Reservoir operating procedure is that on or about July 15 (any time after July 10) the Guernsey Reservoir content is lowered in order to initiate the silt run on July 20. Glendo Reservoir releases during this period are limited to a turbine capacity of one unit. During the silt run, typically July 20 through August 4, releases from Glendo Reservoir are made to meet the irrigation demands downstream of Guernsey Reservoir. The current operating procedures reflect an idealized operation and the actual procedure varies from year to year. Historically, the silt run has occurred near the end of July. However, there have been occasions when the silt run occurred in August or in early July and a second run in August or no silt run was initiated during the water year.

Therefore, the July average end-of-month content for Guernsey Reservoir is not calculated the same as the average end-of-month content for the other reservoirs. In order to adequately determine Guernsey Reservoir evaporation in July, the average end-of-month content is determined by summing the previous end-of-month content and the current end-of-month content and dividing by four (4). This modification increases the accuracy of the reservoir evaporation calculation significantly although some error can still be expected.

2.3.3 Storage Ownership Evaporation

The storage ownership routines utilize the same area-capacity tables and quadratic equations (Figure 2.3.1) and evaporation factors (Table 2.3.1) developed for the reservoir evaporation routines.

The NPRWUM allows all ownerships except Glendo to reaccrue ownership evaporation until the ownership is filled. After an ownership has filled, ownership evaporation is removed from the ownership. Evaporation from the Glendo ownership is removed from the Glendo Evaporation Pool. If the Glendo Evaporation Pool is depleted in a water year, the remaining Glendo ownership evaporation is taken from the Glendo Irrigation Pool. The NPRWUM allows a total accrual of 20,090 af (less carry over from the previous water year) to accrue to the Glendo Evaporation Pool in any one water year. Once the accrual for the Glendo Evaporation Pool is satisfied, the gains are available for accrual to other ownerships in priority.

2.3.3.1 Kendrick Seminoe Ownership Evaporation

The Kendrick Seminoe ownership evaporation is calculated by assuming that all the Kendrick Seminoe ownership resides in Seminoe Reservoir. The Seminoe evaporation factors are used in conjunction with the area determined from the Seminoe Reservoir area-capacity curves for a capacity equal to the average end-of-month Kendrick Seminoe ownership.

2.3.3.2 Kendrick Alcova Ownership Evaporation

The Kendrick Alcova ownership evaporation is calculated by assuming that all the Kendrick Alcova ownership resides in Alcova Reservoir. The Pathfinder evaporation factors are used in conjunction with the area determined from the Alcova Reservoir area-capacity curves for a capacity equal to the average end-of-month Kendrick Alcova ownership.

2.3.3.3 North Platte Pathfinder Ownership Evaporation

For the purpose of calculating ownership evaporation, North Platte Pathfinder ownership is assumed to reside in either Pathfinder or Guernsey reservoirs. The model sums the storage in Seminoe, Kortes, Pathfinder, and Alcova reservoirs and subtracts Kendrick and Glendo (stored in Pathfinder Reservoir) ownerships to obtain the potential North Platte Pathfinder ownership above Alcova Dam. If the potential North Platte Pathfinder ownership above Alcova is positive it is subtracted from the total North Platte Pathfinder ownership to obtain the North Platte Pathfinder ownership stored below Alcova Dam.

The model assumes the North Platte Guernsey ownership is stored in Guernsey Reservoir. The North Platte Guernsey ownership plus the Inland Lakes ownership stored in Guernsey Reservoir is subtracted from the Guernsey Reservoir storage to obtain the maximum North Platte Pathfinder ownership that can reside in Guernsey Reservoir. This value is compared to the North Platte Pathfinder ownership stored below Alcova and the lesser of the two is the North Platte Pathfinder ownership assumed to reside in Guernsey Reservoir for the purpose of calculating North Platte Pathfinder ownership evaporation.

Evaporation of the North Platte Pathfinder ownership stored in Guernsey Reservoir is the ratio of the North Platte Pathfinder ownership stored in Guernsey Reservoir to the Guernsey Reservoir storage. The ratio is multiplied by the evaporation from Guernsey Reservoir calculated in the physical operation of the system OPRES (see Figure 2.3.2). The value obtained is the evaporation of North Platte Pathfinder ownership stored in Guernsey Reservoir.

The remaining North Platte Pathfinder ownership is assumed to reside in Pathfinder Reservoir for the calculation of ownership evaporation. The Pathfinder evaporation factors are used in conjunction with the area determined from the Pathfinder Reservoir area-capacity curves to determine the evaporation from the North Platte Pathfinder ownership stored in Pathfinder Reservoir. The evaporation calculated for the North Platte Pathfinder ownership in Guernsey Reservoir and the evaporation calculated for the North Platte Pathfinder ownership in Pathfinder Reservoir are summed to get the total North Platte Pathfinder ownership evaporation.

  Physical storage above Alcova Dam
    (Seminoe, Kortes, Pathfinder and Alcova Reservoirs)
- Ownerships stored above Alcova Dam
    (Glendo and Kendrick Ownerships)

= Potential North Platte Pathfinder ownership stored above Alcova Dam

  North Platte Pathfinder ownership
- Potential North Platte Pathfinder ownership stored above Alcova Dam

---

= North Platte Pathfinder ownership below Alcova (if positive)

  Physical Guernsey Storage
- North Platte Guernsey ownership
- Inland Lakes ownership in Guernsey Reservoir

= North Platte Pathfinder (Guernsey) ownership space

  Minimum: North Platte Pathfinder ownership below Alcova; and
  North Platte Pathfinder (Guernsey) ownership space

= North Platte Pathfinder ownership in Guernsey Reservoir

  (North Platte Pathfinder ownership in Guernsey Reservoir
/ Physical Guernsey Storage)
* Physical Guernsey Evaporation

= North Platte Pathfinder ownership in Guernsey Reservoir evaporation

Figure 2.3.2 Calculation of North Platte Pathfinder Ownership in Guernsey Reservoir Evaporation

2.3.3.4 North Platte Guernsey Ownership Evaporation

The North Platte Guernsey ownership evaporation is calculated by assuming that all the North Platte Guernsey ownership resides in Guernsey Reservoir. The Whalen Dam evaporation factors are used in conjunction with the area determined from the Guernsey Reservoir area-capacity curves for a capacity equal to the average end-of-month North Platte Guernsey ownership.

2.3.3.5 Inland Lakes Ownership Evaporation

Evaporation on Inland Lakes ownership in the main stem is calculated as the ratio of the Inland Lakes ownership to the total storage in Glendo and Guernsey Reservoir. These ratios are then multiplied by the physical evaporation of Glendo and Guernsey Reservoir (see Figure 2.3.3). Therefore, the Inland Lakes ownership evaporation is a portion of the Glendo and Guernsey Reservoir evaporation. The portion is determined by the amount of Glendo and Guernsey Reservoir storage occupied by Inland Lakes ownership.

	(Inland Lakes Ownership in Glendo Reservoir
/	Physical Glendo Reservoir Storage)
*	Physical Glendo Reservoir Evaporation
=	Inland Lakes Ownership in Glendo Evaporation
	(Inland Lakes Ownership in Guernsey Reservoir
/	Physical Guernsey Reservoir Storage)
*	Physical Guernsey Reservoir Evaporation
=	Inland Lakes Ownership in Guernsey Evaporation
	Inland Lakes Ownership in Glendo Evaporation
+	Inland Lakes Ownership in Guernsey Evaporation
=	Total Inland Lakes Ownership Evaporation in the Main Stem

Figure 2.3.3 Calculation of Inland Lakes Ownership Evaporation in the Main Stem

2.3.3.6 Glendo Unit Ownership Evaporation

The ownership evaporation has to equal the physical evaporation calculated in the reservoir operations section of the NPRWUM. Therefore, the Glendo Unit ownership is used as a slop account to balance physical and ownership evaporation. The Glendo Unit ownership evaporation is calculated by subtracting Kendrick, North Platte Pathfinder, North Platte Guernsey, and Inland Lakes ownership evaporations from the total physical reservoir evaporation. All ownership evaporations are calculated as discussed above. The total reservoir evaporation is the sum of the physical evaporation from Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo, and Guernsey reservoirs as calculated during the physical operation of the model.

2.4 Physical Operation of the North Platte River Reservoirs

This section discusses the criteria utilized by the NPRWUM to control the physical reservoir system of the North Platte River. Operational criteria are included for:

- Guernsey;
- Glendo;
- Gray Reef;
- Alcova;

- Pathfinder;
- Kortes; and
- Seminoe Reservoirs.

The criteria that have been developed include; how to move water between reservoirs, target contents for controlled reservoirs, reservoir evaporation, and how/when to release water. The natural flow and storage ownership accounting procedures are detailed later in Sections 2.6 and 2.7.

Figure 2.4.1 is a schematic that depicts the water movement rules used by the NPRWUM to model the North Platte River system. These rules will be discussed in detail in this section.

2.4.1 Check Canal Capacities

No channel capacity restrictions currently exist that limit Reclamation's ability to make reservoir releases. When the system is full and a spill is possible, water is moved out of the system in an effort to minimize flooding along the river as much as possible. In normal operations, it is preferable that the flow through Casper does not exceed 5000 cfs (flows above 5000 cfs cause concerns from people who reside along the river). Therefore, the NPRWUM uses a value of 5000 cfs to indicate high flow conditions through Casper. If the flow through Casper exceeds 5000 cfs, the model user will be notified by the program that the flow through Casper was greater than 5000 cfs by writing a message to the MESSAGE.LST message file produced by the model. The NPRWUM does not make any attempt to reduce the flow.

Capacities are checked by the NPRWUM for the major ditches and canals served by the Reservoirs of the upper North Platte System. Table 2.4.1 shows the capacities for the canals checked by the model. If the delivery to a canal or ditch is greater than its capacity, the delivery is reduced to the capacity of the canal or ditch. Canal and ditch capacities are checked and any adjustment made before the system demand is determined as described in the Section 2.4.2.

2.4.2 System Demand below Guernsey Reservoir

The model operates the physical system by storing inflows in vacant storage space and releasing water for demands. The model determines the total demand below Guernsey Reservoir for the given month and computes the required Guernsey Reservoir outflow needed to satisfy this demand. During the non-irrigation season (October through April), the demands below Guernsey Reservoir are releases to the Idealized Inland Lakes and storage deliveries to Central Nebraska Public Power and Irrigation District (CNPPID). During the irrigation season (May through September), the demands below Guernsey Reservoir are the requested North Platte Project and Glendo Unit diversions (including orders for storage water deliveries past Tri-State). All diversion data are entered by the model operator in the input data set.

Once the Guernsey Reservoir outflow has been established, the model operates the reservoirs on the North Platte River. The model begins with Guernsey Reservoir and continues in an upstream order to Seminoe Reservoir until all inflows, outflows, and end-of-month contents are determined for each reservoir. The model establishes the operation of each reservoir based on demands, inflows, and operational criteria. When a reservoir spills water, the spill is passed to the next downstream reservoir. If the vacant space in the next downstream reservoir is unable to hold the water spilled from the above reservoir, the spill is reduced by the vacant space in the downstream reservoir and passed downstream until the spill is either captured in subsequent downstream reservoirs or released from Guernsey Reservoir as a spill. Water spilled from Guernsey Reservoir is in addition to that required to meet demands. Table 2.4.4. lists the maximum and minimum reservoir contents used by the model. Table 2.4.5 and Table 2.4.6 list the minimum reach flows and maximum reservoir outflows used by the NPRWUM.

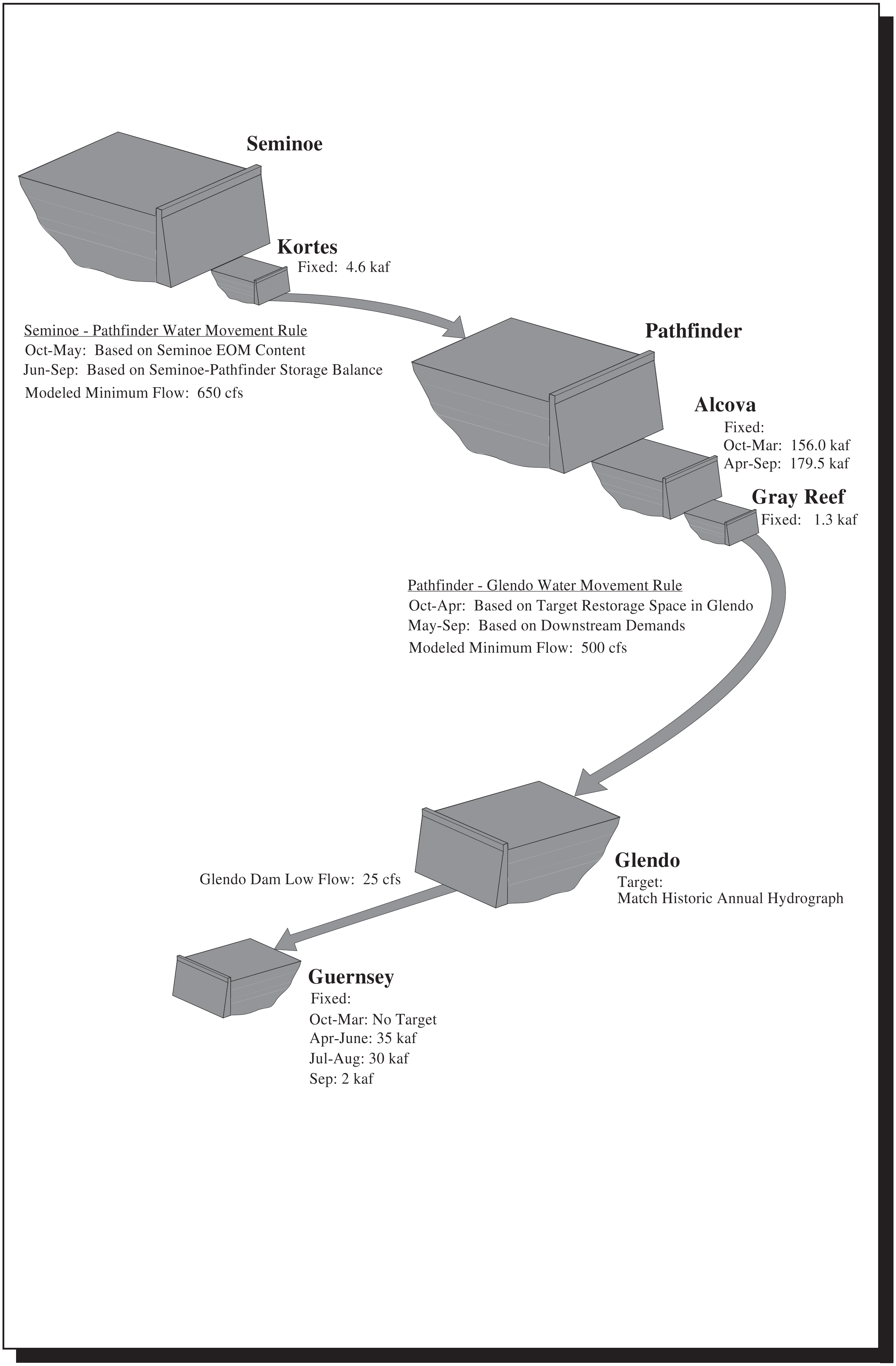

Figure 2.4.4 Water Movement Rules for Reservoirs on the North Platte

Table 2.4.3 Canal Capacities

Canal/Ditch	Capacity (cfs)
Tri-State Canal	1,475.0
Grattan Ditch	24.0
North Platte Ditch	75.0
Rock Ranch Ditch	70.0
Pratt-Ferris Ditch	22.0
Burbank Ditch	5.0
Torrington Ditch	54.0
Lucerne Ditch	74.0
Narrows Ditch	3.3
Mitchell-Gering Canal	370.0
Interstate Canal	2,100.0
Fort Laramie Canal	1,550.0
Casper Canal	600.0

Because gains occurring in the river between Guernsey Reservoir and Tri-State Dam cannot be captured or controlled, these gains cannot be assumed to be 100% usable to meet demands. As a Result, the NPRWUM allows the model operator to choose what percent of the gains in the river between Guernsey Reservoir and Tri-State Diversion Dam are used to satisfy demands during the irrigation season in the Guernsey to Whalen and Whalen to Tri-State Reaches. Therefore, a portion of the demands between Guernsey Reservoir and Tri-State Dam are satisfied with a percentages of the Guernsey to Whalen and Whalen to Tri-State Gains. These gain utilization factors are set by the model operator in the reservoir operations data file (adata(1,J) and adata(2,J)). The remaining unsatisfied demands are used to determine the required outflow from Guernsey Reservoir. The factors used in the NPRWUM were determined in the calibration process. These factors are only applied to the gains in reaches No. 1 (Table 2.4.2) and No. 2 (Table 2.4.3) in the irrigation season (May - September).

Table 2.4.4 Gain Utilization Factors - Reach No. 1

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.95	0.95	0.95	0.95	0.95

Table 2.4.5 Gain Utilization Factors - Reach No. 2

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.90	0.90	0.90	0.90	0.90

2.4.3 Bank Storage-Seepage Functions

Bank Storage and Seepage have been modeled for Seminoe, Pathfinder, Glendo, and Guernsey Reservoirs and the Idealized Inland Lakes. Bank Storage is the percent of an increase in reservoir storage that

Table 2.4.6 Maximum and Minimum Reservoir Contents in Thousands of Acre-Feet (kaf)

Reservoir	Maximum	Minimum
Seminoe	1017.27	0.551
Kortes	4.74	3.20
Pathfinder	1016.51	0.007
Alcova	184.41	*136.50
Gray Reef	1.80	0.06
Glendo	**789.41	*** 63.14
Guernsey	45.61	0.00

* Minimum for NPRWUM purposes physical minimum = 0.091 kaf
** Includes 517.49 kaf conservation pool and 271.92 kaf flood pool
*** Minimum pool for power

filters into the soils surrounding a reservoir. This water is stored in the bank of the reservoir to be released with a decrease in reservoir storage. Water stored in bank storage is released at the same rate it was stored. Seepage is water that filters into the soil surrounding a reservoir that does not return to the reservoir. In the NPRWUM, the rates of bank storage for each reservoir are constants set in cdata(22-31) and the seepage values for each reservoir are allowed to vary for each month (hdata(7-11,I,J)). Modeling reservoirs in this manner allows the reservoir gain/loss to fluctuate with any changes in reservoir content calculated by the model.

Table 2.4.7 Target Minimum Reach Flow Used in the NPRWUM

Reach	Target Minimum Flow		Input Item
	Required	Used	
Kortes - Pathfinder	500 cfs	650 cfs	cdata(32)
Pathfinder - Alcova	0 cfs	0 cfs	adata(9)
Alcova - Glendo	330 cfs	500 cfs	cdata(39)
Glendo - Guernsey	25 cfs	25 cfs	adata(10)

Table 2.4.8 Maximum Reservoir Outflows Used in the NPRWUM (cfs)

Reservoir	Power Plant Capacity	Outlet Capacity	Spillway Capacity
Seminoe	4,200	----	48,500
Kortes	3,000	----	60,000
Pathfinder	2,320	3,000	65,000
Alcova	4,000	----	55,000
Gray Reef	----	20,000	----
Glendo	3,400	6,600	10,335
Guernsey	1,340	----	50,000*

---- Indicates that the Dam has no such structure
* Capacity of north spillway

2.4.4 Guernsey Reservoir Operation

The NPRWUM operates Guernsey as a semi-fixed reservoir that attempts to meet target end-of-month contents in April through September. The target contents are shown in Table 2.4.7.

Table 2.4.9 Target for Minimum Contents in Guernsey Reservoir (kaf)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NT	NT	NT	NT	NT	NT	35.0	35.0	35.0	30.0	30.0	2.0

NT = No Target

No Guernsey Reservoir target is set for October through March. During this period, water will be released from Glendo Reservoir (in excess of the Glendo low flow release) to increase Guernsey storage for release to the Idealized Inland Lakes in October and April and for storage releases to CNPPID. Therefore, the Glendo to Guernsey reach gain, the Guernsey bank storage-seepage, and the Glendo low flow release are the only flow filling Guernsey Reservoir during October through March. The target contents listed in Table 2.4.7 are minimum targets (water will be released from Glendo Reservoir to keep Guernsey Reservoir content at or above the target). The model also does not allow Guernsey Reservoir to go below its specified minimum content (cdata(26); 0.0 kaf) or over its maximum content (cdata(18); 45.6 kaf) at any time.

The vacant storage in Guernsey Reservoir is kept at a maximum in October through March to prevent Glendo low flow releases or high gains in the Glendo to Guernsey reach from causing Guernsey Reservoir to spill. If the Guernsey Reservoir inflow is greater than the required outflow and Guernsey Reservoir is at maximum storage, then water is spilled from Guernsey Reservoir. Water that is spilled from Guernsey Reservoir is in addition to the amount of water needed to meet the demands and eventually passes Tri-State Dam. No conveyance losses are specifically assessed to water that is spilled from Guernsey Reservoir other than losses inherently contained in the historic gain/loss. In May through September, the required Guernsey Reservoir inflow (unsatisfied irrigation demands and water to meet the Guernsey target) is used to establish the required Glendo Reservoir outflow.

2.4.5 Glendo Reservoir Operation

Glendo targets are calculated by the NPRWUM using guidelines set by the model operator in the reservoir operations input file. The model operator determines the accuracy which the model must achieve when attempting to meet the Glendo target calculated by the model. The accuracy is set using cdata(56) (percent of the Glendo target to achieve) in the reservoir operations input file. For example, if cdata(56) is set to 0.95, the model will be satisfied if the Glendo end-of-month content is 95% or more of the Glendo target calculated by the model. The model attempts to peak Glendo storage at 517 kaf (cdata(57)) by the end of May (cdata(54)). In addition, the model attempts to reach a storage of 80 kaf (cdata(58)) in Glendo by the end of September (cdata(55)). Beginning in March (cdata(53)), the model calculates monthly targets to reach these goals smoothly without abrupt changes in reservoir content. When the model calculates the flow needed to meet the Glendo target for the next month, it includes the probable Gray Reef to Glendo Gain (adata(8,J)). Glendo Reservoir must also operate between the specified minimum and maximum content (conservation capacity).

The inflow to Glendo Reservoir is the sum of the Alcova to Glendo gains, the Glendo Reservoir bank storage-seepage, and releases from Gray Reef Reservoir. During the irrigation season, releases from Gray Reef Reservoir include: the irrigation demands unsatisfied with flow from either Glendo or Guernsey Reservoirs; any flow needed to keep Glendo and Guernsey reservoirs at their desired targets; and any flow needed to maintain the minimum flow past Casper (cdata(39)). During the non-irrigation season, the Gray Reef outflow set by the model (Section 2.4.5.2) is the release from Gray Reef Reservoir. Releases from Glendo include: the Glendo low flow release, seepage below Glendo Reservoir, and deliveries to the Idealized Inland Lakes and storage deliveries CNPPID during the non-irrigation season; and deliveries to satisfy downstream demand (flow requested by Guernsey Reservoir to maintain the Guernsey Reservoir target content and to meet any downstream demands unsatisfied from Guernsey Reservoir) during the irrigation season. The Glendo low flow release (adata(10,J)) and the seepage below Glendo Dam (adata(3,J)) are specified by the model operator in the reservoir operations input data file.

2.4.5.1 Glendo Flood Pool

The Standing Operating Procedures (SOP) for the Glendo Reservoir limit the combined discharge capacity of the powerplant and outlet works to 10,000 cfs under Glendo flood control operations. In the NPRWUM, the limit for the combined discharge capacity can be change by the model user by adjusting the value in cdata(50). Therefore, the criterion for use of the flood pool is to maintain flood releases at the value set in cdata(50) or less below Glendo Reservoir. To improve the operation of Glendo Reservoir flood pool, the combined discharge capacity was reduced to 7,000 cfs (3,400 cfs through the powerplant and the remainder through the outlet works). If Glendo's inflow plus the current content is greater than the conservation capacity and discharge capacity is not exceeded, the excess water is released to Guernsey Reservoir and Guernsey Reservoir is reoperated. If Glendo's inflow is greater than its discharge capacity and the conservation capacity is exceeded, the flood pool will hold the additional water until it can be released in the following months. Appendix D contains a detailed description of the Glendo outlet works restrictions.

2.4.5.2 Gray Reef Outflow for the Non-Irrigation Season

To track the movement of Pathfinder and Glendo (stored in Pathfinder Reservoir) ownerships from Pathfinder Reservoir to Glendo Reservoir during the non-irrigation season (October through April), two options are available to the model operator. In the first method (Method A), the model operator sets a Glendo restorage space target (up to 334.24 kaf maximum). This target is the amount of water (stored above Gray Reef Dam) in addition to the Glendo ownership stored above Alcova the user wants moved to Glendo Reservoir during the non-irrigation season (provided sufficient North Platte Pathfinder and Glendo ownership is available above Alcova). The water is used to generate power at the Seminoe, Kortes, Fremont Canyon, and Alcova power generation units and is restored in Glendo Reservoir (provided the space is available in Glendo Reservoir). The restored water is released to satisfy irrigation demands during irrigation season. By setting the target to a value less than the maximum (334.24 kaf) storage space will remain in Glendo Reservoir when the irrigation season begins. This storage space can be used to store high gains that often occur below Gray Reef Dam early in the irrigation season (provided a right is in priority to store the water or the decision is made to allow excess storage in the system).

The NPRWUM compares the physical storage available in Glendo Reservoir, the North Platte Pathfinder (North Platte Pathfinder Storage plus the minimum expected winter inflow above Alcova; (Figure 2.4.2)) and Glendo (stored in Pathfinder Reservoir) ownership available above Gray Reef Dam on October first (Figure 2.4.3), and the Glendo restorage space target. Of these three values, the lowest or minimum value is selected (Figure 2.4.4). The value selected is divided by seven (7) (to achieve the amount that can be released for each of the seven winter months) and compared to the minimum Gray Reef Outflow (cdata(39) converted to kaf; 330 cfs minimum) set in the reservoir operations input file. The highest or maximum value from the second comparison is what is released each month for power production during the winter (Figure 2.4.5).

Minimum Expected Inflow Above Seminoe (October - April)
\+ Minimum Expected Sweetwater River Inflow (October - April)
\+ Minimum Expected Kortes - Pathfinder Gain (October - April)

= Minimum Expected Inflow Above Alcova (October - April)

Figure 2.4.5 Minimum Expected Winter Inflow Above Alcova

North Platte Pathfinder Ownership
\+ Minimum Expected Inflow Above Alcova (October - April)
\+ Glendo Ownership Stored Above Alcova

= Ownership Available for Movement to Glendo

Figure 2.4.6 Method A: Ownership Available for Movement to Glendo Reservoir

Lesser of:
(Vacant Storage In Glendo Reservoir)/7
(Ownership Available for Movement to Glendo)/7
(Glendo Target Restorage Space +
Glendo Ownership Stored Above Alcova)/7

= Winter Water to Move to Glendo

Figure 2.4.7 Method A: Winter Water to Move to Glendo

Greater of:
Winter Water to Move to Glendo
Minimum Gray Reef Outflow (cdata(39))

= Monthly Winter Release from Gray Reef

Figure 2.4.8 Method A: Gray Reef Winter Release for Power Production

The second alternative available in the model (Method B) for the movement of water to Glendo Reservoir during the non-irrigation season is to set the Gray Reef outflow as a function of the total storage above Gray Reef Dam (total storage in Seminoe, Kortes, Pathfinder, Alcova, and Gray Reef on October 1). With this method of calculating Gray Reef outflow, the user designates three values of storage above Gray Reef Dam. In October (month 1 in the model), the model compares the values set by the model operator with the total reservoir storage above Gray Reef Dam to determine the Gray Reef outflow. The first value set by the model operator is the minimum storage above Gray Reef Dam (cdata(41)). The model will release the base Gray Reef outflow (cdata(44)) if the total reservoir storage above Gray Reef Dam is below this value. The second value is the low storage above Gray Reef Dam (cdata(42)). If the total reservoir storage above Gray Reef Dam is between this value and the minimum value, the model will release the low Gray Reef outflow (cdata(45)). The third value is the medium storage above Gray Reef Dam (cdata(43)). If the total reservoir storage above Gray Reef Dam is between the low value and the medium value, the average Gray Reef outflow (cdata(46)) is released. However, if the total reservoir storage above Gray Reef Dam is greater than the medium value, the high Gray Reef outflow (cdata(47)) is released (Figure 2.4.6). This method of calculating the Gray Reef outflow is activated by a flag set by the user in the reservoir operations data input file (cdata(48)).

Total Storage < Minimum Storage
Release: Base Gray Reef Outflow

Minimum Storage < Total Storage < Low Storage
Release: Low Gray Reef Outflow

Low Storage < Total Storage < Median Storage
Release: Average Gray Reef Outflow

Median Storage < Total Storage
Release: High Gray Reef Outflow

Total Storage Above Gray Reef Dam:
Sum on October First: Seminoe, Kortes, Pathfinder,
Alcova, and Gray Reef Reservoir Storage

Figure 2.4.9 Method B: Gray Reef Winter Release for Power Production

After the Gray Reef outflow has been set in Method B (using the total system storage above Gray Reef Dam), the model compares the Gray Reef outflow, the storage space available in Glendo Reservoir, and the Pathfinder and Glendo (ownership above Gray Reef) ownerships plus the minimum expected winter inflow above Alcova (Figure 2.4.2 and Figure 2.4.3). Of these three values, the least or minimum value is chosen (Figure 2.4.7). The chosen value is divided by seven (7) to obtain the amount that can be released for each of the seven winter months.

Lesser of:
(Vacant Storage In Glendo Reservoir)/7
(Ownership Available for Movement to Glendo)/7
(Method B: Calculated Gray Reef Outflow)/7

= Winter Water to Move to Glendo

Figure 2.4.10 Method B: Winter Water to Move to Glendo

For either option, the model rechecks the storage space available in Glendo Reservoir before releasing the Gray Reef outflow in April. If ownership storage for Glendo, Guernsey, and the Inland Lakes in the main stem have filled the Glendo storage space by April, the model will reduce the Gray Reef outflow.

2.4.6 Gray Reef Reservoir Operation

Gray Reef Reservoir is the next upstream reservoir operated by the NPRWUM. No operating criteria exist for Gray Reef except to stay within minimum (100 af) and maximum (1800 af) contents (cdata(24) and (25)). Because storage capacity of Gray Reef Reservoir is so small, any demands placed on its storage are passed directly to Alcova Reservoir. Evaporation is the only direct demand on Gray Reef Reservoir. Gray Reef Reservoir evaporation is replaced with water from Alcova Reservoir in order to maintain the target content of Gray Reef Reservoir (cdata(52)). Hence, the Gray Reef Reservoir required inflow is equal to the Gray Reef Reservoir outflow plus the Gray Reef Reservoir evaporation.

2.4.7 Alcova Reservoir Operation

Alcova Reservoir is operated as a fixed reservoir based on the desired monthly targets shown in Table 2.4.8.

Table 2.4.10 Alcova Monthly Target Contents (kaf)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
156.04	156.04	156.04	156.04	156.04	156.04	179.50	179.50	179.50	179.50	179.50	179.50

In addition to maintaining monthly targets, deliveries to the Kendrick Project (Casper Alcova Irrigation District) are made from Alcova Reservoir. The outflow from Alcova Dam is equal to the requested Gray Reef Reservoir inflow. Because Alcova must meet the targets set in the reservoir operations input file, all demands below Pathfinder Reservoir and above Glendo Reservoir are passed upstream to Pathfinder Reservoir. The Alcova Reservoir inflow is equal to the Alcova Reservoir outflow plus Alcova evaporation plus deliveries to the Casper Canal. If the Alcova Reservoir end-of-month content is less than the target content, the release from Pathfinder Reservoir is increased. Conversely, if the Alcova Reservoir end-of-month content is greater than the target content, the additional water is passed through Gray Reef Reservoir to Glendo Reservoir and Glendo Reservoir is reoperated with the increased inflow (the extra water passed through Gray Reef plus the Alcova to Glendo Gain plus existing releases for downstream demands).

2.4.8 Pathfinder Reservoir Operation

The criteria for operating Pathfinder Reservoir are to maintain the reservoir between the 31,400 af minimum and 1,016,507 af maximum storage capacities (cdata(22) and (13)), provide releases through the Pathfinder Dam outlet works, and provide power production at Fremont Canyon Power Plant. The demand on Pathfinder Reservoir is the requested Alcova inflow (irrigation demands not met by downstream reservoirs, flows to maintain target contents in Alcova Reservoir, and flows to maintain the Gray Reef reservoir content) and Pathfinder Reservoir evaporation. The maximum Pathfinder Reservoir outflow without using the spillway is limited to the capacity of Fremont Canyon power plant (see Table 2.4.6). If Pathfinder Reservoir content is greater than the maximum capacity, the excess water is passed to Alcova Reservoir and Alcova Reservoir is reoperated. If reservoir storage content plus the Sweetwater River and Pathfinder inflows cannot meet outflow demands, the requested release from Kortes Reservoir is increased. The initial Pathfinder inflow is estimated using the criteria described in Section 2.4.10.1.

2.4.9 Kortes Reservoir Operation

The criteria for operating Kortes Reservoir are to maintain storage between the minimum (1500 af) and maximum (4739 af) storage capacities (cdata(21) and cdata(12)) and provide a release of 650 cfs (cdata(32)) between Kortes and Pathfinder reservoirs (Miracle Mile). Kortes Reservoir target content is set at 4.6 kaf (cdata(51)). If Kortes Reservoir storage content is less than the target content, the Kortes inflow is increased by the difference of the target content and the current content. If Kortes Reservoir content is greater than the target content, the additional water is passed to Pathfinder Reservoir and Pathfinder Reservoir is reoperated. Since Kortes storage capacity is small, the model passes flow demands from Pathfinder Reservoir and demands to meet the minimum flow through to Seminoe Reservoir. Evaporation is the only direct demand on Kortes Reservoir. Kortes Reservoir evaporation is replaced with water from Seminoe Reservoir.

2.4.10 Seminoe Reservoir Operation

Seminoe Reservoir is operated under the criteria of maintaining storage between the minimum (31,100 af) and maximum (1,017,300 af) storage capacities (cdata(11) and (20)). If the inflow to Seminoe Reservoir is greater than the vacant storage, water is passed through Kortes to Pathfinder and Pathfinder Reservoir is reoperated. If storage in Seminoe Reservoir plus the inflow to Seminoe is insufficient to meet demands (unsatisfied Pathfinder demands and Kortes evaporation), the model issues a message which indicates severe operational problems. If this occurs, the model processes each reservoir one at a time, beginning with Seminoe Reservoir, storing only the portion of the inflows needed to maintain the reservoir’s minimum storage level and passing the remainder downstream to the next reservoir. This process is repeated until the Guernsey Reservoir outflow is determined. This newly computed Guernsey outflow becomes the total amount of water available to meet demands below Guernsey Reservoir and is the basis for the Natural Flow and Storage Ownership Accounting performed that month.

2.4.10.1 Water Movement to Pathfinder Reservoir

The October through May Kortes Reservoir outflow is based on the storage in Seminoe Reservoir. There are three levels of outflow from Kortes reservoir (adata1(6,J) - adata1(8,J)). These levels depend on whether the storage in Seminoe Reservoir is considered to be low (cdata(33)), average, or high (cdata(34)). Table 2.4.9 shows the Kortes Reservoir outflows for the three levels of Seminoe Reservoir storage.

Table 2.4.11 Kortes Reservoir Winter Outflow (cfs)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Low	750	825	1020	1190	1250	1150	1040	890	0	0	0	0
Avg	1125	1275	1550	1700	1600	1480	1550	1275	0	0	0	0
High	1550	1650	1875	2000	1725	1600	1550	1750	0	0	0	0

In June through September, the model attempts to balance the storage in Seminoe and Pathfinder Reservoirs. This balance is the percent of the total Seminoe and Pathfinder storage that is stored in Seminoe Reservoir. These percentages are set by the model user (adata1(9,J)) in the natural flow data file (see Table 2.4.10). The balance is only performed if the increased flow is greater than the minimum set in the reservoir operations input file (cdata(32)) and is less than the maximum Kortes turbine capacity (cdata(36)). The balance is not performed if Seminoe storage is not above the minimum set by the model operator (cdata(20)).

Table 2.4.12 Balance Between Pathfinder and Seminoe Storage

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.52	0.55	0.58	0.60

2.4.11 End of Physical Operation

After the operation of Seminoe Reservoir, the physical operation of the reservoirs for one month has been completed. Water has been released downstream to meet demands, inflows not used to meet downstream demands have been stored in vacant storage space, and excess water above the capacity of reservoirs or specified target contents has been passed downstream as necessary. No consideration has been given to meeting ownership criteria at this time. The Natural Flow and Ownership accounting are processed in separate sections of the model and are discussed in Sections 2.6 and 2.7 of this documentation, respectively.

2.5 Power Generation/Reservoir Releases

The NPRWUM power generation subroutines utilize the same method of computing monthly power generation, outlet works releases, and spillway releases as the subroutines PWRGEN and PRTOUT in Reclamation's North Platte River Annual Operating Plan model (e.g., the NPRAOP Model). The NPRAOP Model is used by Reclamation's Wyoming Area Office in Mills, Wyoming, to produce the Annual Operating Plan report (U.S. Department of Interior, 1994) for Reclamation facilities on the North Platte River.

The method uses lookup tables which relate average reservoir content (a measure of head) to Mega Watt Hours (energy) per acre-foot (MWh/af) of turbine release. Maximum turbine discharge in kaf is determined using the energy per acre-foot factor and a powerplant availability factor. Availability factors for each powerplant are set by the model user in the reservoir operations input file and tell the NPRWUM what portion of the month all the turbines were available for power generation. A factor of one indicates the turbines were available for power generation 100 % of the time. There are twelve factors, one for each month of the year, which can be specified by the user (adata(17,J) through adata(22,J)).

Another lookup table uses average reservoir content to determine the maximum release rate in cfs. Maximum turbine discharge in kaf is again determined using the maximum release rate and the powerplant availability factor. The two independent calculations which determine maximum turbine release are then compared and the smaller value selected. That value is further checked against the known reservoir release and limited if necessary.

The total turbine release in units of kaf multiplied by the generation factor in MWh/af determines the monthly generation in GigaWatt Hours (GWh).

The total volume of reservoir release minus the turbine release determines the total turbine bypass. The turbine bypass is generally passed through the outlet works, up to the outlet capacity, if one is present. The remaining bypass volume is shown as passing over the spillway if one exists.

NPRWUM output in year-by-year format applicable to power generation typically consists of the following lines:

Average End-of-Month Content, kaf
End-of-Month Elevation, ft
Availability Factor
Total Turbine Discharge Capacity, kaf
Total Turbine Release, kaf
Turbine Bypass, kaf
Reservoir Outlet Release, kaf (if applicable)
Reservoir Spillway Release, kaf (if applicable)
Capacity (power), MW note: This row is not used at this time.
Power Generation, GWh

Generation values for each powerplant and total generation are also written to summary tables.

The lookup tables for each powerplant are contained in the NPRAOP.TBL data file, which is required to run the NPRWUM. Programming notes concerning the lookup table format and use may be found in the comment lines of the data file. The NPRAOP subroutine PWRGEN utilized four functions written in VAX FORTRAN which had to be slightly modified in order to compile properly using Lahey FORTRAN-90. The functions include IGTDAT, IGTLEN, LDTABL, and LOOKUP.

2.6 Natural Flow and Storage Flow Accounting

The Natural Flow subroutine (OPNFLOW) of the NPRWUM simulates the daily natural flow/storage flow segregation and distribution procedures performed by Reclamation. These procedures are set forth in the "North Platte River Ownership and Natural Flow Accounting Procedures" agreement for water year 1993, herein referred to as the SONFAP (Storage Ownership and Natural Flow Accounting Procedure). The segregation and distribution procedures in OPNFLOW utilize a monthly time step. Therefore, all values not input in acre-feet per month are converted to acre-feet per month before they are used in any calculations. Daily lag times identified in the SONFAP are ignored in the monthly accounting of the natural flow contained in the NPRWUM.

2.6.1 Determination of Natural Flow Available

Accounting of natural flow in the North Platte River and distribution to Wyoming and Nebraska appropriations is only performed during the irrigation season (May through September). During this time, available natural flow is determined on a monthly basis and distributed to the appropriate Wyoming and Nebraska Canals. The available natural flow (natural flow computed to arrive at Guernsey Dam plus gains between Guernsey Dam and Tri-State Dam) is divided among the Wyoming and Nebraska appropriators, 25% to Wyoming and 75% to Nebraska. Irrigation demands are satisfied with the available natural flow (up to their respective appropriations) before requesting storage water. Any portion of the available natural flow that occurs above Guernsey Reservoir and not used to satisfy the demands during the irrigation season is available for accrual to a storage ownership account (provided an ownership is in priority and the flow exists above the ownerships place of storage).

In addition, the Casper Canal is entitled to natural flow above Alcova to satisfy a portion or all of its demand provided the following conditions are met. First, irrigation demands below Guernsey are satisfied with the available natural. Second, the North Platte Pathfinder, North Platte Guernsey, and Kendrick Seminoe ownerships must have filled during the current year. Third, the natural flow needed to satisfy the Casper Canal Demand must exist above Alcova.

Sections 2.6.1.1 through 2.6.1.6 discuss the natural flow segregation process performed by the NPRWUM.

2.6.1.1 Natural Flow at Gray Reef Dam

The natural flow at Gray Reef Dam is equal to the natural flow above Alcova. The natural flow above Alcova is calculated as the Seminoe Reservoir inflow (North Platte River near Sinclair, Wyoming and the Medicine Bow River near Hanna, Wyoming) plus the Sweetwater River above Pathfinder Reservoir plus a daily ungauged accruals (Figure 2.6.1). The gaged inflows are obtained from Reclamation's HYDROMET and the daily ungauged accruals are set in the SONFAP (Table 2.6.1). The NPRWUM converts the daily ungauged accrual (adata1(1,J)) in the SONFAP from cubic-feet per second (cfs) to thousands of acre-feet per month (kaf/mo) for inclusion in the calculation of natural flow above Alcova.

After the natural flow above Alcova Dam has been determined, the storage flow below Gray Reef Reservoir is calculated. The storage flow at Gray Reef Dam is the total flow at the Dam minus the natural flow above Alcova (Figure 2.6.2).

If the calculated natural flow above Alcova is greater than the total flow at Gray Reef Dam, the downstream demands are satisfied without any storage from the reservoirs above Gray Reef. In this case, the storage flow at Gray Reef is set to zero and the remaining natural flow above Alcova is available for accrual to ownerships in the Storage Ownership Accounting subroutine (OPSOA).

North Platte River near Sinclair, Wyoming
\+ Medicine Bow River near Hanna, Wyoming
\+ Sweetwater River above Pathfinder Reservoir
\+ Daily ungauged accrual converted to kaf per month

= Natural Flow above Alcova Dam

Figure 2.6.11 Calculation of Natural Flow above Alcova Dam

Table 2.6.13 Daily Ungauged Accrual for Natural Flow Calculation above Alcova

Gain	May	June	July	Aug	Sept
(cfs)	90	45	40	35	35
(kaf/mon)	5.5	2.7	2.5	2.2	2.1

Total flow below Gray Reef Dam
\- Natural flow above Alcova Dam

= Storage flow at Gray Reef Dam

Figure 2.6.12 Calculation of Storage Flow at Gray Reef Dam

2.6.1.2 Natural Flow at Orin Junction

If the flow below Gray Reef Dam does not contain any storage flow, the Gray Reef to Glendo storage carriage loss is zero. Otherwise, the Gray Reef to Glendo storage carriage loss is determined by dividing the storage flow at Gray Reef by the total flow at Gray Reef and multiplying by the Gray Reef Reservoir to Glendo Reservoir carriage loss (Figure 2.6.3). The Gray Reef to Glendo Reservoir carriage loss (adata1(2,J)) is set by the SONFAP (Table 2.6.2).

(Storage flow at Gray Reef / Total flow at Gray Reef)
* Gray Reef to Glendo carriage loss (Table 2.7.2)

= Storage carriage loss (Gray Reef to Glendo)

Storage flow at Gray Reef
\- Storage carriage loss (Gray Reef to Glendo)

= Storage flow at Orin Junction

Figure 2.6.13 Calculation of Storage Flow at Orin Junction

The Gray Reef to Glendo storage carriage loss is subtracted from the Gray Reef storage flow to obtain the Orin Junction storage flow (Figure 2.6.3). The Orin Junction natural flow is the Orin Junction storage flow subtracted from the Orin Junction gaged flow (Figure 2.6.4).

Table 2.6.14 Gray Reef Reservoir to Glendo Reservoir Carriage Loss

Loss	May	June	July	August	Sept
(cfs)	43	61	70	61	45
(kaf/mon)	2.6	3.6	4.3	3.8	2.7

Gaged flow at Orin Junction
\- Storage flow at Orin Junction

= Natural flow at Orin Junction

Figure 2.6.14 Calculation of Natural Flow at Orin Junction

2.6.1.3 Natural Flow at Guernsey Dam

The Orin Junction natural flow is passed through Glendo Reservoir without loss. The Guernsey Dam natural flow is the Orin Junction natural flow plus 20 cfs of river accrual (adata1(3,J)) (Figure 2.6.5). The river accrual of 20 cfs or approximately 1.2 kaf/mo is set in the SONFAP.

Natural flow at Orin Junction
\+ 1.2 kaf/mo river accrual

= Natural flow at Guernsey Dam

Figure 2.6.15 Natural Flow at Guernsey Dam

Guernsey Dam storage flow is obtained by subtracting the Guernsey natural flow from the total Guernsey outflow (Figure 2.6.6).

Total Guernsey outflow
\- Guernsey Natural Flow

= Storage flow at Guernsey Dam

Figure 2.6.16 Storage Flow at Guernsey Dam

2.6.1.4 Natural Flow at Whalen Diversion Dam

The Guernsey to Whalen storage carriage loss is the Guernsey storage flow divided by the total Guernsey outflow multiplied by the Guernsey Reservoir to Whalen Dam carriage loss (Figure 2.6.7). The Guernsey to Whalen carriage loss (adata1(4,J)) is set in the SONFAP (Table 2.6.3). The Guernsey to Whalen storage carriage loss is subtracted from the Guernsey storage flow to obtain the Whalen storage flow (Figure 2.6.7).

(Guernsey Storage Flow / Total Guernsey Outflow)
* Guernsey to Whalen carriage loss (Table 2.7.3)

= Storage Carriage Loss (Guernsey to Whalen)

Guernsey Storage Flow
\- Storage Carriage Loss (Guernsey to Whalen)

= Whalen Diversion Dam Storage Flow

Figure 2.6.17 Storage Flow at Whalen Diversion Dam

Table 2.6.15 Guernsey Dam to Whalen Diversion Dam Carriage Loss

Gain	May	June	July	Aug	Sept
(cfs)	4	5	6	5	4
(kaf/mon)	0.24	0.30	0.37	0.31	0.24

The total Whalen Diversion Dam inflow is the sum of the flow in the river below Whalen Dam, the total diversion to the Interstate Canal, and the total diversion to the Fort Laramie Canal (Figure 2.6.7). These values are obtained from gages operated by Reclamation, USGS, and Wyoming. The Whalen Dam natural flow is obtained by subtracting the Whalen storage flow from the total flow at Whalen (Figure 2.6.8).

Flow in the River below Whalen Dam
\+ Total diversion to the Interstate Canal
\+ Total diversion to the Fort Laramie Canal

= Total Whalen Diversion Dam inflow

Total inflow to Whalen Diversion Dam
\- Storage flow at Whalen Diversion Dam

= Natural flow at Whalen Diversion Dam

Figure 2.6.18 Natural Flow at Whalen Diversion Dam

2.6.1.5 Natural Flow at Tri-State Diversion Dam

The storage carriage loss for Whalen Diversion Dam to Tri-State Diversion Dam is calculated by dividing the storage flow at Whalen by the total flow at Whalen and multiplying by the Whalen to Tri-State Carriage loss (Figure 2.6.9). The carriage loss (adata1(5,J)) is set in the SONFAP (Table 2.6.4). The storage flow at Tri-State Dam is the storage flow at Whalen Dam minus the Whalen to Tri-State storage carriage loss (Figure 2.6.9).

	(Storage flow at Whalen / Total flow at Whalen)
*	Carriage loss Factor (Whalen to Tri-State) (Table 2.7.4)
=	Storage carriage loss (Whalen to Tri-State)
	Storage flow at Whalen Dam
-	Storage carriage loss (Whalen to Tri-State)
=	Storage flow at Tri-State

Figure 2.6.19 Storage flow at Tri-State Diversion Dam

Table 2.6.16 Whalen Diversion Dam to Tri-State Dam Carriage Loss

Gain	May	June	July	Aug	Sept
(cfs)	16	22	25	22	16
kaf/mon)	1.0	1.3	1.5	1.4	1.0

2.6.1.6 Available Natural Flow

The available natural flow is the total natural flow available to natural flow appropriations. This flow is obtained by subtracting the Tri-State Dam storage flow from the total flow at Tri-State Dam (Figure 2.6.10). The total flow at Tri-State Dam is the sum of all releases from Guernsey Reservoir plus any gain (loss) from Guernsey Dam to Tri-State Dam. The releases from Guernsey Reservoir include deliveries to Interstate, Fort Laramie, and Farmers canals, storage deliveries below Tri-State, and any spill from Guernsey.

	Total flow at Tri-State
-	Storage flow at Tri-State
=	Natural flow available for diversion

Figure 2.6.20 Natural Flow Available

2.6.2 Distribution of Natural Flow

The available natural flow is distributed to Wyoming and Nebraska canals as set by the North Platte Decree. The available natural flow is divided between the states, twenty-five percent (25%) to Wyoming and seventy-five (75%) to Nebraska. If any portion of one state's share of the available natural flow is not consumed, it is available for use by irrigators in the other state. The following text describes the natural flow appropriation process employed by Reclamation to appropriate the available natural flow to the individual appropriators residing in the states of Wyoming and Nebraska.

Natural flow is distributed to Wyoming and Nebraska canals according to the priority of each canal's appropriation. The natural flow allocated to each canal is determined by the size and number of its appropriations (a canal may have more than one appropriation). The natural flow distributed to a canal also depends on the total water diverted by that canal. For example, if a ditch diverts less water than its appropriation and there is enough natural flow to satisfy its appropriation, the ditch will only receive the amount that it diverted not its entire appropriation. Conversely, if a ditch diverts more water than its natural flow appropriation, the additional water must come from storage. A ditch also withdraws water from storage if its demand is less than or equal to the appropriation and there is not enough natural flow to satisfy the demand.

The Interstate and Fort Laramie canals deliver water to irrigated lands in Nebraska and Wyoming. Separate appropriations exist for the water delivered in each state and each appropriation is processed with the other appropriations from that state.

In addition, several appropriations have the same priority. If there is not sufficient natural flow to meet the demand of appropriations with the same priority, the available natural flow is divided proportionally between the appropriators. This is the case for the Lingle-Hill, Interstate (WY Laterals), and Fort Laramie appropriations in Wyoming and the Gering-Fort Laramie, Interstate, and Northport appropriations in Nebraska.

Prior to distributing the available natural flow, the total diversions made by the separate appropriations must be known. However, the total diversions for the Grattan, Rock Ranch, Burbank, Wright & Murphy, and Farmer's Irrigation canals include allocations from multiple appropriations. Therefore, the total diversion for each of these canals is divided amongst their corresponding appropriations before proceeding to the natural flow distribution calculations.

Due to daily fluctuations within the system, accurate simulation of the daily distribution of the natural flow is difficult using monthly quantities. For example, if a daily total diversion (cfs) exceeds the corresponding natural flow appropriation (cfs), the amount diverted in excess of the natural flow appropriation is charged as storage water to that appropriation for that day (provided natural flow is available for diversion). However, it is possible for the same appropriator's monthly total diversion (kaf) to be less than the monthly appropriation (kaf) (a result of reductions in diversions later in the month). In which case, the model would calculate a monthly storage diversion of zero for that appropriation.

2.6.2.1 Wyoming Natural Flow Distribution

The Wyoming natural flow is distributed to thirteen canals with eighteen appropriations. There are more appropriations than canals because several canals have more than one right to divert natural flow. The Wyoming appropriators are listed in column one of Table 2.6.5, and the natural flow appropriation is displayed in column two. Appropriations are listed by priority and canals sharing a priority are presented in the same cell as other canals with the same priority (in column one of the table). The priority number is printed at the beginning of the first line of each cell in the first column. For ditches with multiple appropriations, a number to the right of the ditch name distinguishes between appropriations.

Table 2.6.5 is a sample daily natural flow distribution for Wyoming appropriations. The numbers used in this example are for a single day and the values are in cfs. However, the calculations performed are the same for a monthly model.

Distributing the natural flow begins by determining the demand for each ditch (the total flow diverted to each ditch). This value is entered in the third column of Table 2.6.5.

For ditches with multiple appropriations, the demand is proportioned between the appropriations. If the demand is greater than the first appropriation, the demand for that right is equal to its appropriation. The remainder of the demand is assigned to the next appropriation. This process is repeated until either the natural flow appropriations are great enough to satisfy the demand or the last appropriation for the ditch is processed. The demand that remains unsatisfied when the final appropriation for the ditch is processed is assigned to the last appropriation (regardless of the amount of the appropriation).

Figure 2.6.11 uses the Grattan Ditch to illustrate the distribution of the demand for a single ditch among multiple appropriations. The Grattan diversion is greater than the first Grattan appropriation. Therefore, the demand for the first Grattan diversion is equal to the first Grattan appropriation. The remaining Grattan demand is greater than the second Grattan appropriation. Accordingly, the second Grattan demand is equal to the second Grattan appropriation. The remaining Grattan demand is assigned to the third and final Grattan appropriation.

The fourth column of Table 2.6.5 is the natural flow allocated to each appropriation. The natural flow is allocated by the priority listed in column one of the table. The total flow diverted is compared to the natural flow appropriation and the least of these two values is the demand on the natural flow. This natural flow demand is compared to the available natural flow and the lesser of these two values is the natural flow allocated to the appropriation being considered (see Figure 2.6.12).

Table 2.6.17 Sample Daily Natural Flow Distribution for Wyoming

<table>
<tr><th>Natural Flow Appropriation (Canal)</th><th>Amount of NF Appropriation (cfs)</th><th colspan="2">Total Water Diverted (cfs)</th><th colspan="2">Natural Flow (cfs)</th><th colspan="2">Storage Flow (cfs)</th></tr>
<tr><td>1. Grattan (No. 1)</td><td>8.7</td><td colspan="2">8.7</td><td colspan="2">8.7</td><td colspan="2">0.0</td></tr>
<tr><td>2. North Platte</td><td>53.4</td><td colspan="2">37.0</td><td colspan="2">37.0</td><td colspan="2">0.0</td></tr>
<tr><td>3. Rock Ranch (No. 1)</td><td>37.1</td><td colspan="2">37.1</td><td colspan="2">37.1</td><td colspan="2">0.0</td></tr>
<tr><td>4. Pratt Ferris</td><td>22.0</td><td colspan="2">5.0</td><td colspan="2">5.0</td><td colspan="2">0.0</td></tr>
<tr><td>5. Burbank (No. 1)</td><td>4.4</td><td colspan="2">4.4</td><td colspan="2">4.4</td><td colspan="2">0.0</td></tr>
<tr><td>6. Torrington</td><td>34.9</td><td colspan="2">31.0</td><td colspan="2">31.0</td><td colspan="2">0.0</td></tr>
<tr><td>7. Lucerne</td><td>63.2</td><td colspan="2">67.0</td><td colspan="2">63.2</td><td colspan="2">3.8</td></tr>
<tr><td>8. Burbank (No. 2)</td><td>0.7</td><td colspan="2">0.6</td><td colspan="2">0.6</td><td colspan="2">0.0</td></tr>
<tr><td>9. Narrows</td><td>2.3</td><td colspan="2">2.0</td><td colspan="2">2.0</td><td colspan="2">0.0</td></tr>
<tr><td>10. Lingle Water Users</td><td rowspan="2">164.0</td><td rowspan="2">164.0</td><td>123.0</td><td rowspan="2">164.0</td><td>123.0</td><td rowspan="2">0.0</td><td>0.0</td></tr>
<tr><td>Hill District (No. 1)</td><td>41.0</td><td>41.0</td><td>0.0</td></tr>
<tr><td>11. Wright/Murphy (No. 1)</td><td>2.4</td><td colspan="2">2.4</td><td colspan="2">2.4</td><td colspan="2">0.0</td></tr>
<tr><td>12. Grattan (No. 2)</td><td>1.0</td><td colspan="2">1.0</td><td colspan="2">1.0</td><td colspan="2">0.0</td></tr>
<tr><td>13. Wright/Murphy (No. 2)</td><td>1.5</td><td colspan="2">0.6</td><td colspan="2">0.6</td><td colspan="2">0.0</td></tr>
<tr><td>14. Grattan (No. 3)</td><td>9.1</td><td colspan="2">11.3</td><td colspan="2">9.1</td><td colspan="2">2.2</td></tr>
<tr><td>15. Lingle Water Users</td><td rowspan="2">33.0</td><td rowspan="2">58.0</td><td>43.0</td><td rowspan="2">3.3</td><td>2.5</td><td rowspan="2">54.7</td><td>40.5</td></tr>
<tr><td>Hill District (No. 2)</td><td>15.0</td><td>0.8</td><td>14.2</td></tr>
<tr><td>Interstate(WY laterals)</td><td>33.0</td><td colspan="2">35.0</td><td colspan="2">3.3</td><td colspan="2">31.7</td></tr>
<tr><td>Fort Laramie</td><td>731.8</td><td colspan="2">740.0</td><td colspan="2">76.3</td><td colspan="2">663.7</td></tr>
<tr><td>16. Rock Ranch (No. 2)</td><td>13.8</td><td colspan="2">13.9</td><td colspan="2">0.0</td><td colspan="2">13.9</td></tr>
<tr><td>Totals</td><td>1216.3</td><td colspan="2">1219.0</td><td colspan="2">449.0</td><td colspan="2">770.0</td></tr>
</table>

Case 1. NF diverted by appropriation # 10 (Lingle/Hill):

Avail. NF = 260 cfs
NF Appropriation = 164 cfs
Total Lingle/Hill Diversion = 222 cfs **(166 + 56)**
Lingle Diversion = 166 cfs = 75 % of Total **((166 / 222) x 100%)**
Hill Diversion = 56 cfs = 25 % of Total **((56 / 222) x 100%)**
Appropriation # 10 Lingle = 75% = 123 cfs **(164 x 75%)**
Hill = 25% = 41 cfs **(164 x 25%)**

Case 2. NF avail. for appropriation # 15 (Lingle/Hill, Interstate, Fort Laramie):

Avail. NF = 82.9 cfs
Total NF Appropriation = 797.8 cfs **(731.8 + 33.0 + 33.0)**
Lingle/Hill, Interstate Diversion = 4 % **((33.0 / 797.8) x 100%)**
Fort Laramie Diversion = 92 % **((731.8 / 797.8) x 100%)**
NF for Lingle/Hill = 4% = 3.3 cfs **(82.9 x 4%)**
Lingle NF = 75% = 2.5 cfs **(3.3 x 75%)**
Hill NF = 25% = 0.8 cfs **(3.3 x 25%)**
NF for Interstate = 4% = 3.3 cfs **(82.9 x 4%)**
NF for Fort Laramie = 92% = 76.3 cfs **(82.9 x 92%)**

Grattan Demand = 21 cfs

Grattan Appropriation No. 1 = 8.7 cfs
Grattan Appropriation No. 2 = 1.0 cfs
Grattan Appropriation No. 3 = 9.1 cfs

Grattan Demand is Greater Than Grattan Appropriation No. 1

Grattan Demand No. 1 = 8.7 cfs
Remaining Grattan Demand = 21 cfs - 8.7 cfs = 12.3 cfs

Remaining Grattan is Greater Than Grattan Appropriation No. 2

Grattan Demand No. 2 = 1.0 cfs
Remaining Grattan Demand = 12.3 cfs - 1.0 cfs = 11.3 cfs

Remaining Grattan Demand is Assigned to Grattan Appropriation No. 3

Grattan Demand No. 3 = 11.3 cfs

Figure 2.6.21 Distribution of the Demand Among the Grattan Appropriations

If multiple appropriations have the same priority or if multiple ditches share an appropriation, the natural flow available is split between appropriations and between ditches sharing an appropriation. These cases are demonstrated at the bottom of Table 2.6.5.

In Case 1 of Table 2.6.5, the Lingle Water Users and the Hill District share an appropriation. Since the two ditches share an appropriation, the natural flow is split between the two canals. The appropriation is split in the same proportion as the flow in each ditch to the total flow of both ditches. As seen in Case 1 of Table 2.6.5, the Lingle diversion is 166 cfs and the Hill diversion is 56 cfs and the total diversion for both ditches is 222 cfs. Therefore, seventy-five percent (75%) of the total diversion is water that is used by the Lingle Water Users and the remaining twenty-five percent (25%) is used by the Hill District. The 164 cfs natural flow appropriation is allocated to the ditches in the same proportions, 123 cfs or 75% to Lingle and 41 cfs or 25% to Hill.

Minimum (total flow diverted, natural flow appropriation) = natural flow demand

Minimum (natural flow demand, natural flow available) = natural flow allocation

Figure 2.6.22 Natural Flow Allocation for a Single Appropriation

In Case 2 of Table 2.6.5, the Lingle/Hill, Interstate (WY Laterals), and Wyoming Fort Laramie appropriations have the same priority. Since there is not enough natural flow available to satisfy these demands, the available natural flow is divided between the appropriations. The natural flow is split in the same proportion as each appropriation to the sum of the appropriations.

The Lingle/Hill appropriation is 33 cfs, the Interstate appropriation is 33 cfs, and the Fort Laramie appropriation is 731.8 cfs. The sum of these appropriations equals 797.8 cfs. Therefore, the Lingle/Hill and Interstate appropriations are each four percent (4%) of the total appropriation and the remaining ninety-two percent (92%) of the total appropriation belongs to the Fort Laramie Canal. The four percent (4%) of the natural flow that goes to the Lingle/Hill appropriation is split in the same ratio as calculated for the number ten appropriation (75% to Lingle and 25% to Hill in this example). If a ditch does not need the entire flow it is allocated after the split, the other appropriations can have this water as long the total appropriation of a ditch is not exceeded.

The final column in Table 2.6.5 is the storage flow needed (in addition to natural flow) to satisfy the remaining ditch demand. The storage flow is obtained by subtracting the natural flow (column 4) from the total flow (column 3). Storage flow is limited by the contract each ditch has with the Reclamation for the delivery of water.

In times of surplus or excess, the Wyoming appropriators are entitled to 2 cfs per 70 acres under Wyoming water law. However, the NPRWUM has not been programed to deliver 2 cfs per 70 acres in times of surplus or excess.

2.6.2.2 Nebraska Natural Flow Distribution

Table 2.6.6 lists the Nebraska natural flow appropriations by priority. The available natural flow is distributed to these appropriations similar to the Wyoming natural flow distribution. The demand for each canal is determined. The demand is split for the Farmers Canal because it has multiple appropriations. The natural flow available, the total flow diverted, and the natural flow appropriation are compared to determine the natural flow diversion. The difference between the total flow and the natural flow is the storage flow.

The natural flow that canals with the same priority receive is determined by the ratio of the amount diverted by the canal to the total amount diverted by all the canals with the same priority. The total amount diverted is 2611 cfs (in priority five in the example in Table 2.6.6). The Gering-Fort Laramie canal diverts 763 cfs or twenty-nine percent (29%) of the total. The Interstate Canal diverts 1684 cfs or sixty-six percent (66%) of the total. The Northport Canal diverts 164 cfs or six percent (6%) of the total. The available natural flow distributed to each canal is apportioned in these percentages.

2.6.3 Contracts for Storage

Canals that receive water from storage have a contract with Reclamation. The contract states how much water the canal may receive during a water year. These amounts are checked in OPNFLOW after the available natural flow has been distributed to Wyoming and Nebraska appropriators. If a canal receives more storage in a water year than its contract, a message is written to the MESSAGE.LST output file produced by the NPRWUM.

2.6.4 Total Flow Passing Tri-State

The total flow that passes Tri-State Diversion Dam is comprised of the water orders for storage below Tri-State and other water. The other water passing Tri-State consists of: water released during flood events; gains in the system below Guernsey not used to meet demands; and other spills in excess of what can be retained or utilized in the system. The other water is not considered to be “natural flow passing Tri-State” by the NPRWUM, but is passed on downstream without making adjustments to either the storage or natural flow accounting of the system above Tri-State Dam. The total flow past Tri-State is reported in the NATFLOW.LST output file, where it is categorized into water orders (storage) and other water. The accounting of the water in the Tri-State to Lewellen reach is discussed in Section 2.9.3.

2.6.5 Problems Encountered in a Monthly Model

The approach implemented in the monthly natural flow model duplicates the daily accounting and distribution calculations using monthly data in place of daily data. Sections 2.6.5.1 through 2.6.5.3 provide a discussion of the problems associated with a monthly model and the steps that were taken in an attempt to improve the model.

Table 2.6.18 Sample Daily Natural Flow Distribution for Nebraska

Natural Flow Appropriation (Canal)	Amount of NF Appropriation (cfs)	Total Water Diverted (cfs)	Natural Flow (cfs)	Storage Flow (cfs)
1. Farmers (No. 1)	859.0	824.0	824.0	0.0
2. Mitchell	194.0	103.0	103.0	0.0
3. Gering	193.0	232.0	193.0	39.0
4. Farmers (No. 2)	42.0	0.0	0.0	0.0
5. Gering - Fort Laramie	784.0	763.0	66.0	697.0
Interstate	1596.0	1684.0	147.0	1537.0
Northport	230.0	164.0	14.0	150.0
Totals	3898.0	3770.0	1347.0	2423.0

Case 1. NF avail. for appropriation # 5 (Gering -Fort Laramie, Interstate, Northport):

Avail. NF	= 227 cfs		
Total flow diverted	= 2611 cfs		**(763 + 1684 + 164)**
Total Gering - Fort Laramie Diversion	= 763 cfs	= 29 % of Tot.	**((763 / 2611) x 100%)**
Total Interstate Diversion	= 1684 cfs	= 65 % of Tot.	**((1684 / 2611) x 100%)**
Total Northport Diversion	= 164 cfs	= 6 % of Tot.	**((164 / 2611) x 100%)**
Gering - Fort Laramie NF	= 66 cfs		**(227 x 29%)**
Interstate NF	= 147 cfs		**(227 x 65%)**
Northport NF	= 14 cfs		**(227 x 6%)**

2.6.5.1 Determination of Storage Flows and 3-Day Average Natural Flows at Orin Junction

The "Storage Flow below Gray Reef Reservoir" is calculated by subtracting the "Total Natural Flow at Gray Reef Reservoir" from the "Gray Reef Outflow". On a monthly basis, this operation estimates the monthly storage below Gray Reef properly if storage flow existed every day of the month. However, during those periods when storage existed for only a portion of the month, this operation underestimates the recorded monthly storage below Gray Reef Reservoir. Similar problems exist with the monthly calculations of storage carriage losses from Alcova to Glendo Reservoir, storage flow at Whalen Dam, and storage carriage losses Guernsey Reservoir to Wyoming-Nebraska state line.

The use of monthly data smooths or averages these periods of no storage flow. The model uses this data as if the average storage flow for the month existed each day. This causes some discrepancies between the historic natural flow and the natural flow calculated by the model. This must be accepted since it is impossible to determine the months when storage flow exists for only part of the month for the entire study period. Historic months of partial storage flow also introduce model inaccuracies when operating parameters and diversion amounts are changed to model different scenarios for the operation of the North Platte River.

Additional problems exist in the calculation of the natural flow at Orin Junction with a monthly model. By agreement between Reclamation, the Wyoming State Engineers Office, and the State of Nebraska, the daily natural flow at Orin Junction is averaged over a three-day period providing a more gradual transition in the calculated daily natural flow during periods of abrupt changes in the recorded flow. This is unnecessary since the use of monthly data in a monthly model averages the natural flow at Orin Junction.

2.6.5.2 Determination of Excess-to-Ownership Water Diversions

Excess water may exist in the system on a given day due to releases from the Excess-to-Ownership Account. When this occurs, the storage diversion is denoted as an excess diversion and is included with the natural flow diversions.

The calculation of the excess diversions is more complicated with the use of a monthly model since all, a portion, or none of the monthly storage diversion is considered to be excess water. Therefore, for the purposes of the model excess water is not considered part of the total storage diversion. If excess water exists in the system, the model releases this water to satisfy demands before releasing storage water. The released water is not charged against any storage ownership other than the Excess-to-ownership account. Once again, the averaging effect of a monthly model causes some error.

2.6.5.3 Losses and Gains in the System

After the monthly available natural flow is calculated, it is distributed between the Wyoming and Nebraska appropriations. However, for every month there is a system loss, the natural flow available for distribution is maintained with water borrowed from storage. A natural flow system loss is a deficit between the physical natural flow and the calculated natural flow in the system. A natural flow system loss occurs when the physical natural flow (modeled tributary inflow + reservoir bank storage and seepage + reach gains above Tri-State Dam) in the system is less than the calculated natural flow of the system determined using the "paper" gains as set forth in the SONFAP. A natural flow "system loss" is borrowed from storage and replaced by subsequent gains as set forth in the SONFAP. The system loss is tracked in the storage ownership section to allow the storage ownership to balance with the physical system.

2.7 Storage Ownership Accounting

The Storage Ownership Accounting subroutine (OPSOA) simulates Reclamation's storage ownership accounting on a monthly basis. The required input includes the system inflows above Pathfinder (North Platte River above Seminoe, Medicine Bow River above Seminoe, and Sweetwater River above Pathfinder), Kortes to Pathfinder gain, Alcova to Glendo gain, Glendo to Guernsey gain, Seminoe evaporation factors, Pathfinder evaporation factors, and Whalen evaporation factors. Information computed in the reservoir operation and natural flow subroutines used by the storage ownership subroutine includes the total Guernsey Reservoir outflow, total reservoir evaporation, total reservoir storage, flow remaining after appropriating natural flow, any deficits in natural flow, Glendo Unit deliveries, Kendrick Project deliveries, North Platte Project deliveries, and deliveries from Excess-to-Ownership.

The Storage Ownership Accounting Procedures are modeled for each of following ownerships:

- North Platte Pathfinder;
- North Platte Guernsey;
- Kendrick Seminoe;
- Kendrick Alcova;
- Glendo Evaporation Pool;
- Glendo Irrigation Pool;
- Glendo Power Pool;
- Inland Lakes; and
- Excess-to-Ownership.

Accrual and storage of water is computed separately for each ownership. Accrual is determined according to the priority and location of projects and facilities on the North Platte River. An ownership's end-of-month storage is based on the previous end-of-month storage, ownership accrual, ownership deliveries, and ownership evaporation for the current month.

OPSOA checks for Kendrick water downstream of Alcova Reservoir. It also balances the physical reservoir storage with the ownership storage (after the end-of-month ownership storage has been calculated for all ownerships). The final step is to sum each Ownership's total evaporation and total accrual to for the year. The amount of water delivered to the Idealized Inland Lakes during the water year is also tracked at the end of the Storage Ownership Accounting subroutine.

2.7.1 Methodology

Ownership accruals are operated according to priority and location. The account that is in priority is allowed to accrue any available water (provided the water enters the system upstream of the reservoir associated with the storage right). Water is accrued first from the gains in the reach directly above the reservoir associated with the ownership. If the account is not filled, water is accrued from the next upstream reach (provided an account with an earlier or equal priority does not have a claim to the water in the upstream reach). This allows the most efficient use and storage of system gains. A flowchart of the Storage Ownership Accounting subroutine is included in Appendix E.

2.7.2 Water Available for Ownership Accrual

The water available for accrual to ownerships is calculated for three reaches of the river (above Alcova Reservoir, between Alcova and Glendo, and between Glendo and Guernsey). The water in each reach is available to any ownership that accrues water downstream of the reach as long as another storage right with a senior priority is not violated.

The water available for accrual in each reach is calculated differently during the irrigation versus the non-irrigation season. During the non-irrigation season (October-April), the water available for accrual is the sum of the inflows and gains (losses) that historically occurred in that reach for the current month.

The water available for accrual above Alcova is the sum of the North Platte above Seminoe, the Medicine Bow above Seminoe, the Sweetwater above Pathfinder, the Kortes to Pathfinder Gain (Loss), the Seminoe Reservoir bank storage-seepage, and the Pathfinder Reservoir Bank Storage-Seepage. This water is available in priority to all the ownerships except the Inland Lakes (the Inland Lakes are only entitled to accrue the gains below Alcova Reservoir in the months of October, November, and April). The volume of water available for accrual above Glendo Reservoir and downstream of Alcova Reservoir is the Alcova to Glendo Gain (Loss) and the Glendo Reservoir bank storage-seepage. Water in this reach is accrued to the Guernsey, Glendo, and Inland Lakes ownerships during the non-irrigation season. The water available for accrual above Guernsey Reservoir and below Glendo Reservoir is the Glendo to Guernsey Gain (Loss) and the Guernsey Reservoir bank storage-seepage. Water in this reach is accrued to the Guernsey and Inland Lake ownerships during the non-irrigation season. Figure 2.7.1 identifies each reach and the water available for accrual. Negative water available for accrual in any reach is charged against the ownership that is in priority to accrue the gains.

<u>Calculation of Water Available for Accrual (October-April)</u>

Water Available for Accrual Above Alcova	= North Platte River above Seminoe
	+ Medicine Bow River above Seminoe
	+ Seminoe Bank Storage-Seepage
	+ Sweetwater River above Pathfinder
	+ Kortes to Pathfinder Gain (Loss)
	+ Pathfinder Bank Storage-Seepage
Water Available for Accrual Alcova to Glendo	= Alcova to Glendo Gain (Loss)
	+ Glendo Bank Storage-Seepage
Water Available for Accrual Glendo to Guernsey	= Glendo to Guernsey Gain (Loss)
	+ Guernsey Bank Storage-Seepage

Note: The Alcova to Glendo gain (loss) equals the flow at the Orin gage minus 98% of the Gray Reef Outflow

Figure 2.7.23 Calculation of Water Available for Project Accrual During the Non-Irrigation Season

In May through September (irrigation season), all the physical inflows, gains, and losses upstream of Guernsey Dam are summed. This sum is compared to the Guernsey Reservoir outflow. If the physical sum is greater, the Guernsey Reservoir outflow is subtracted from the sum of the physical inflows to obtain the amount available for accrual to the ownership accounts. OPSOA determines the water available for accrual in each reach by utilizing the gains in a lower to upper reach progression to satisfy the Guernsey Reservoir outflow. Therefore, the Glendo to Guernsey reach gain is used first. If the Glendo to Guernsey reach gains are not large enough to satisfy the Guernsey Reservoir outflow, the model uses the Alcova to Glendo gain next. If the outflow still remains unsatisfied, the model removes water from the gains above Alcova. Figure 2.7.2 shows the method of calculating water available for accrual in each reach. After the amount available for accrual in each reach during the irrigation season is determined, the ownership accounts accrue water according to priority and location on the river as would happen during the non-irrigation season.

Calculation of Water Available for Accrual (May-September)

Physical Inflows Above Guernsey
 = Physical Inflows Above Alcova
  = North Platte River above Seminoe
  + Medicine Bow River above Seminoe
  + Seminoe Reservoir Bank Storage-Seepage
  + Sweetwater River above Pathfinder
  + Kortes to Pathfinder Gain (Loss)
  + Pathfinder Reservoir Bank Storage-Seepage

 + Physical Alcova to Glendo Gain
  = Alcova to Glendo Gain (Loss)
  + Glendo Reservoir Bank Storage-Seepage

 + Physical Glendo to Guernsey Gain
  = Glendo to Guernsey Gain (Loss)
  + Guernsey Reservoir Bank Storage-Seepage

Water Available for Accrual Above Guernsey
 = Physical Inflows above Guernsey - Guernsey Reservoir outflow
 set to zero if negative

Water Available for Accrual Glendo to Guernsey
 Greater of: Zero (0)
  Physical Glendo to Guernsey Gain - Guernsey Reservoir outflow

Water Available for Accrual Alcova to Glendo
 Greater of: Zero (0)
  Physical Alcova to Glendo Gain - unsatisfied Guernsey Reservoir outflow

Water Available for Accrual Above Alcova
 Greater of: Zero (0)
  Physical Inflows Above Alcova - unsatisfied Guernsey Reservoir outflow

Figure 2.7.24 Calculation of Water Available for Project Accrual During the Irrigation Season

2.7.3 Ownership Accruals

Each water year Reclamation, the Wyoming State Engineers Office, and the State of Nebraska produce an agreement on how to account for Natural Flow and Storage Ownership on the North Platte River for the next year. This document is referred to as the "North Platte River Ownership and Natural Flow Accounting Procedures; Part A Storage Ownership Accounting Procedures" and describes the order in which Ownerships will accrue water. A sample North Platte River Ownership and Natural Flow Accounting Procedures agreement (SONFAP) is contained in Appendix B.

2.7.3.1 North Platte Pathfinder Ownership Accrual

The SONFAP states that all river gains upstream of Pathfinder Reservoir for the October 1 through April 30 period are to accrue to Pathfinder ownership until filled. In addition, gains from May 1 through September 30 in excess of natural flow demands may accrue to Pathfinder ownership until filled.

The subroutine checks whether the ownership has filled during the current year to determine if accrual is allowed to the ownership this month. If accrual is allowed, the allowable accrual is determined. The allowable accrual is the difference between the ownership storage right and the previous end-of-month ownership plus evaporation for the current month minus the year-to-data deliveries (Figure 2.7.3). The accrual is then calculated as the lesser of the amount needed to fill the allowable accrual or all water available for accrual above Alcova. The accrual of ownership storage continues until the maximum storage for the ownership is reached.

	Maximum ownership
-	Previous end-of-month ownership
+	Evaporation for current month
-	Ownership deliveries year-to-date
=	Allowable accrual

Figure 2.7.25 Calculation of Monthly Allowable Accrual

2.7.3.2 Inland Lakes Accrual

The SONFAP states that during the months of October, November, and April gains downstream from Alcova Reservoir will accrue to the Inland Lakes until a total of 46,000 acre-feet of ownership is obtained. These gains are stored in Glendo and Guernsey reservoirs and transferred to the Inland Lakes when Pathfinder Irrigation District (Interstate Canal) ceases operation in the fall or resumes operation in the spring.

Historically, the Inland Lakes Account has accrued water in the mainstem of the North Platte in October, November, and April. Typical operation also transfers water from the mainstem account to the Inland Lakes in October and April. However, deliveries have also occurred in February, March, and May. Accruals occurring in October or April are credited to the total amount accrued to the Inland Lakes Account even though deliveries are being made.

Based on the month of the year, the Inland Lakes Account is checked to determine if accrual is allowed during the current month. If accrual is allowed, the account is checked to determine if the annual allowable ownership (46,000 acre-feet) has been attained. If the account has filled, no accrual is allowed to the Inland Lakes ownership account.

If accrual is allowed, the Inland Lakes accrual capacity is determined and compared to the water available for accrual in the Glendo to Guernsey reach. If the water available for accrual in this reach contains enough water to satisfy the Inland Lakes accrual, the account is filled and the remaining water, if any, is available for the accrual to the Guernsey ownership. Otherwise, the NPRWUM attempts to satisfy the remaining portion of the accrual from the Alcova to Glendo reach. If the water available for accrual in the Alcova to Glendo reach contains enough water to satisfy the remaining Inland Lakes accrual, the account is filled and the remaining water, if any, is available for the accrual first to the Guernsey ownership and then to the Glendo ownership.

2.7.3.3 North Platte Guernsey Ownership Accrual

The SONFAP states that river gains upstream of Guernsey Reservoir for the October 1 through April 30 period and not credited to the Pathfinder and Inland Lakes ownership accounts will accrue to Guernsey ownership until filled. Gains from May 1 through September 30 in excess of natural flow demands may also accrue in priority to Guernsey ownership until filled.

The model checks if the ownership has filled this year to determine if an accrual is allowed. If an accrual is allowed, the model checks the water available for accrual (in the Glendo to Guernsey, Alcova to Glendo, and the above Alcova reaches after satisfying ownerships with a greater priority) against the accrual capacity. If the accrual capacity is greater than the water available for accrual in all three (3) reaches, the available water is credited to the Guernsey account and no water remains for the Kendrick and Glendo Ownerships. However, if the water available for accrual exceeds the accrual capacity, the Guernsey account is allowed to fill with water from the reaches in a downstream to upstream fashion with any remaining water in upstream reaches available to accrue to the Kendrick or Glendo ownership accounts as possible.

2.7.3.4 Kendrick Ownership Accrual

The SONFAP states that all gains upstream of Alcova Reservoir for the October 1 through April 30 period after Pathfinder and Guernsey ownerships have filled are to accrue to Kendrick Seminoe ownership until filled. Likewise, all gains upstream of Alcova Reservoir for the October 1 through April 30 period after Pathfinder and Guernsey ownerships have filled are to accrue to Kendrick Alcova ownership until filled. Gains above Alcova from May 1 through September 30 in excess of natural flow demands and senior storage rights may also accrue to the Kendrick ownerships until filled.

Separate subroutines calculate the accrual for the Kendrick Seminoe and Kendrick Alcova. However, the accruals for each account are calculated the same. The Kendrick accrual subroutine examines whether the ownership account has filled during the water year to determine if an accrual is allowed. The subroutine then quantifies the maximum capacity and the allowable accrual. If the Kendrick ownership has not filled, it can accrue water from the water available for accrual above Alcova if both the Pathfinder and Guernsey ownerships have filled this water year.

The amount allowed to be accrued to Kendrick ownership is the ownership storage right minus the current ownership plus the evaporation for the current month minus the year-to-date deliveries. The accrual is the lesser of the amount needed to fill the ownership or all the water available for accrual above Alcova after satisfying Pathfinder and Guernsey ownerships. If Kendrick does not accrue all the water available for accrual, the remainder is available to Glendo ownership.

The exception to Kendrick Seminoe followed by Kendrick Alcova accrual is Casper Canal natural flow. If Casper Canal is taking water and Kendrick Seminoe has filled during the water year, Casper Canal is entitled to natural flow (up to its appropriation) before Kendrick Alcova accrues any water.

2.7.3.5 Glendo Unit Ownership Accrual

Glendo Unit Ownership consist of the Glendo Evaporation Pool, the Glendo Irrigation Pool, and the Glendo Power Pool. Accruals to these ownerships are calculated separately in the model. The Glendo Unit ownerships are operated such that all gains upstream of Glendo Reservoir for the period December 1 through March 31 after the Pathfinder, Guernsey, and Kendrick ownerships have filled are to accrue to the Glendo ownerships until filled. At any time during this period that the Guernsey ownership has filled and the Pathfinder or Kendrick ownerships have not filled, all gains between Alcova and Glendo will accrue to Glendo ownerships until filled. Also, all gains upstream of Glendo Reservoir for the periods October 1 through November 30 and April 1 through April 30 after the Pathfinder, Guernsey, Kendrick, and Inland Lakes ownerships have filled are to accrue to Glendo ownerships until filled. At any time during these periods that the Guernsey and Inland Lakes ownerships have filled and the Pathfinder or Kendrick ownerships have not filled, all gains between Alcova and Glendo will accrue to Glendo ownerships until filled. Gains from May 1 through September 30 in excess of natural flow demands and senior storage rights may also accrue to this ownership until filled.

The subroutine checks whether the project storage has filled to determine if an accrual is allowed. If an accrual is allowed, the subroutine calculates the allowable accrual to the Glendo Unit account. The Glendo Evaporation account is allowed to fill the estimated annual evaporation in a water year. Evaporation is the first of the Glendo ownerships to accrue water. The maximum accrual for the account is maximum ownership (cdata2(6); 20,090 af) minus water carried over in the Evaporation Pool from the previous water year. The Irrigation Pool is the second Glendo account to accrue water. The North Platte Decree limits the accrual to the Glendo Irrigation account to 40,000 acre-feet in any one water year with carryover storage not to exceed 100,000 acre-feet. The power head pool of 63,148 acre-feet was filled once and is not allowed to accrue water. Glendo ownership accrues water first from the water available for accrual in the Alcova to Glendo reach and then from the water available for accrual above Alcova if the ownership was not satisfied and upstream demands storage ownerships have been satisfied.

2.7.3.5.1 Glendo Contractors Accrual

The Glendo Irrigation Pool is divided into two accounts: 37.5 kaf for Wyoming (15 kaf in a water year) and 62.5 kaf for Nebraska (25 kaf in a water year). Furthermore, water is contracted for in each state by irrigation districts. The NPRWUM tracks the accruals to the individual Glendo contractors from each state. The Glendo contractors for Wyoming are Burbank, Grattan, Torrington, Lucerne, Wright & Murphy, and an "unassigned" contract. The Glendo contractors for Nebraska are Mitchell, Bridgeport, Enterprise, and Central Nebraska Public Power and Irrigation District (CNPPID). The Irrigation Pool's accrual is divided proportionally between Wyoming and Nebraska, then divided proportionally to these states' Glendo contractors. Any unused portion of one state's accrual can be taken by the other state, if possible, as set forth in the *Reservoir Operating Policy and Marketing Principles* dated December 7, 1982 (Appendix I).

2.7.3.6 Excess-to-Ownership Accrual

There is no water right for the excess-to-ownership account. The excess-to-ownership account is kept only by agreement of Reclamation, Wyoming, and Nebraska. The excess-to-ownership accrual is calculated from each of the three river reaches. The water available to the excess-to-ownership account is any water remaining in the system after removing natural flow and filling all storage ownerships downstream of the reach in which the excess occurred. This water is held in the system (provided reservoir storage space exists to hold the water) and used to replace evaporation lost from the ownerships and to augment natural flow. Therefore, the excess-to-ownership water not used to replace evaporation from the ownerships is released to augment the natural flow before any ownership storage water is released.

The subroutine checks to see if Excess-to-Ownership accrual is allowed. If accrual is allowed, the excess account accrues water from each reach until either all excess water is accrued or the physical limitations of the storage facilities are reached.

The Excess-to-Ownership function is activated by a series of flags set by the model operator in the storage ownership accounting data base (cdata(26-32)). The Excess-to-Ownership account accrues water in a downstream to upstream manner. The account can accrue water up to the amount of extra storage space available in reservoirs downstream of the reach where excess occurs. In high water years, water may be retained in the dams higher in the system to help prevent flooding downstream in the system.

2.7.4 Ownership Storage

Ownership storage is processed in a different order in the model than accrual. The order in which ownership is calculated is as follows:

1. North Platte Guernsey ownership;
2. Inland Lakes ownership;
3. Kendrick ownerships;
4. North Platte Pathfinder ownership; and
5. Glendo ownerships.

Ownership storage are calculated in this order because the calculation of North Platte Pathfinder ownership evaporation in Guernsey Reservoir requires information calculated in the previous ownerships. The Glendo Evaporation ownership requires the evaporation calculated for the other ownerships to determine Glendo evaporation.

2.7.4.1 Excess-to-Ownership

Excess-to-Ownership (ETO) is calculated at the end of the ETO accrual since no deliveries are made from the ETO account in OPSOA and ownership evaporations are removed from the ETO account when water is available in the account. The SONFAP states that only Guernsey and Glendo ownerships evaporations are removed from the Excess-to-Ownership account, but the model user may choose to remove the evaporation from the other ownership accounts as well (cdata2(29)). The account's content is calculated as the previous end-of-month content minus the deliveries and evaporation, plus any accruals. The evaporation is equal to the evaporation from the other ownerships on the system and the deliveries are either releases to augment the natural flow or the storage flow. Accruals are calculated by the ETO accrual subroutine prior to determining its content. Flags set in the storage ownership data file allow the model user to specify whether they want to use the ETO account to replace evaporation and/ or augment natural flow.

The use of ETO water to replace evaporation charges on ownerships is controlled by two options. The first option will allow ETO to only replace evaporation for the Guernsey and Glendo ownerships. The Guernsey ownership evaporation is replaced first and any remaining ETO water is used to replace the Glendo ownership evaporation. The second option will allow ETO to replace ownership evaporation for Kendrick and Pathfinder ownerships. The ETO water will not be pro-rated between the ownerships under either option.

2.7.4.2 North Platte Guernsey Ownership

North Platte storage deliveries are made from North Platte Guernsey ownership until North Platte Guernsey ownership is depleted. After North Platte Guernsey ownership is depleted, North Platte storage deliveries come from North Platte Pathfinder ownership. Consequently, North Platte Guernsey ownership storage is calculated before North Platte Pathfinder ownership storage since North Platte storage deliveries from North Platte Pathfinder ownership are not known until it is determined whether North Platte Guernsey has been depleted. Guernsey storage ownership is the previous end-of-month ownership minus the deliveries and evaporation, plus any accruals (accruals may include the amount needed to replace evaporation for the month). The evaporation is calculated for an average end-of-month (eom) content (previous eom content plus current eom content divided by two) and iterated until a constant value is obtained for the month. Evaporation may be replaced with water from the Excess-to-Ownership account provided enough water exists in Excess-to-Ownership. Accruals are calculated in North Platte the Guernsey ownership accrual subroutine.

2.7.4.3 Inland Lakes Ownership

A relationship exists between Inland Lakes and Pathfinder ownerships. This relationship is to allow the transfer of water between the two ownerships. In the historic operation of the North Platte, water was often transferred to (or from) the Inland Lakes ownership account to (or from) other ownerships on the river (predominately Pathfinder and Guernsey). Additionally, in order to model the river below Guernsey (return flows) during the calibration of the model, deliveries to the Inland Lakes had to be close to the historic deliveries. To solve this problem, water is transferred from Pathfinder ownership when more water was delivered to the Inland Lakes than the Inland Lakes had accrued (or could accrue during the month). When more water is accrued than was historically delivered, the water remaining in Inland Lakes ownership at the end of April is transferred to Pathfinder ownership from the Inland Lakes ownership account. Transfers to Pathfinder ownership are not allowed to cause North Platte Pathfinder ownership to go beyond its maximum capacity. Water that can not be transferred to North Platte Pathfinder is available to be accrued by other ownerships.

The Inland Lakes ownership is the previous end of months ownership minus the deliveries, evaporation, and transfers from Inland Lakes, plus accruals and transfers to Inland Lakes. The deliveries are the historic deliveries to the Inland Lakes (i.e. releases from Guernsey Reservoir diverted through the Interstate Canal to the Inland Lakes). The evaporation is calculated as the proportion of the Inland Lakes ownership to the computed physical Glendo (or Guernsey) Reservoir storage times the computed physical Glendo (or Guernsey) Reservoir evaporation for the current month. The Inland Lakes evaporation is iterated until a constant value is obtained for the month. The accrual is calculated in the Inland Lakes accrual subroutine.

2.7.4.4 North Platte Pathfinder Ownership

The North Platte Pathfinder storage ownership deliveries are the remainder of the North Platte storage deliveries after North Platte Guernsey ownership water is exhausted. The ownership is the previous end-of-month ownership minus the deliveries, evaporation, and transfers from North Platte Pathfinder, plus accruals (accruals may include the amount needed to replace evaporation for the month) and transfers to North Platte Pathfinder. The evaporation is calculated for an average end-of-month content and iterated until a constant value is obtained for the month. Accruals are calculated in the North Platte Pathfinder ownership accrual subroutine. If there is not enough water in the ownership account to satisfy the storage demands, the shortage is divided proportionally between the North Platte and Warren Act Contractors based on their storage demands only and the system reoperated. The North Platte Pathfinder ownership is not allowed to violate the minimum Pathfinder Reservoir storage (cdata(22)) set by the model user in the input file.

2.7.4.5 Kendrick Ownership

The Kendrick ownership deliveries are set in the reservoir operations data base. Deliveries from Kendrick projects are first removed from Kendrick Seminoe ownership and second from Kendrick Alcova if Kendrick Seminoe is depleted. In addition to deliveries and accruals (accruals may include the amount needed to replace evaporation for the month), water is borrowed between North Platte Pathfinder and Kendrick ownerships. Kendrick ownerships are the previous end-of-month ownership minus the storage deliveries, evaporation, and transfers from Kendrick, plus accruals and transfers to Kendrick. The evaporation is calculated for an average end of month content and iterated until a constant value is obtained for the month. Accruals are calculated in the Kendrick ownership accrual subroutine. If there is not enough water in the ownership account to satisfy the storage demands for both the Casper-Alcova Irrigation District (CAID) and the City of Casper, the CAID demand is satisfied first, if possible, and any remaining water goes to meet the City of Casper’s demand. After these demands have been adjusted accordingly, the system is reoperated with the new demands. (Note: The City of Casper’s demand is set to zero for calibration and validation, since no water has been delivered to the City under this contract historically.) The total Kendrick ownership is not allowed to be less than the combined storage of the minimum Seminoe Reservoir (cdata(20)) and the Alcova Reservoir target (adata(12)) storage set by the model user in the input files.

2.7.4.6 Glendo Unit Ownership

The deliveries from the Glendo irrigation account are the sum of the storage deliveries to the various projects with contracts for Glendo storage. Glendo irrigation pool ownership is the previous end-of-month ownership minus the deliveries plus any accruals to the Glendo irrigation pool. The Glendo evaporation pool is reduced by Glendo evaporation. The evaporation is the difference between the sum of the physical system evaporation for each reservoir and the sum of the ownership evaporation for the other ownerships. Accruals are calculated in the Glendo ownership accrual subroutines. If there is not enough water in the ownership account to satisfy the demands, the shortage is assigned to the Glendo Contractors that have exhausted their individual storage supplies from the Glendo irrigation pool.

The physical operation of the North Platte System often reduces the volume of water stored in Glendo Reservoir below Glendo ownership. When this occurs, the model exchanges water stored in Glendo Reservoir with water stored in Pathfinder and Seminoe reservoirs. Therefore, the water stored in Glendo Reservoir may be released from the system to satisfy North Platte storage demand. The water exchanged remains in Glendo ownership and is used for power production and returned to Glendo Reservoir during the non-irrigation season.

2.7.4.6.1 Glendo Contractors Accounts

The deliveries made from the irrigation account are also tracked individually for the Glendo contractors: Burbank, Grattan, Torrington, Lucerne, Wright & Murphy, and an “unassigned” contract for Wyoming; and Mitchell, Bridgeport, Enterprise, and CNPPID for Nebraska. For example, a storage delivery taken by Torrington is charged directly to the Glendo-Torrington account. Thus, the Glendo-Torrington account ownership is the previous end-of-month ownership minus the deliveries plus any accruals to the Glendo-Torrington account. The Glendo contractors are limited to their contract amounts in any water year not to exceed their portion of Glendo Irrigation Pool storage in successive years. The Glendo contractors are monitored on a monthly basis and are limited to their yearly contract amount or the amount of water held in ownership under their account in Glendo with exceptions as noted in the *Glendo Reservoir Operating Policy and Marketing Principles* dated December 7, 1982 (Appendix I).

2.7.5 Alternative Analysis Accounts

The NPRWUM is also capable of simulating the operation of additional accounts in Pathfinder, Glendo, and Seminoe Reservoirs. These accounts have been programmed for future use in evaluating alternatives and were not used during the calibration/validation process. The alternative analysis accounts are discussed below.

2.7.5.1 Pathfinder Alternative Analysis Accounts

The NPRWUM can simulate up three alternative analysis accounts in the North Platte Pathfinder ownership. Two of these accounts, a municipal (20,000 acre-feet) and an environmental account (34,000 acre-feet), are associated with the Pathfinder Reservoir modification, which would increase the capacity of the existing Pathfinder Reservoir by approximately 54,000 acre-feet to recapture storage space lost to sediment. The third account takes a specified quantity of the 1,016,507 acre-feet of the Pathfinder ownership and dedicates it to an environmental account. These accounts can be modeled simultaneously or individually.

The two accounts used to simulate the Pathfinder Reservoir modification are identified in the NPRWUM as the Pathfinder enlargement #1 ownership and Pathfinder enlargement #2 ownership and are controlled via cdata2(33) through cdata2(39). These accounts accrue water under the same priority date (12/06/04) as the North Platte Pathfinder storage right and proportionally share the accruals and evaporation credited to the North Platte Pathfinder ownership. The deliveries from the Pathfinder enlargement #1 and #2 accounts are controlled by adata(31) and adata(32), respectively. If the deliveries from these accounts are greater than the water stored in them, all the available water is delivered and the unsatisfied portion is reported as a shortage. The accounts are also limited to their respective maximum contents. The maximum allowable accrual for any water year is the maximum content minus the carry over storage from the previous water year.

The account that dedicates a part of the Pathfinder ownership (1,016,507 acre-feet) to an environmental account is controlled by specifying a maximum content in cdata2(35) and setting cdata2(36) to one. This account proportionally shares the accruals and evaporation credited to the North Platte Pathfinder ownership. Releases from this account are controlled via adata(34,J). If the delivery from this account is greater than the water stored in it, all the stored water is delivered and the unsatisfied portion is reported as a shortage. The account is also limited to its maximum content. The maximum allowable accrual for any water year is the maximum content minus the carry over storage from the previous water year.

2.7.5.2 Glendo Alternative Analysis Accounts

Two alternative analysis accounts can be modeled in Glendo Reservoir: an environmental account that consists of a specified amount of the Glendo Reservoir reregulation space and an environmental account created from a percentage of the Glendo Irrigation Pool. These accounts can be modeled simultaneously or individually.

The NPRWUM can use a portion of the reregulation space as an additional storage account. This additional account is controlled by the model user via cdata2(15) through cdata2(17). The NPRWUM assigns this account the most junior storage right on the system and it accrues water after all other rights have been satisfied with respect to river reaches. The deliveries from this account are controlled by adata(30). If the delivery from this account is greater than the water stored in it, all the stored water is delivered and the unsatisfied portion is reported as a shortage. The account is also limited to its maximum content. The maximum allowable accrual for any water year is the maximum content minus the carry over storage from the previous water year.

The alternative account modeled as a specifed maximum percentage of the Glendo Irrigation Pool ownership is activated when cdata2(61) is set to a number between zero (0) and one (1). For example, a value of 0.05 dedicates 5 % of the Glendo Irrigation ownership to the alternative account. This account proportionally shares a percentage of all the accruals and evaporation (if the Glendo Evaporation Pool has been depleted) that are credited to the Glendo Irrigation ownership. The alternative account is further proportionally subdivided into a Wyoming and Nebraska alternative account (0.375 and 0.625, respectively). Releases from the Wyoming and Nebraska alternative accounts are controlled via adata(35,J) and adata(36,J), respectively. If the deliveries from these accounts are greater than the water stored in them, all the stored water is delivered and the unsatisfied portion is reported as a shortage.

2.7.5.3 Kendrick Seminoe Alternative Analysis Account

The NPRWUM is capable of modeling an alternative account of a specified maximum content (cdata2(64)) in the Kendrick Seminoe ownership for environmental uses. This account is controlled via cdata2(64) and cdata2(65). This account accrues water under the same priority date as the Kendrick Seminoe ownership storage right and proportionally shares the accruals and evaporation credited to the Kendrick Seminoe ownership. Releases from this account are controlled via adata(37,J). If the delivery from this account is greater than the water stored in it, all the stored water is delivered and the unsatisfied portion is reported as a shortage. The account is also limited to its maximum content. The maximum allowable accrual for any water year is the maximum content minus the carry over storage from the previous water year.

2.7.6 Kendrick Water Downstream of Alcova Dam

The NPRWUM attempts to provide a minimum flow (cdata(39); 330 cfs) below Gray Reef Dam at all times by passing North Platte Pathfinder ownership and Glendo ownership stored in Pathfinder Reservoir through Gray Reef Dam. The NPRWUM uses the conservation storage space in Glendo Reservoir to restore the water. If the Pathfinder and Glendo ownerships cannot provide enough water to meet this flow, the flow below Gray Reef Dam is limited to the amount of Pathfinder and Glendo ownership in storage above Gray Reef Reservoir and the flow falls below the minimum. However, a flag/option (cdata2(22)) that will allow the movement of Kendrick ownership water below Alcova, if available, can be set by the model user to meet the portion of the minimum flow below Gray Reef Dam not satisfied by the Pathfinder and Glendo ownerships. The total Kendrick ownership water moved below Alcova is treated as water borrowed by the Pathfinder ownership and is repaid to the Kendrick ownership with water accrued to the Pathfinder ownership.

2.7.7 Physical and Ownership Storage Balance

Computations are also performed by the Storage Ownership subroutine to assure that the physical system storage equals the ownership storage. When the physical system storage is greater than the ownership storage, the difference of the physical storage and ownership storage is assigned as a spill to balance the system. The balance spill is added to the Guernsey Reservoir outflow to release the water from the physical system. After water in excess of capacity is released, the physical system is reoperated to reflect the change in physical storage.

Sometimes in the NPRWUM the ownership storage is greater than the physical storage. The cause of this situation has not been identified, but could be related to problems using a monthly time step and average end-of-month contents in computations. When this situation occurs, the NPRWUM first checks to see if a balance spill exist from an early iteration of the month. If there was a balance spill, it is reduced. If the ownership storage is still greater than the physical storage, the NPRWUM continues to try to balances the system by reducing the accruals. The remaining difference is first taken from the available water in ETO account, provided the ETO option is on and water exists in the ETO account. Any of the difference not met by reducing the ETO account is taken from the ownership accounts by assigning a negative accrual to the ownership that is in priority. The negative accruals are assigned by reach: Alcova to Glendo, Guernsey to Glendo, and above Alcova. If the Alcova to Glendo reach gain is negative, the NPRWUM assigns a negative accrual to the ownership in priority in that reach to reduce the ownership storage and continues to the above Alcova reach, if necessary, to balance the system. If the Glendo to Guernsey reach gain is negative, the NPRWUM assigns a negative accrual to the ownership in priority in that reach to reduce the ownership storage and continues to the above reaches, if necessary, to balance the system. Otherwise, the NPRWUM assigns a negative accrual to the ownership in priority in the above Alcova reach to reduce the ownership storage to balance the system. If these efforts to balance the system fail, the “alternate method of distribution” is done. This method removes the remaining difference from the ownerships beginning with the North Platte Pathfinder ownership, North Platte Guernsey ownership, Glendo Evaporation Pool ownership, Glendo Irrigation Pool ownership, Excess-to-Ownership account, Kendrick Seminoe ownership, and ending with the Kendrick Alcova ownership until the system balance is satisfied.

2.8 Return Flow

The North Platte River Water Utilization Model (NPRWUM) employs an analytical method of computing return flow from irrigated areas as developed by Robert E. Glover (1960), Professor of Civil Engineering at Colorado State University. The method developed by Mr. Glover utilizes the hydrologic properties of the aquifer underlying the irrigated area, the distance between drainage channels, and the percolation to the ground-water reservoir. The NPRWUM has been equipped with a subroutine called GLOVER that estimates return flows based on the Glover method. Further discussion of the Glover analysis can be found in papers written by Patrick A. Hurley (1967) and Robert E. Glover (1975).

Three (3) large reaches are used to simulate the North Platte River below Guernsey. These reaches in downstream order are Guernsey to Whalen (no return flows are modeled within this reach), Whalen to Tri-State, and Tri-State to Lewellen. These large reaches contain multiple sub-basins within their boundaries. A map of the North Platte River from Guernsey to Lewellen is presented as Figure 2.8.1 through Figure 2.8.5. The NPRWUM does not attempt to identify the individual return flow contributions of these sub-basins within their respective reaches, instead they are lumped together at the end of the reach. Since the NPRWUM uses the lumped reach approached, a representative portion of the North Platte River basin below Guernsey was selected from which to derive the parameters for the GLOVER Subroutine. The select basin extended from Whalen Diversion Dam to the termination point of the Belmont Canal near the North Platte River just above Lisco, Nebraska, and was bounded by the uppermost irrigation canals to the north and south of the river. The estimated parameters from this basin were applied to both the Whalen to Tri-State (Reach No. 2) and Tri-State to Lewellen (Reach No. 3), the only reaches in which return flows are modeled.

2.8.1 GLOVER Subroutine

The GLOVER subroutine in the NPRWUM uses five input parameters to calculate return flow; transmissivity (gpd/ft), storage coefficient or specific yield, reach width or drain spacing (ft), initial condition recharge (kaf/mo), and deep percolation from canal seepage and irrigation (kaf). A general discussion of the development of these parameters is presented in the following text. Appendix C provides additional information regarding these parameters.

2.8.1.1 Transmissivity / Storage Coefficient

Estimates of transmissivity were developed by reviewing well registration data for Nebraska and a U.S. Geological Survey Water-Resources Investigations 3-75 report entitled "Hydrologic Analysis of the Valley-Fill Aquifer, North Platte River Valley, Goshen County, Wyoming" (Crist, 1975). Transmissivities for wells in Nebraska were estimated from the specific capacity of wells computed from well registration logs (U.S. Department of Interior, 1977). An average transmissivity of 174,000 gpd/ft was estimated using these sources. During calibration this value was reduced to 150,000 gpd/ft to lengthen the return flow timing. The transmissivity for both Reaches No. 2 (cdata(65)) and Reach No. 3 (cdata(66)) are set at 150,000 gpd/ft.

An assumed storage coefficient of 0.23 (cdata(73)) is used for the entire area below Guernsey Reservoir. This value was taken directly from the U.S. Geological Survey Water-Resources Investigations 3-75 report for Goshen County, Wyoming and is referenced on page 14 of that report.

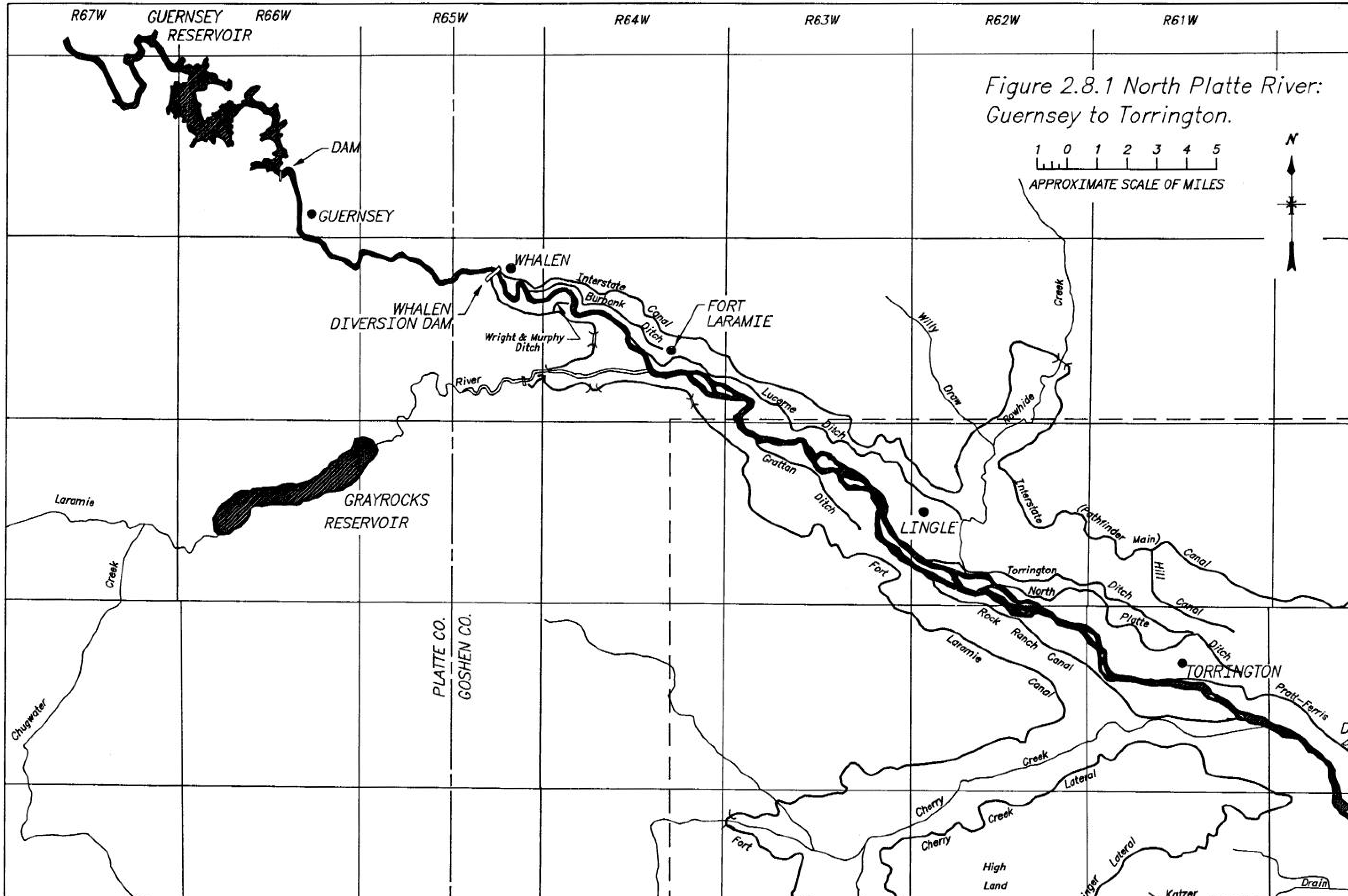

Figure 2.8.1 North Platte River:
Guernsey to Torrington.
1 0 1 2 3 4 5
APPROXIMATE SCALE OF MILES
N
R67W
R66W
R65W
R64W
R63W
R62W
R61W
GUERNSEY
RESERVOIR
DAM
GUERNSEY
WHALEN
WHALEN
DIVERSION DAM
Interstate
Burbank
Canal
Ditch
FORT
LARAMIE
Wright & Murphy
Ditch
River
Lucerne
Ditch
Grattan
Ditch
Willy
Draw
Creek
Rawhide
Interstate
(Pathfinder Main)
Canal
Hill
Canal
LINGLE
Torrington
Ditch
North
Platte
Ditch
Fort
Laramie
Rock
Ranch
Canal
Laramie
Canal
TORRINGTON
Pratt-Ferris
GRAYROCKS
RESERVOIR
Laramie
Creek
Chugwater
PLATTE CO.
GOSHEN CO.
Creek
Lateral
Cherry
Creek
Cherry
High
Land
Lateral
Katzer
Drain
Fort

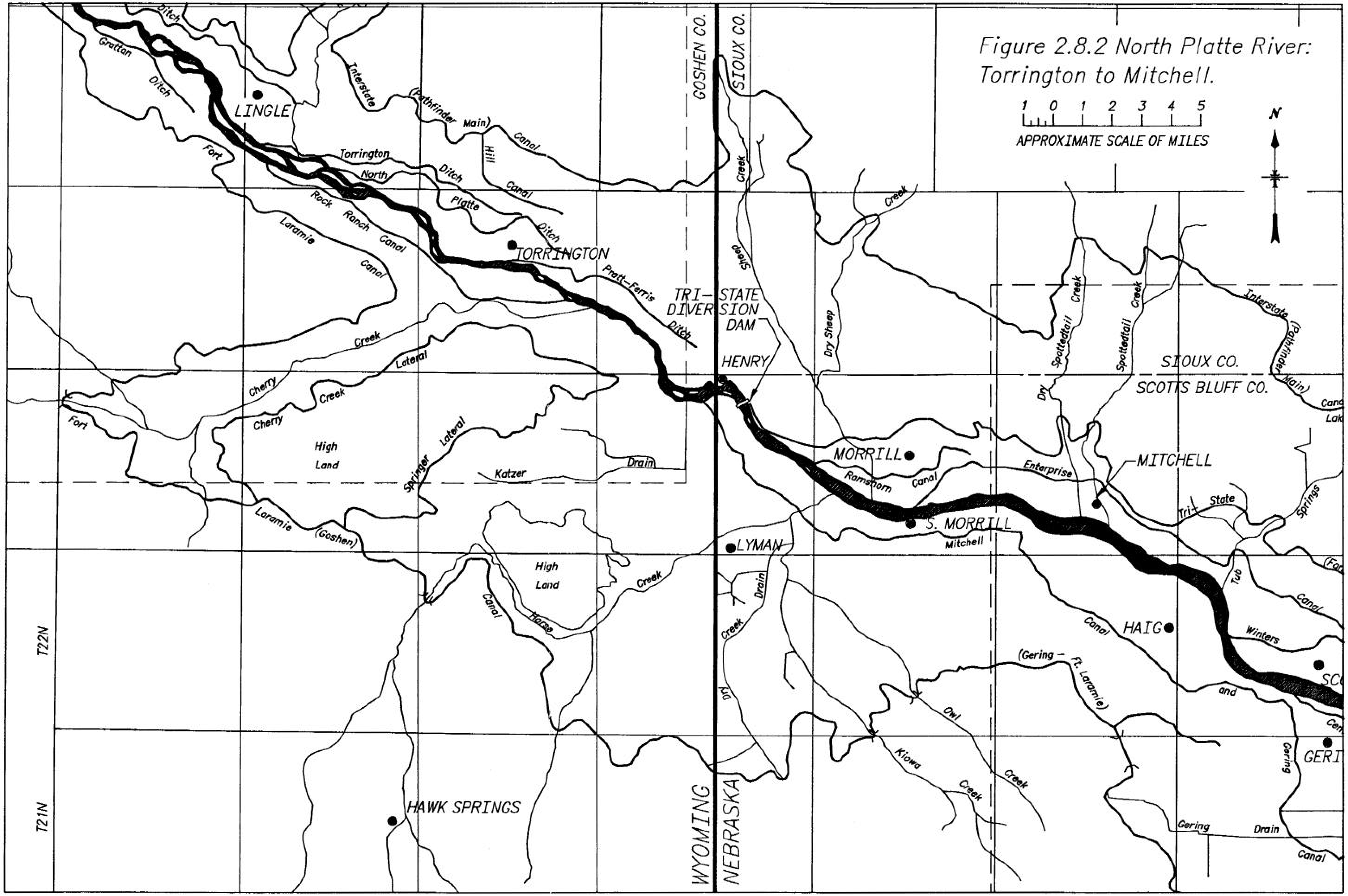

Figure 2.8.2 North Platte River: Torrington to Mitchell.

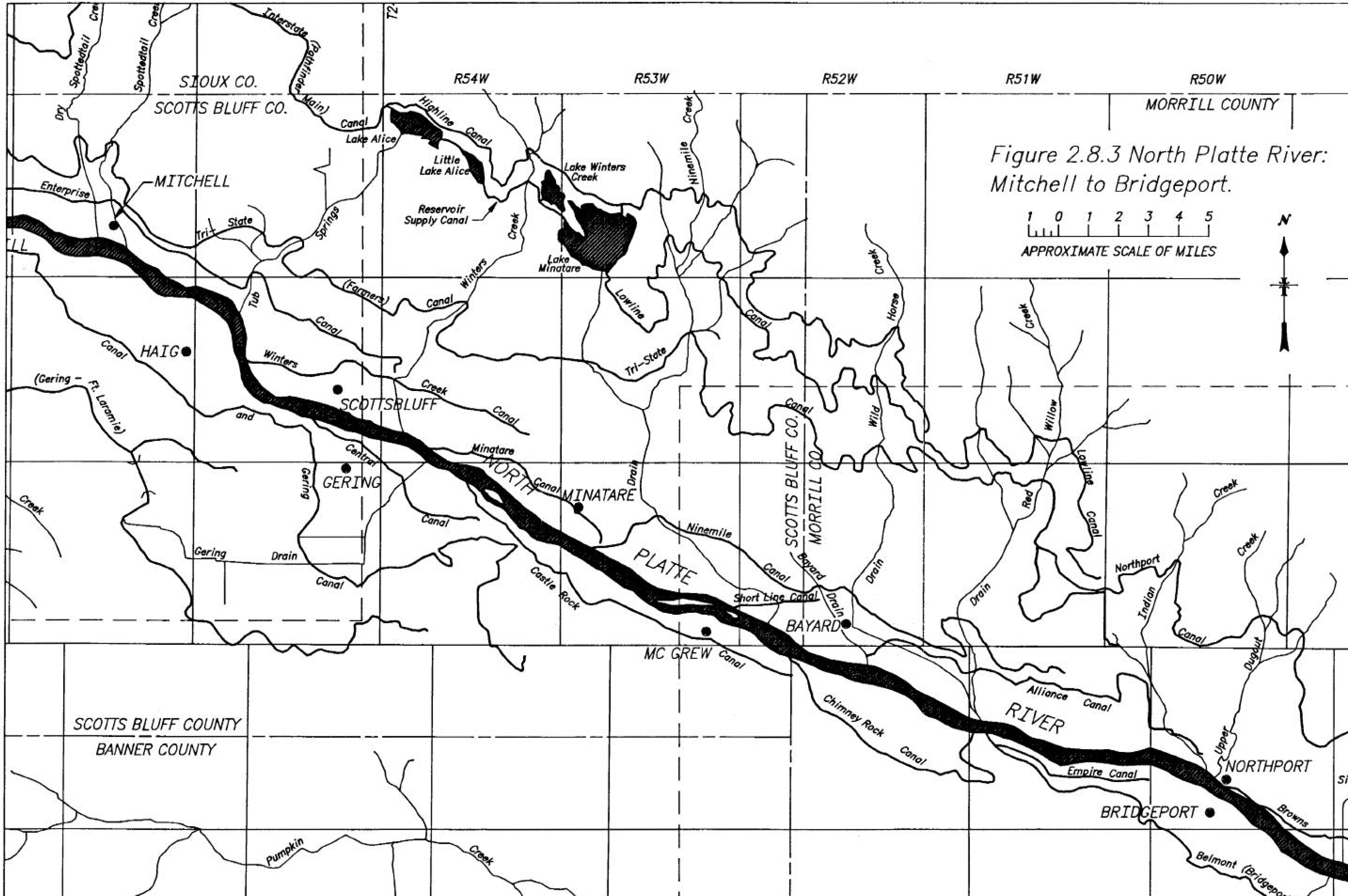

Figure 2.8.3 North Platte River: Mitchell to Bridgeport.

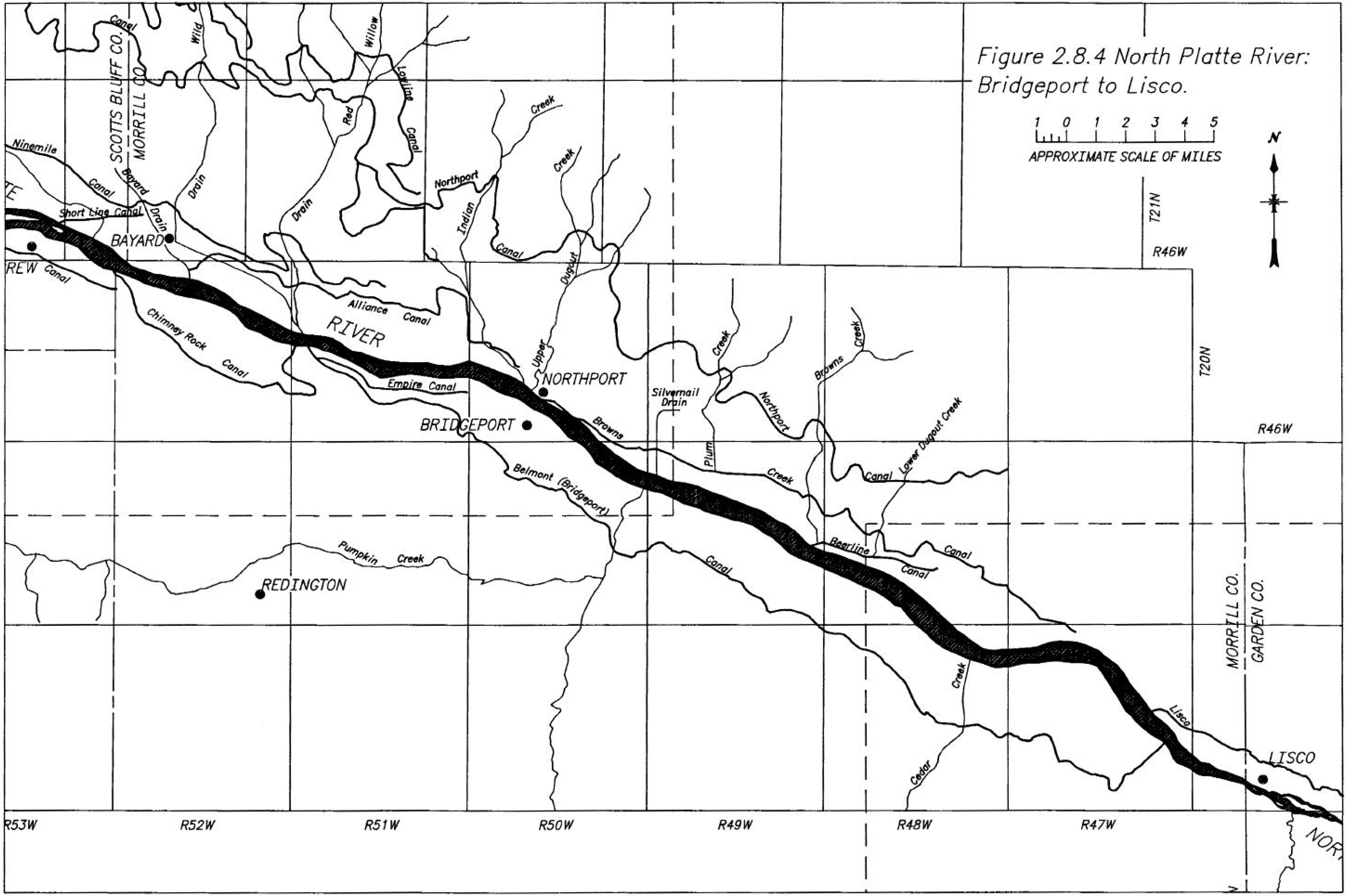
Figure 2.8.4 North Platte River: Bridgeport to Lisco.
1 0 1 2 3 4 5
APPROXIMATE SCALE OF MILES
N
SCOTTS BLUFF CO.
MORRILL CO.
BAYARD
NORTHPORT
BRIDGEPORT
REDINGTON
LISCO
RIVER
Ninemile Canal
Short Line Canal
Bayard Drain
Chimney Rock Canal
Alliance Canal
Empire Canal
Belmont (Bridgeport)
Pumpkin Creek
Northport Canal
Indian Creek
Upper Dugout
Silvernail Drain
Plum Creek
Browns Creek
Lower Dugout Creek
Beerline Canal
Cedar Creek
Lisco
Red Willow
Lowline Canal
MORRILL CO.
GARDEN CO.
T21N
T20N
R46W
R53W
R52W
R51W
R50W
R49W
R48W
R47W

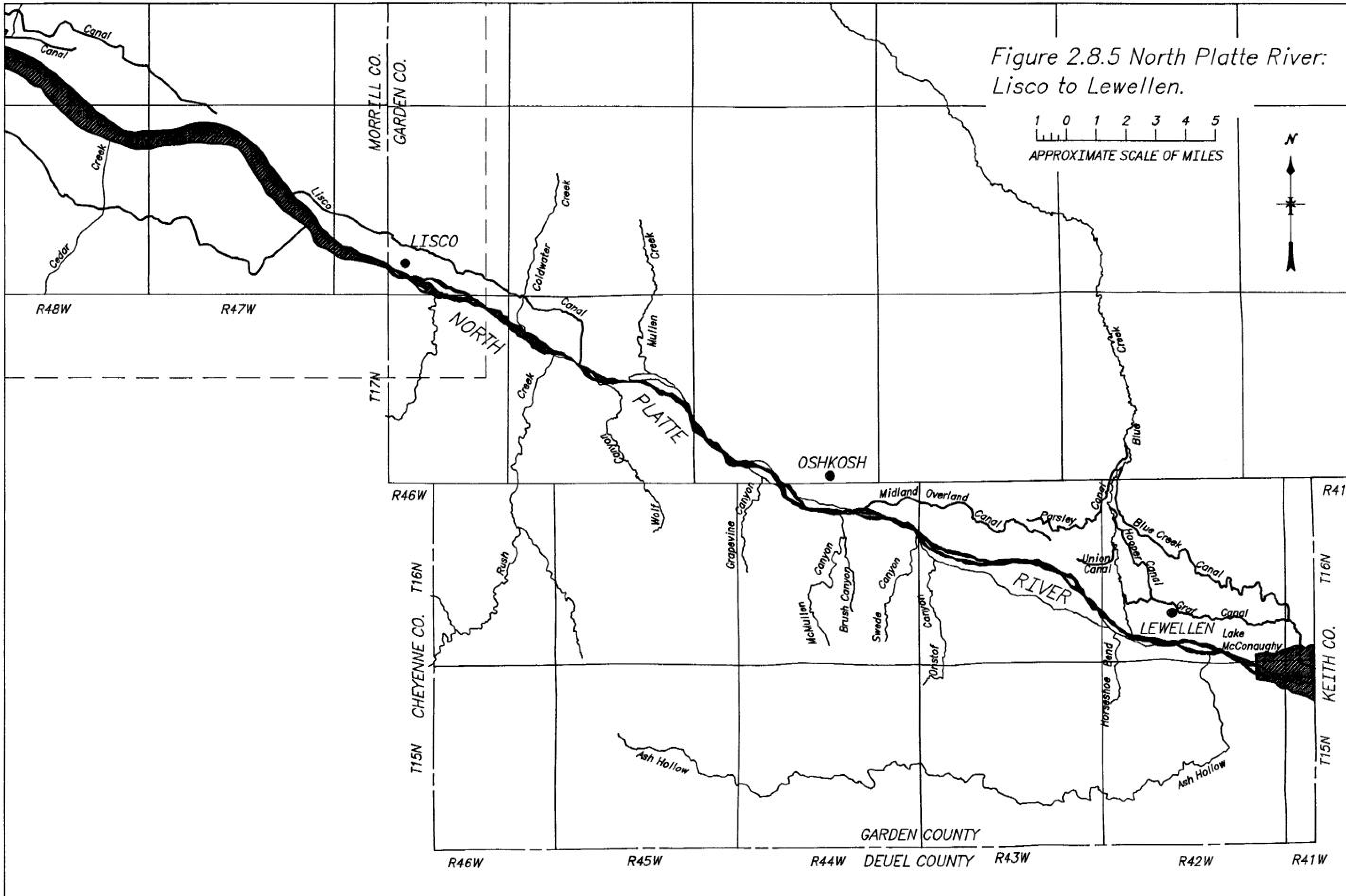

Figure 2.8.5 North Platte River: Lisco to Lewellen.

2.8.1.2 Reach Width

An average reach width for the selected basin was calculated by dividing the total area of the basin by the sum of the lengths of the individual drains, creeks, and the North Platte River within the basin (Hurley, 1967). The average reach width was estimated to be two miles or 10,560 feet (Table C-7). This value is used for both Reach No. 2 (cdata(71)) and Reach No. 3 (cdata(72)).

2.8.1.3 Initial Condition Recharge

The initial condition recharge is used by the GLOVER subroutine to "prime" the ground water conditions for the first year of a model run. The average initial condition recharge was estimated using Reclamation's BASIN computer model. Appendix C, Section 1.4 contains a discussion of the development of the initial condition recharge parameters. An average initial condition recharge of 1.50 kaf/month is used for both Reach No. 2 (cdata(88)) and Reach No. 3 (cdata(89)).

2.8.1.4 Recharge From Irrigation

The water that enters the ground-water reservoir must be determined before the return flow can be calculated. This is the water that is available for flow into the drains. It consists of canal seepage and the deep percolation losses from irrigation applications. This total will be referred to as "deep percolation".

To obtain the deep percolation, the model first reduces the diversion using the non beneficial use factor (cdata(60)), which accounts for water lost to nonreturnable sources such as evaporative and phreatophyte losses. This factor is set at one (1) percent. Then the consumptive use is determined by multiplying the monthly diversion (less nonreturnable losses) by the efficiency. The remaining water is divided between surface runoff and deep percolation using the surface runoff factors (Table 2.8.1) that have been set at 0.30 (adata(25)). Thus, 30 percent of the monthly diversion not consumptively used is accounted as surface runoff and the rest goes to deep percolation (Figure 2.8.6).

Table 2.8.19 Surface Runoff Factors

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

Irrigation Season:
- Divtmp = (Diversion) x (1 - Nonbeneficial Use Factor)
- Consumptive Use = (Divtmp) x (Efficiency)
- Returnable Water = (Divtmp) - (Consumptive Use)
- Surface Runoff = (Returnable Water) x (Surface Runoff Factor)
- Deep Percolation = (Returnable Water) - (Surface Runoff)

Non-Irrigation Season:
- Divtmp = (Diversion) x (1 - Nonbeneficial Use Factor)
- Surface Runoff = (Returnable Water) x (Surface Runoff Factor)
- Deep Percolation = (Returnable Water) - (Surface Runoff)

Figure 2.8.31 Computation of Deep Percolation

The efficiency factors used in the NPRWUM vary by water year and are contained in hdata items hdata2(1-78,i,j) and represent the overall efficiency of the basin between Guernsey and Lewellen. Table 2.8.2 shows the efficiency factors developed for use in the NPRWUM for all modeled diversions. Each diversion has been assigned an hdata2 input item containing its own efficiency that can be varied independently of the others. As scenario runs are made, the efficiencies associated with the modeled deliveries can be adjusted to examine changes to the overall operation in the system with respect to efficiency.

Table 2.8.20 Efficiencies Used by the NPRWUM

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.52	0.52	0.52	0.52	0.52
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.47	0.47	0.47	0.47	0.47
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.44	0.44	0.44	0.44	0.44
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.42	0.42	0.42	0.42	0.42
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.51	0.51	0.51	0.51	0.51
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.39	0.39	0.39	0.39	0.39
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.20	0.20	0.20	0.20	0.20
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.46	0.46	0.46	0.46	0.46
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.30	0.30	0.30	0.30	0.30
1974	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.31	0.31	0.31	0.31	0.31
1975	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.39	0.39	0.39	0.39	0.39
1976	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.47	0.47	0.47	0.47	0.47
1977	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.48	0.48	0.48	0.48	0.48
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.58	0.58	0.58	0.58	0.58
1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.48	0.48	0.48	0.48	0.48
1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.44	0.44	0.44	0.44	0.44
1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.54	0.54	0.54	0.54	0.54
1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.60	0.60	0.60	0.60	0.60
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.20	0.20	0.20	0.20	0.20
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.20	0.20	0.20	0.20	0.20
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.44	0.44	0.44	0.44	0.44
1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.42	0.42	0.42	0.42	0.42
1987	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.50	0.50	0.50	0.50	0.50
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.54	0.54	0.54	0.54	0.54
1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.47	0.47	0.47	0.47	0.47
1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.60	0.60	0.60	0.60	0.60
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.60	0.60	0.60	0.60	0.60
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.60	0.60	0.60	0.60	0.60
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.60	0.60	0.60	0.60	0.60
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.57	0.57	0.57	0.57	0.57
Avg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.46	0.46	0.46	0.46	0.46

2.8.2 Return Flow Computation

The GLOVER subroutine computes return flow based on the assumption that, of a given volume of water added to the ground-water reservoir, a portion will be discharged to a drain or effluent stream and a portion will remain in transient storage. For a given time interval the quantity remaining in storage may be computed if the hydrologic characteristics of the aquifer and drain spacing are known. If the original quantity of water added is known, the difference between the original quantity and the remaining increment indicates the discharge or return flow to the drains. The decimal fraction of the original volume that is remaining in the ground after a period of time has passed is termed "p". Hence, the part of the deep percolation that drains out each month is the difference of the part remaining in storage at the beginning of the month (p_1) and the part remaining in storage at the beginning of the next month (p_2) . This decimal fraction of the original volume that is remaining in the ground after a period of time establishes the return flow timing or patterns used by the NPRWUM. These return flow patterns are calculated by the GLOVER subroutine for Reach No. 2 and Reach No. 3 during the initial call to the subroutine and are used throughout the period of record. The model user can inspect the return flow timing patterns generated by the NPRWUM by viewing the RETFLOW.TIM output file. These return flow patterns can be altered by the model user by changing the value of the storage coefficient, transmissivity, and/or reach width.

When the Δp's have been calculated and the monthly deep percolation determined for a reach, the computation of the monthly return flow can begin. The total return flow in any month is the sum of all the monthly increments of return flow that discharge into the drains during that month. The GLOVER subroutine uses the time period of ½ month. Therefore, the total return flow calculated in August, for example, would be the amount of deep percolation in August multiplied by the Δp for the time elapsed, ½ month, plus July's deep percolation multiplied by the Δp for ½ to 1½ months time, plus June's deep percolation multiplied by the Δp for 1½ to 2½ months time, and so on until the last Δp multiplied by a month's deep percolation is added.

The surface runoff for a given month is assumed to return directly to the river in the same month that it occurred. Therefore, the total return flow for a month is equal to the return flow from deep percolation as computed by the GLOVER subroutine plus the surface runoff.

2.8.3 Adjustment to Historical Reach Gains

The return flow is used to adjust the historical reach gains entered in the NPRWUM. If irrigation deliveries within a reach are identical to historic, then the historic reach gain will be used to compute the flow at the next accounting point. If the irrigation deliveries within a reach are not equal to historic, the NPRWUM will calculate an adjusted reach gain by adding the difference of the return flow computed for the new/altered deliveries and the return flow computed for the historic deliveries to the historical reach gain (Figure 2.8.7). This adjusted reach gain is then used to calculate the flow at the next accounting point, revealing the change in flow to the reach from reduced or increased deliveries.

	Historical Reach Gain
+	(Return Flow Modeled Deliveries - Return Flow Historical Deliveries)
=	Adjusted Reach Gain

Figure 2.8.32 Adjustment of the Historical Reach Gain

2.8.4 Irrigation Reuse and Well Irrigation

Irrigation reuse and net recharge due to well irrigation options in the model are described in the following text. The irrigation reuse option allows the model to simulate irrigation reuse in Reaches No. 2 and No. 3. The amount of reuse is controlled by the model user via hdata items hdata1(60-63,i,j). For example, if the model user wanted to implement 20% reuse in a reach, they would use a factor of 0.20. The NPRWUM then takes 20% of all water available for return and reuses it by means of a phantom diversion. The phantom diversion functions identically to a canal diversion by reducing the diverted amount by evaporation and consumptive use with the remaining portion being assign as water available for return. The phantom reuse diversion occurs after all other diversions in a reach have been processed and is assumed to take place at the bottom of the reach.

Another option included in the NPRWUM provides the ability to simulate the impacts of ground water depletions due to well irrigation. This option is controlled though hdata items hdata1(64-67,i,j). The model user must enter their estimate of monthly net recharge from well irrigation in the given hdata items. The monthly net recharge is the net change in ground water content due to pumping and is entered as a negative value to indicate it is a depletion. The model adds the net recharge from well irrigation to the water available for return in the reach just before calling the GLOVER subroutine to determine the return flow. This option allows the model user to investigate other than historic ground water use in periods of surface water shortages. However, the use of this option will require the model user to make a judgement of how ground water usage will increase if surface water shortages occur.

The reuse and ground water depletion options were not used during the calibration/validation of the NPRWUM.

2.9 Operation of the River Downstream of Guernsey Reservoir

The final phase of the NPRWUM is to operate the North Platte River system below Guernsey Reservoir. This Section describes how the river system is operated in this phase. The North Platte River from Guernsey Dam to Lewellen was modeled by dividing the river into three (3) reaches. The reaches were selected using the general criteria that return flows from lands irrigated within the reach would return to the river before the beginning of the next reach. Only two (2) canals violated this criteria: Interstate (Pathfinder) and Fort Laramie (Goshen and Gering-Fort Laramie) Canals. The special handling of these canals is explained in their respective sections. The Inland Lakes also required special consideration and is discussed under the Idealized Inland Lakes Section 2.9.5. The three (3) river reaches modeled downstream of Guernsey Reservoir are:

! Guernsey to below Whalen (Reach No. 1);
! Whalen to below Tri-State (Reach No. 2); and
! Tri-State to Lewellen (Reach No. 3).

Historical reach gains were developed using historical gaged records. These historical reach gains include all water returned to the river from the drains; both irrigation return flow and storm water runoff. When an adjustment to the historical reach gain is made (Section 2.8.3), it is intended that the portion of the reach gain associated with the irrigation return flow is adjusted, leaving the storm water runoff portion intact.

Historical reach gains associated with Reaches No. 1 and No. 2 are reduced by the NPRWUM during the irrigation season if the gain utilization factors are less than one (1.0) and are used in the operation of the river below Guernsey. These gain utilization factors control the amount of the gain in these reaches that go to meet irrigation demands (Section 2.4.2 and Section 3.5.1.7). The gain utilization factors used in the NPRWUM are shown in Table 2.4.2 and Table 2.4.3 of Section 2.4.2. In the following text, the term historical reach gain for Reaches No. 1 and No. 2 include any reductions based on these gain utilization factors.

The model simulates the river below Guernsey Reservoir in an iterative fashion beginning with the inflow to Reach No. 1 and continuing downstream to the end of Reach No. 3, accounting for the gross water and diversions in each reach. Flow in the river below Guernsey Reservoir is only determined by the NPRWUM at the beginning and ending of each reach, except for Reach No. 3. While Reach No. 3 also maintains the gross water balance, it gives an accounting of the flow in the river below each modeled diversion point, discussed later in Section 2.9.3. The inflow to each reach is known, since it is equal to the outflow of the preceding reach. If the diversions within the reach are not identical to the historical demands, the historical reach gain is adjusted by the difference of the return flow associated with the historical demands and the return flow from the deliveries made by the model in the reach. Otherwise, the adjusted reach gain will be equal to the historical reach gain. The outflow from a reach is equal to the inflow plus the adjusted reach gain and any tributary inflow not included in the reach gain minus the diversions. On the first pass through a reach, the NPRWUM assumes that the available water (inflow plus reach gain plus tributary inflow, if any) in the reach will satisfy all the diversions in the reach. If the outflow from the reach is greater than or equal to zero (0), the assumption is valid and the model continues with the next downstream reach. However, if a shortage of water is identified in the reach, the outflow from the reach is less than zero (0), the available water in the reach is apportioned amongst the appropriators in the reach to determine which diversion(s) is shorted. A diversion's shortage is computed as the delivery entered by the model user minus the delivery actually made by the model. If possible, the shortage is called from storage and the reach reiterated with the increased inflow. Otherwise, the reach is reiterated with the reduced diversion(s). This process continues until the outflow of the reach is greater than or equal to zero (0). Although the NPRWUM does not explicitly model the geographical location of the canals, ditches, and return flows within the reaches, each reach maintains a water balance and the available water in each reach is appropriated according the priority dates of the water rights within the reach, if a shortage occurred. Hence, all shortages reported by the NPRWUM are according to priority, assuming the diverters in the reach were physically able to divert their apportioned water.

2.9.1 Guernsey to Below Whalen - Reach No. 1

Reach No. 1, Guernsey to below Whalen, consists of a stretch of the river beginning below Guernsey Reservoir and ending below Whalen Dam. The Interstate and Fort Laramie Canals divert water from this reach via the Whalen Diversion Dam. The return flows from these canals return below Whalen Dam and no other diversions from the river that would provide return flows within this reach are modeled. Therefore, no adjustment to the historical reach gain is made in this reach. The inflow to Reach No. 1 is equal to the Guernsey Reservoir outflow. The Guernsey Reservoir outflow was previously determined by the reservoir operation portion of the NPRWUM. The outflow for the reach is equal to the inflow plus the historical reach gain minus the diversions by Interstate and Fort Laramie Canals (Figure 2.9.1).

	Modeled Guernsey Reservoir Outflow
+	Guernsey to below Whalen Reach Gain
-	Fort Laramie Canal Diversion
-	Interstate Canal Diversion
=	Modeled Whalen Dam Outflow (Inflow Reach No. 2)

Figure 2.8.33 Modeled Whalen Dam Outflow

2.9.1.1 Interstate Canal

The Interstate Canal diverts water at the Whalen Diversion Dam on the north side of the North Platte River. The modeled diversions in this reach are:

- Diversion above the gage at mile post 2.7;
- Lingle Diversion;
- Hill Diversion;
- Wyoming Laterals Diversion;
- Pathfinder Diversion; and
- Delivery to Inland Lakes.

The Interstate Canal Diversion above mile post 2.7 is the diversion of water between the head of the Interstate Canal and the gage on the Interstate Canal at mile post 2.7. The Wyoming Laterals, Lingle, and Hill divert water between the gage at mile post 2.7 and the Wyoming/Nebraska state line. The return flows from these diversions are included in the return flow for Reach No. 2.

The Pathfinder Diversion contains the water diverted for the Pathfinder Irrigation District (ID). The Pathfinder Irrigation District consists of the Pathfinder Main Canal, the Highline Canal, Reservoir Supply Canal, Lowline Canal, and the Inland Lakes. The Pathfinder Main Canal is the equivalent of the Interstate Canal exclusive of non-Pathfinder ID diversions.

Water diverted into the Pathfinder Main Canal (Interstate Canal exclusive of non-Pathfinder ID diversions) for the Pathfinder District includes deliveries to the Inland Lakes and deliveries for irrigation from the Main Canal. The Main Canal deliveries are located in Reach No. 3, except for 2000 acres associated with non-consenting/non-district lands in Wyoming. Therefore, it was necessary to divide the water available for return from the Main Canal's delivery between Reach No. 2 and Reach No. 3. During the irrigation season, the water available for return is split 10% to Reach No. 2 and 90% to Reach No. 3 using the ratio of the length of the Main Canal from the Whalen Diversion Dam to the turnout of the first lateral that returns water in Reach No. 3 (approximately 45.6 miles) to the total length of the Main Canal from the Whalen Diversion Dam to the Inland Lakes (approximately 94.6 miles) and miles of lateral served from the Main Canal in Reach No. 3 (approximately 426 miles (Pathfinder, 1993)). Water diverted through the Main Canal for the Inland Lakes during the non-irrigation season is also charged a conveyance loss which is split 48% to Reach No. 2 and 52% to Reach No. 3 using the ratio of the length of the Main Canal from the Whalen Diversion Dam to the turnout of the first lateral that returns water in Reach No. 2

(approximately 45.6 miles) to the total length of the Main Canal from the Whalen Diversion Dam to the Inland Lakes (approximately 94.6 miles). The conveyance loss factors for the Inland Lakes delivery are shown in Table 2.9.3.

2.9.1.2 Fort Laramie Canal

The Fort Laramie Canal diverts water at the Whalen Diversion Dam on the south side of the North Platte River. It consists of the following:

- Wright and Murphy Diversion;
- Goshen Diversion; and
- Gering-Fort Laramie Diversion.

Lands irrigated by the Wright and Murphy provide return flows to only Reach No. 2. The Gering-Fort Laramie and the Goshen Irrigation Districts provide return flows to both Reach No. 2 and Reach No. 3. The water available for return from the Gering-Fort Laramie ID is split 15% to Reach No. 2 and 85% to Reach No. 3 on the basis of approximately 63 miles of the Fort Laramie Canal above Horse Creek and a total length of the Fort Laramie Canal (130 miles) plus the length of the Gering-Fort Laramie ID laterals (302 miles). The water available for return from the Goshen ID is split 74% to Reach No. 2 and 26% to Reach No. 3 on the basis of approximately 63 miles of the Fort Laramie Canal above Horse Creek and a total length of the Fort Laramie Canal within the Goshen ID (85 miles).

2.9.2 Whalen to Below Tri-State - Reach No. 2

Reach No. 2, Whalen to below Tri-State, consists of a stretch of the river beginning below Whalen Dam and ending below Tri-State Dam. The modeled diversions in this reach are:

- Burbank Ditch Diversion;
- Lucerne Ditch Diversion;
- Grattan Ditch Diversion;
- Rock Ranch Ditch Diversion;
- Torrington Ditch Diversion;
- North Platte Ditch Diversion;
- Narrows Ditch Diversion;
- Pratt-Ferris Ditch Diversion;
- Mitchell-Gering Canal Diversion; and
- Tri-State Canal Diversion (Farmers, Northport, and Ramshorn).

The water contributing to the return flows from these diversions return in Reach No. 2 with the exceptions of the Mitchell-Gering and the Tri-State Canals, which return to the river in Reach No. 3. The inflow to Reach No. 2 is the outflow from the previous reach plus the inflows of the Laramie River (hdata(5,I,J)). Once the return flows have been computed for the contributing canals/ditches, the NPRWUM proceeds to adjust the historical reach gain for Reach No. 2 and compute the outflow from the reach. The outflow from Reach No. 2 (flow below Tri-State Dam) is equal to the Whalen Dam outflow plus the inflow from the Laramie River plus the reach gain minus the total diversions in the reach (Figure 2.9.2). If the modeled outflow is less than the water orders for storage passing Tri-State, the assumption that the available water in the reach would satisfy the diversions is not valid. Therefore, the NPRWUM will set the historical reach gain equal to the adjusted reach gain and completely reoperate the system. If the shortage of water in the reach is available to be passed from the natural flow or called from storage, the water is released from the upper system and the reach is reiterated with the increased inflow. Otherwise, the available water in the reach will be apportioned amongst the appropriators as described in Section 2.6 and the reach reiterated with the reduced diversion(s).

	Modeled Whalen Outflow
+	Laramie River Inflow
+	Reach Gain (Reach No. 2)
-	Total Diversions (Reach No. 2)
=	Modeled Tri-State Dam Outflow (Inflow Reach No. 3)

Figure 2.8.34 Modeled Tri-State Dam Outflow

2.9.2.1 Tri-State Canal

The Tri-State Canal Diversion includes the Farmers Canal Diversion, the Northport Canal Diversion, and the Ramshorn Canal Diversion. Since about 1971, the Ramshorn Canal has been partially inactive. The Ramshorn Irrigation District was dissolved in September of 1992 and no longer possess any surface water rights for irrigation. The Ramshorn Canal input data (hdata(52,I,J) and hdata1(26,I,J)) may be set to zero (0) for future model runs. Both the Farmers Canal and the Northport Canal diversions are the total amounts of water diverted from the river and do not include water from the drains. The total Tri-State Canal Diversion computed by the NPRWUM is equal to the sum of the Northport Diversion, the Ramshorn Diversion, and the Farmers Diversion. Water diverted from the drains is included as a separated input item to the NPRWUM and is model in the Tri-State to Lewellen reach where it occurs.

2.9.3 Tri-State to Lewellen - Reach No. 3

Reach No. 3, Tri-State to Lewellen, consists of a stretch of the river beginning below Tri-State Dam and ending at Lewellen, Nebraska. The modeled diversions in this reach are:

- Enterprise Canal Diversion;
- Winters Creek Canal Diversion;
- Central Canal Diversion;
- Minatare Canal Diversion;
- Castle Rock Canal Diversion;
- Nine Mile Canal Diversion;
- Short Line Canal Diversion;
- Chimney Rock Canal Diversion;
- Bridgeport Diversion via Belmont Canal;
- Empire Diversion via Belmont Canal;
- Browns Creek Canal Diversion;
- Beerline Canal Diversion;
- Lisco Canal Diversion; and
- Midland-Overland Canal Diversion.

The water contributing to the return flows from these diversions return in Reach No. 3. Several diversions from the drains occur in the Tri-State to Lewellen Reach. These drains carry return flows from irrigated lands that can be diverted by other down gradient canals and used for irrigation. Diversions from the drains modeled by the NPRWUM are:

- Farmers Canal Diversion from drains;
- Northport Canal Diversion from drains;
- Enterprise Canal Diversion from drains;
- Winters Creek Canal Diversion from drains; and
- Alliance Canal Diversion from drains.

Typically these canals divert water from several drains. For example, the Hydrographic Reports for the State of Nebraska (1988) shows that the Enterprise Canal diverts water from the Morrill Drain, Winter Creek, and Dry Spottedtail Creek. The individual diversions taken from the various drains for these canals have been summarized into a total diversion. Hence, the Enterprise Canal diversion from the drains (hdata(64,I,J)) is the sum of the water diverted from the Morrill Drain, Winter Creek, and Dry Spottedtail Creek.

The NPRWUM satisfies the diversions from the drains using the modeled return flows from lands above the drains. Hence, the computed return flow from the Pathfinder ID in Reach No. 3 is used to first satisfy the Northport's Diversion from the drains and the remainder is used to satisfy Farmers' Diversion from the drains. Next, any remaining Pathfinder return flow water is added to the Farmers return flow and that quantity is used to first satisfy the drain diversions of the Enterprise Canal, Winters Creek Canal, and finally the Alliance Canal. If any of these drain diversions are shorted, additional water is called from storage, if possible, or the delivery associated with the shorted diversion is reduced.

The additional water that is called from storage is released from the associated ownership and delivered via the North Platte River to the canal. Only the Farmers, Northport, and Enterprise drain diversions have storage contracts and are allowed storage water to offset a shortage from the drains. The Farmers and Northport Diversions, which take water from the river through the Tri-State Canal, are the only drain diversions that are subject to any canal capacity (cdata(75)). The drain diversions take only the user-supplied deliveries entered in the input file. The NPRWUM does not increase the diversions from the drains if the drain flows exceed the user-supplied values, nor are the associated river diversions decreased.

The NPRWUM, assuming the available water in the reach will satisfy all the diversions, processes Reach No. 3 employing both the gross water accounting used for Reaches No. 1 and No. 2 and tracks the flow in the river from one diversion to another down to Lewellen. Before the model begins to process the diversions in Reach No. 3, the Tri-State to Lewellen reach gain is prorated into smaller subreach gains associated with sections of the river between two modeled diversion points. These subreaches in downstream are:

- Tri-State Dam to Enterprise Canal;
- Enterprise Canal to Winters Creek Canal;
- Winters Creek Canal to Central Canal;
- Central Canal to Minatare Canal;
- Minatare Canal to Castle Rock Canal;
- Castle Rock Canal to Nine Mile Canal;
- Nine Mile Canal to Short Line Canal;
- Short Line Canal to Chimney Rock Canal;
- Chimney Rock Canal to Belmont Canal;
- Belmont Canal to Browns Creek Canal;
- Browns Creek Canal to Beerline Canal;
- Beerline Canal to Lisco Canal;
- Lisco Canal to Midland-Overland Canal; and
- Midland-Overland Canal to Lewellen.

The factors used to prorate the gain (hdata1(46,I,J) through hdata1(59,I,J)) were developed by accounting for the distance each modeled diversion point was from the Tri-State Dam and the location of Horse Creek, Sheep Creek, Dry Spottedtail Creek, Tub Springs, Winters Creek, Gering Drain, Bayard Sugar Factory Drain, Red Willow Creek, Pumpkin Creek, and Blue Creek in relation to the North Platte River.

The NPRWUM adjusts the historic net gain in Reach No. 3 before the gain is prorated if there is any water orders for storage passing Tri-State Dam. Storage deliveries to government contractors below Tri-State Dam were taken from Reclamation's Compiled Water Records, Water Distribution below Guernsey - Natural Flow and Storage sheet. The storage used by contractors below Tri-State Dam reported on this sheet summarizes the amount of storage water diverted by a contractor at their point of diversion (headgate) and does not include carriage losses between Tri-State Dam and their diversion point. The historic Tri-State to Lewellen net reach gain is calculated as the flow at Lewellen plus the sum of the diversions minus Blue Creek minus the flow passing Tri-State Dam. In months that contain water orders for storage passing Tri-State Dam, the gain would be over predicted if it were not reduced by the charged carriage losses. The carriage losses assessed to storage orders below Tri-State Dam were obtained from the Department of Water Resources (DWR) in Bridgeport, Nebraska, and are shown in the Table 2.9.1. The values shown in the table are fixed in the model's code and cannot be changed via the input files.

Table 2.8.21 Carriage Losses Charged to Water Orders for Storage Below Tri-State Dam

Canal	Charged Loss	Canal	Charged Loss
Enterprise	20%	Belmont	33%
Central	28%	Browns Creek	40%
Chimney Rock	28%	Beerline	40%

For example, if the Water Distribution below Guernsey - Natural Flow and Storage sheet showed Beerline had taken 25 cfs of storage water, a 40% carriage loss would be added and the water order for storage passing Tri-State would have been 35 cfs (25x1.40 = 35). If the flow passing Tri-State Dam consisted only of Beerline's 35 cfs water order for storage, the NPRWUM would reduce the initial net Tri-State to Lewellen reach gain by 10 cfs, which is the 40% carriage loss (35/1.40*0.40 = 10). Otherwise, the net Tri-State to Lewellen reach gain would be over predicted by 10 cfs, since Beerline only diverts 25 cfs at their headgate. When additional storage water is ordered by the model to offset a shortage, the net Tri-State to Lewellen reach gain is further reduce by the incremental amount of the carriage loss charged to the additional storage order. CNPP&ID water orders for storage are charged a 10% carriage loss (cdata(74)). Immediately after the gain is adjusted to account for charged carriage losses, the NPRWUM prorate the gain to the subreaches.

After the Reach No. 3 gain has been prorated, the NPRWUM proceeds to track the flow passing Tri-State Dam from diversion to diversion downstream to Lewellen. As the flow is tracked downstream, the model satisfies the water rights in order of priority from the most senior right to the most junior right using only the subreach gains immediately above their diversion points and the flow passing Tri-State Dam, exclusive of water orders for storage. For example, the Enterprise Canal's water right (3rd in order of priority - Table 2.9.2) is satisfied from the Tri-State Dam to Enterprise Canal subreach gain and the flow passing Tri-State Dam after the rights for the Minatare, Nine Mile, and Winters Creek Canals have been satisfied. Likewise, Browns Creek Canal's water right (9th in order of priority) is satisfied from the subreach gains beginning with the Belmont Canal to Browns Creek Canal subreach gain moving upstream to the flow passing Tri-State Dam after the water rights for priorities one (1) through eight (8) have been satisfied. If rights with an earlier priority date have depleted the available flow, the right being processed is shorted. This process is repeated for all the rights which divert from the river in Reach No. 3. When a right is shorted (including diversions from the drains), the model calls additional water from storage, if possible, adjusts the reach gain, and reoperates the entire system or reduces the delivery by the shortage, adjusts the reach gain, and reiterates Reach No. 3 until the flow at Lewellen calculated using the gross water accounting approach (Figure 2.9.3) is equal to the flow at Lewellen calculated by tracking the flow from the last modeled diversion (Midland-Overland Diversion) down to Lewellen (Figure 2.9.4).

	Modeled Tri-State Dam Outflow
+	Adjusted Reach Gain (Reach No. 3)
+	Blue Creek Inflow
-	Total Diversions from River (Reach No. 3)
=	Modeled Flow at Lewellen, Nebraska

Figure 2.8.35 Modeled Flow at Lewellen - Gross Water Accounting

	Modeled Flow below Midland-Overland Diversion
+	Midland-Overland to Lewellen Subreach Gain
+	Blue Creek Inflow
=	Modeled Flow at Lewellen, Nebraska

Figure 2.8.36 Modeled Flow at Lewellen - Tracked by Diversion Point

After the modeled flow at Lewellen has been determined, the NPRWUM proceeds to write the variables to the output files and continue the process with the next month of the study period until the last month of the study period is processed. An accounting of the storage used by the diverters in Reach No. 3 is reported in the natural flow output file (NATFLOW.LST). This accounting is performed only for the Warren Act and Glendo Contractors.

2.9.3.1 Reach No. 3 Natural Flow Accounting

The PRORITY Subroutine of the NPRWUM performs a simplified accounting of the natural flow appropriations for the Tri-State to Lewellen reach. The iflgapp variable (cdata1(69)) controls the appropriation of the natural flow by this subroutine. If iflgapp is “on”, set to one (1), the subroutine appropriates the natural flow below Tri-State Dam according to Table 2.9.2. Otherwise, the subroutine only appropriates the natural flow rights if a shortage condition exists in Reach No. 3 and the natural flow diversions are allowed to exceed their appropriation. First, the natural flow appropriations are defined and converted from cfs to kaf. Next, the canals' natural flow diversions are identified. A canal's natural flow diversion is equal to the total delivery minus the storage delivery, distributed amongst its appropriations. At this point, a canal's natural flow diversion can exceed its total appropriation. If a canal has multiple appropriations, any water above its total appropriation will be held in the natural flow diversion associated with the most junior appropriation. These natural flow diversions are checked against the prorated gain to ensure the diversions were physically possible within the priority system. Any water that passes Tri-State Dam exclusive of the water orders for storage is also considered natural flow and is used to meet the natural flow demands in the reach. If a shortage is identified or the iflgapp flag is "on", the NPRWUM will limit the canals natural flow diversions to their respective appropriations and proceed to appropriate the prorated gain, reduce deliveries as needed, and increase water orders for storage, if possible. Otherwise, the natural flow diversions are considered satisfied for the given month and the model continues on to process the next month.

Table 2.8.22 Appropriation of the Natural Flow - Tri-State to Lewellen Reach

Natural Flow Appropriation (Canal)	Natural Flow Appropriation (cfs)	Date of Priority
1. Minatare (D919)	247.15	01/14/1888
Nine Mile (D919)	2.28	01/14/1888
2. Winters Creek (D952)	124.29	10/18/1888
3. Enterprise (D920)	138.68	03/28/1889
4. Castle Rock (D921)	82.57	04/18/1889
5. Belmont (D828)	90.40	12/19/1889
6. Central (D926)	36.00	06/23/1890
7. Chimney Rock (D844)	60.00	12/03/1890
8. Empire (D858)	28.57	06/25/1891
9. Browns Creek (D857)	87.50	01/20/1892
10. Short Line (D946)	65.57	05/01/1893
11. Lisco (D856)	19.87	07/01/1893
12. Nine Mile (D925)	200.00	12/06/1893
13. Lisco (D787)	15.41	03/27/1894
14. Midland-Overland (D789)	8.77	06/09/1894
15. Midland-Overland (D791)	14.43	08/14/1894
16. Beerline (D887)	14.19	10/13/1894
17. Midland-Overland (A1742)	1.25	11/20/1894
18. Castle Rock (A186)	6.74	10/22/1895
19. Lisco (A243)	11.43	02/24/1896
20. Castle Rock (A350)	0.85	07/22/1896
21. Empire (A866)	0.49	07/20/1907
22. Lisco (A991)	3.00	04/06/1910
23. Chimney Rock (A2190)	0.67	02/02/1931

Source: Nebraska Department of Water Resources, 1995

2.9.4 Idealized Inland Lake

The Inland Lakes receive water through the Interstate Canal and are operated by the Pathfinder Irrigation District (ID). The Inland Lakes consist of:

- Lake Alice;
- Little Lake Alice;
- Winters Creek; and
- Lake Minatare.

Due to the limited capacity of the Interstate Canal, the Inland Lakes function is to store water and deliver water to lands irrigated by the Pathfinder ID as needed. The Pathfinder ID delivery system consists of the Pathfinder Main (Interstate Canal exclusive of non-Pathfinder ID diversions), Highline, Reservoir Supply, and Lowline Canals (Figure 2.9.5). The Pathfinder Diversion includes water delivered above the Inland Lakes via the Pathfinder Main and Highline Canals and water to be stored by the Inland Lakes to meet system deliveries later in the irrigation season. Water stored in the Inland Lakes is delivered to lands via the Reservoir Supply and Lowline Canals. The Reservoir Supply Canal data accounts for any water delivered by the Winters Creek Canal for irrigation.

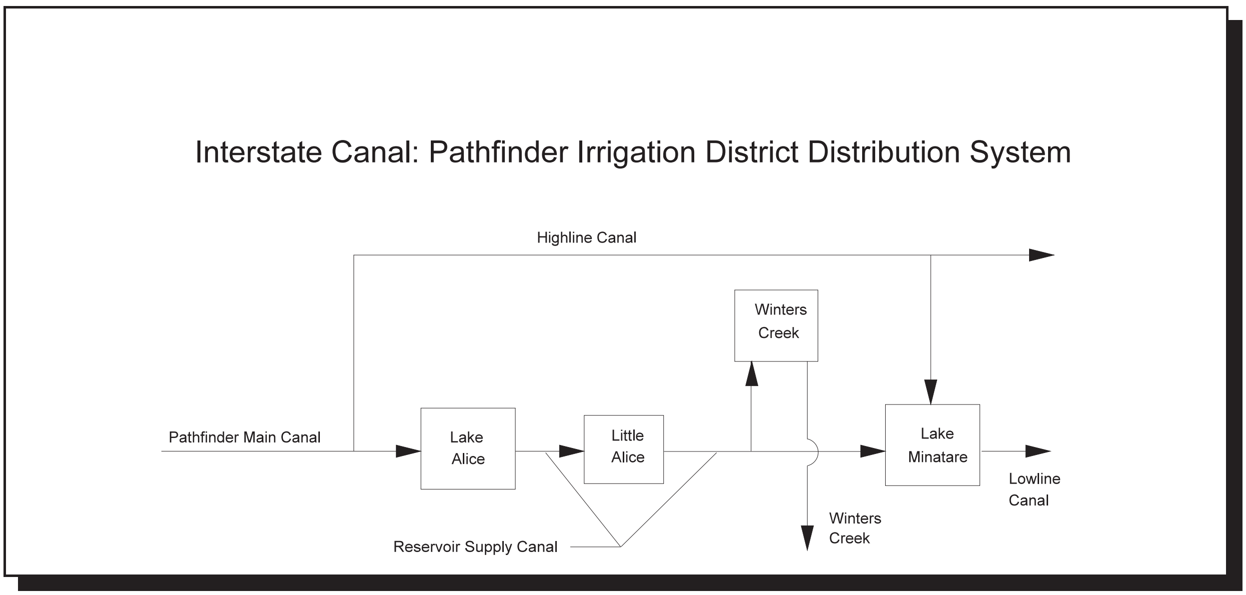

Figure 2.8.37 Inland Lakes

It was necessary to approximate the operation of the Inland Lakes to assure a water balance is maintained between the inflows, outflows, and storage. The operation of the Inland Lakes has been idealized in the NPRWUM, meaning that the physical system has been manipulated into a theoretical depiction. This theoretical depiction combines Lake Alice, Little Lake Alice, Winters Creek, and Lake Minatare into one lake, hereafter referred to as the Idealized Inland Lake. The following assumptions were made to create the Idealized Inland Lake. First, the Idealized Inland Lake has a capacity equal to the combined total storage of all four lakes (74,055 af) and no restrictions are enforced on the amount of water that can be passed through the inlet and outlet works. Second, the inflow to the Idealized Inland Lake is equal to the flow of the Pathfinder Main Canal after irrigation deliveries and is inclusive of the Highline Canal. Finally, the outflow from the Idealized Inland Lake is the irrigation deliveries made by the Highline, Reservoir Supply, and Lowline Canals. Under these assumptions, the flow in the Highline Canal is passed through the Idealized Inland Lake and the water delivered for irrigation to lands located in the vicinity above the Inland Lakes occurs immediately after exiting the Idealized Inland Lake. Thus, the Highline Canal's demand on the Idealized Inland Lakes is equal to the amount of water that would have been diverted into the Highline Canal from the Pathfinder Main Canal under actual conditions minus water delivered from the Highline Canal to Lake Minatare. A schematic diagram of the Idealized Inland Lake is shown in Figure 2.9.6.

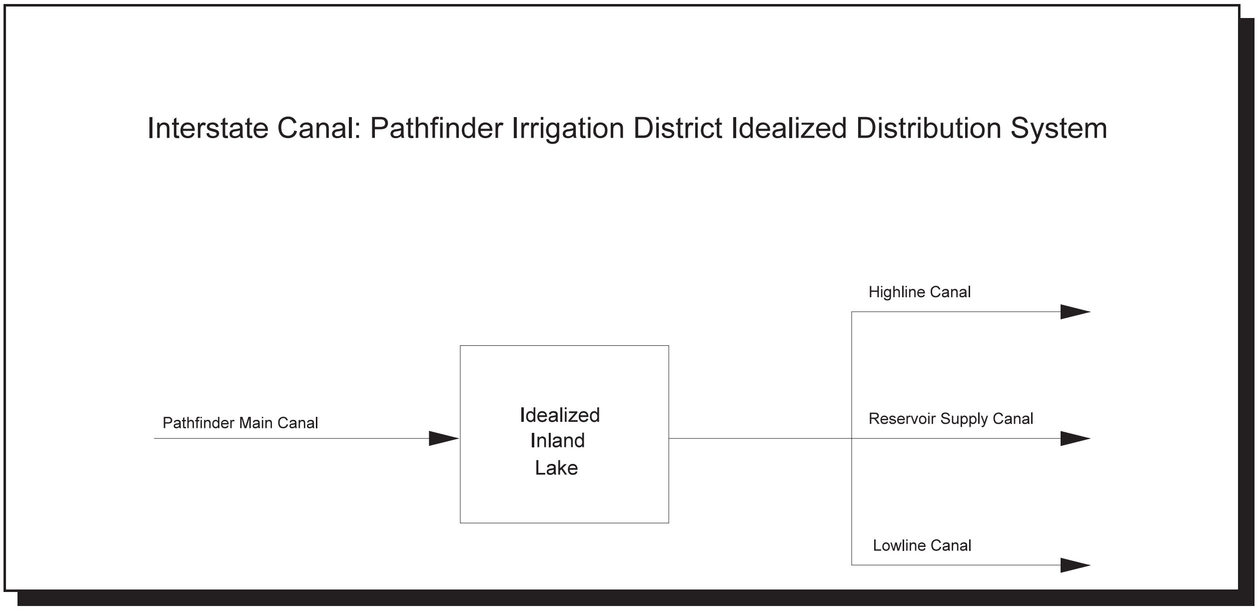

Figure 2.8.38 Idealized Inland Lake

The NPRWUM operates the Idealized Inland Lake strictly on a theoretical basis and performs no ownership accounting of the water stored in it. The Idealized Inland Lake is operated solely on the criteria that the physical storage capacity cannot be less than zero or greater than its capacity of 74,055 af. (Note: The Inland Lakes ownership account in the main stem cannot accrue more than 46,000 af in any water year.) If the storage goes below zero, the demand on storage water is reduced. If the storage exceeds the capacity, the delivery from the Idealized Inland Lake is increased.

The data used to develop the Idealized Inland Lake were taken from Reclamation's Compiled Water Records (CWR) as provided by the Pathfinder ID. Water diverted to the Idealized Inland Lake in the non-irrigation season was determined to be the flow at mile post 2.7 of the Interstate Canal, assuming no other diversion took place during the winter months from the Interstate Canal. In addition, the NPRWUM delivers the remainder of the Inland Lakes ownership water, if any, in April. Canal loss (conveyance loss) for non-irrigation season deliveries are estimated by using a monthly canal loss factor times the delivery. The monthly canal loss factors were computed by dividing the monthly summation of the canal loss and monthly summation of the flow at mile post 2.7 for the 1961-89 period (Table 2.9.3). These non-irrigation season canal losses are split 48% to Reach No. 2 and 52% to Reach No. 3. Water diverted to the Idealized Inland Lake during the irrigation season is the Pathfinder Diversion less the water delivered to irrigate lands from the Pathfinder Main Canal. Canal losses for the irrigation season are accounted for in the Pathfinder Diversion.

Table 2.8.23 Canal Loss Factors for Conveying Water to the Idealized Inland Lake October - April

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
0.20	0.50	0.50	0.50	0.50	0.45	0.45	0.0	0.0	0.0	0.0	0.0

Please note that the Idealized Inland Lake operation is included in the NPRWUM only for the purpose of balancing the deliveries to and from the Inland Lakes. It is not intended to be used for detailed analysis of the Inland Lakes.

2.9.4.1 Evaporation

The NPRWUM has been equipped with a subroutine called ILVAP, which performs the evaporation calculations for the Idealized Inland Lake. The evaporation is calculated as the surface area times the evaporation factor for Whalen Diversion Dam, since evaporation data at the Lake Minatare station is limited. The surface area is computed from the average end-of-month content using an Area-Capacity Table developed for the Idealized Inland Lake. The Idealized Inland Lake uses the Area-Capacity Table (Table 2.9.4) for Lake Minatare.

Table 2.8.24 Idealized Inland Lake Area-Capacity Table

Reservoir Content (af)	Surface Elevation (ft)	A1 Coefficient Term	A2 Coefficient Term	A3 Coefficient Term
0	4073.4	0	0	38.27
259	4076.0	258.7	199	18.00
1343	4080.0	1342.7	343	14.00
2939	4084.0	2938.7	455	18.88
5061	4088.0	5060.7	606	23.25
7857	4092.0	7856.7	792	28.00
11473	4096.0	11472.7	1016	24.38
15927	4100.0	15926.7	1211	21.88
21121	4104.0	21120.7	1386	23.50
27041	4108.0	27040.7	1574	18.00
33625	4112.0	33624.7	1718	15.25
40741	4116.0	40740.7	1840	19.63
48415	4120.0	48414.7	1997	16.00
56659	4124.0	56658.7	2125	11.00
65335	4128.0	65334.7	2213	12.75
74391	4132.0	74390.7	2315	20.13
83973	4136.0	83972.7	2476	7.71

3.0 OPERATION OF THE NPRWUM

The North Platte River Water Utilization Model (NPRWUM) is a computer simulation of a complicated river system. In order to simulate many of the nuances that make the North Platte so complicated, many flags, options, and user defined values were included in the NPRWUM and its corresponding data bases. The intent of this Section is to aid the user in understanding these items as well as the structure of the NPRWUM and its associated data files. Section 3.0 also describes the system requirements for operating the NPRWUM and what to expect during model operation.

3.1 Description of the Model

The NPRWUM is based on the OPSTUDY program developed by Fred Otradovsky (1986) of the Bureau of Reclamation. The model is written in FORTRAN 77 and contains over 15,000 lines of code. These 15,000 lines include intricate comment statements that document the model algorithms. The NPRWUM was developed using the Green Hills™ Fortran Compiler (version 1.8.7) on a Data General AViiON 530 Workstation running the DG/UX operating system. At the request of the Hydrology Study Team (formed to help develop the NPRWUM), the model was converted to run on IBM™-compatible Personal Computers (PC). The Lahey™ Fortran Compiler (F77L-EM32) was used to create the executable version for the PC. The model's source code was developed using the basic features of the Fortran language and should be portable to various compilers on other computer systems provided the memory limitations of the compiler used are not prohibitive. The MICROSOFT™ Fortran Compiler used in the DOS operating system cannot compile the program due to the memory limitations of the MICROSOFT™ compiler.

The NPRWUM is a monthly water balance model developed to simulate the operation of Reclamation's projects on the North Platte River. The model has been developed exclusively for the North Platte River Basin and cannot be adapted to model other river basins. The NPRWUM uses only the inflows, the irrigation demands, and the options set by the model user to simulate the operation of Reclamation's facilities on the North Platte River. The major irrigation deliveries below Guernsey Reservoir associated with these facilities are also modeled. The terminus point of the model is at Lewellen, Nebraska (the estimated flow in the river is the last item determined). The

NPRWUM requires four (4) input files to define the hydrologic and power generation characteristics of a model scenario and produces seven (8) output files that contain the results (Figure 3.1.1). The maximum study period that can be simulated using the NPRWUM is 60 water years.

3.1.1 Model Structure

The NPRWUM is organized into four subroutines (OPRES, OPNFLOW, OPSOA, and OPIRR) called by the main body of the program (OPMAIN). Each of these four subroutine calls additional subroutines to complete the operation of one phase of the system. The four phases are the physical reservoir operations, natural flow accounting, storage ownership accounting, and operation of the North Platte River between Guernsey and Lewellen. All the subroutines called by the model and their flow charts are found in Appendix E.

The subroutines that read the data from the input files and write the results to the output files are also controlled by OPMAIN (Figure 3.1.2).

OPRES controls the physical operation of the reservoirs. The reservoirs are operated in an upstream manner beginning with Guernsey Reservoir and ending with Seminoe Reservoir. This subroutine determines the inflow, outflow, power generation (for existing powerplants), evaporation, and EOM contents associated with each reservoir, including the Idealized Inland Lake. Minimum flows in the Miracle Mile and below Gray Reef Dam are also maintained.

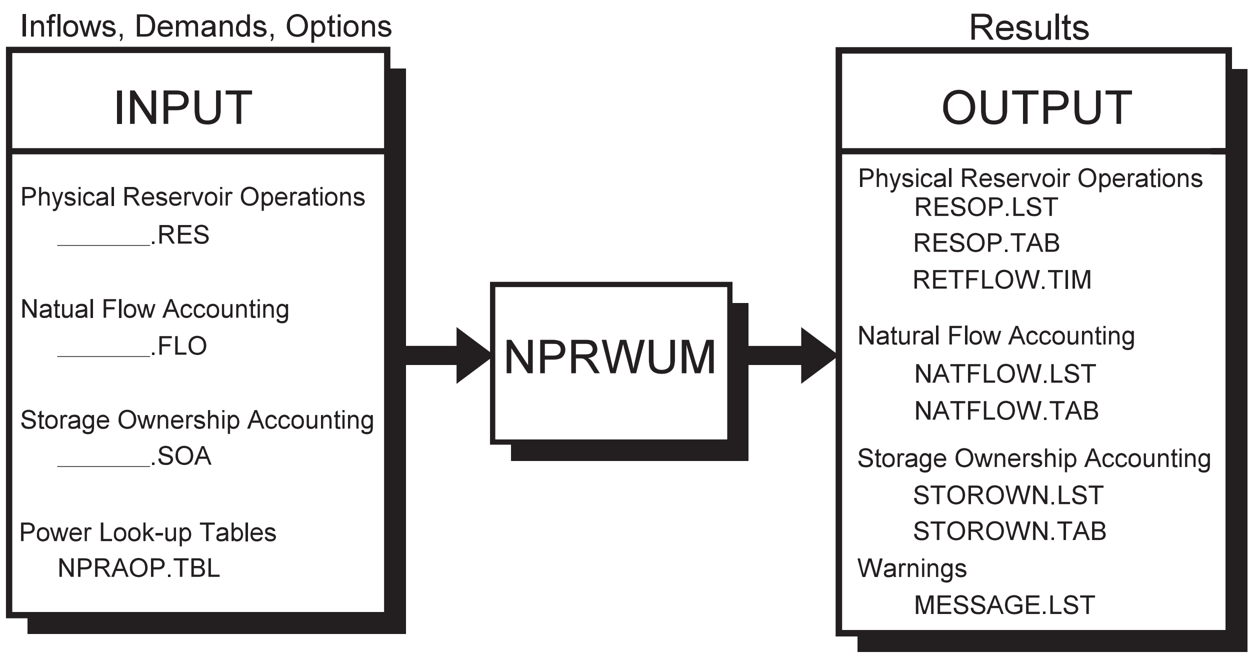

Figure 3.8.393.1.1 NPRWUM - Input / Output Flow Diagram

OPNFLOW controls the natural flow accounting, which is only done in May through September. OPNFLOW takes the physical inflows that occur during the irrigation season (May-September) and calculates the total natural flow available to meet irrigation demands. The total available natural flow is distributed among the demands in order of priority. Any portion of a demand not fully satisfied from the natural flow is assigned as storage delivery, according to existing storage contracts.

OPSOA controls the storage ownership accounting. OPSOA determines the water available for accrual, EOM content, evaporation, storage deliveries from each ownership account, and balances the total physical and ownership storage in the system. Available water for accrual in the non-irrigation season (October-April) is equal to the total physical inflows above Guernsey Reservoir and is accrued to the ownerships in priority according to their storage rights and physical location on the river. In the irrigation season, the water available for accrual is equal to the unused portion of the natural flow. The storage deliveries assigned in OPNFLOW are passed to OPSOA, where they are delivered from the appropriate ownership account. Once the ownership accounting has concluded, the total physical and ownership storage in the system are balanced. When the physical system storage is greater than the ownership storage, the difference of the physical storage and ownership storage is assigned as a spill to balance the system. The balance spill is added to the Guernsey Reservoir outflow to release the water from the physical system. If the ownership storage is greater than the physical storage, the ownership(s) are reduced. When this situation occurs, the NPRWUM first checks to see if a balance spill exists from an early iteration of the month. If there was a balance spill, it is reduced. If the ownership storage is still greater than the physical storage, the NPRWUM continues to try to balances the system by reducing the accruals. The remaining difference is first taken from the available water in ETO account, provided the ETO option is on and water exists in the ETO account. Any of the difference not met by reducing the ETO account is taken from the ownership accounts by assigning a negative accrual to the ownership that is in priority. The negative accruals are assigned by reach: Alcova to Glendo, Guernsey to Glendo, and above Alcova. If the Alcova to Glendo reach gain is negative, the NPRWUM assigns a negative accrual to the ownership in priority in that reach to reduce the ownership storage and continues to the above Alcova reach, if necessary, to balance the system. If the Glendo to Guernsey reach gain is negative, the NPRWUM assigns a negative accrual to the ownership in priority in that reach to reduce the ownership storage and continues to the above reaches, if necessary, to balance the system. Otherwise, the NPRWUM assigns a negative accrual to the ownership in priority in the above Alcova reach to reduce the ownership storage to balance the system. If these efforts to balance the system fail, the “alternate method of distribution” is done. This method removes the remaining difference from the ownerships beginning with the North Platte Pathfinder ownership, North Platte Guernsey ownership, Glendo Evaporation Pool ownership, Glendo Irrigation Pool ownership, Excess-to-Ownership account, Kendrick Seminoe ownership, and ending with the Kendrick Alcova ownership until the system balance is satisfied.

OPIRR controls the operation of the North Platte River between Guernsey, Wyoming, and Lewellen, Nebraska. OPIRR takes the Guernsey Reservoir outflow, accounts for reach gains, models irrigation deliveries from the river, and compute the flow at various points on the river. It also determines the return flows associated with these irrigation deliveries and adjusts the reach gains if the modeled return flows vary from historic.

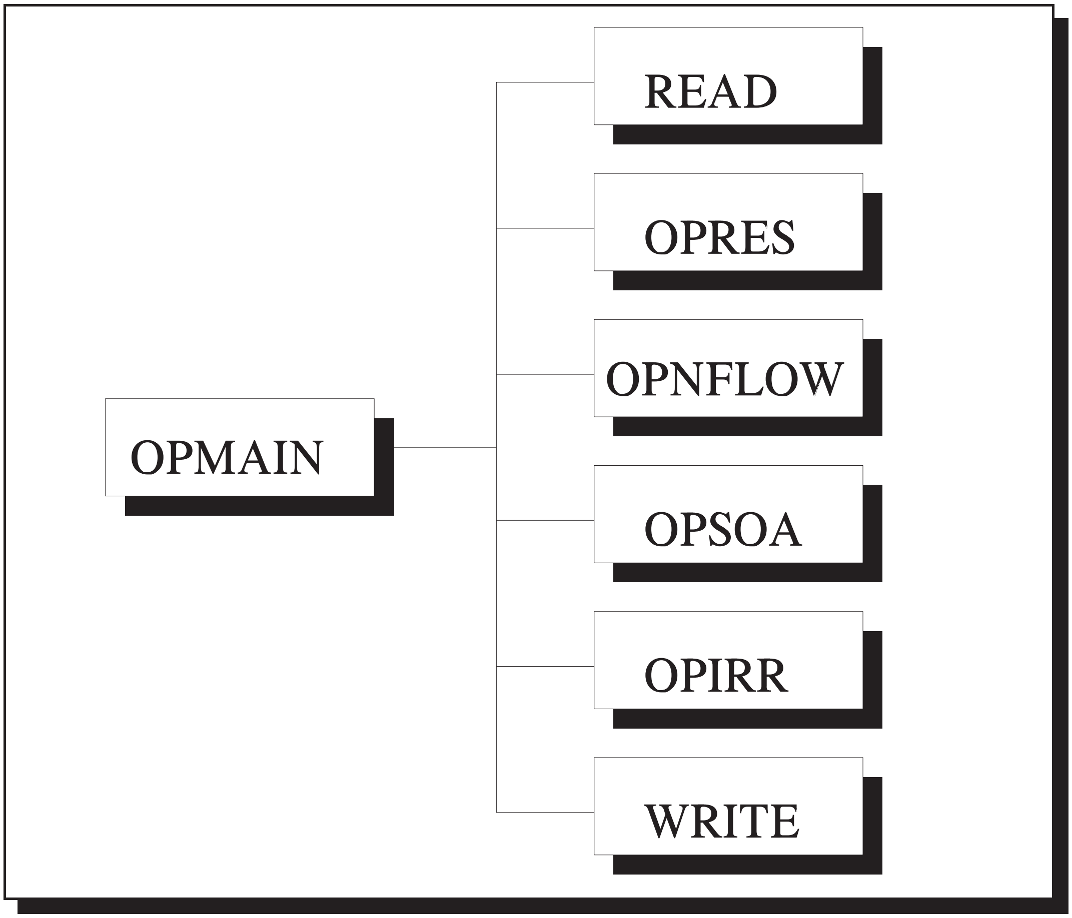

Figure 3.8.403.1.2 General Structure of the NPRWUM

3.2 Input Files

The input data files are in a format consistent with the original OPSTUDY model developed by the Bureau of Reclamation (Otradovsky, 1986). The data from the input data files are read by the READ subroutine (called from the OPMAIN subroutine of the OPSTUDY program) and the general format of each file is the same. The first four lines in a data file consist of input file control information. The input file control information is followed by cdata, section headings for model output files, model output line item descriptions, table headings, adata, and hdata. The input and output arrays are:

cdata(x)	single item input;
adata(x,J)	12 item input;
hdata(x,I,J)	hydrologic data input;
flow(x,J)	yearly output; and
table(x,I,J)	summary table output.

The cdata(x) array is used to read and store single item constants such as reservoir size, canal capacity, option flags, etc. It may also be used to input the starting value of a variable such as the initial content of a reservoir. A cdata’s identifier is represented by the value of 'x' and corresponds to the sequential order of the cdata items in the input file. The maximum number of cdata items allowed in the input files are 125. Cdata items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPRWUM as cdata(x), cdata1(x), and cdata2(x).

The adata(x,J) array is provided to read and store monthly constants consisting of 12 values, which may vary from one month to the next but not from water year to water year. An example would be the EOM reservoir target contents for Alcova Reservoir. An adata’s identifier is represented by the values of 'x' and 'J'. The value 'x' corresponds to the sequential order of the adata items in the input file and 'J' is the month number. The maximum number of adata items allowed in the input files are 50. Adata items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPRWUM as adata(x,J), adata1(x,J), and adata2(x,J).

The hdata(x,I,J) array is provided to read and store hydrologic data or similar records where the record includes several years of monthly data such as historic stream flow records. The record identifier is represented by the value of 'x', 'I' is the year number, and 'J' is the month number. The maximum number of hdata items allowed in the input files are 85. Hdata items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPRWUM as hdata(x,I,J), hdata1(x,I,J), and hdata2(x,I,J).

The flow(x,J) array provides the yearly output from the study where 'x' is the line number and 'J' is the month number. The maximum number of flow items allowed in the input files are 300. Flow items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPRWUM as flow(x,J), flow1(x,J), and flow2(x,J).

The table(x,I,J) array provides for storage and output of summary tables to be printed at the end of the study where 'x' is the table number, 'I' is the year number, and 'J' is the month number. The maximum number of table items allowed in the input files are 50. Table items in the reservoir operations, natural flow accounting, and storage ownership accounting input files are identified respectively in the NPRWUM as table(x,I,J), table1(x,I,J), and table2(x,I,J).

3.2.1 Input File Control Information

The input file control information consists of instructions on how the READ subroutine is to read the information in the input data file, which information will be used by the model, and how the results from the model will be written to the output files. The file format for the reservoir operations, natural flow accounting, and storage ownership accounting input files is shown below.

INPUT

Card type 1 — Parameter card
No. of cards - 1
Card format (A5, 12I5)

Col. 1- 5	ISTUDY - study number (alpha-numeric)
Col. 6-10	ISTART - the first water year of the study
Col. 11-15	IEND - the last water year of the study
Col. 16-20	NG - number of line group headings
Col. 21-25	NL - number of line headings
Col. 26-30	NT - number of summary tables
Col. 31-35	NC - number of constants and initializing 'cdata' values.
Col. 36-40	NA - number of average monthly 'adata' constants
Col. 41-45	NH - number of monthly input 'hdata' arrays
Col. 46-50	IFRST - first water year of input data
Col. 51-55	NYI - number of years of input 'hdata' to be read
Col. 56-60	NRES - line number of reservoir end-of-month content
Col. 61-65	NCL - number of comment lines to be read
Col. 66-70	INPT - flag to read 'hdata' one year at a time. 0 = no, 1 = yes If INPT = 1, hdata must be sorted by years and hdata must be dimensioned (x,J).
Col. 71-75	NOUT - number of summary tables to be saved (Not Used)
Col. 76-75	IPLT - the number of summary tables to be plotted. If ‘IPLT’ is negative, single mass curves will not be plotted. (Not Used)

Card type 2 Line-group card
No. of cards - 1
Card format (free-field integer)

The number of lines to be printed after each line-group heading.
One line of 'NG' items.
NOTE If 'NG' = 0, omit this card.
If 'NL' = 0, 'NG' must also be zero.

Card type 3 Output file card
No. of cards = 1 (Omit this card if NOUT = 0)
Card format (A7, 24I3)

Col. 1-7	IFILE - File name under which output tables are to be saved.
Col. 8-10	ISAVE(1) - Table number of the first table to be saved. Enter remaining table No.'s in the order in which they are to be save using three spaces per entry.

Card type 4 Plot file card
No. of cards = 1 (Omit this card if IPLT = 0)
Card format (24I3)

Col. 1-3	IPLOT(1) - The table number of the first table to be plotted. Enter the remaining table numbers in the order in which they are to be plotted using 3 spaces per entry. Tables containing EOM reservoir contents should be entered as negative values.

Card type 5 Title cards
No. of cards = 2
Card format (8A10)

Col. 1-80	Title and run description. Center the title on the card.

Card type 6 Comment cards
No. of cards = 'NCL'
Card format(8A10)

Description of run, purpose, data used, and assumptions. Include any information that will assist in interpreting the results of the run. This information will be printed on a separate page at the start of the output listing.

Card type 7 Cdata cards
No. of cards = 'NC'
Card format(F10.0, 4A10)

Col. 1-10	CDATA - constant or initial value
Col. 11-50	CNAME - description of constant or initial value

Card type 8 Line group headings
No. of cards = 'NG' number of line groups
Card format (4A10)

Col. 1-40	AGHEAD - line group heading

Card type 9 — Line heading cards
No. of cards = ‘NL’ number of line headings
Card format (3A8, A3)

Col. 1-27 ALHEAD - line heading or description

Card type 10 — Table heading cards
No. of cards = ‘NT’ number of tables
Card format (8A10)

Col. 1-80 ATHEAD - table heading or description. Center the table heading on the card.

Card type 11 — Adata heading cards
No. of cards = ‘NA’ number of adata arrays
Card format (8A10)

Col. 1-80 ANAME - name or description of data
**NOTE: Each ‘adata heading’ card must be followed by an ‘adata’ card.

Card type 12 — Adata cards
No. of cards = ’NA’ number of adata arrays
Card format (12F6.0)

Col. 1-6	ADATA(x,1) - January constant
Col. 7-12	ADATA(x,2) - February constant
.	. .
.	. .
.	. .
Col. 67-72	ADATA(x,12) - December constant

NOTE: Use the ADATA array to read and store monthly constants such as monthly reservoir targets where the reservoir target requirement for all January's is the same and all February's is the same, etc.
**** NOTE: The AHEAD and ADATA cards are entered as pairs.

Card type 13 — Hdata heading cards
No. of cards = ‘NH’ number of hdata arrays
Card format (8A10)

Col. 1-80 ALIST - name or description of data
**NOTE: Each ‘hdata heading’ card must be followed by a series of ‘hdata’ cards.

Card type 14 — Hdata cards
No. of cards = ‘NYI x NH’ number of years times number of hdata items
Card format (I5, 12F6.0 or free-field) All hdata items use the free-field format.

Col. 1-5	year or other identification (integer only)
Col. 6-11	HDATA(x,i,1) - January data
Col. 12-17	HDATA(x,i,2) - February data
.	. .
.	. .
.	. .
Col. 72-77	HDATA(x,i,12) - December data

Note: Data are listed one year (12 months of record) per card. HDATA may be sorted by files (INPT = 0) or by years (INPT = 1). Each series of hdata card must be preceded by a ‘hdata heading’ card.

3.3 Output Files

The NPRWUM produces two output files each for the physical operations, natural flow, and storage ownership, a ".LST" and ".TAB" output file. The output files associated with the physical reservoir operations are RESOP.LST and RESOP.TAB. The output files associated with the natural flow are NATFLOW.LST and NATFLOW.TAB. The output files associated with the storage ownership are STOROWN.LST and STOROWN.TAB. In addition to these output files, the NPRWUM reports any run time warning message to the MESSAGE.LST file and the return flow timing patterns to the RETFLOW.TIM file.

3.3.1 ___.LST Output Files

The ".LST" files contain the yearly output of a model run listed by station name followed by the station's monthly values, repeated for the total number of defined stations. Each accounting point is assigned a station name and the monthly output data for each station is assigned to a corresponding two-dimensional flow array in the NPRWUM. The first number identifies the station and the second number (J) is the month of the year (i.e., the first output item in the RESOP.LST file would be flow(1,J), the second flow(2,J), etc. ...).

The ".LST" files are organized into 14 columns across the page. Column one (1) contains a brief description of the output item or station name. Columns two (2) through thirteen (13) are the monthly values reported in a water year format (October through September). The last column (14) is the sum of monthly values in columns 2 through 13. The program always uses column 14 to display the sum of the monthly values. The sums in the last column are meaningless when the EOM reservoir contents, Year-to-Date (YTD) ownership accruals, or similar items are reported. After the last year of the study, the NPRWUM creates a summary of the yearly output data. This summary section reports the average of the monthly values over the period of the study at the end of the ".LST" output file. These monthly averages include the zero, negative, and positive values contained in columns 2 through 13 for a station and caution is required when using these averages.

3.3.2 ___.TAB Output Files

The ".TAB" files contain a listing of selected stations and their monthly values organized into tabular format from the beginning of the study to the end. A three-dimensional table array provides for the storage and output of summary tables as identified in the input files. The first number identifies the station and the second number (I) is the year and the third number (J) is the month of the year (i.e., the first output item in the RESOP.TAB file would be table(1,I,J), the second flow(2,I,J), etc. ...). When additional tables are added to the input files, the model user must make modifications to the source code by assigning the desired output item to the appropriate table array item.

3.3.3 RETFLOW.TIM Output File

The RETFLOW.TIM output file contains the return flow timing patterns calculated by the GLOVER Subroutine and used for Reaches No. 2 and No. 3 below Guernsey and the Alcova to Glenrock Reach. This output file also lists the parameters used to generate the given return flow timing patterns.

3.3.4 MESSAGE.LST Output File

The MESSAGE.LST output file contains a listing of warning messages produced by the NPRWUM during execution. The model user should examine this file after each run and note the warning messages contained therein. These messages provide a general commentary of what condition were encountered during the model's execution and its response. A listing of the possible warning messages produced by the model is shown in Table 3.3.1.

Warning Message	Explanation
GLENDO RESERVOIR OUTFLOW EXCEEDS MAXIMUM FOR MONTH xx OF YEAR xxxx	Glendo Reservoir has no vacant space remaining in the flood pool to attenuate high inflows. If high flows cannot be held in upstream reservoirs, the model will allow the Glendo outflow to exceed its maximum capacity and will pass the inflow that is unable to be held in the flood pool.
FLOW IN THE NORTH PLATTE AT GLENROCK EXCEEDS xxxxx CFS FOR MONTH xxx OF xxxx	The flow in the river exceeds the value set by the model user in cdata(49) (5000 cfs). Minor flooding along the river's banks begins to occur near 5000 cfs. The model does not attempt to reduce the flow in this situation, it only provides this warning message.
FLOW IN THE NORTH PLATTE AT GLENROCK IS LESS THAN xxxx CFS FOR MONTH xxx OF xxxx	The flow in the river is less than the value set by the model user in cdata(39) (330 cfs). This indicates that there is not enough ownership water available above Alcova to satisfy the 330 cfs. The model allows the minimum flow set by the model user to be violated in this situation.
YEAR = xxxx MONTH = xx SEMINOE RESERVOIR BELOW RECOMMENDED LEVEL, SEVERE OPERATIONAL PROBLEMS EXIST	The model is unable to operate the North Platte River System with the current hydrologic configuration in the input files (inflows, demands, and options). The model processes each reservoir one at a time, beginning with Seminoe Reservoir, storing only the portion of the inflows needed to maintain the reservoir's minimum storage level and passes the remainder downstream to the next reservoir. This process is repeated until the operational problem overcome.
SEVERE OPERATIONAL PROBLEMS CORRECTED BY REDUCING KORTES OUTFLOW & ALL FLOWS ABOVE	Severe operational problems were corrected by reducing the outflow of Seminoe and Kortes Reservoirs to maintain minimum storage levels.
SEVERE OPERATIONAL PROBLEMS CORRECTED BY ADJUSTING OUTFLOWS ABOVE GLENDO RESERVOIR	Severe operational problems were corrected by reducing the outflows of all Reservoirs above Glendo Reservoir.
SEVERE OPERATIONAL PROBLEMS CORRECTED BY REDUCING GUERNSEY OUTFLOW & ALL FLOWS ABOVE	Severe operational problems were corrected only after all outflows of the reservoirs were adjusted to get a new Guernsey Reservoir outflow.
GLENDO TARGET IS SUSPENDED FOR MONTH xxx OF xxxx, PATHFINDER OUTFLOW EXCEEDED	The targeted Glendo Reservoir inflow computed by the model to reach the desired EOM content has been suspended for this month because it would require a spill situation at Pathfinder Reservoir.
PATHFINDER RESERVOIR OUTFLOW EXCEEDS THE TURBINE CAPACITY FOR MONTH xxx OF xxxx	After making every attempt to adjust the Pathfinder Reservoir outflow, the Pathfinder release still exceeds the combined capacity of the turbine outflow. The release is made and the model continues.
OPERATIONAL PROBLEMS MAY EXIST FOR ALCOVA RESERVOIR	The physical content of Alcova Reservoir is below the elevation required to make releases to the Casper Canal.

EOM STORAGE BELOW THAT REQUIRED TO MAKE CASPER CANAL DELIVERIES	The physical content of Alcova Reservoir is below the elevation required to make the requested Casper Canal Delivery. However, the delivery was met because the water in the Kendrick ownership exceeded the request.
YEAR = xxxx MONTH = xx TRI-STATE CANAL DIVERSION EXCEEDS CANAL CAPACITY ADJUSTED FARMERS, NORTHPORT, AND RAMSHORN DIVERSIONS PROPORTIONATELY	The requested deliveries exceed the canal's capacity. The deliveries are reduced proportionately and the model continues.
YEAR = xxxx MONTH = xx GRATTAN DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx NORTH PLATTE DITCH DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx ROCK RANCH DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx PRATT-FERRIS DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx BURBANK DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx TORRINGTON DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx LUCERNE DIVERSION EXCEEDS CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx NARROWS DIVERSION EXCEEDS DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.
YEAR = xxxx MONTH= xx MITCHELL-GERING DIVERSION EXCEEDED DITCH CAPACITY, ADJUSTED ACCORDINGLY	The requested deliveries exceed the canal's capacity. The deliveries are reduced proportionately and the model continues.
YEAR = xxxx MONTH= xx FORT LARAMIE CANAL DIVERSION EXCEEDS CANAL CAPACITY. ADJUSTED WRIGHT-MURPHY FT LARAMIE (GOSHEN), AND GERING-FT LARAMIE DIVERSIONS PROPORTIONATELY	The requested deliveries exceed the canal's capacity. The deliveries are reduced proportionately and the model continues.
YEAR = xxxx MONTH= xx INTERSTATE CANAL DIVERSION EXCEEDS CANAL CAPACITY, DIVERSION ADJUSTED ACCORDINGLY	The requested deliveries exceed the canal's capacity. The deliveries are reduced proportionately and the model continues.
YEAR = xxxx MONTH= xx KENDRICK DIVERSION EXCEEDS CANAL CAPACITY, ADJUSTED ACCORDINGLY	The requested delivery exceeds the canal's capacity. The delivery is reduced to the canal's capacity and the model continues.

YEAR = xxxx MONTH= xx ROCK RANCH STORAGE DIVERSION EXCEEDS WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx LINGLE STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx HILL STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx FARMERS STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx GERING STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx GRATTAN STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN GRATTAN ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx BURBANK STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN BURBANK ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx TORRINGTON STORAGE DIVERSION EXCEEDS GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN TORRINGTON ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx LUCERNE STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN LUCERNE ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= WRIGHT AND MURPHY STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN WRIGHT & MURPHY ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= CORN CREEK STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.

YEAR = xxxx MONTH = xx STORAGE IN CORN CREEK ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx MITCHELL STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN MITCHELL ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx BRIDGEPORT STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN BRIDGEPORT ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx ENTERPRISE STORAGE DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN ENTERPRISE ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx CENTRAL NEBRASKA POWER DIVERSIONS EXCEED GLENDO CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount and was limited to its contract amount by the model.
YEAR = xxxx MONTH = xx STORAGE IN CENTRAL NEBRASKA POWER ACCOUNT NOT SUFFICIENT FOR DIVERSIONS	The storage in the account is insufficient to meet the requested delivery and the storage delivery is reduced to the available water in the account.
YEAR = xxxx MONTH= xx CENTRAL STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx CHIMNEY ROCK STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx BROWNS CREEK STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
YEAR = xxxx MONTH= xx BEERLINE STORAGE DIVERSIONS EXCEED WARREN ACT CONTRACT xxx xxx	The storage delivery exceeded its storage contract amount, but the requested delivery was made by the model.
INITIAL TOTAL RESERVOIR CONTENT DOES NOT EQUAL INITIAL TOTAL OWNERSHIP	The sum of the initial physical reservoir contents in the reservoir operations input file does not equal the sum of the initial ownership contents in the storage ownership accounting input file. The initial reservoir contents and initial ownerships must be adjusted until their sums are equal.

NO OWNERSHIP WAS IN PRIORITY BELOW ALCOVA, MOVING TO UPPER RESERVOIRS FOR DISTRIBUTION	When the ownership storage is greater then the physical storage in the system, the accrual for the ownership in priority is reduced by the difference. The model first reduces the accrual to ownerships in priority below Alcova, then reduces the accrual to ownerships in priority above Alcova.
NO OWNERSHIP WAS IN PRIORITY BELOW GLENDO, MOVING TO UPPER RESERVOIRS FOR DISTRIBUTION	The model attempted to balance Physical and Ownership storage from Guernsey Ownership, but Guernsey was not in priority and the model moved to above Alcova to try to balance the system.
NO OWNERSHIP WAS IN PRIORITY, MOVING TO ALTERNATE METHOD OF DISTRIBUTION	When the ownership storage is greater then the physical storage in the system and no ownership was in priority, the system is balanced by the reducing the ownerships beginning with the North Platte Pathfinder, North Platte Guernsey, Glendo, ETO, Kendrick Seminoe, and ending with Kendrick Alcova.
REDUCING GLENDO TARGET BECAUSE OF KENDRICK OWN. BELOW ALCOVA	If the model is not allowed to use Kendrick ownership to meet the minimum flow below Gray Reef when the Pathfinder ownership is deficient, reduce the Glendo target inflow to ensure that no Kendrick water is moved to Glendo.
MINIMUM FLOW PAST CASPER VIOLATED BECAUSE NO PATHFINDER OWNERSHIP IS AVAILABLE ABOVE ALCOVA.	If the model is not allowed to use Kendrick ownership to meet the minimum flow below Gray Reef when the Pathfinder ownership is deficient, reduce the minimum flow.
REDUCING GRAY REEF OUTFLOW BECAUSE OF KENDRICK OWN BELOW ALCOVA	If the model is not allowed to use Kendrick ownership to meet the minimum flow below Gray Reef when the Pathfinder ownership is deficient, reduce the Gray Reef outflow to ensure that no Kendrick water is moved to Glendo.
KENDRICK OWN EXISTS BELOW ALCOVA BY xxxx KAF	If the model is allowed to use Kendrick ownership to meet the minimum flow below Gray Reef when the Pathfinder ownership is deficient, the quantity of Kendrick water moved is reported.
EFFICIENCY (x.xx) TO HIGH, REDUCING TO 0.95	If an efficiency is greater than 95%, the model reduces it to 95%.
WARNING TABLE name INPUT PARAMETER parm NOT IN TABLE OUTPUT VALUE RETURNED VALUE FOR YEAR: xxxx MONTH: xxx	The given reservoir content is above or below the values in the reservoir's power look-up table (content vs. Max turbine release). When the content is below the lowest value in the table, the model uses the lowest maximum turbine release on the table and reports the value used. When the content is above the highest value in the table, the model uses the highest maximum turbine release on the table and reports the value used.

3.4 System Requirements for the NPRWUM

The NPRWUM included on the diskette in Appendix H was compiled with the Lahey™ Fortran Compiler (F77L-EM32). The compiled version, NPRWUM.EXE, is a stand alone executable file that is operable on IBM™-compatible Personal Computers (PC) with an 80486 processor or better. The model requires at least eight (8) megabytes of RAM, MS-DOS 5.0 or higher, and 20 megabytes available hard disk space (30 megabytes recommended).

3.4.1 Running the Model

After the model has been installed on your Computer's hard drive and the files extracted according to the instructions in Appendix H, the model is ready to run. To run the NPRWUM, type NPRWUM at the DOS prompt and press enter. The model will prompt you for the names of the reservoir operation input file, natural flow input file, and storage ownership input file. The reservoir operation input files for the calibration and validation runs are CAL8094.RES and VAL6579.RES, respectively. The natural flow input files for the calibration and validation runs are CAL8094.FLO and VAL6579.FLO, respectively. The storage ownership input files for the calibration and validation runs are CAL8094.SOA and VAL6579.SOA, respectively. The model automatically assigns the reservoir operation output file, message file, natural flow output file, and storage ownership output file to RESOP.LST, MESSAGE.LST, NATFLOW.LST, and STOROWN.LST, respectively. Figure 3.4.1 demonstrates how to run the model and recreate the calibration output files. The bolded text in the figure represents input required by the model user in response to the model's prompts. Once the input file names are entered correctly by the model user, the model begins to process each month of the water year until finished. The water year and month currently being processed by the model are written to the screen during execution of the model. Month one (1) is October, month two (2) is November, ... and month twelve (12) is September.

```
Prompt>  NPRWUM ↩

        +--------------------------------------------------+
        |      32-bit Power for Lahey Computer Systems     |
        |    Phar Lap's 386|DOS-Extender(tm) Version 5.1   |
        |   Copyright © 1986-93 Phar Lap Software, Inc.    |
        |            Available Memory = xxxxx Kb           |
        +--------------------------------------------------+

WHAT IS THE NAME OF THE RESERVOIR OPERATION INPUT FILE? CAL8094.RES ↩

WHAT IS THE NAME OF THE NATURAL FLOW INPUT FILE? CAL8094.FLO ↩

WHAT IS THE NAME OF THE STORAGE OWNERSHIP INPUT FILE? CAL8094.SOA ↩

YEAR,MONTH =      1980      1
YEAR,MONTH =      1980      2
YEAR,MONTH =      1980      3
YEAR,MONTH =      1980      4
YEAR,MONTH =      1980      5
     •              •       •
     •              •       •
     •              •       •
YEAR,MONTH =      1994     12

RESERVOIR OPERATIONS OUTPUT IS IN
RESOP.LST
NATURAL FLOW OPERATIONS OUTPUT IS IN
NATFLOW.LST
STORAGE OWNERSHIP OUTPUT IS IN
STOROWN.LST

.TAB FILES CONTAIN TABLES OF SELECTED INFORMATION

WARNING MESSAGES FROM OPERATIONS ARE IN MESSAGE.LST

RETURN FLOW TIMINGS ARE IN RETFLOW.TIM

Prompt>
```

Figure 3.4.13.4.1 Sample Computer Screen Display During Execution of the NPRWUM

When the model has finished execution, check to verify that the RESOP.LST, RESOP.TAB, MESSAGE.LST, NATFLOW.LST, NATLOW.TAB, STOROWN.LST, STOROWN.TAB, and RETFLOW.TIM output files have been created on your hard drive. Each time the model is run, any existing ".LST" or ".TAB" file listed above will be over written and replaced by the data from the current run. These files must be renamed by the model user before making another run if the model user wishes to save them for later reference. To ensure that the model is running correctly on your PC, use the DOS "FC" (File Compare) command to compare an output file sent with the documentation (RES_8094.CAL) to an output file just created by the model (RESOP.LST). (i.e., *Prompt* > FC RESOP.LST RES_8094.CAL | MORE ↩)

Errors encountered during a model run may cause the model to stop operations and return the user to the DOS prompt. The errors will either be a result of run time problems reported by the Lahey Compiled model or inconsistent input parameters in the input data sets. Some of the most common Lahey Fortran run time errors occur when the model user misspells the name of an input file, tries to use a file for input that is not in the correct format, or there is not enough vacant space on the hard drive to create the output files (Table 3.4.1). The reader is referred to the Programmer's Reference for Lahey F77L-EM32 Fortran (Lahey, 1992) beginning on page 105 for a complete listing of errors and their explanations. During execution, the model will check to ensure that certain input data items are consistent. If inconsistencies in the input data exist, the model will write a message to the screen identifying the problem and stop execution. These messages are shown in Table 3.4.2. Warnings generated by the model are discussed in Section 3.3.3, Table 3.3.1.

Table 3.4.13.4.1 Lahey Fortran Run Time Errors

Error Number	Error Message Text	Action
113	Invalid numeric input	Check input file for proper format.
125	Unable to write file	Check that vacant space is available on the hard Drive.
151	File specified doesn't exist	Run the model again and enter the names of the calibration or validation input files as prompted by the model.

3.5 Description of Model Options

Information that a user can modify to model different scenarios is contained in the three input data files. The three data files correspond to the three functions performed by the NPRWUM: physical reservoir operations, storage and natural flow accounting, and storage ownership accounting. The various options and input parameters are described in the following sections to help the model user understand how the parameters can be adjusted and what happens when different options are chosen.

3.5.1 Reservoir Operation Input File

The physical reservoir operations input file contains the data to operate the North Platte system based on physical parameters (i.e., inflows, reservoir capacities, storage moved between reservoirs, etc. ...).

Table 3.4.23.4.2 NPRWUM Run Time Errors

NPRWUM Error Message	Explanation/Action
"Initial total Reservoir content does not equal initial total Ownership"	The sum of the initial physical reservoir contents in the reservoir operations input file does not equal the sum of the initial ownership contents in the storage ownership accounting input file. The initial reservoir contents and initial ownerships must be adjust until their sums are equal.
"The model was unable to balance ownership and physical storage due to limited ownership"	After all attempts to balance the system were exhausted, there was not enough ownership available to balance the system. The model's execution is stop, keeping it from generating errant numbers. Input data may be unrealistic.
"TSLLGNA prorated incorrectly-fctrs must sum to 1" "TSLLCHK = xxxx TSLLGNA = xxxx"	The factors (hdata1(46-59,I,J)) used to prorate the Tri-State to Lewellen gain (TSLLGNA) do not sum to one. Adjust these factors until the sum equals 1.
"Main Canal Delivery exceeds Pathfinder Diversion - Reduce Main Canal Delivery, try with IPMFLAG = 1 (cdata(59))"	The Pathfinder Delivery has been reduced and cannot meet the historic deliveries to land above the Idealized Inland Lakes. The Main Canal Delivery (hdata(19,I,J)) must be reduced or the IPMFLAG flag set to 1. This flag calculates the Main Canal Delivery as a percentage of the Pathfinder Diversion. The percentage are found in adata(23,J).

3.5.1.1 Reservoir Parameters

Reservoir input parameters such as initial EOM content (cdata(3-10)), maximum and minimum storage contents (cdata(11-26)), evaporation factors (adata(13-16,J)), bank storage (cdata(27-31)) and seepage factors (hdata(7-11,I,J)), and EOM targets (cdata(40, 51-58) - adata(11-12,J)) can be changed by replacing the current values in this input file with values chosen by the model user. For example, if the starting year of a study changes, the initial EOM contents should be changed to the September EOM contents from the water year pervious to the new starting water year. Increasing or decreasing the evaporation factors will cause the reservoirs' evaporation losses to increase or decrease. If the bank storage factor for a reservoir is increased, more of a change in reservoir content will go to bank storage (positive change in storage) or will be released from bank storage (negative change in storage). The bank storage function in the NPRWUM can be turned off by setting the bank storage flag (cdata(92)) to zero (0). When IBNKFLAG is set to zero (0), a reservoir's gain/loss is equal to the reservoir's seepage as entered in hdata items' hdata(7-11,I,J) and no bank storage is accounted for. A positive reservoir seepage value indicates that the reservoir is losing water due to seepage, while a negative seepage value indicates that a reservoir is gaining water (side inflow is greater than reservoir seepage). Adjusting the reservoir targets and maximum and minimum storage contents allow the model user to change the operating regime of the reservoirs.

3.5.1.2 Delivery/Irrigation Parameters

Irrigation related factors such as the efficiency (see Section 3.5.3.4), non-beneficial use (cdata(60)), and surface runoff factors (adata(25,J)) control the amount of a diversion that contributes to surface runoff or deep percolation. The irrigation deliveries (hdata(20-71,I,J), including water orders for storage) in this file can also be adjusted to simulate changed conditions.

3.5.1.3 Return Flow Timing Parameters

The timing of the return flows from irrigation can be increased or decreased by changing parameters for the GLOVER subroutine: transmissivities (cdata(64-66)), reach widths (cdata(70-72)), and storage coefficient (cdata(69,73)). If the return flow timing increases, water available for return flow takes longer to return. The return flow timing will increase if the transmissivities are decreased, reach widths increased, or storage coefficient increased, while the reverse is also true. The initial condition recharge parameters (cdata(88-90)) act to prime the initial return flow conditions. If these values are increased, the return flow occurring in the initial years of the study will also increase.

3.5.1.4 Gray Reef Winter Outflow Option

The Gray Reef winter outflow option (cdata(48)) controls the method used to move water between Gray Reef Reservoir and Glendo Reservoir in the winter months. When cdata(48) is equal to zero (0), the outflow is based on the size of the Glendo restorage space cdata(40). When the option is set to one (1), the outflow is based on the total physical storage above Alcova Reservoir as of October 1. Section 2.4.5.2 provides further details on this option.

3.5.1.5 Pathfinder Main Canal Option

The Pathfinder Main Canal deliveries occurring above the Idealized Inland Lakes can be a function of the historic Main Canal deliveries or a percentage of the total Pathfinder delivery. When the option (cdata(59)) is equal to zero (0), the Pathfinder Main Canal deliveries are equal to the historic deliveries reported by the Pathfinder Irrigation District (hdata(19,I,J)). When this option is set to one (1), the Main Canal delivery is computed by the model as a percentage (adata(23,J)) of the total Pathfinder delivery (hdata(33,I,J)).

3.5.1.6 Seminoe-Pathfinder Water Movement Rule

The Seminoe to Pathfinder water movement rule consists of adjusting the Seminoe Reservoir outflow (adata1(6-8,J)) based on the storage in Seminoe Reservoir (October through June; cdata(33,34)) and of maintaining a balance (adata1(9,J)) between the storage in Seminoe and Pathfinder Reservoir (July through September; cdata(35)). These rules are followed as long as the minimum flow out of Kortes Dam is not violated (cdata(32)) and that the maximum Kortes turbine capacity is not exceeded (cdata(36)).

3.5.1.7 Gain Utilization Parameters

The use of the Guernsey to Whalen and Whalen to Tri-State gains to satisfy diversions in these reaches can be controlled by adjusting the utilization factors (adata(1-2,J)). A utilization factor of one (1.0) makes 100% of the gain occurring in the reach available to satisfy diversion demands, while a value between 0.0 and 1.0 reduces the amount of the gain available to satisfy diversion demands. These factors simulate rain storm events in the lower reaches for which the system cannot be perfectly operated and used completely to meet the diversions.

3.5.1.8 Glendo Low Flow

The Glendo Low Flow values (adata(10,J)) are used to control the year around releases from the Glendo Dam. These values can be varied by the model user and must be between 25 and 45 cubic feet per second.

3.5.1.9 Pathfinder-Fremont Canyon Bypass

The Pathfinder-Fremont Canyon bypass (adata(9,J)) can be used to release water directly below the Pathfinder Dam instead of releasing it through the Fremont Canyon Powerplant.

3.5.1.10 Powerplant Availability Parameters

The powerplant availability factors (adata(17-22,J)) control the availability of the turbines at the powerplants for generation. A factor of 1.0 indicates that the turbines at the given powerplant were available and ready for generation 100% of the time during the month. A value less than 1.0 can be used to model the turbine down time for maintenance.

3.5.1.11 Natural Flow and Ownership Accounting Flags

The natural flow and Ownership accounting subroutines of the NPRWUM can be skipped by setting the flags for cdata(1-2) to zero (0). Both flags must be set to zero (0). When both flags are set to zero (0), only the physical operation of the reservoirs will be performed by the model.

3.5.2 Natural Flow Input File

The storage and natural flow accounting input file contains the data to calculate natural flow available at Tri-State Diversion Dam and to segregate storage and natural flow demands.

3.5.2.1 Natural Flow Rights and Storage Contracts

The natural flow rights and storage contracts in the NPRWUM are items cdata1(1) through cdata1(68). These values can be updated by the model user as needed.

3.5.2.2 Appropriate Natural Flow below Tri-State Dam Option

The option (cdata1(69)) to appropriate the natural flow below Tri-State Dam is used to tell the NPRWUM to appropriate the natural flow in the river between Tri-State Dam and Lewellen every month. When this option is equal to one (1), the model will appropriate the natural flow in this reach. When this option is set to zero (0), the model will only appropriate the natural flow in this reach if a shortage of water is identified.

3.5.2.3 Natural Flow Section Gains and Losses

The section gains and losses (adata1(1-5,J)) for the natural flow accounting can be adjusted by the model user. These values are currently set to the values in the SONFAP.

3.5.2.4 Historic Irrigation Deliveries

Historic irrigation deliveries (hdata1(2-45,I,J)) are included in the natural flow accounting input file. These items are used by the model to establish the background return flow condition that the model uses to adjust the reach gain and should not be changed.

3.5.2.5 Tri-State to Lewellen Subreach Factors

These are the factors used by the NPRWUM to prorate the Tri-State to Lewellen reach gain to the subreaches in Reach No. 3. The sum of the subreach factors in any given month must equal one (1). The model user can change the distribution of the Tri-State to Lewellen reach gain to the subreaches by adjusting these factors.

3.5.2.6 Irrigation Reuse

The irrigation reuse option allows the model to simulate irrigation reuse in Reaches No. 2 and No. 3. The amount of reuse is controlled by the model user via hdata items hdata1(60-63,i,j). For example, if the model user wanted to implement 20% reuse in a reach, they would use a factor of 0.20. The NPRWUM then takes 20% of all water available for return and reuses it by means of a phantom diversion. The phantom diversion functions identically to a canal diversion by reducing the diverted amount by evaporation and consumptive use with the remaining portion being assign as water available for return. The phantom reuse diversion occurs after all other diversions in a reach have been processed and is assumed to take place at the bottom of the reach. A reuse factor for both the historic and modeled condition exists for Reaches No. 2 and No. 3. The historic reuse factors are used by the model to establish the historic return flow condition that the model uses to adjust reach gain and should not be changed. The modeled (adjustable) reuse factors are used by the model to simulate the response of a change in reuse.

3.5.2.7 Well Irrigation Parameters

The net recharge from well irrigation option is controlled though hdata items' hdata1(64-67,i,j). The model user must enter their estimate of monthly net recharge from well irrigation in the given hdata items. The monthly net recharge is the net change in ground water content due to pumping and is entered as a negative value to indicate it is a depletion. The model adds the net recharge from well irrigation to the water available for return in the reach just before calling the GLOVER subroutine to determine the return flow. This option allows the model user to investigate other than historic ground water use in periods of surface water shortages. However, the use of this option will require the model user to make a judgement of how ground water usage will increase if surface water shortages occur. A net recharge from well irrigation data set for both the historic and modeled condition exists for Reaches No. 2 and No. 3. The historic net recharge from well irrigation values are used by the model to establish the historic return flow condition that the model uses to adjust the reach gain and should not be changed. The modeled (adjustable) net recharge from well irrigation values are used by the model to simulate the response of a change in well irrigation.

3.5.3 Storage Ownership Input File

The storage ownership accounting input file contains the data necessary to track water accrued to and delivered from the ownership accounts.

3.5.3.1 Ownership Parameters

Ownership input parameters such as initial contents, accrual flags, and maximum accruals and ownership contents are cdata2(1-21, 23-26) items. The initial ownership contents should be equal to the September EOM ownership contents from the water year prior to the beginning of the study. The sum of the initial ownership contents must equal the sum of the initial physical contents of the reservoirs. If necessary, the model user should adjust the initial ownership contents to satisfy this condition. The initial contents for the individual Glendo contractors accounts are calculated by the NPRWUM from the initial Glendo Irrigation Pool ownership content (cdata2(8)) proportionally. The accrual flags indicate whether an ownership is allow to accrue water. A value of one (1) enables an ownership to accrue, while a value of zero (0) disables the accrual option. The Inland Lakes ownership account in the main stem is allowed to accrue water only in the months of October, November, and April (adata2(1,J)). These accrual limits are set in accordance with the SONFAP. The maximum ownership contents for the Kendrick Seminoe, Kendrick Alcova, North Platte Guernsey, and North Platte Pathfinder ownerships are the maximum capacity values used for the Seminoe, Alcova, Guernsey, and Pathfinder Reservoirs, respectively.

3.5.3.2 ETO Options

The ETO options allow the model user to decide to accrue ETO from in Glendo and Guernsey (cdata2(26)), to accrue ETO in Seminoe and Pathfinder (cdata2(27)), replace evaporation from Glendo and Guernsey ownerships (cdata2(28)), replace evaporation from Kendrick and Pathfinder ownerships (cdata2(29)), augment natural flow with ETO (cdata2(30)), augment storage flow with ETO (cdata2(31)), and limit ETO storage to the space available in Glendo Reservoir (cdata2(32)).

3.5.3.3 Kendrick Water below Alcova Option

Cdata2(22) is a flag that allows (1 = YES) or does not allow (0 = NO) Kendrick ownership to be moved below Alcova Reservoir (Kendrick point of diversion). If Kendrick water is not allowed below Alcova, there exists a possibility of violating the minimum flow past Casper, Wyoming. However, allowing water below its point of diversion is not an acceptable practice.

3.5.3.4 Irrigation Efficiencies

Irrigation efficiencies (hdata2(1-78,I,J)) control the amount of a diversion that is consumptively use. As efficiency factors are increased, a greater portion of the delivery is consumptively used and the water available for return flow is decreased. An efficiency factor data set for both the historic and modeled condition exists for all modeled diversions. The historic efficiency factors are used by the model to establish the historic return flow condition that the model uses to adjust the reach gain and should not be changed. The modeled (adjustable) efficiency factors are used by the model to simulate the response of a change in efficiency.

3.5.3.5 Pathfinder Ownership Options

The NPRWUM can simulate two additional ownership accounts in the Pathfinder Reservoir. These two accounts, Pathfinder enlargement #1 ownership and Pathfinder enlargement #2 ownership, are controlled via cdata2(33) through cdata2(39). These ownerships accrue water under the same priority date (12/06/04) as the North Platte Pathfinder storage right. The original North Platte Pathfinder storage right of 1,070,000 acre-feet has been reduced to 1,016,507 acre-feet due to sedimentation over its life time. The combined capacity of the Pathfinder enlargement #1 and #2 accounts should not be greater than the amount lost to sedimentation (53,493 acre-feet). Water available for accrual under the 12/06/04 priority date is accrued to these ownerships on a proportional share basis. The deliveries from the Pathfinder enlargement #1 and #2 accounts are controlled by adata(31) and adata(32), respectively.

3.5.3.6 ETO Account Option

Glendo Reservoir has a reregulation space of 334,240 acre-feet that is used to restore North Platte Pathfinder water released from Pathfinder Reservoir to generate power in the winter months. This reregulation space has also been used to capture large inflows and hold them in the Excess-to-Ownership (ETO) account, which is later used to replace ownership evaporation and augment the flow of the North Platte River. The model user controls the operation of the ETO account via cdata2(25) through cdata2(27). Cdata2(28) and cdata2(29) control the use of the ETO account to replace ownership evaporation. Cdata2(30) and cdata2(31) control the use of the ETO account to augment the flow of the North Platte River.

3.5.3.7 Glendo Reregulation Space Options

The NPRWUM can use a portion of the reregulation space as an additional storage account. This additional account is controlled by the model user via cdata2(15) through cdata2(17). The NPRWUM assigns this account the most junior storage right on the system and it accrues water after all other rights have been satisfied with respect to river reaches. The deliveries from this account are controlled by adata(30).

3.5.3.8 Pathfinder Alternative Account Options

This option allows the model user to create and simulate an alternative account of a specified maximum content (cdata2(35)) in the North Platte Pathfinder ownership. This account is activated when cdata2(36) is set to one (1) in the storage ownership input file (_.SOA). When active, this account proportionally shares the accruals and evaporation credited to the North Platte Pathfinder ownership. Releases from this account are controlled via adata(34,J). This account can be used by the model user to explore the possibility of dedicating a portion of the Pathfinder ownership to an environmental account.

3.5.3.9 Kendrick Seminoe Alternative Account Options

This option allows the model user to create and simulate an alternative account of a specified maximum content (cdata2(64)) in the Kendrick Seminoe ownership. This account is activated when cdata2(65) is set to one (1) in the storage ownership input file (_.SOA). When active, this account proportionally shares the accruals and evaporation credited to the Kendrick Seminoe ownership. Releases from this account are controlled via adata(37,J). This account can be used by the model user to explore the possibility of dedicating a portion of the Kendrick Seminoe ownership to an environmental account.

3.5.3.10 Glendo Irrigation Pool Alternative Account Options

This option allows the model user to create and simulate an alternative account of a specified maximum percentage (cdata2(61)) of the Glendo Irrigation Pool ownership. This account is activated when cdata2(61) is set to a number between zero (0) and one (1) in the storage ownership input file (_.SOA). A value of 0.05 dedicates 5 % of the Glendo Irrigation ownership to the alternative account. The account is inactive only when cdata2(61) is set to zero (0). When active, this account proportionally shares the accruals and evaporation (if the Glendo Evaporation Pool has been depleted) is credited to the Glendo Irrigation ownership. The alternative account is further proportionally subdivided into a Wyoming and Nebraska alternative account (0.375 and 0.625, respectively). Releases from the Wyoming and Nebraska alternative accounts are controlled via adata(35,J) and adata(36,J), respectively. These accounts can be used by the model user to explore the possibility of dedicating a portion of the Glendo Irrigation ownership to an environmental account.

4.0 Calibration/Validation of the NPRWUM

4.1 Introduction

This section describes the calibration and validation of the NPRWUM. The output from the NPRWUM was compared to data from a historical period of record. The historical period of record used contained several management decisions not simulated by the NPRWUM. Hence, exact replication of the historical conditions was not possible. For this reason, additional runs were performed to test various features of the model. These tests, used to verify the model's algorithms, are also discussed in this section. The result of the calibration and validation runs are presented in Appendix G.

4.2 Selection of Calibration/Validation Periods

No distinct operating criteria or rules exist for implementation in a computer model which accurately describe the North Platte system over an extended period of time. This variability makes calibration of the NPRWUM difficult. Previous models of the North Platte River System forced reproduction of these varying conditions by creating input data sets and program algorithms that provided specific instructions for given months and years to address each situation. These items allowed for exact prediction of the operation of the North Platte River System during calibration periods, but they limited the flexibility of these models to evaluate scenarios. If the NPRWUM were calibrated in this manner, the model would become useless outside of the calibration/validation period and the output would be questionable when these year/month specific instruction were removed to create scenario runs that utilized current operating criteria.

The objective of the operational evaluation of existing North Platte River Projects is to determine if Reclamation's current operations are in compliance with Section 7 of the Endangered Species Act. In order to develop a model consistent with the stated objective, existing or currently utilized operational criteria and rules were programmed into the model and are applied consistently throughout the entire period of study.

Historic hydrologic data for 1980-94 were chosen for the calibration period since this period reflects operational characteristics closest to current levels of operation. To the extent possible, options in the NPRWUM are set to simulate the North Platte River using the operational criteria and constraints set forth in the 1993 SONFAP and the modified Decree. The model's output from this time period was reviewed to determine that: no operating limits or boundaries were violated; a water balance was maintained; and general historic trends were followed. Adjustments were made to the model's parameters until the above criteria were satisfied. The 1965-79 period was to validate the results obtained during calibration.

4.3 Water Balance

The calibration results were checked to ensure that a water balance existed between inflows, outflows, and storage in the system. A water balance exists when the sum of the inflows minus the sum of the outflows minus the change in storage equals zero. The inflows are the North Platte River above Seminoe, the Medicine Bow River, the Sweetwater River, reach gains (losses), and reservoir gains (losses). The outflows are the Guernsey Reservoir outflow, deliveries to the Casper Canal, and reservoir evaporation. The change in storage is the sum of the current EOM reservoir contents minus the sum of the previous EOM reservoir contents.

Table 4.3.1 shows the results of the water balance performed by the NPRWUM. The non-zero values are caused by rounding errors within the model and are considered to be acceptable. In addition to the water balance for the entire system, a water balance was conducted for each of the five major reservoirs in the system (Seminoe, Pathfinder, Alcova, Glendo, and Guernsey). These individual water balances confirmed that the inflows, outflows, and change in storage of each reservoir balanced.

Table 3.3.34.3.1 North Platte River System Water Balance

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1971	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1973	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1974	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1975	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1976	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1977	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1986	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1987	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1989	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0

4.4 Verification

The NPRWUM is programmed and options are set using operational criteria and constraints set in the 1993 SONFAP and the modified Decree. In addition to following the SONFAP and the modified Decree, the NPRWUM must not violate any physical or legislative constraints set in the system. Therefore, the NPRWUM was checked to verify that the many constraints of the North Platte System were not violated.

The verification of the NPRWUM consisted of commenting and structuring the source code, preparing flowcharts, reviewing the operating criteria, and examining the output files. The Fortran source code of the model was reviewed line by line, checking that the comment statements were distinguishable from the rest of the code and that the comments contained an adequate description of the portion of code they were addressing. Flowcharts were created for each subroutine contained in the model, which allowed an additional review of the code. These flowcharts outline graphically the model's stepwise progression though operation of the system. Staff members of the Water and Lands Division that are directly responsible for the daily accounting of the North Platte River were consulted about the model's implementation of daily operating criteria. The daily accounting records were reviewed on numerous occasions to provide insight on how to best accommodate the daily accounting into a monthly model. The output files were also verified by examining reservoir contents, ownerships, accruals, flows, and natural flows to ensure that physical and legislative constraints were implemented correctly in the model's code.

During the review of EOM reservoir contents, it was confirmed that the reservoirs did not go above or below their maximum and minimum contents set in the model. Ownerships were also checked to determine that they did not violate their maximum limit. The model output was examined to ensure that ownerships were accruing water in sequence by priority, that ownerships did not accrue water from a reach below their point of storage, that the Inland Lakes accrued water during the proper times of the water year, and that Glendo Irrigation Pool did not violate its maximum accrual in a single water year. Flows were inspected to verify that minimum flows in the Kortes to Pathfinder and Gray Reef to Glendo reaches of the North Platte River were met. The calculation and distribution of Natural Flow was also verified. Finally, miscellaneous items such as operation of the Glendo flood pool and reservoir release restrictions were checked for proper functioning.

Verification of the NPRWUM has enable several errors in the code to be identified and corrected. Although a considerable amount of time has been dedicated to verifying the code, some errors may still exist. Additional errors identified will be handle individually when found and will be corrected using the best programming techniques available.

4.5 Calibration/Validation

Calibration of the NPRWUM consisted of comparing the model's output (created using historical 1980-94 hydrologic data) to historic data. The comparison focused on natural flow delivered, flow from Guernsey Reservoir, End-Of-Month (EOM) ownerships, and EOM reservoir contents. Trends in these items were examined to ensure: that the model output reflected the historic wet and dry conditions; that flows increased and decreased at the proper times during the water year; and that reservoirs and ownerships filled at the appropriate time within the water year. Adjustments were made to the model's parameters or code until the calibration was satisfactory. After calibration was completed, the validation period (1965-79) was run to confirm that no inconsistencies occurred in the output. Appendix G contains the graphs and tables that demonstrate calibration/validation of the NPRWUM and the tables of historic values that were used for comparison with the modeled parameters. A listing of the input files showing the parameter settings used for the calibration/validation has also been included at the end of Appendix G. Brief descriptions of some of the input items have been included to help document the use and source of the data.

4.5.1 Natural Flow

The calibration/validation demands are set in the model input data sets. These values are the historic water diverted by each canal. The demands in the data sets are not adjusted (increased) during dry years to reflect a full annual demand. Therefore, demands are fully met throughout the calibration/validation periods with the exception of the Glendo Contractors as noted in Section 4.5.3.3. The demands are met with a combination of natural flow and storage delivered. The process is such that any demand not met by natural flow is satisfied by storage. As a result, natural flow has a direct effect on the storage delivered. For every acre-foot that natural flow is over predicted, storage delivered is under predicted and vice versa.

Deliveries from Excess-to-Ownership (ETO) to satisfy demands are included in the natural flow delivered. Consequently, the over prediction of ETO or the historical inconsistencies in the use of ETO results in the over prediction of natural flow delivered.

The over prediction of natural flow in May, June, and September is often the result of deliveries that are only made for part of a month. For example, irrigators often do not call for water until the middle of May. However, the model calculates the natural flow available for the entire month. When this happens, natural flow that entered the system in the first part of the month is available to irrigators in the later in the month. Another illustration of this effect, is when heavy rains or runoff occur in June before or after storage has been delivered. This results in storage deliveries for only part a month, but natural flow is calculated for the whole month. Finally, irrigators tend to reduce deliveries throughout September in anticipation of shutting down for the non-irrigation season or deliveries are not made for the last few days of the month. Once again, natural flow that occurs later in the month is available to satisfy demands earlier in the month. The water that is delivered as natural flow in September was historically stored by some of the ownerships with lesser priorities (i.e., Kendrick).

The over prediction of natural flow results in the over prediction of ownership storage. This relationship exists since there is a direct relationship between natural flow and storage delivered. The increased natural flow results in decreased storage deliveries. This means that ownership storage is not reduced by historical amounts and is thus over predicted.

4.5.2 Flow below Guernsey

During the calibration/validation period the factor that has the greatest effect on the flows below Guernsey Dam is the Guernsey Reservoir outflow. The Guernsey Reservoir outflow also creates the greatest variance in flows lower on the North Platte River (i.e., below Tri-State Dam and at Lewellen, NE). In fact, a modeled surge or deficit in the historic flow below Guernsey Dam is easily tracked to flow at Lewellen.

Historically, water was released from ownership in the non-irrigation season in anticipation of high inflows during the remainder of the water year. This is not possible with the NPRWUM since it was decided not to allow the model to evacuate ownership other than to satisfy a demand. Instead, the NPRWUM stores water until forced to make a spill due to limited capacity or all the ownerships are full. As a result, flows below Guernsey Dam are under predicted during the late winter months of a wet year and over predicted during the irrigation season of the same water year. Contributing to the over prediction of flows below Guernsey Dam is the under prediction of ETO during extremely wet water years.

4.5.3 Ownership Storage

4.5.3.1 North Platte Ownership

The North Platte Ownership is a combination of the North Platte Pathfinder and North Platte Guernsey Ownerships. The tables and graphs for these ownerships reveal that the NPRWUM consistently over predicts all North Platte Ownerships. The primary reason for this is the over prediction of North Platte Guernsey Ownership. When North Platte Guernsey is over predicted, more deliveries to North Platte contracts are made from the North Platte Guernsey account. This water no longer comes from the North Platte Pathfinder Ownership. Thus, North Platte Pathfinder is over predicted.

North Platte Guernsey is over predicted as a result of a difference in the method used to limit North Platte Guernsey Ownership and Inland Lakes Ownership in the main stem. Prior to 1985 the combined North Platte Guernsey and Inland Lakes Ownerships were limited to the capacity of Guernsey Reservoir. This rule is not used in the NPRWUM since the NPRWUM simulates 1993 levels of and management. Another way that management has changed regarding North Platte Guernsey and Inland Lakes is prior to 1985 no evaporation was charged to either ownership during the winter.

Ownerships cannot deliver storage and accrue water in the same month in a monthly model. If they deliver storage, there was not sufficient natural flow to satisfy the demands and there is no water available to accrue. However, as stated in Section 4.5.1 it is possible for high gains early in the month to be accrued and for deliveries to be made later in the month. This causes the over prediction of ownership in a monthly model. For example, North Platte Pathfinder filled early in the month and made deliveries before the month ended. In which case, the historic tables of end of month ownership will not show Pathfinder filling that year, but the model will continue to accrue water to North Platte Pathfinder until filled. Consequently, the North Platte Pathfinder Ownership is over predicted that year and Kendrick will probably be under predicted since it will come into priority at a later time.

The over prediction of natural flow also provides a direct benefit to North Platte Pathfinder Ownership. The more the demand from a ditch is met from natural flow the more water that remains in ownership. The majority of the ditches that have natural flow rights have storage contracts for North Platte Ownership. Therefore, the over prediction of natural flow has a significant effect on North Platte Ownership.

In addition to the above explanation for the high North Platte Pathfinder Ownership, water was also released from this ownership in wet years to accommodate high spring runoff. The water years that this occurred in were 1974, 1984, and 1987.

4.5.3.2 Kendrick Ownership

The Kendrick Ownership calculated by the model is the combination of the Kendrick Seminoe and Kendrick Alcova Ownerships.

Kendrick benefits from the over prediction of the North Platte Pathfinder Ownership due to the over prediction of North Platte Guernsey Ownership. Because there is more water in North Platte Pathfinder, it fills earlier and Kendrick is able to come into priority sooner. However, Kendrick is under predicted because it was often in priority to store the gains that historically occurred in late September. These gains are used to satisfy natural flow demand earlier in the month as explained in Section 4.5.1. Kendrick is also under predicted when North Platte Pathfinder filled and made deliveries in the same month (see Section 4.5.3.1).

Releases were also made from the Kendrick Ownership in wet years to provide space to store high spring runoff. This occurred in water years 1971, 1984, and 1985.

4.5.3.3 Glendo Unit Ownership

The Glendo Ownerships have the most junior storage right on the North Platte River in Wyoming. This is reflected in the poor calibration/validation results shown in Appendix G. The primary cause of the under prediction of Glendo Unit Ownership is the over prediction of North Platte Guernsey Ownership. An examination of the total ownership in the system reveals that the total ownership is fairly close to historic. However, the distribution of this ownership is often unbalanced. Water that is accrued to North Platte Guernsey historically was accrued in the Glendo Unit Ownerships.

Finally, releases were made from Glendo Unit Ownership to make room for high spring flows in water years 1971, 1972, 1973, 1974, 1980, 1983, 1984, 1985, 1986, and 1987.

The Glendo Unit Ownership has been revised in the NPRWUM to account for the Glendo Contractors individually. The Glendo irrigation pool is divided amongst the Glendo Contractor according to the GLENDO RESERVOIR OPERATING POLICY AND MARKETING PRINCIPLES (Appendix I). However, the NPRWUM limits these contractors to their respective contract amounts. As a result of the revised accounting, the NPRWUM now reports shortages for the Glendo Contractors under the Calibration and Validation runs (Table 4.5.1). These shortages are the total combined shortage for all of the Glendo Contractors and are the direct result of holding the Glendo Contractors to their contract amounts.

Table 3.5.14.5.1 Total Glendo Shortages (kaf)

YEAR	JUN	JUL	AUG	SEP
1966		1.2		
1977		0.3		
1981			0.7	
1982		0.7	1.7	
1983		0.4	0.0	
1985		0.1	0.3	
1986		0.4	0.5	
1987		1.2	0.5	
1988		0.9	2.0	
1989		1.0	9.6	
1990		3.8	9.5	0.7
1991			4.4	
1992		5.4	10.1	1.7
1994	0.5	1.5	7.9	

4.5.3.4 Inland Lakes Ownership in the Main Stem

The Inland Lakes Ownership stored in the main stem was also limited by the storage space in Guernsey Reservoir prior to 1985. However, this did not effect the Inland Lakes Ownership as much as it did North Platte Guernsey. The Inland Lakes Ownership was not as effected as North Platte Guernsey since the Inland Lakes come into priority before North Platte Guernsey and would not be limited by North Platte Guernsey Ownership already existing in the system. The Inland Lakes also come into priority in April when deliveries are made to the Idealized Inland Lakes. The deliveries would decrease the combine Inland Lakes and North Platte Guernsey Ownership and allow more accrual. Prior to 1985, evaporation was not charged against Inland Lakes Ownership in the Main Stem during the non-irrigation season.

The differences observed in the tables and graphs of the Inland Lakes Ownership in the main stem are due to the differences between the daily gains used in the historic storage ownership accounting and the monthly gains used in the model's storage ownership accounting that were calculated from historic monthly data. These differences will remain in the model since the model uses all inflows and gains calculated from gauged flows not the sum of the daily gains used historically.

4.5.3.5 Excess-to-Ownership

Excess-to-Ownership (ETO) is water that is stored above the ownership capacity of the North Platte River system. For calibration purposes, the ETO water is used to replace evaporation from North Platte Guernsey and Glendo Unit Ownerships and to augment natural flow. The option to replace evaporation from the North Platte Pathfinder and Kendrick Ownerships was also enable, which reduce amount the Kendrick Ownership was under predict in the late calibration years. Since the over prediction of natural flow benefits ownership, the over prediction of ETO also benefits ownership, particularly North Platte Pathfinder. Historically, much ownership water was released and reaccrued during wet water years or released and accrued to ETO and transferred to an ownership or used in other ways besides augmenting natural flow. Therefore, the prediction of ETO can have a significant effect on the Ownership in the system.

Another historical benefit that ETO provided to ownership, is when ETO accrues water and makes deliveries within the same month. The ETO water delivered allows ownerships to not make storage deliveries. In addition, the right that is in priority may be able to accrue water since deliveries are made from the ETO account.

4.5.4 Physical Storage

Physical storage is important to the NPRWUM since the amount stored in each reservoir may effect the ownership accruals and the Guernsey Reservoir Outflow. However, exact duplication is not necessary for model calibration/validation. As a result, attempts were made to match the historic Seminoe outflows and the historic Glendo hydrograph. In addition, Alcova, Kortes, and Gray Reef Reservoirs are operated as fixed reservoirs with hard targets for each month. Guernsey Reservoir was allowed to achieve any level of storage as long as it was not greater than its maximum content or below its target content set during the irrigation season. Pathfinder Reservoir was regulated by Seminoe outflows and outflows to match the Glendo hydrograph.

The Seminoe outflows were divided into three groups based on the storage in Seminoe Reservoir. The groups are below average, average, and above average. If Seminoe Reservoir storage is below average, the below average releases are made, and the same for the other levels of storage. The release is evaluated by the model for every month through June. Table 4.5.2 shows the values used as a first approximation to determine the values used in the model. Also shown are the time periods used to calculate these approximations.

Table 3.5.24.5.2 Seminoe Reservoir Outflow (kaf)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
Average	1025	1150	1400	1525	1450	1350	1425	1450	1965-94
Below Average	525	525	675	675	600	650	925	1075	1990-94
Above Average	1175	1300	1575	1750	1600	1550	1575	1650	1970-89

In addition to attempting to match the Seminoe outflow in October through May the model balances storage between Seminoe and Pathfinder Reservoirs during the rest of the year. A percent of the total water stored in the two reservoirs is stored in Seminoe and the rest is stored in Pathfinder. This was also adjusted during calibration/validation.

The Glendo hydrograph was calculated by averaging the EOM storage in Glendo Reservoir for each month for the entire calibration/validation period. This was done for historic and modeled data. The input items in the model were then adjusted until the two graphs were very similar. Figure 4.5.1 shows the graph of the historic and calculated Glendo hydrograph.

Prior to 1986 Guernsey Reservoir was kept at or near zero through October. Releases of 2-5 af were often made to keep the reservoir at this level.

4.5.5 Power Generation

Because a strict calibration/validation of physical storage to historic values was not performed, the power generated by the model was not close to historic. This is demonstrated by the first set of graphs and tables in the power generation section of Appendix G. Power generation is not just dependant on reservoir storage but is also controlled by reservoir outflow. Both have to be very similar to historic for power generation to calibrate/validate close to historic. Therefore, a version of the NPRWUM was forced to have the same EOM contents and reservoir releases as historic to test the power generation subroutines.

4.5.5.1 Analysis and Verification of Power Computations Within the NPRWUM

The power generation output from forced run was used to create the graphs and tables shown in the power generation section of Appendix G. The graphs show that the modeled values are very close to historic. This indicates that the model is calculating power generation correctly.

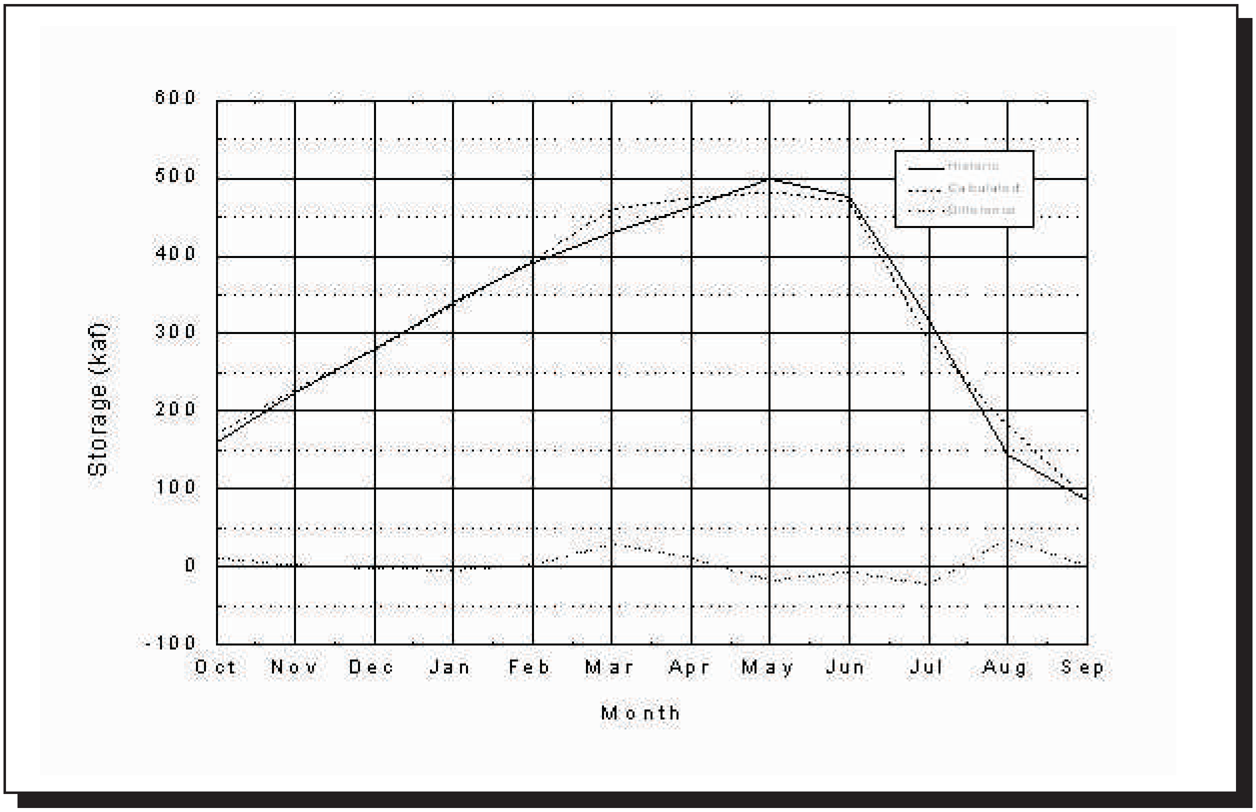

Figure 3.5.24.5.1 Yearly Glendo Storage Hydrograph

4.5.6 Return Flow

The return flows computed in the NPRWUM are solely a function of the diversions and are not used to directly calculate the flows at any accounting point in the model. Rather, the return flows are used to adjust the reach gains when the modeled diversions diverge from the historic diversions. The adjusted reach gains are used to directly calculate the flows at the various accounting points in the model. Calibration of the modeled return flows to an accounting point was not possible for the reason stated above, nor could the return flow be directly calibrated against the historic reach gains since these gains include the influences of such things as well irrigation and precipitation that are not considered in the modeled return flows. In order to verify that the return flows calculated in the model were reasonable, the modeled Consumptive Use (CU) from Guernsey to Lewellen was calculated for each water year and reviewed to ensure that the modeled CU was higher during dry water years and lower during wet water year. The Guernsey to Lewellen modeled CU is show in Table 4.5.3 and was calculated as the total modeled diversions Guernsey to Lewellen minus the total modeled Guernsey to Lewellen return flows.

Return flows were added for the Casper Canal Deliveries and the average modeled CU for these deliveries are shown in Table 4.5.4.

Table 3.5.34.5.3 Modeled CU - Guernsey to Lewellen

Val	Total Div (kaf)	Total Return Flow (kaf)	CU (kaf)	Cal	Total Div (kaf)	Total Return Flow (kaf)	CU (kaf)
1965	1152.7	475.4	667.3	1980	1337.4	596.7	780.7
1966	1345.1	612.8	732.6	1981	1225.8	605.2	620.6
1967	1098.0	588.7	509.3	1982	1177.9	484.6	693.3
1968	1293.0	668.7	624.3	1983	1282.7	726.4	556.3
1969	1368.8	674.3	694.5	1984	1406.0	1060.6	345.4
1970	1356.4	726.4	630.0	1985	1497.2	947.4	549.8
1971	1247.7	873.5	374.2	1986	1313.2	748.5	564.7
1972	1315.3	827.9	487.4	1987	1157.8	625.8	532.0
1973	1395.5	842.5	553.0	1988	1314.9	566.4	748.5
1974	1506.9	982.8	524.1	1989	1161.4	590.3	571.1
1975	1406.8	879.7	527.1	1990	892.4	448.1	444.3
1976	1432.9	788.8	644.1	1991	1075.4	391.9	683.5
1977	1286.1	694.1	592.0	1992	928.8	392.9	535.9
1978	1294.2	549.0	745.2	1993	1127.6	390.9	736.7
1979	1302.0	558.0	744.0	1994	1295.0	479.2	818.5

Table 3.5.44.5.4 Average Modeled CU - Casper Canal

Val	Total Div (kaf)	Total Return Flow (kaf)	CU (kaf)	Cal	Total Div (kaf)	Total Return Flow (kaf)	CU (kaf)
1965-79	60.2	29.2	31.0	1980-94	73.5	35.5	38.0

Graphs containing the modeled Guernsey to Lewellen diversions, gains, and return flows are shown in Figure 4.5.2. The graphs also include precipitation, which is equal to the sum of the monthly precipitation reported at the TORRINGTON EXP FARM (Index No. 8995, SCOTTSBLUFF WSO AP (Index No. 7665), and BRIDGEPORT (Index No. 1145) weather stations. This figure consists of five graphs; two graphs representing dry conditions (1977, 1989), two graphs representing wet conditions (1983, 1984), and a graph of the average values over the period 1965-94. These graphs show a downward trend in the gains between June and July, demonstrating the influence of reduces precipitation and the likely results of increase well irrigation. The modeled return flows exhibit an upward trend between these months, which is consistent with the increase in diversions and verifies that the return flows are solely a function of the diversions. No graphs for the Casper Canal return flows were prepared or analyzed.

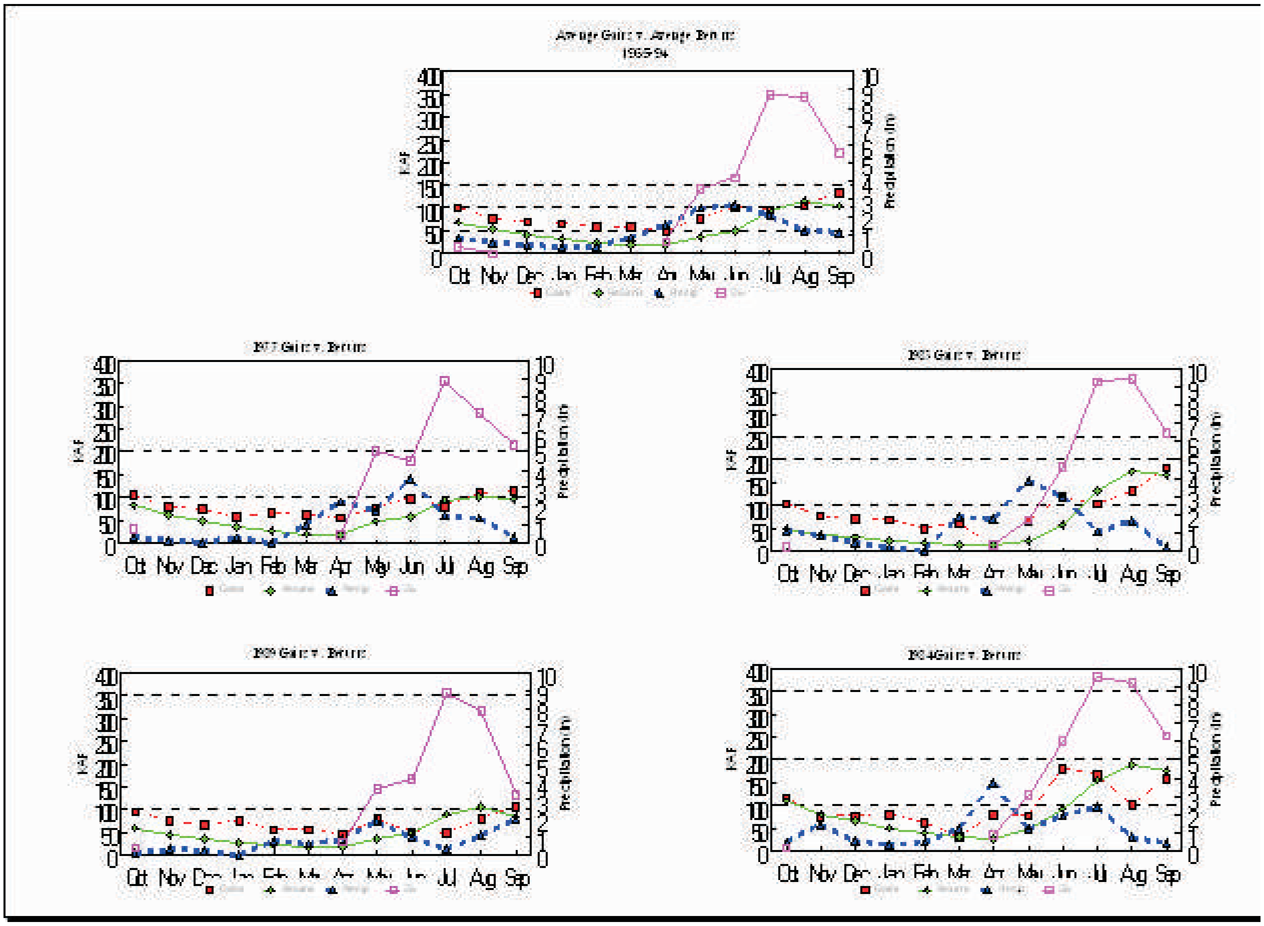

Figure 4.5.2 Gains vs. Return Flows - Guernsey to Lewellen

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APPENDIX A

Reservoir Area-Capacity Tables

Table A-1 Seminoe Reservoir Area-Capacity Relationships

SEMINOE RESERVOIR
KENDRICK PROJECT

EQUATION NUMBER	ELEVATION BASE	CAPACITY BASE	COEFFICIENT A1 (INTERCEPT)	COEFFICIENT A2 (1ST TERM)	COEFFICIENT A3 (2ND TERM)
1	6157.00	0	0.0000	0.0000	0.0000
2	6160.00	0	0.0000	0.0000	0.0500
3	6170.00	4	5.0000	1.0000	2.1500
4	6180.00	229	230.0000	44.0000	3.9500
5	6190.00	1064	1065.0000	123.0000	6.5500
6	6200.00	2949	2950.0000	254.0000	10.9000
7	6210.00	6579	6580.0000	472.0000	9.6000
8	6220.00	12259	12260.0000	664.0000	17.2500
9	6210.00	20624	20625.0000	1009.0000	24.2500
10	6240.00	33139	33140.0000	1494.0000	31.2500
11	6250.00	51204	51205.0000	2119.0000	36.4500
12	6260.00	76039	76040.0000	2848.0000	49.2500
13	6270.00	109444	109445.0000	3833.0000	56.0000
14	6280.00	153374	153375.0000	4953.0000	59.0000
15	6290.00	208804	208804.9999	6133.0000	69.0000
16	6300.00	277034	277034.9999	7513.0000	71.9000
17	6310.00	359354	359354.9999	8951.0000	80.1500
18	6320.00	457679	457679.9999	10714.0000	104.7000
19	6330.00	575289	575289.9999	12808.0000	122.8500
20	6340.00	715654	715654.9998	15265.0000	144.2500
21	6350.00	882729	882729.9998	18150.0000	152.9286
22	6357.00	1017273	1017273.4997	20291.0000	157.0000
23	6360.00	1079559	1079560.1062	21232.3787	151.3000
24	6370.00	1307014	1307013.0234	24262.4236	169.2547
25	6375.00	1432555	1432555.4996	25953.0000	161.0000

Capacity (AF) = A1 + (A2 x y) + (A3 x y^2)
Area (acres) = A2 + (2 x A3 x y)
y (feet) = relative elevation above elevation base

Table A-2 Kortes Reservoir Area-Capacity Relationships

KORTES RESERVOIR
PICK-SLOAN MISSOURI BASIN PROGRAM

EQUATION NUMBER	ELEVATION BASE	CAPACITY BASE	COEFFICIENT A1 (INTERCEPT)	COEFFICIENT A2 (1ST TERM)	COEFFICIENT A3 (2ND TERM)
1	5990.00	0	0.0000	0.0000	0.0500
2	6010.00	19	20.0000	2.0000	0.1000
3	6020.00	49	50.0000	4.0000	0.1500
4	6030.00	104	105.0000	7.0000	0.2500
5	6050.00	344	345.0000	17.0000	0.3000
6	6060.00	544	545.0000	23.0000	0.4000
7	6070.00	814	815.0000	31.0000	0.3500
8	6090.00	1574	1575.0000	45.0000	0.3000
9	6110.00	2504	2595.0000	57.0000	0.2500
10	6130.00	3834	3835.0000	67.0000	0.7000
11	6140.00	4574	4575.0000	81.0000	0.5500

Capacity (AF) = A1 + (A2 x y) + (A3 x y^2)
Area (acres) = A2 + (2 x A3 x y)
y (feet) = relative elevation above elevation base

Table A-3 Pathfinder Reservoir Area-Capacity Relationships

PATHFINDER RESERVOIR
NORTH PLATTE PROJECT

EQUATION NUMBER	ELEVATION BASE	CAPACITY BASE	COEFFICIENT A1 (INTERCEPT)	COEFFICIENT A2 (1ST TERM)	COEFFICIENT A3 (2ND TERM)
1	5670.00	0	0.0000	0.0000	0.0000
2	5690.00	0	0.0000	0.0000	0.7000
3	5695.00	17	17.5000	7.0000	3.0000
4	5700.00	127	127.1000	37.0000	4.2000
5	5705.00	417	417.5000	79.0000	4.4000
6	5710.00	922	922.5000	123.0000	4.6000
7	5715.00	1652	1652.5000	169.0000	18.2000
8	5720.00	2952	2952.5000	351.0000	14.6000
9	5725.00	5072	5072.5000	497.0000	32.1000
10	5730.00	8359	8360.0000	818.0000	30.2000
11	5735.00	13204	13205.0000	1120.0000	45.3000
12	5740.00	19937	19937.5000	1573.0000	56.6000
13	5745.00	29217	29217.5000	2139.0000	48.2000
14	5750.00	41117	41117.5000	2621.0000	47.6000
15	5755.00	55412	55412.5000	3097.0000	50.2000
16	5760.00	72152	72152.5000	3599.0000	42.8000
17	5765.00	91217	91217.5000	4027.0000	60.5000
18	5770.00	112864	112865.0000	4632.0000	40.8000
19	5775.00	137044	137045.6064	5039.3707	47.4000
20	5785.00	192179	192179.9999	5988.0000	69.2000
21	5790.00	223849	223849.9999	6680.0000	61.1000
22	5795.00	258777	258779.6225	7288.8255	22.0500
23	5805.00	339874	339874.9999	8932.0000	100.6000
24	5810.00	387049	387049.9999	9938.0000	124.2000
25	5815.00	439844	439844.9999	11180.0000	128.5000
26	5820.00	498957	498957.4999	12465.0000	143.7000
27	5825.00	564874	564874.6565	13902.3106	162.5500
28	5835.00	720152	720152.4998	17153.0000	168.2000
29	5840.00	810122	810122.4998	18835.0000	159.6000
30	5845.00	908287	908287.4997	20431.0000	154.6000
31	5850.00	1014307	1014307.4997	21977.0000	186.2000

Capacity (AF)= A1 +(A2 x y) + (A3 x y^2)
Area (acres)= A2 + (2 x A3 x y)
y (feet) = relative elevation above elevation base

Table A-4 Alcova Reservoir Area-Capacity Relationships

ALCOVA RESERVOIR
KENDRICK PROJECT

EQUATION NUMBER	ELEVATION BASE	CAPACITY BASE	COEFFICIENT A1 (INTERCEPT)	COEFFICIENT A2 (1ST TERM)	COEFFICIENT A3 (2ND TERM)
1	5320.00	0	0.0000	0.0000	0.3000
2	5330.00	29	30.0000	6.0000	2.2000
3	5340.00	309	310.0000	50.0000	2.8500
4	5350.00	1094	1095.0000	107.0000	7.4000
5	5360.00	2904	2905.0000	255.0000	6.3000
6	5370.00	6084	6085.0000	381.0000	7.5500
7	5380.00	10649	10650.0000	532.0000	7.0500
8	5390.00	16674	16675.0000	673.0000	7.1500
9	5400.00	24119	24120.0000	816.0000	6.7000
10	5410.00	32949	32950.0000	950.0000	7.7000
11	5420.00	43219	43220.0000	1104.0000	7.8500
12	5430.00	55044	55045.0000	1261.0000	7.9000
13	5440.00	68444	68445.0000	1419.0000	8.1500
14	5450.00	83449	83449.8167	1582.1116	8.7394
15	5465.00	109147	109147.5000	1844.0000	1.6000
16	5470.00	118557	118557.5000	1920.0000	9.0000
17	5485.00	149382	149382.5000	2190.0000	10.0000
18	5490.00	160582	160582.4999	2290.0000	9.4000
19	5495.00	172267	172267.4999	2384.0000	8.7000
20	5500.00	184404	184404.6967	2471.3100	9.3500
21	5510.00	210052	210052.4999	2658.0000	9.9000

Capacity (AF) = A1 + (A2 x y) + (A3 x y^2)
Area (acres) = A2 + (2 x A3 x y)
y (feet) = relative elevation above elevation base

Table A-5 Gray Reef Reservoir Area-Capacity Relationships

GRAY REEF RESERVOIR
PICK-SLOAN MISSOURI BASIN PROGRAM

EQUATION NUMBER	ELEVATION BASE	CAPACITY BASE	COEFFICIENT A1 (INTERCEPT)	COEFFICIENT A2 (1ST TERM)	COEFFICIENT A3 (2ND TERM)
1	5305.00	0	0.0000	0.0000	0.000
2	5306.00	0	-.0000	0.0000	.5000
3	5308.00	2	2.0000	2.0000	3.0000
4	5310.00	17	18.0000	14.0000	2.5000
5	5312.00	55	56.0000	24.0000	1.7500
6	5314.00	110	111.0000	31.0000	2.7500
7	5316.00	183	184.0000	42.0000	2.2500
8	5318.00	276	277.0000	51.0000	2.5000
9	5320.00	388	389.0000	61.0000	5.2500
10	5122.00	531	532.0000	82.0000	4.7500
11	5324.00	714	715.0000	101.0000	3.2500
12	5326.00	929	930.0000	114.0000	4.0000
13	5328.00	1173	1174.0000	130.0000	6.7500
14	5330.00	1460	1461.0000	157.0000	6.2500
15	5332.00	1799	1800.0000	102.0000	2.7500

Capacity (AF) = A1 + (A2 x y) + (A3 x y^2)
Area (acres) = A2 + (2 x A3 x y)
y (feet) = relative elevation above elevation base

Table A-6 Glendo Reservoir Area-Capacity Relationships

EQUATION NUMBER	ELEVATION BASE	CAPACITY BASE	COEFFICIENT A1 (INTERCEPT)	COEFFICIENT A2 (1ST TERM)	COEFFICIENT A3 (2ND TERM)
1	4508	0	0.0000	1.0000	0.00000
2	4510	18	18.0269	17.9817	2.80183
3	4520	478	478.038	74.0494	9.94509
4	4530	2213	2212.890	272.996	18.4506
5	4540	6788	6787.910	642.051	41.3951
6	4550	17348	17347.800	1469.970	40.5033
7	4560	36098	36097.700	2279.990	42.5018
8	4570	63148	63147.700	3129.980	43.5073
9	4580	98798	98797.600	4000.030	54.4988
10	4590	144248	144248.000	5090.050	71.4969
11	4600	202298	202297.000	6520.170	62.4874
12	4610	273748	273748.000	7770.170	69.9864
13	4620	358448	358447.000	9170.200	89.9840
14	4630	459148	459147.000	10970.200	139.4870
15	4640	582798	582797.000	13670.200	164.4020
16	4650	736848	736847.000	17050.400	155.9700
17	4660	922948	922947.000	20170.400	174.9650

Capacity (AF) = A1 + (A2 x y) + (A3 x y^2)
Area (acres) = A2 + (2 x A3 x y)
y (feet) = relative elevation above elevation base

Table A-7 Guernsey Reservoir Area-Capacity Relationships

GUERNSEY RESERVOIR
NORTH PLATTE PROJECT

EQUATION NUMBER	ELEVATION BASE	CAPACITY BASE	COEFFICIENT A1 (INTERCEPT)	COEFFICIENT A2 (1ST.TERM)	COEFFICIENT A3 (2ND TERM)
1	4370.00	0	0.0000	0.0000	2.0000
2	4375.00	50	50.0000	20.0000	9.0000
3	4380.00	374	375.0000	110.0000	11.0000
4	4385.00	1199	1200.0000	220.0000	16.5000
5	4390.00	2712	2712.5000	385.0000	29.0000
6	4395.00	5362	5362.5000	675.0000	38.0000
7	4400.00	9687	9687.5000	1055.0000	42.0000
8	4405.00	16012	16012.5000	1475.0000	38.0000
9	4410.00	24337	24337.5000	1855.0000	28.5000
10	4415.00	34324	34325.0000	2140.0000	23.5000

Capacity (AF) = A1 + (A2 x y) + (A3 x y^2)
Area (acres) = A2 + (2 x A3 x y)
y (feet) = relative elevation above elevation base

APPENDIX B

Storage Ownership and Natural Flow Accounting Procedures

NORTH PLATTE RIVER OWNERSHIP AND NATURAL FLOW ACCOUNTING PROCEDURES

PART A.

STORAGE OWNERSHIP ACCOUNTING PROCEDURES

The parties to this criteria agree that administration and operation under this agreement are to conform with Wyoming and Nebraska State Laws, the U.S. Reclamation Law, and the U.S. Supreme Court Decree of 1945 and the 1952 Stipulation, as appropriate.

The North Platte system storage ownership shall equal the total storage in Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo, and Guernsey reservoirs, except for water held in storage under separate contract for other entities by the Bureau of Reclamation or waters held in temporary storage.

All storage ownerships are to be filled in order of priority as provided for by Paragraph III of the 1952 Modification of the U.S. Supreme Court Decree of 1945, Wyoming State Law and as water becomes available. Any water bypassed or spilled is to be charged to that ownership which may not then be refilled until all other appropriations from the river have been satisfied. No storage ownership delivery or evaporation charges will be assessed when water is being spilled from the system.

A one-day time lag will be used in computing the evaporation chargeable to each ownership. Evaporation chargeable today is considered to be equal to yesterday's total actual evaporation.

A. Pathfinder - 1,016,507 A.F. (current capacity) Priority Date - 12/06/04

1. All river gains upstream of Pathfinder Reservoir for the October 1 through April 30 period are to accrue to this ownership until filled. Gains May 1 through September 30 in excess of natural flow demands may accrue to Pathfinder ownership until filled.

2. Any Pathfinder ownership in Guernsey Reservoir on September 30 will remain in Pathfinder ownership after October 1. This water will not transfer to Guernsey ownership, but will remain in Pathfinder ownership and may be transferred upstream as Guernsey ownership or the Inland Lakes accrue water. Pathfinder ownership transferred to the Inland Lakes will remain in Pathfinder ownership.

3. The Pathfinder evaporation charge is computed as though all Pathfinder ownership is in Pathfinder Reservoir except for that portion which may be in Guernsey Reservoir which shall be computed at the same rate as that of Guernsey Reservoir.

B. Inland Lakes

No agreement was reached as to storage in or for the account of the Inland Lakes. This matter is pending in litigation in the U. S. Supreme Court. The parties do not agree on the question whether natural flow may be stored from the North Platte River in or for the account of the Inland Lakes under the existing Wyoming permits for the North Platte Project. Reserving all of their legal rights, the parties agree that, during any water year, while this litigation is pending:

1. During the months of October, November and April gains downstream from Alcova Reservoir will accrue to the Inland Lakes, up to a total of 46,000 A.F., and at a rate not to exceed 910 cubic feet per second. These gains may be stored in Guernsey and Glendo reservoirs and transferred to the Inland Lakes when Pathfinder Irrigation District resumes spring operations. The transfer is to be completed no later than May 15th.

2. Evaporation will be charged to this ownership for water stored in upstream reservoirs at the rate determined for the reservoir where stored.

3. The amount of water transferred from this account to the Inland Lakes shall not exceed 46,000 A.F. annually less evaporation losses, measured into the Interstate Canal if other water is being released and at Guernsey if only Inland Lakes water is being released.

In addition, the following conditions apply:

a. For Water Year 1993, the Alcova to Guernsey accruals during the months of October, November and April have been or will be credited to the Inland Lakes account up to a total of 46,000 A.F.

b. Reclamation will maintain and make available to Wyoming upon request records accounting for all water stored in the Inland Lakes or accrued to the Inland Lakes account in other reservoirs.

c. Nothing in these procedures is intended to restrict the delivery of North Platte Project storage water to the Inland Lakes.

C. Guernsey - 45,612 A.F. (current capacity) Priority Date - 04/20/23

1. River gains upstream of Guernsey Reservoir for the October 1 through April 30 period and not credited to the Inland Lakes will accrue to this ownership until filled. Gains May 1 through September 30 in excess of natural flow demands may accrue to Guernsey ownership until filled.

2. The Guernsey evaporation charge is computed as though all Guernsey ownership is in Guernsey Reservoir.

3. The Hydrographer-Commissioner of District 14 will be notified in a timely manner of all releases made to fulfill contractual obligations to Federal contractors by the Bureau of Reclamation.

4. Guernsey Reservoir releases after April 30 are to be natural flow calls upon the river following coordination among Wyoming, Nebraska and Bureau of Reclamation personnel. When Guernsey Reservoir releases exceed the natural flow of the river at this point, then the difference is a release of storage water.

5. Guernsey ownership transferred to the Inland Lakes will remain in Guernsey ownership.

D. Kendrick - 1,201,678 A.F. (current capacity; Seminoe - 1,017,273 A.F., Alcova - 184,405 A.F.) Priority Dates (Seminoe - 12/01/31, Alcova - 04/25/36)

1. All gains upstream of Seminoe Reservoir for the October 1 through April 30 period after Pathfinder and Guernsey ownerships have filled are to accrue to Kendrick (Seminoe) ownership until filled. Likewise, all gains upstream of Alcova Reservoir for the October 1 through April 30 period after Pathfinder and Guernsey ownerships have filled are to accrue to Kendrick (Alcova) ownership until filled. Gains May 1 though September 30 in excess of natural flow demands may accrue to the Kendrick ownership until filled.

2. The evaporation chargeable to Kendrick ownership shall be the actual Seminoe and Alcova Reservoir evaporation yesterday, plus the evaporation for Kendrick ownership stored in any other reservoir but assumed to be in Seminoe Reservoir, minus any loss charged to storage held under contract for other entities by the Bureau of Reclamation in Seminoe Reservoir.

E. Glendo - 183,238 A.F. (current capacity) Priority Date - 08/30/51

1. This ownership consists of a power head pool of 63,148 A.F. (elevation 4,570), an irrigation ownership pool not to exceed 100,000 A.F. and an estimated evaporation pool of 20,090 A.F.

2. All gains upstream of Glendo Reservoir for the period October 1 through April 30 after the Pathfinder, Guernsey, and Kendrick ownerships and the Inland Lakes Account have filled are to accrue to the Glendo ownership until filled. At any time that the Guernsey ownership has filled and the Pathfinder or Kendrick ownerships have not filled, all gains between Alcova and Glendo will accrue to Glendo ownership. Gains May 1 through September 30 in excess of natural flow demands may accrue to this ownership until filled.

3. When the power head pool of 63,148 A.F. (elevation 4,570) is filled, no further accounting need be made for this pool. This minimum power head pool can be filled but once from the river. All Glendo ownership evaporation will be charged against the irrigation pool unless storage for evaporation has been underestimated and evaporation encroaches upon the power head pool. In this case refilling of the power head pool may be allowed as an exception by the Wyoming State Engineer.

4. Glendo ownership can accrue annually in the irrigation pool up to 40,000 A.F. plus estimated evaporation, provided this total irrigation ownership including carryover storage does not exceed 100,000 A.F. plus estimated evaporation. Any difference between actual evaporation charged to the Glendo ownership and that estimated previously will be accounted for by adjustment of next year's allowable storage for evaporation.

5. The Glendo ownership will be accounted for on both a State and an individual contractor basis. Such accounting will include accruals, releases, evaporation, exchanges and carryover storage. Such amounts will be allocated by account in proportion to each entity's contracted amount of the Glendo water supply. The total accrual to the irrigation ownership shall not exceed 40,000 A.F. per year, nor will the irrigation pool including carryover storage accrue beyond 37,500 A.F. for Wyoming or 62,500 A.F. for Nebraska.

6. The evaporation chargeable to the Glendo ownership is the total actual evaporation minus that chargeable to other ownerships and minus any loss charged to storage held under contract for other entities by the Bureau of Reclamation in Glendo Reservoir.

7. Gains Alcova to Glendo for the October 1 through April 30 period are to be computed Glendo Reservoir inflow minus 98 percent of the Gray Reef outflow two (2) days earlier.

F. Precipitation Events

1. All ownership accounts downstream from Guernsey Dam shall be charge on a proportional basis to the extent of the amount of water from additional precipitation events passing Tri-State Dam for each day that storage water is diverted. Where those additional precipitation events inadvertently cause flows to pass Tri-State Dam, such quantities shall not be charged against any storage ownership account, and the Bureau of Reclamation will make the appropriate and timely Guernsey Dam outflow adjustments. The Division 1 Superintendent of the Wyoming Board of Control and the Division Supervisor of the Nebraska Department of Water Resources shall consult and jointly determine the duration of time during which no storage ownership account will be charged because of additional precipitation events inadvertently causing flows past the Tri-State Dam.

G. Excess to Ownership

1. River gains upstream of Guernsey Reservoir and below Alcova Dam in excess of natural flow demand not applied to the Inland Lakes ownership, the Guernsey ownership or Glendo ownership, as set forth herein, will accrue to "Excess to Ownership."

2. "Excess to Ownership" water shall be used to replace evaporation on the Glendo and Guernsey ownerships, once the ownerships are filled, and until the first release of ownership water occurs from either ownership account.

3. Any "Excess to Ownership" water which is capture in quantities greater than needed to accomplish item 2 above will be converted and released to fill natural flow demand when natural flow demand exceeds the actual natural flow on a given day.

4. The "Excess to Ownership" water account will accrue and be released in such a manner so as not to interfere with authorized project purposes, or as would endanger the safety of a structure.

PART B.

NATURAL FLOW COMPUTING PROCEDURE

Inflow to Seminoe Reservoir

The Seminoe inflow will be the sum of the flows of the North Platte River above the Seminoe Reservoir and the Medicine Bow River above Seminoe Reservoir.

Natural Flow above Alcova Reservoir

The natural flow above Alcova Reservoir will be the inflow to Seminoe plus the flow of the Sweetwater River entering Pathfinder Reservoir and to this total will be added the following daily accrual for each month:

May	June	July	August	September
90 cfs	45 cfs	40 cfs	35 cfs	35 cfs

The total of Seminoe inflow plus the flow of the Sweetwater River plus the accrual will be called the natural flow entering Alcova Reservoir and will be passed through Alcova Reservoir and Gray Reef Reservoir without loss.

Gray Reef Reservoir to Glendo Reservoir

Water released at the Gray Reef Reservoir will be charged daily with the following losses set by the Decree to account for the losses between Alcova and Glendo Reservoirs.

May	June	July	August	September
43 cfs	61 cfs	70 cfs	61 cfs	45 cfs

There will be a two (2) day time lag in transporting water from Gray Reef Reservoir to Glendo Reservoir. Water released at Gray Reef Reservoir will reach Glendo Reservoir two (2) days after the release date.

Glendo Outflow

A one (1) day time lag will be used in transporting water through the Glendo Reservoir. Natural flow entering the Glendo Reservoir will one (1) day later be called the Glendo Outflow and be passed through the Glendo Reservoir without loss.

Glendo Reservoir through Whalen Dam

Water released at Glendo Reservoir plus 20 cfs of river accrual will be called the Guernsey Reservoir inflow for that day. A one (1) day time lag will be used in bringing water from the Glendo outflow through Whalen Dam, which will include the two Government canals just above Whalen Dam. This water will be passed through Whalen Dam without loss.

Whalen Dam to Wyoming-Nebraska State Line or to the Tri-State Dam

A one (1) day time lag is used in taking water from the River Station below Whalen Dam to the River Station below Tri-State Dam.

River Losses Guernsey Reservoir to Nebraska State Line

A loss of natural flow may be borrowed from storage and replaced from subsequent gains. Carriage losses in the river section Guernsey River to the Wyoming-Nebraska State Line set by the Decree are as follows:

May	June	July	August	September
20 cfs	27 cfs	31 cfs	27 cfs	20 cfs

These ownership accounting and natural flow computing procedures shall be subject to revision and adoption at the annual Natural Flow and Ownership Meeting, and shall not be considered as applicable for any year not adopted. Conditions arising in exception to these procedures will be resolved by agreement of the signatory parties.

It is the intent of this document to provide a reasonable means to maintain the status quo and to provide for conflict-free administration of the river pending resolution of the matters now in litigation.

Wyoming State Engineer — Date

Director, Nebraska Dept. of Water Resources — Date

Project Manager, Bureau of Reclamation — Date

APPENDIX C

Parameters for GLOVER Subroutine

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1.0 RETURN FLOW PARAMETERS

The GLOVER subroutine uses five input parameters to calculate return flow; transmissivity (gpd/ft), storage coefficient or specific yield, reach width or drain spacing (ft), initial condition recharge (kaf/mo), and deep percolation irrigation (kaf). This appendix provides further explanation of how the transmissivity, reach width (drain spacing), initial condition recharge, and efficiency values were estimated. Estimates of these return flow parameters were made for the Alcova to Glenrock (Casper Canal), Whalen to Tri-State, and Tri-State to Lewellen Reaches modeled in the North Platte River Water Utilization Model (NPRWUM).

The return flow parameters for lands irrigated from the Casper Canal were estimated using the areal extent bounded by Section 4 of Range 80 West, Township 33 North. The return flow parameters estimated for this area were used for the entire Casper Canal.

The NPRWUM uses three (3) large reaches to simulate the North Platte River below Guernsey. The reaches in downstream order are Guernsey to Whalen (no return flows are modeled within this reach), Whalen to Tri-State, and Tri-State to Lewellen. These large reaches contain multiple sub-basins within their boundaries. The NPRWUM does not attempt to identify the individual return flow contributions of these sub-basins within their respective reaches, instead they are lumped together at the end of the reach. Return flow parameters were not estimated for each sub-basin, rather a single value for each parameter was estimated using a selected basin between the Whalen Dam and Lisco, Nebraska. This basin extended from Whalen Diversion Dam to the termination point of the Belmont Canal near the North Platte River just above Lisco, Nebraska, and was bounded by the uppermost irrigation canals to the north and south of the river. The estimated parameters were used for both the Whalen to Tri-State (Reach No. 2) and Tri-State to Lewellen (Reach No. 3).

1.1 Transmissivity

The transmissivity estimated for the Casper Canal was determined using data contained in the KENDRICK PROJECT, STATUS REPORT (U.S. Department of Interior, 1955). From Table 7 of that report, a coefficient of permeability (hydraulic conductivity, k) of 1.1 in3/in2/hr (16.5 gal/ft2/day) and saturated thickness (M) of approximately 60 feet were used to arrive at an estimated transmissivity of 990 gpd/ft (T = kM) or approximately 1000 gpd/ft.

The transmissivity estimated for the basin below Guernsey was determined by taking an average of the spot transmissivities from the USGS Water-Resources Investigation 3-75 report, Plate 4 (Crist, 1975) and transmissivities estimated from specific capacities computed from well registration logs. The pump test data from the well registration logs were used to estimate the specific capacity of each well. The specific capacity was use to estimate an associated transmissivity value (U.S. Department of Interior, 1977). A sample calculation of the transmissivities estimated from the well registration logs is shown in Figure C-1. Estimates of transmissivities computed for wells in Nebraska have been summarized on microfiche and are available for inspection at Reclamation's Wyoming Area Office. The data used to determine the average transmissivity for the area are summarized in Table C-1 through Table C-5. The initial calculation of the average transmissivity is shown in Table C-6. The initial value of 174,000 gpd/ft was adjusted to 150,000 gpd/ft during calibration. The transmissivity for both Reaches No. 2 and No. 3 are set at 150,000 gpd/ft.

Given: Pump Rate = 1500 gpm, Static Level = 110 ft, Pumped Level = 125 ft

Find: Estimate Transmissivity

Solution:

Draw Down = Pumped Level - Static Level
= 125 ft - 110 ft
= 15 ft

Specific Capacity = (Pump Rate) / (Draw Down)
= 1500 gpm / 15 ft
= 100 gpm/ft

Transmissivity = Specific Capacity x factor
= 100 gpm/ft x 2250
= 225,000 gpd/ft

Figure C-1 Sample Transmissivity Calculation

Table C-1 Transmissivities near the Interstate Canal

Township	Range	Section	Transmissivity (gpd/ft)
21N	51W	1	78750
		2	2813*
		11	153409
22N	53W	3	153947
		11	244214
		13	39375
22N	54W	13	454688
		14	145313
		15	143182
23N	53W	27	40500
		35	34615
23N	54W	5	187500
		7	1091250*
		14	38982
		18	39527
		26	125000
		28	208929

23N	55W	4	500000
		7	33750
		8	29847
		9	112500
		13	36779
		15	81818
		17	90863
		19	506000
		20	157769
		21	60361
		29	94408
		30	45000
		34	84375
		35	225000
		36	132353
23N	56W	3	100000
		4	42188
		5	79412
		6	218423
		7	93750
		8	225000
		10	65389
		11	138462
		12	25584
		13	180980
		14	105000
		15	60938
		23	152419
		24	192854
		25	176458
		26	285717
23N	57W	1	147857
		2	148253
		3	637619
		4	337500
		5	210938
		6	306818
		7	11842
		10	225000
		11	540000
		12	425000
24N	61W	2	335104
25N	61W	28	32912
25N	63W	3	332860
		11	270028
26N	62W	27	32164
Total			10415223
* value not included in computation			

Table C-2 Transmissivities near the Tri-State Canal

Township	Range	Section	Transmissivity (gpd/ft)
21N	51W	8	75000
		9	13578
		18	25253
		20	55023
		21	27344
		22	39706
		29	21582
		31	309375
		33	100467
		34	120536
21N	52W	4	49769
		5	160714
		6	86786
		7	385714
		8	142734
		9	62791
		10	158824
		11	43015
		12	697500
		15	176786
		16	152080
		17	115733
		18	140385
		20	170368
		21	260726
		22	162955
		23	37184
		25	107566
		26	77045
21N	53W	1	320063
		2	100446
		3	90236
		4	29184
		5	24545

22N	53W	18	132065
		19	440625
		22	112126
		23	28929
		26	204543
		28	133195
		29	230625
		30	275398
		31	231429
		32	133235
		33	117857
		34	116618
		35	190280
		36	83510
22N	54W	8	90000
		16	71250
		21	75000
		22	98438
		23	375000
		24	159107
		25	151875
		26	159965
22N	55W	2	76399
		3	122500
		4	47893
		11	216563
		12	197900
23N	55W	33	37500
23N	56W	16	135000
		18	80357
		22	237143
23N	57W	13	268844
		14	619632
		15	93126
		16	83170
		17	182971
		18	236250
23N	58W	13	286364
Total			11073695

Table C-3 Transmissivities near the Enterprise Canal

Township	Range	Section	Transmissivity (gpd/ft)
21N	53W	7	190759
		9	104217
22N	54W	18	154063
		28	257813
		29	130963
22N	55W	8	86825
		9	78458
		10	80243
		14	284598
		15	223393
		16	220313
		17	394737
23N	56W	20	445313
		27	336161
		29	405000
		35	189087
		36	900000*
23N	57W	23	468750
		24	281250
		25	525000
		27	95417
Total			4952360

* value not included in computation

Table C-4 Transmissivities near the Fort Laramie Canal

Township	Range	Section	Transmissivity (gpd/ft)
21N	54W	6	77344
21N	55W	1	34213
		24	12054
		29	18199
21N	58W	2	922050
23N	58W	16	316731
		21	315000
		22	114000
		26	40385
		27	90000
		33	95762
		34	122143
		35	27404
Total			2185285

Table C-5 Transmissivities near the Mitchell-Gering Canal

Township	Range	Section	Transmissivity (gpd/ft)
21N	53W	19	44883
		27	300375
		35	120000
21N	54W	4	13554
		5	50225
		9	28125
22N	55W	7	260938
		18	435667
		19	138462
		20	33142
		27	155357
22N	56W	2	247500
		3	101989
		4	25562
		9	173077
		10	97159
		11	163451
		12	249107
		13	127244
		14	173690
		24	80140
23N	56W	30	286364
		32	28205
		33	393750
		34	122813
23N	57W	29	665625
		30	164198
23N	58W	4	82031
		14	202902
		15	251847
		23	440237
		24	1575000*
Total			5657619

* value not included in computation

Table C-6 Average Transmissivity

Area Group	Number of Wells	Sum of Transmissivities gpd/ft
Interstate Canal	61	10,415,233
Tri-State Canal	72	11,073,695
Enterprise Canal	20	4,952,360
Fort Laramie Canal	13	2,185,285
Mitchell-Gering Canal	31	5,657,619
Total	166	28,626,573
Average (trans/wells)		174,000

1.2 Reach Width

The average reach width for the Casper Canal lands was determined by measuring the distance between drains OTD-11, OTD-11-5-0.3, and OTD-11-5 located in Section 4 of T33N, R80W. The average drain spacing for these measurements was approximately 0.7 inches or 1400 feet based on the map scale of 1:24000.

An average reach width for the selected basin below Guernsey was calculated by dividing the total area of the basin by the sum of the lengths of the individual drains, creeks, and the North Platte River within the basin (Hurley, 1967). The average reach width was estimated to be two miles or 10,560 feet (Table C-7). This value is used for both Reach No. 2 and Reach No. 3.

Table C-7 Reach Width Computation

Name of Creek and/or Drain	Length (mi)	Accumulated Length (mi)
Rawhide Creek	10.5	10.5
Sheep Creek and Related Drains*	22.8	33.3
Dry Sheep Creek*	8.7	42.0
Dutch Flats, Voirs, Akers and Stewart Drains*	10.5	52.5
Wet Spottedtail and Dry Spottedtail Creeks	21.3	73.8
Sunflower and McAllister Drains	5.4	79.2
Banner, Tub Springs, and Hiersche Drains*	11.4	90.6
Dunham-Andrews Drain	9.6	100.2
Winter Creek and Related Drains	16.8	117.0
Baltes and Alliance Drains	9.3	126.3

Nine Mile Creek and Related Drains*	35.5	161.8
Wild Horse Creek*	22.8	184.6
Leavitt Drain	9.6	194.2
Red Willow and West Water Creeks	16.4	210.6
Scottsbluffs Drains No. 1 and No. 2	7.8	218.4
McGrew Drain	2.4	220.8
Bayard Drain	4.5	225.3
Laramie River	3.6	228.9
Cherry Creek and Related Drains	46.2	275.1
Burchell, Lehmar, Lasell, and Grant Drains	9.3	284.4
Katzer and Related Drains	31.5	315.9
Horse Creek	21.6	337.5
Dry Creek Drain and Related Drains	53.7	391.2
Lane Drain*	1.5	392.7
Browns Drain*	1.5	394.2
Stiver Drain	1.2	395.4
Gering Drain	13.9	409.3
North Platte River	86.7	496.0
Total Area (mi^2)		1001.7
Estimated Reach Width (area/length)	2.0	10,560 ft
* unidentified private drains exist nearby, but were not included		

1.3 Efficiency Factors

The NPRWUM calculates the Consumptive Use (CU) of a diversion as the monthly diversion (less evaporation) times the efficiency. The efficiency factors used in the NPRWUM vary by year and are contained in hdata items hdata2(1-82,i,j) and represent the overall efficiency of the basin between Guernsey and Lewellen. Table C-8 below shows the efficiency factors developed for use in the NPRWUM. The efficiency factors for the Casper Canal were assumed to be 0.50 over the entire period.

Table C-8 Efficiency Factors used by the NPRWUM

Development of Basin-wide Efficiency Factors										
Average Precipitation 1941-94: 15.05 in/yr							Average Annual Runoff: 480.0 kaf/yr			
Water Year	Annual Precip (in)	Precip Factor	Hist Gain (kaf)	Adjusted Runoff (kaf)	Return Flow (kaf)	Div (kaf)	1% Evap	CU (kaf)	Eff	Adj Eff
1965	17.95	1.19	1116.6	571.2	545.4	1153.3	11.5	596.4	0.52	0.52
1966	12.84	0.85	1116.1	408.0	708.1	1348.8	13.5	627.2	0.47	0.47
1967	16.09	1.07	1118.3	513.6	604.7	1099.5	11.0	483.8	0.44	0.44
1968	12.85	0.85	1146.6	408.0	738.6	1293.1	12.9	541.6	0.42	0.42
1969	11.22	0.75	1027.1	360.0	667.1	1370.3	13.7	689.5	0.51	0.51
1970	13.51	0.90	1255.8	432.0	823.8	1356.9	13.6	519.5	0.39	0.39
1971	16.17	1.07	1583.4	513.6	1069.8	1247.7	12.5	165.4	0.13	0.20
1972	15.14	1.01	1185.3	484.8	700.5	1315.3	13.2	601.6	0.46	0.46
1973	17.91	1.19	1543.7	571.2	972.5	1395.6	14.0	409.1	0.30	0.30
1974	10.52	0.70	1364.9	336.0	1028.9	1507.0	15.1	463.0	0.31	0.31
1975	10.77	0.72	1189.5	345.6	843.9	1406.8	14.1	548.8	0.39	0.39
1976	13.31	0.88	1179.8	422.4	757.4	1433.5	14.3	661.8	0.47	0.47
1977	12.75	0.85	1072.6	408.0	664.6	1286.7	12.9	609.2	0.48	0.48
1978	17.58	1.17	1098.5	561.6	536.9	1294.2	12.9	744.4	0.58	0.58
1979	15.37	1.02	1158.3	489.6	668.7	1302.0	13.0	620.3	0.48	0.48
1980	14.04	0.93	1207.7	446.4	761.3	1376.7	13.8	601.6	0.44	0.44
1981	13.81	0.92	1005.3	441.6	563.7	1225.3	12.3	649.3	0.54	0.54
1982	21.65	1.44	1068.8	691.2	377.6	1177.9	11.8	788.5	0.68	0.60
1983	16.02	1.06	1576.3	508.8	1067.5	1283.2	12.8	202.9	0.16	0.20
1984	14.94	0.99	1681.5	475.2	1206.3	1406.0	14.1	185.6	0.13	0.20
1985	11.00	0.73	1180.8	350.4	830.4	1497.2	15.0	651.8	0.44	0.44
1986	19.14	1.27	1358.8	609.6	749.2	1314.6	13.1	552.3	0.42	0.42
1987	20.19	1.34	1218.2	643.2	575.0	1159.9	11.6	573.3	0.50	0.50
1988	15.90	1.06	1106.1	508.8	597.3	1318.5	13.2	708.0	0.54	0.54
1989	9.03	0.60	904.9	288.0	616.9	1172.7	11.7	544.1	0.47	0.47
1990	16.38	1.09	800.7	523.2	277.5	903.7	9.0	617.2	0.69	0.60
1991	15.44	1.03	834.9	494.4	340.5	1079.2	10.8	727.9	0.68	0.60
1992	14.47	0.96	816.5	460.8	355.7	941.9	9.4	576.8	0.62	0.60
1993	19.51	1.30	943.0	624.0	319.0	1127.6	11.3	797.3	0.71	0.60
1994	13.36	0.89	984.4	427.2	557.2	1305.0	13.1	734.8	0.57	0.57
Avg.	14.96	0.99	1161.5	477.3	684.2	1270.0	12.7	573.1	0.46	0.46

These basin-wide efficiency factors are derived from the historic reach gain between Guernsey and Lewellen. The annual average runoff of approximately 480.0 kaf/yr (Sayler, 1995) was scaled by the ratio of the precipitation in the water year to the average precipitation 1941-94 to give the adjusted runoff for that water year. The adjusted runoff was subtracted from the historic gain to get the return flow. The CU was calculated as the diversion minus one (1) percent evaporation minus the return flow. The efficiency is equal to the CU divided by the difference of the diversion and evaporation. The efficiencies are further limited to no less than 20 percent and no greater than 60 percent. The adjusted efficiencies shown in the right most column are used for each month of the irrigation season for the associated water year. Each diversion in the model is assigned this same set of efficiencies, one set for the historic demands and another set for the modeled deliveries. As scenario runs are made, the efficiencies associated with the modeled deliveries can be adjusted to examine changes to the overall operation in the system with respect to efficiency.

1.4 Initial Condition Recharge

The initial condition recharge is used by the GLOVER Subroutine to establish or "prime" the ground water conditions for the initial year of any NPRWUM run. To estimated the initial condition recharge for the Casper Canal lands, the average annual return flow for the period 1975-79 of 17,510 acre-feet as reported in Table 16 of the PROPOSED MUNICIPAL USE BY CASPER OF KENDRICK WATER SUPPLY (Wright Water Engineers, 1980) was divided by 12 months to get 1.5 kaf/month. To estimate the initial condition recharge for the basin below Guernsey, the average annual (1965-94) Guernsey to Lewellen gross gain of 1161.5 kaf/yr was reduced by the estimated average annual runoff of 480 kaf/yr to give the estimated average annual return flow of 681.5 kaf/yr. The average annual Guernsey to Tri-State and Tri-State to Lewellen gross reach gains of 276.7 kaf/yr and 884.8 kaf/yr, respectively, were used to develop factors to prorate the average annual return flow between these reaches. The average annual return flow for the Guernsey to Tri-State was 162.4 kaf/yr (681.5 x [276.7/1161.5]) and average annual return flow for the Tri-State to Lewellen reach was 519.1 kaf/yr (681.5 x [884.8/1161.5]). The average annual return flow values were divided by 12 to convert them to kaf/month as required for input into the model. The monthly initial condition recharge values used in the model are shown in Table C-9.

Table C-9 Initial Condition Recharge

Reach	Initial Condition Recharge (kaf/month)
Alcova to Glenrock (Casper Canal)	1.5
Guernsey to Tri-State	13.5
Tri-State to Lewellen	43.3

APPENDIX D

Glendo Operating Release Criteria

Glendo Reservoir Outlet Works Release Restrictions

The Glendo Dam outlet works consists of a 21-foot diameter concrete tunnel controlled by a 15.6 by 21 foot gate on the upstream end and branches from the main conduit at the downstream end to three 7.25 by 7.75 foot slide gates and two turbines. The three outlet gates can release a combine maximum discharge of 13,000 cfs, with the turbines inoperable. However, releases through the outlet works greater than 6,600 cfs are expected to cause damage to the outlet works. The uncontrolled spillway, located in Glendo Dam, will start to discharge when the reservoir elevation reaches 4653.0 feet and can release 10,335 cfs at a reservoir elevation of 4669.0 feet. The Glendo Dam also can release a low-flow of 25-40 cfs through the low-flow outlet works when the reservoir elevation is greater than 4560 feet.

1. Surcharge Operations

   When the reservoir water surface elevation is above 4,653.0 feet (top of flood control pool), releases through the outlet gates are to be 6,600 cfs and the turbine discharging up to a total of 3,400 cfs. Water will begin to discharge over the uncontrolled spillway at this elevation and has a maximum discharge of 10,335 cfs at elevation of 4669.0 feet.

2. Flood Control Operations

   When the reservoir water surface elevation is between 4,635.0 and 4653.0 feet, the outlet works' discharge shall be limited to 6,600 cfs. This flow combined with powerplant releases of 3,400 cfs will provide the required 10,000 cfs release while the reservoir level is in the flood control pool.

3. Conservation Pool Operations

   When the reservoir water surface elevation is below 4,635.0 (top of conservation storage), the outlet works' discharge shall be limited to 5,500 cfs, with the turbine operable.

4. Low-level Reservoir Operations

   When the elevation is at 4570.0 (minimum power pool) or below, the turbines are not operated due to expected damage from cavitation. Unrestricted operations of the Glendo Dam outlet works could entrap air in the horizontal portion of the upstream tunnel when the water surface elevation is below 4,561.0 feet. Blowbacks caused by this trapped air could cause serious damage to the outlet works' intake structure and gate shaft. To avoid such an occurrence, the operating restrictions shown in Table D-1 apply when the reservoir water surface elevation is below 4,558.0. The reservoir level must not be drawn down below 4,547.0 feet.

Table D-1 Operating Restrictions for Water Surface Elevation below 4,558 ft

Reservoir Water Surface Elevation (feet)	**Maximum Discharge (cfs)**
4,558.0	5,300
4,557.0	4,700
4,556.0	4,200
4,555.0	3,700
4,554.0	3,200
4,553.0	2,700
4,552.0	2,160
4,551.0	1,660
4,550.0	1,250
4,549.0	900
4,548.0	500
4,547.0	200

APPENDIX E

Flowcharts

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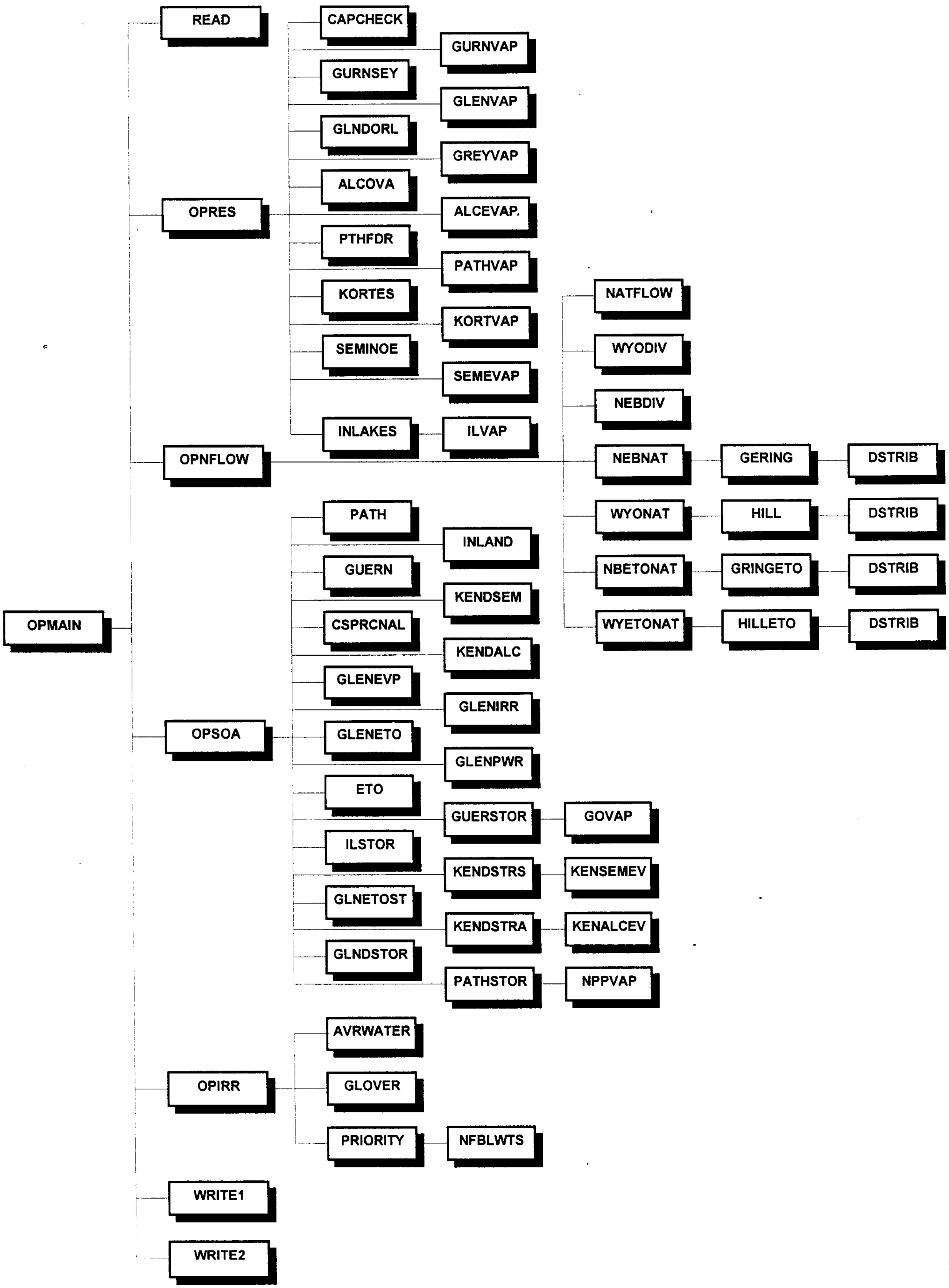
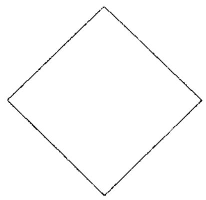
NPRWUM STRUCTURE

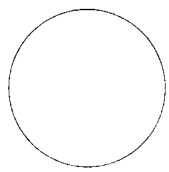


Explanation of Symbols

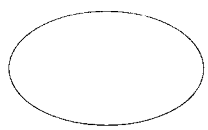
Assignments or Computations



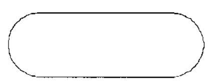
Conditions



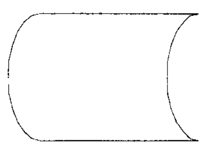
Connections of Subroutines and Functions



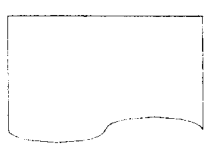
Connections within OPIRR subroutine



Return or Exit

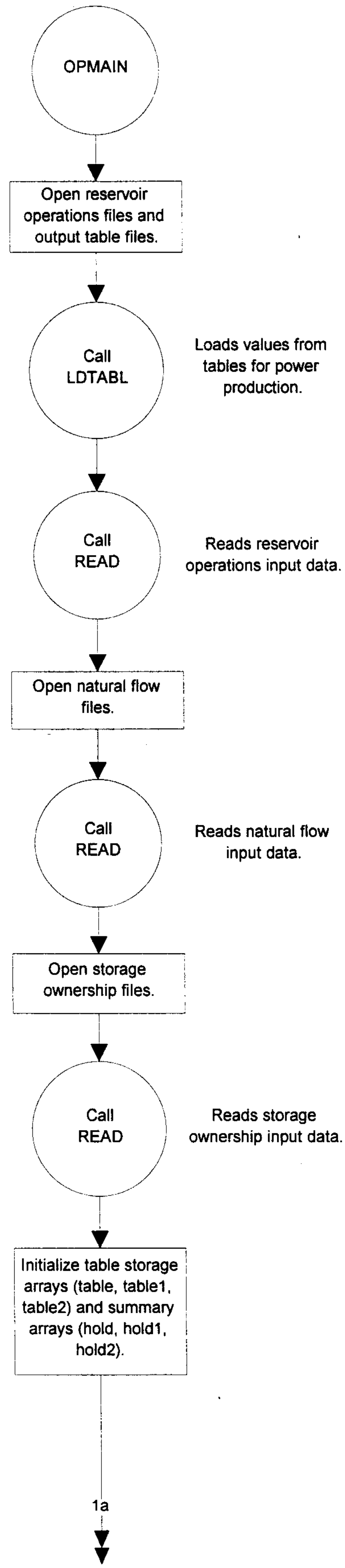


Input

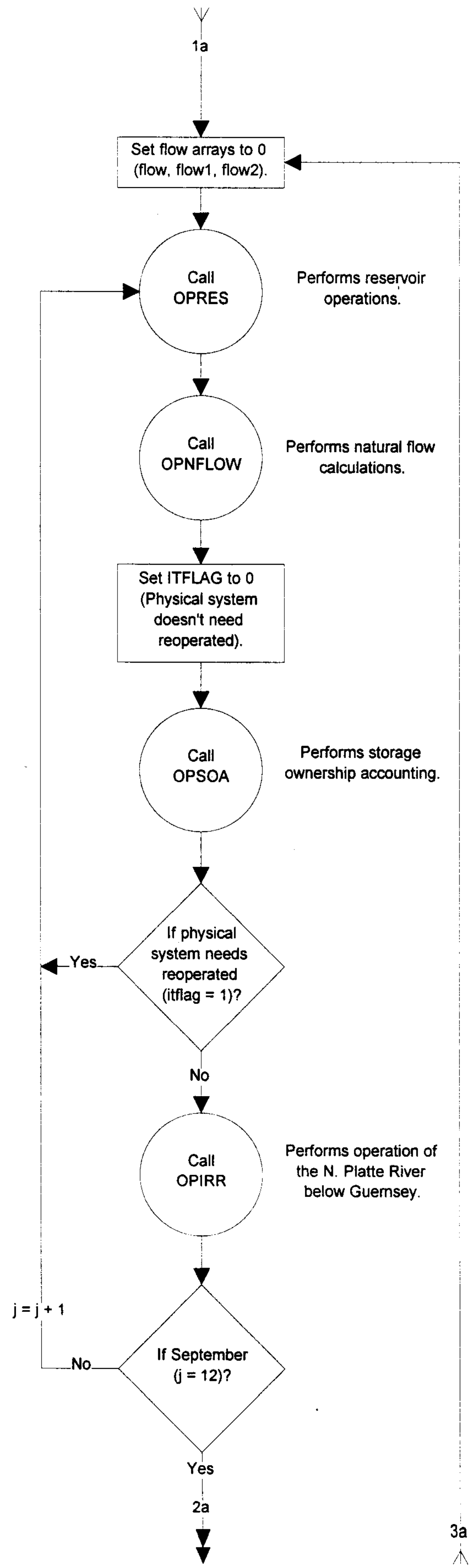


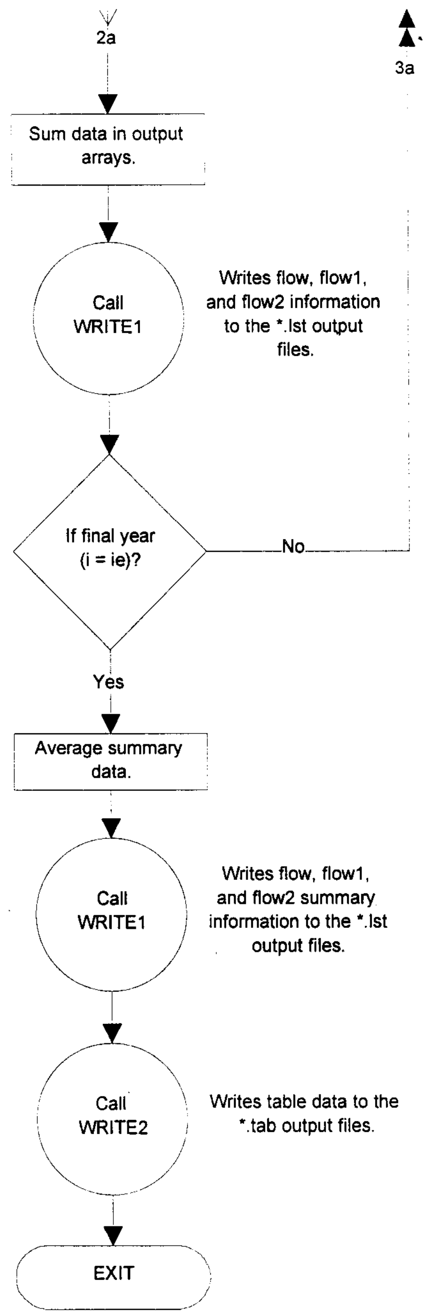
Output

Program OPMAIN

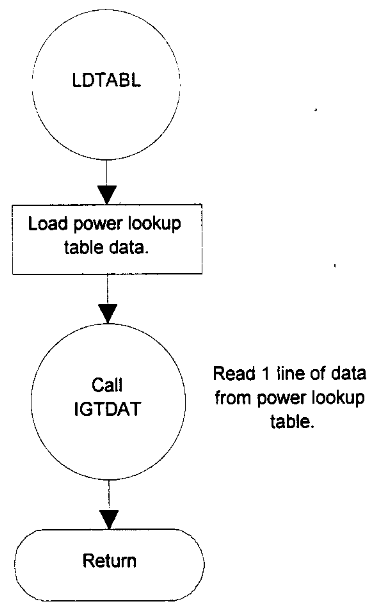


Program OPMAIN

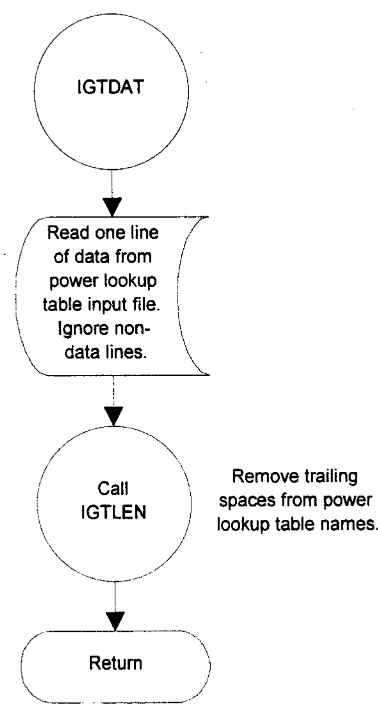



2a
3a
Sum data in output arrays.
Call WRITE1
Writes flow, flow1, and flow2 information to the *.lst output files.
If final year (i = ie)?
No
Yes
Average summary data.
Call WRITE1
Writes flow, flow1, and flow2 summary information to the *.lst output files.
Call WRITE2
Writes table data to the *.tab output files.
EXIT

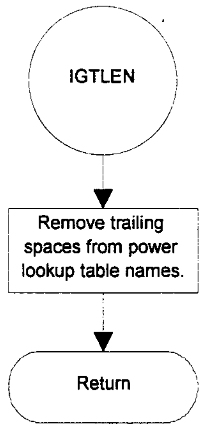
Function LDTABL



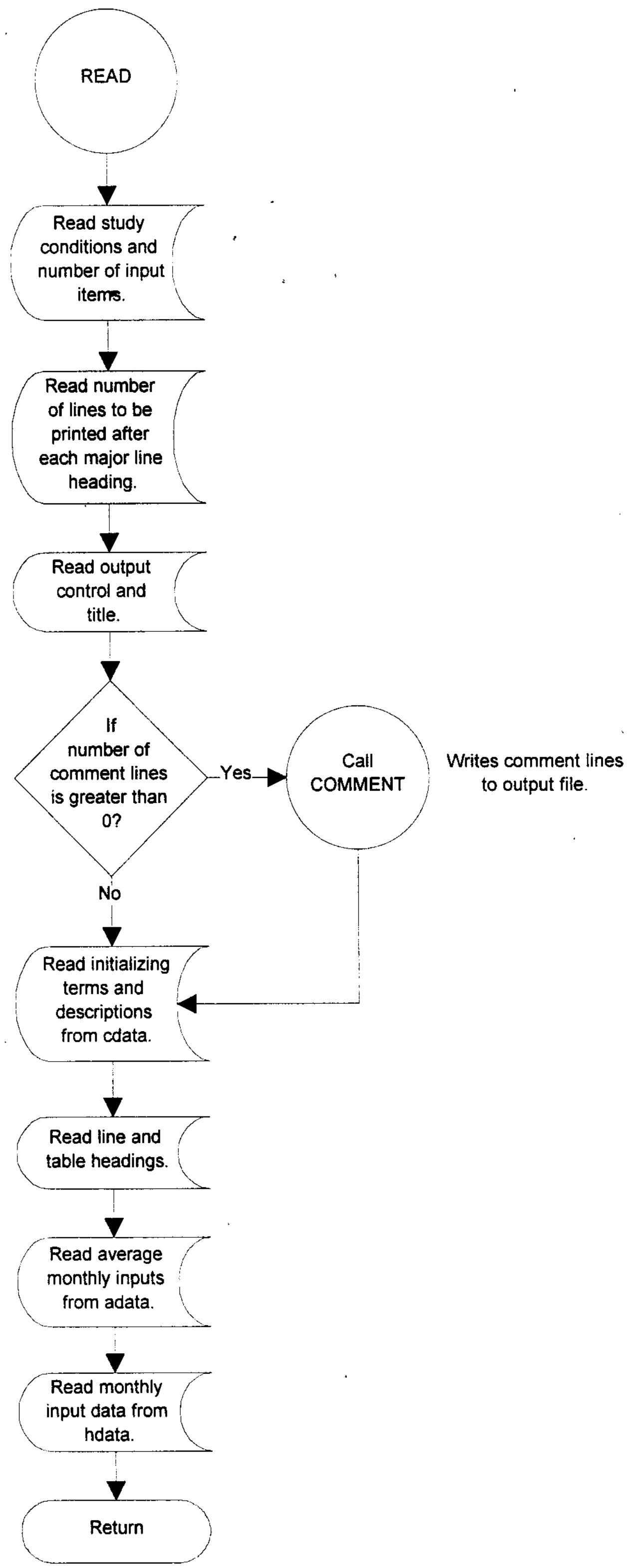
Function IGTDAT



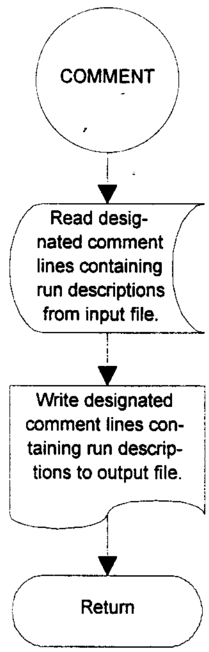
Function IGTLEN



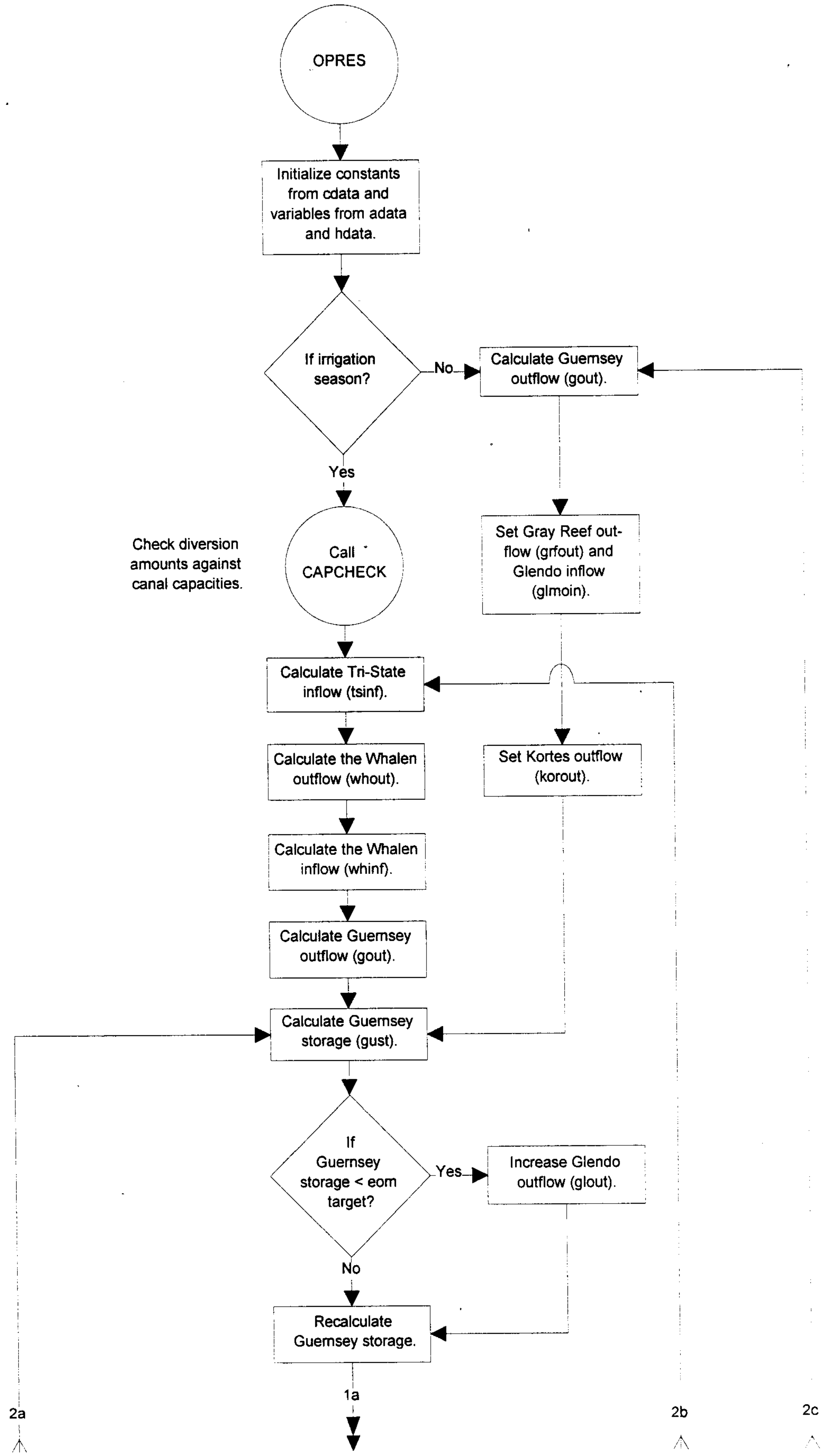
Subroutine READ

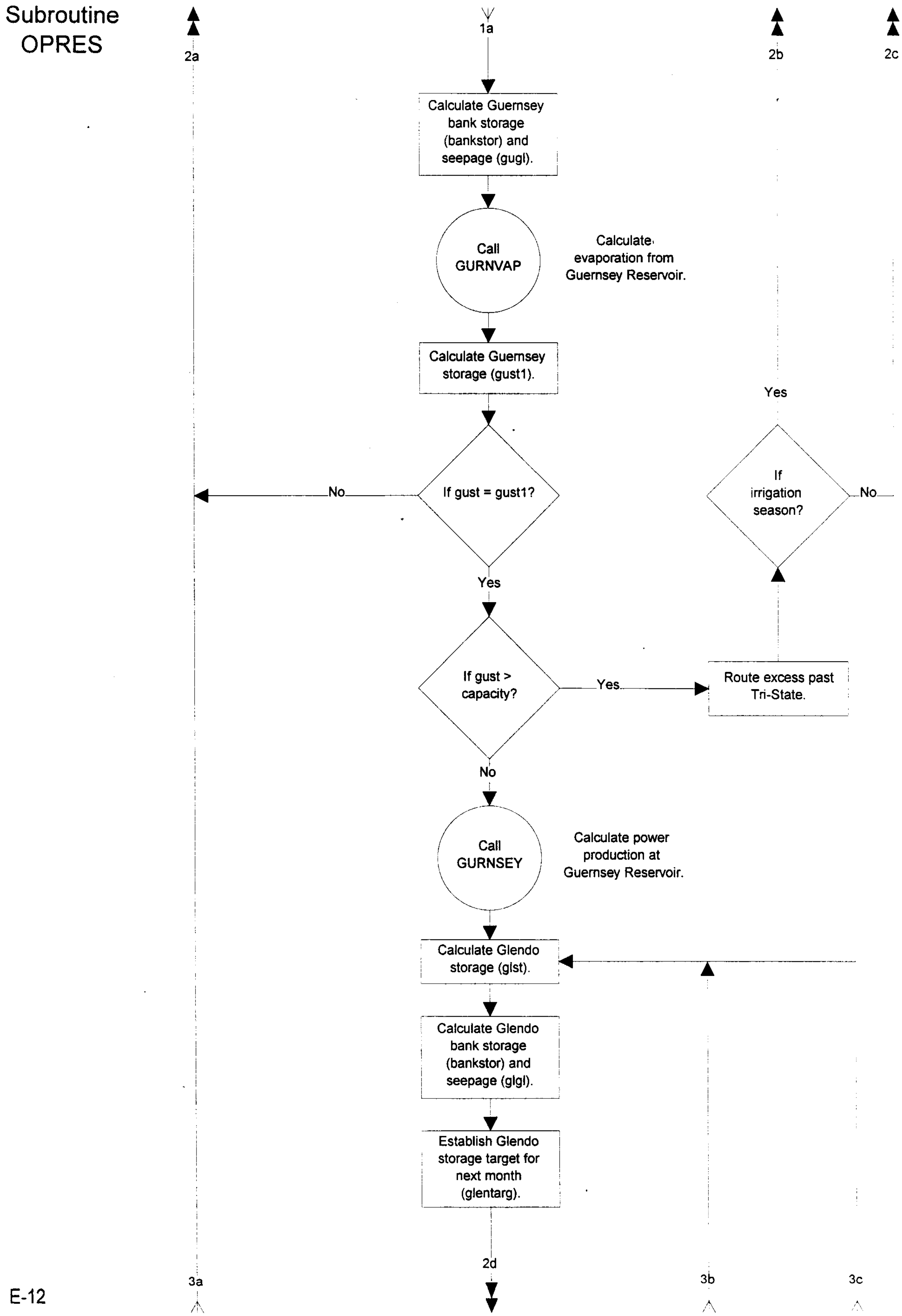


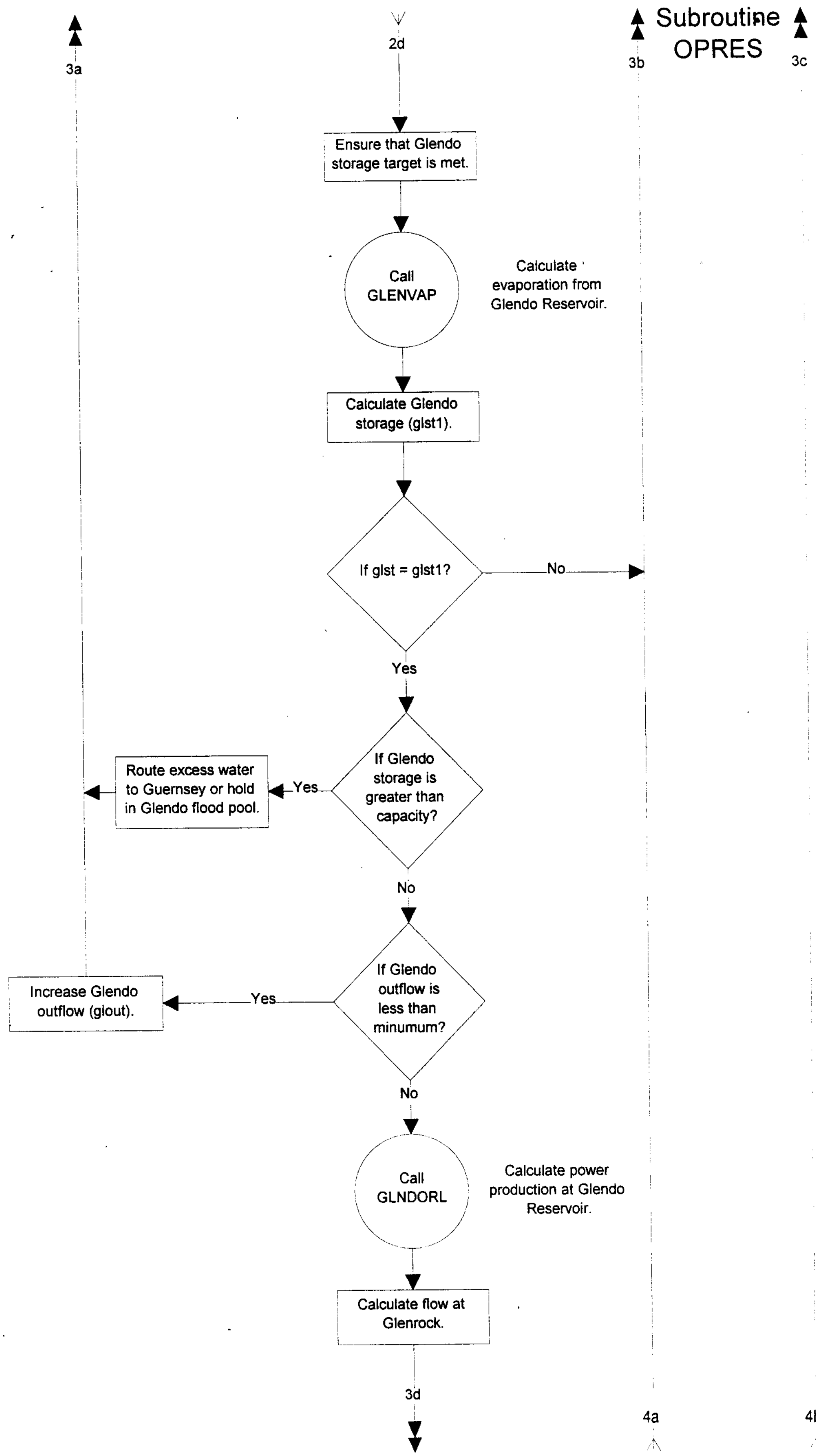
Subroutine COMMENT



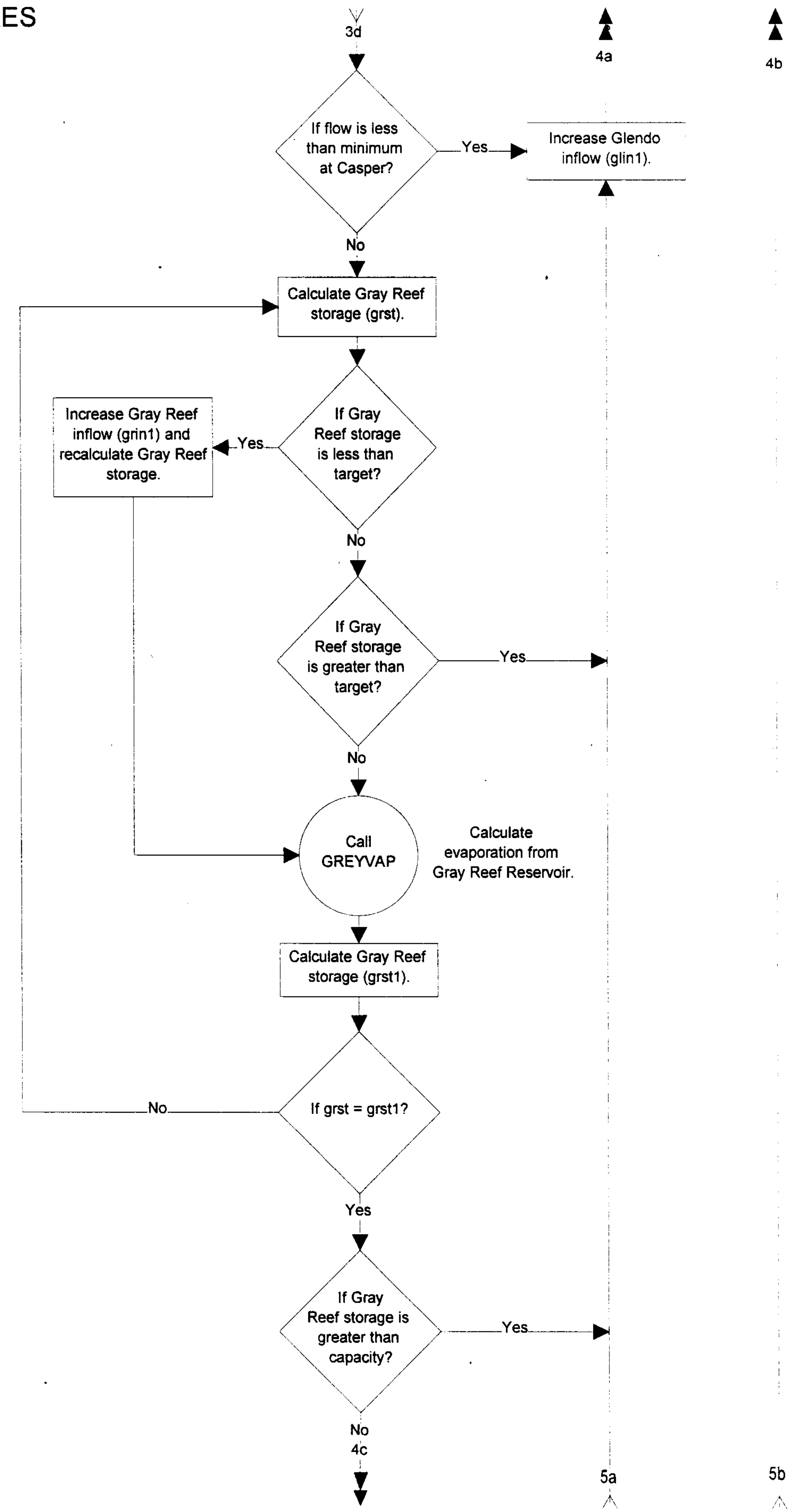
Subroutine OPRES



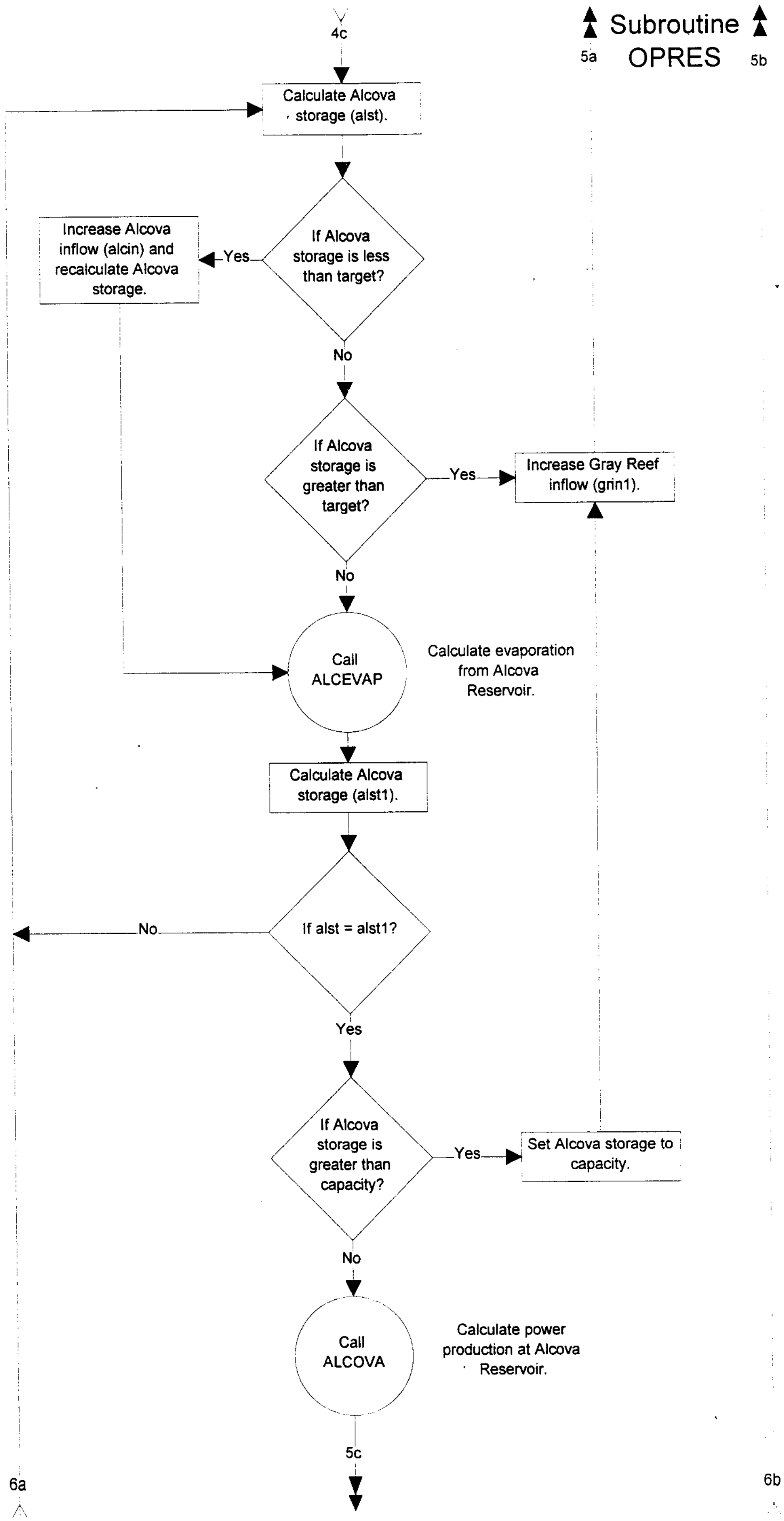

Subroutine
OPRES
2a
1a
2b
2c
Calculate Guernsey bank storage (bankstor) and seepage (gugl).
Call GURNVAP
Calculate evaporation from Guernsey Reservoir.
Calculate Guernsey storage (gust1).
If gust = gust1?
No
Yes
If irrigation season?
Yes
No
If gust > capacity?
Yes
No
Route excess past Tri-State.
Call GURNSEY
Calculate power production at Guernsey Reservoir.
Calculate Glendo storage (glst).
Calculate Glendo bank storage (bankstor) and seepage (glgl).
Establish Glendo storage target for next month (glentarg).
2d
3a
3b
3c


Subroutine OPRES
3a
2d
3b
3c
Ensure that Glendo storage target is met.
Call GLENVAP
Calculate evaporation from Glendo Reservoir.
Calculate Glendo storage (glst1).
If glst = glst1?
No
Yes
Route excess water to Guernsey or hold in Glendo flood pool.
Yes
If Glendo storage is greater than capacity?
No
Increase Glendo outflow (glout).
Yes
If Glendo outflow is less than minumum?
No
Call GLNDORL
Calculate power production at Glendo Reservoir.
Calculate flow at Glenrock.
3d
4a
4b

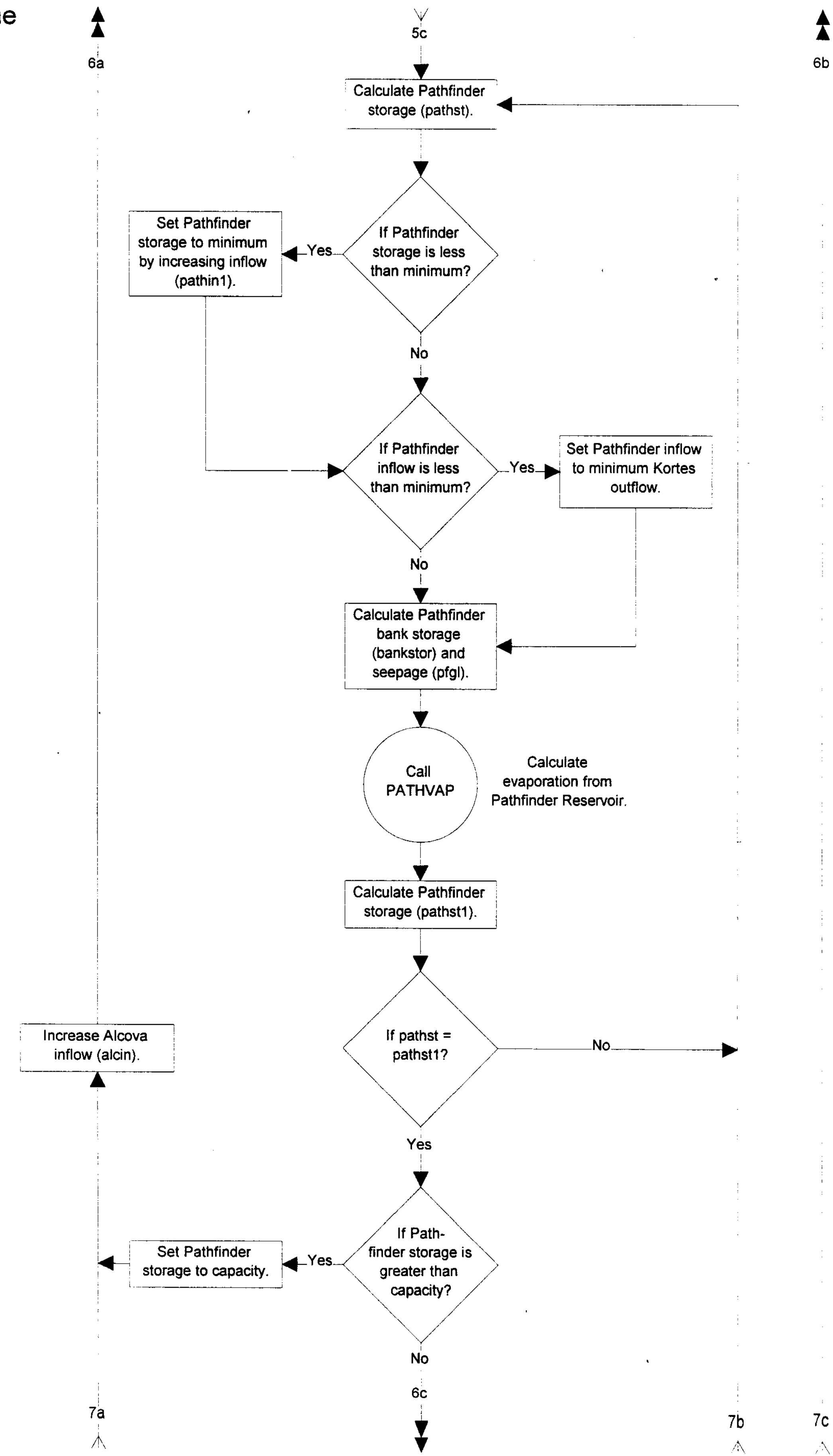
Subroutine OPRES

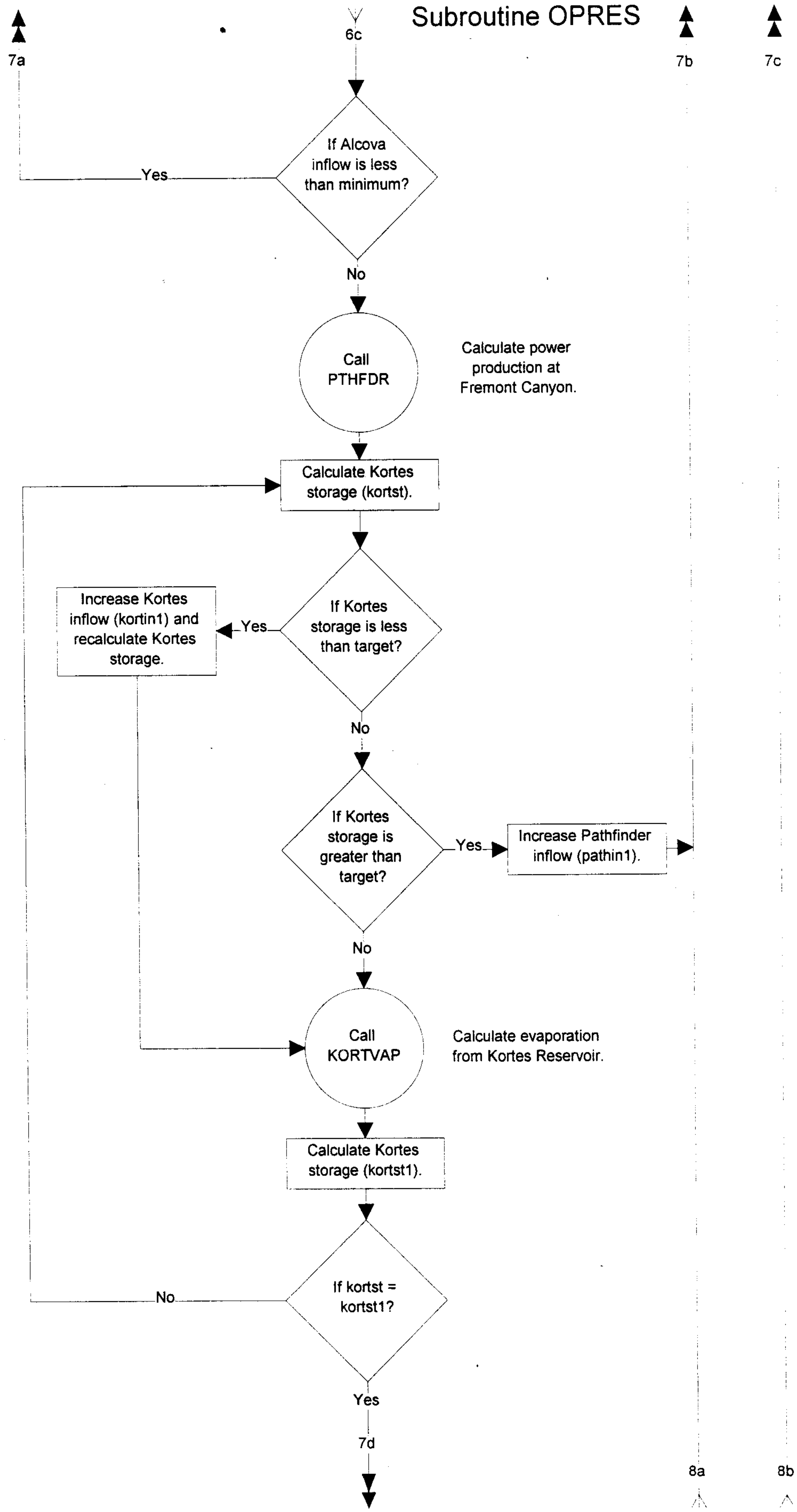


Subroutine OPRES



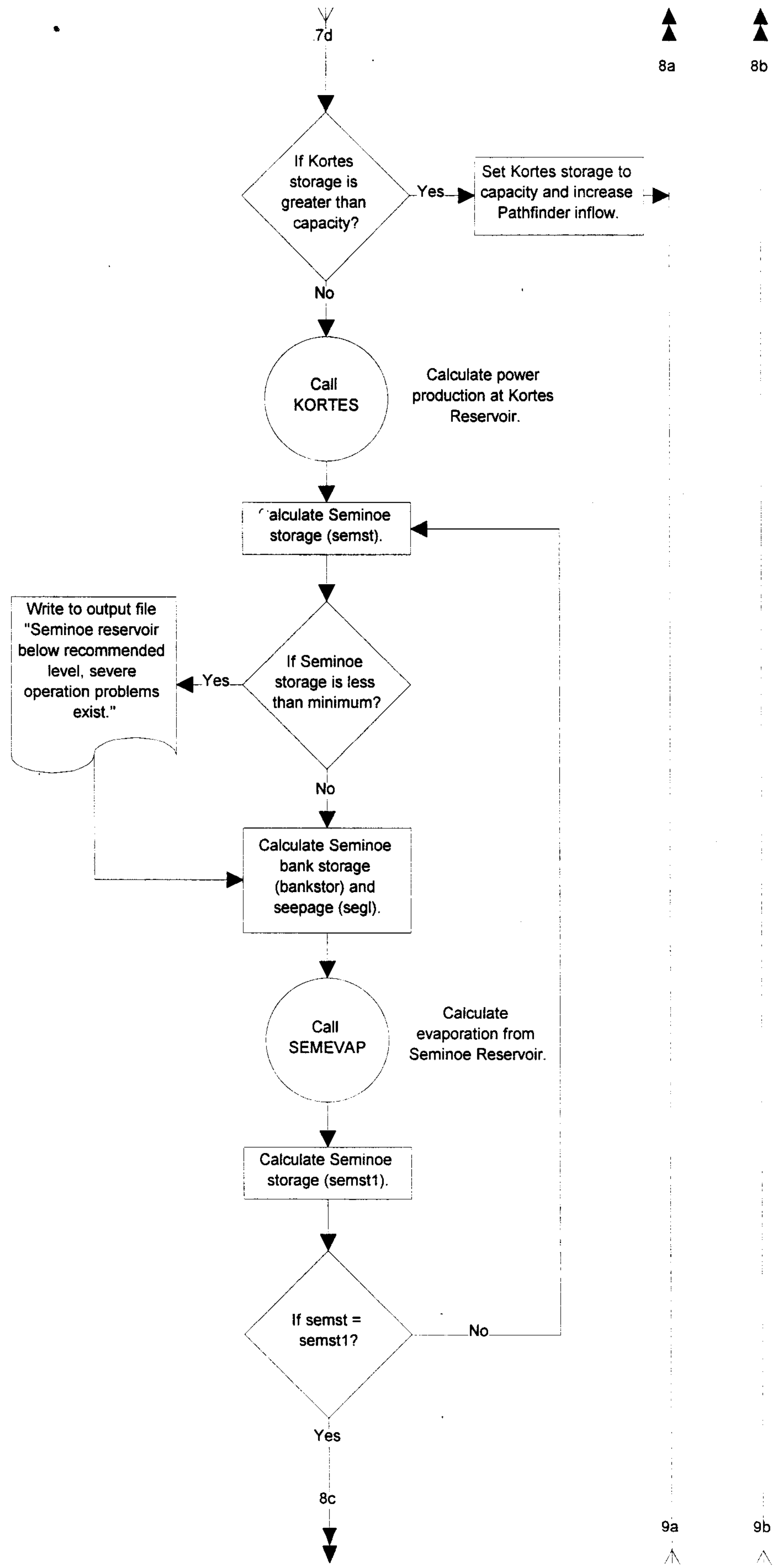
Subroutine OPRES



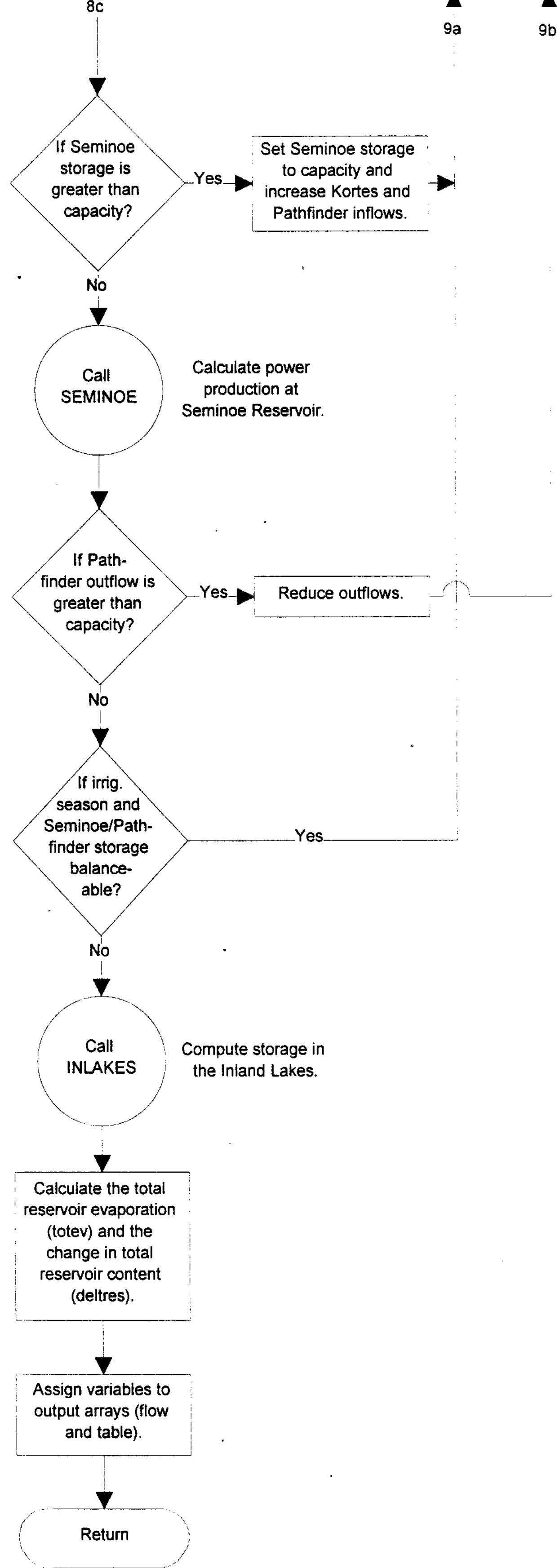


6c
7a
7b
7c
If Alcova inflow is less than minimum?
Yes
No
Call PTHFDR
Calculate power production at Fremont Canyon.
Calculate Kortes storage (kortst).
If Kortes storage is less than target?
Yes
Increase Kortes inflow (kortin1) and recalculate Kortes storage.
No
If Kortes storage is greater than target?
Yes
Increase Pathfinder inflow (pathin1).
No
Call KORTVAP
Calculate evaporation from Kortes Reservoir.
Calculate Kortes storage (kortst1).
If kortst = kortst1?
No
Yes
7d
8a
8b

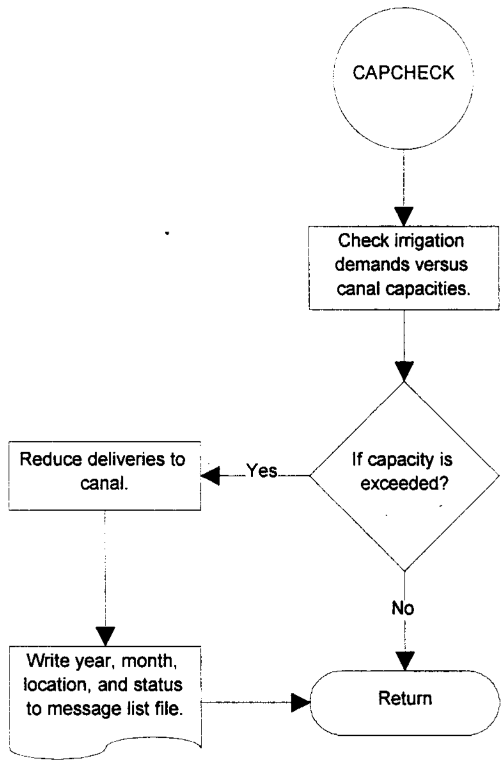
Subroutine OPRES



Subroutine OPRES

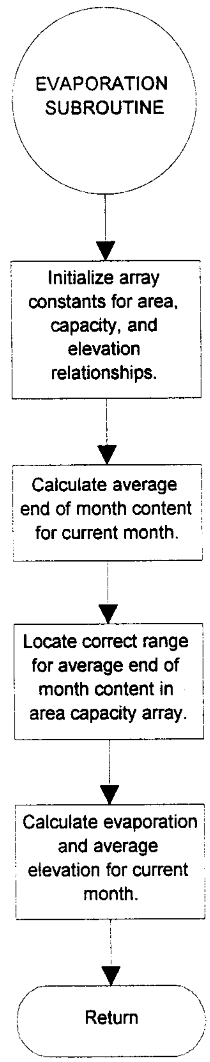


Subroutine CAPCHECK



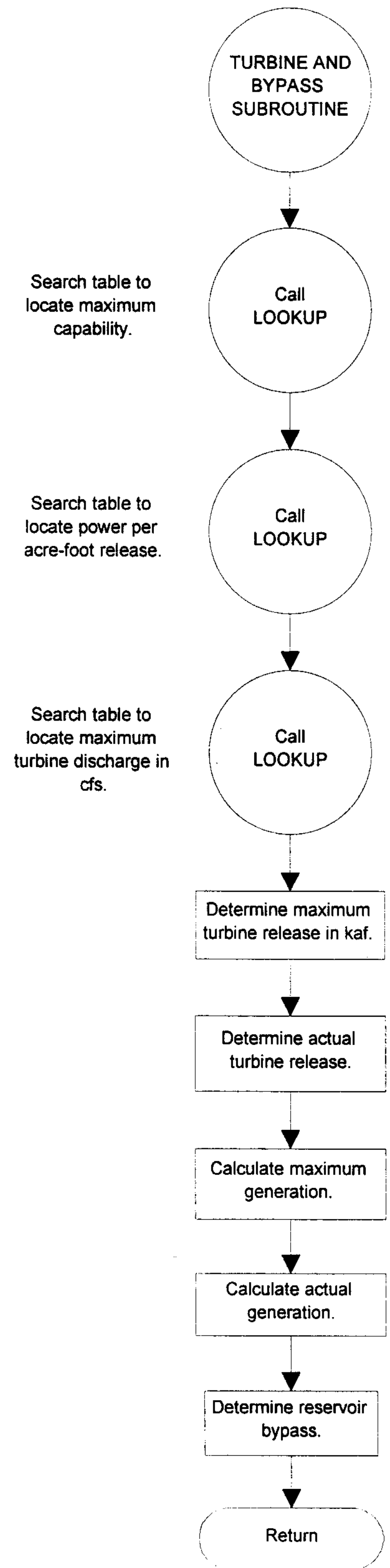
Subroutines for the Calculation of Reservoir Evaporation

(ALCEVAP, GLENVAP, GREYVAP, GURNVAP, KORTVAP, PATHVAP, SEMEVAP)

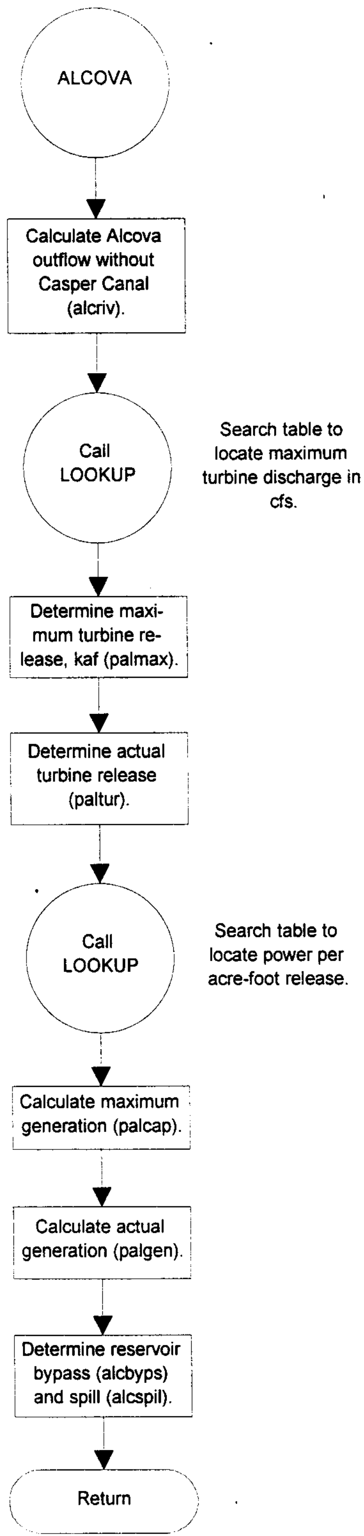


Subroutines for the Calculation of Turbine and Bypass Release

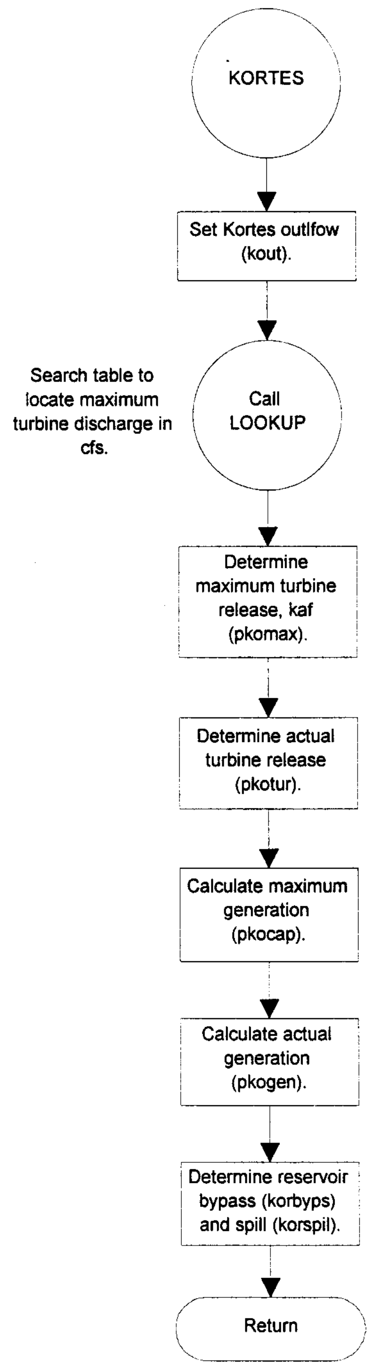
(GURNSEY, GLNDORL, PTHFDR, SEMINOE)



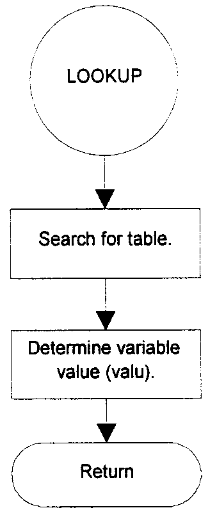
Subroutine ALCOVA



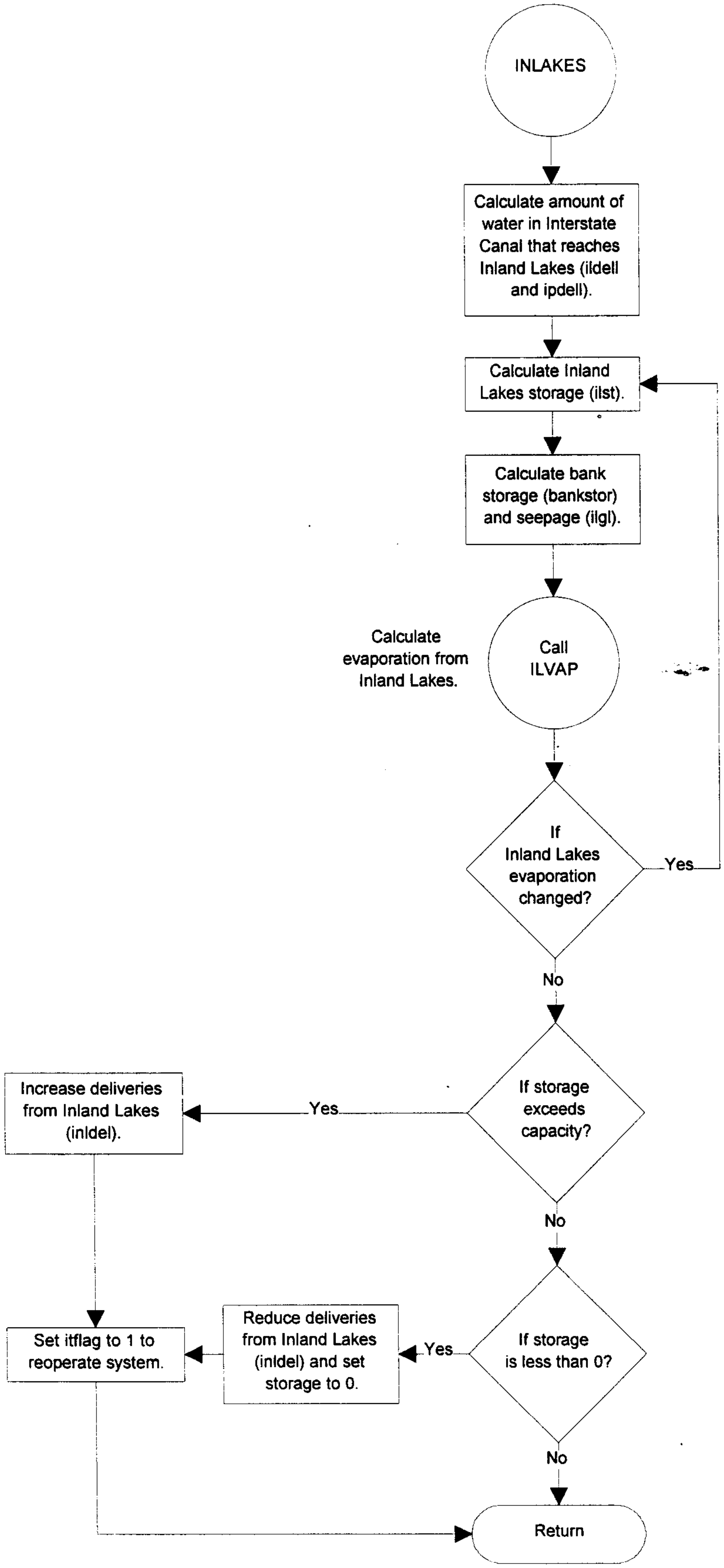
Subroutine KORTES



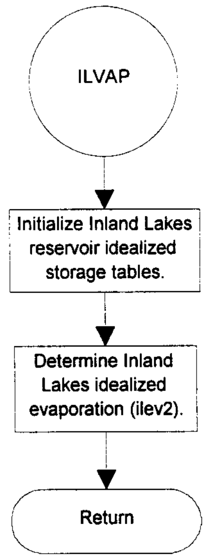
Function LOOKUP



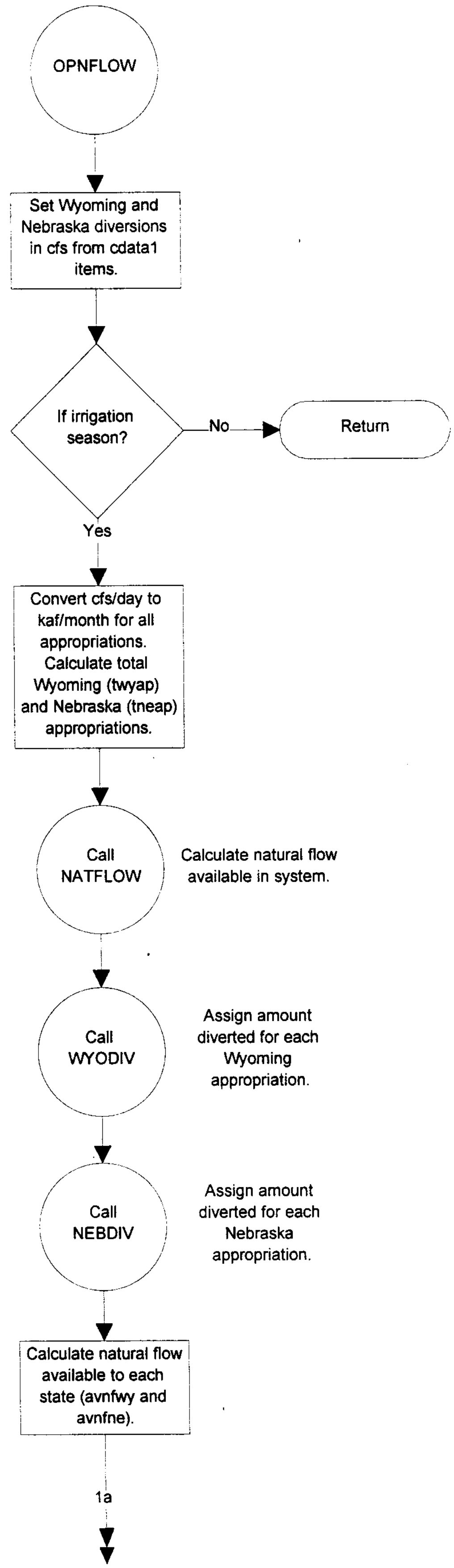
Subroutine INLAKES



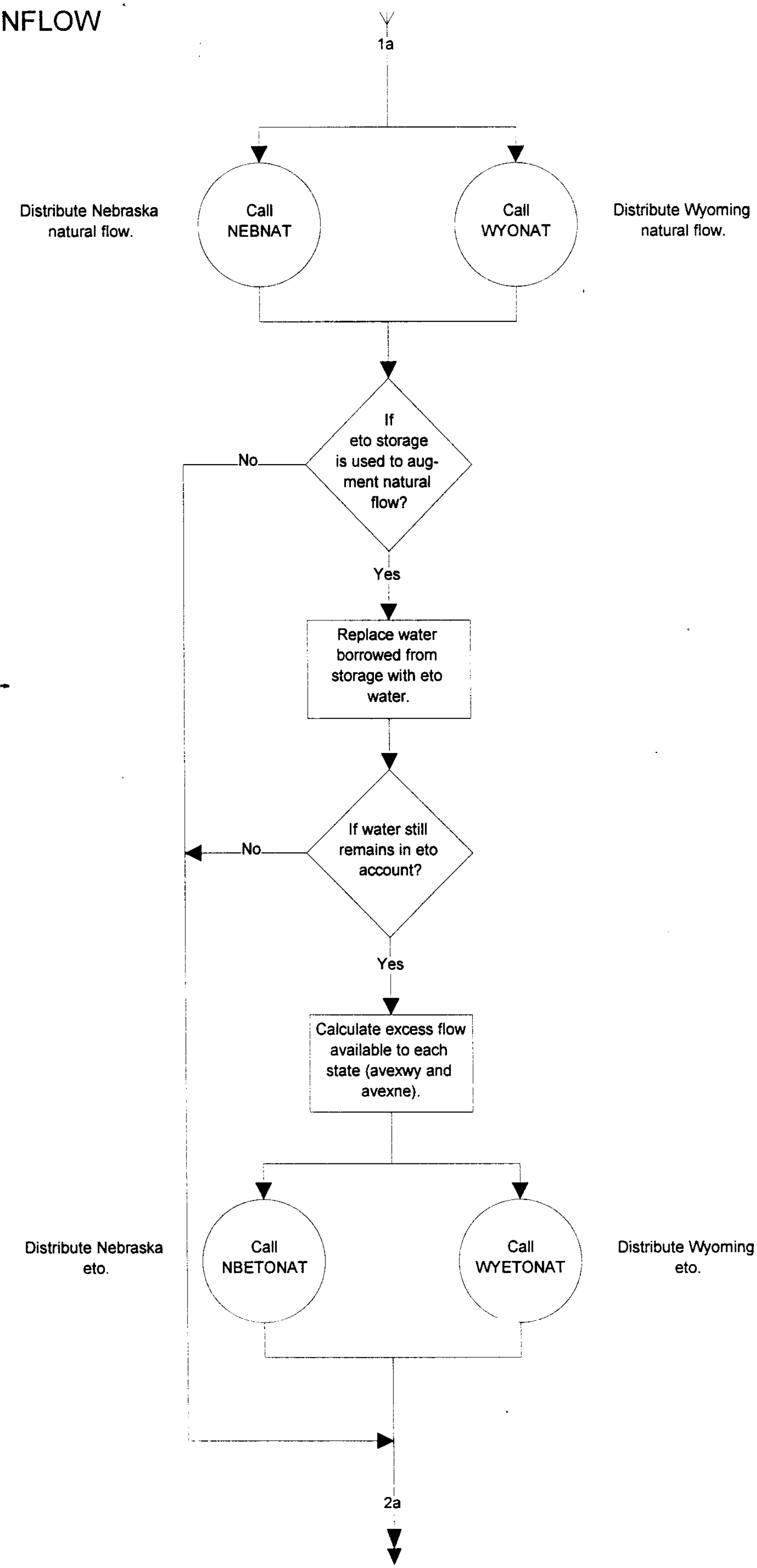
Subroutine ILVAP

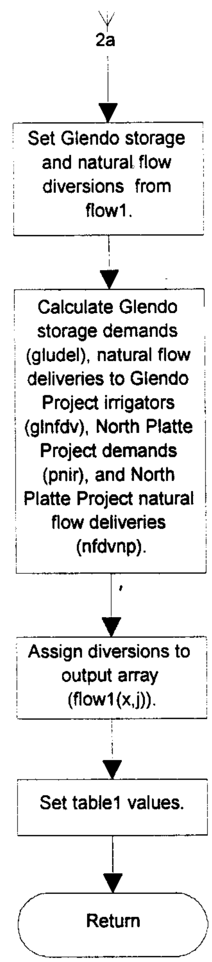


Subroutine OPNFLOW

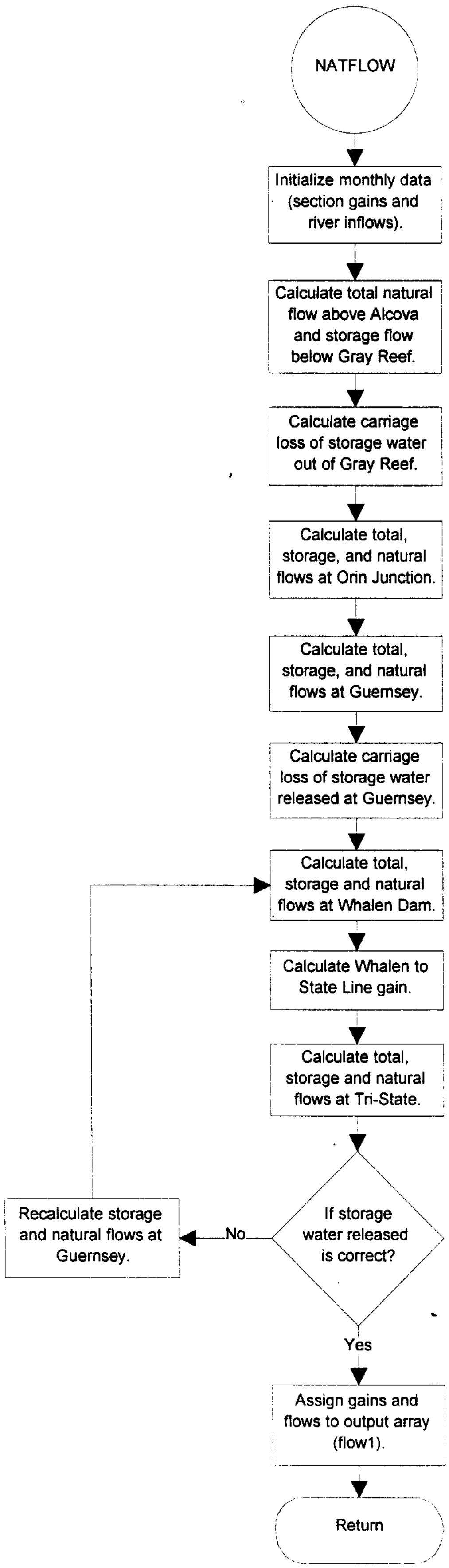


Subroutine OPNFLOW



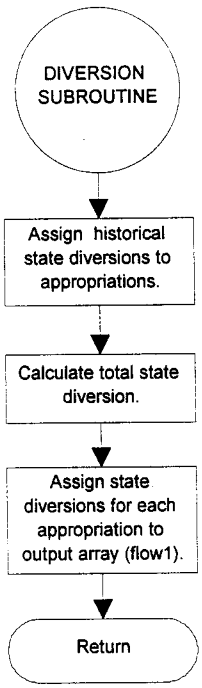

2a
Set Glendo storage and natural flow diversions from flow1.
Calculate Glendo storage demands (gludel), natural flow deliveries to Glendo Project irrigators (glnfdv), North Platte Project demands (pnir), and North Platte Project natural flow deliveries (nfdvnp).
Assign diversions to output array (flow1(x,j)).
Set table1 values.
Return

Subroutine NATFLOW

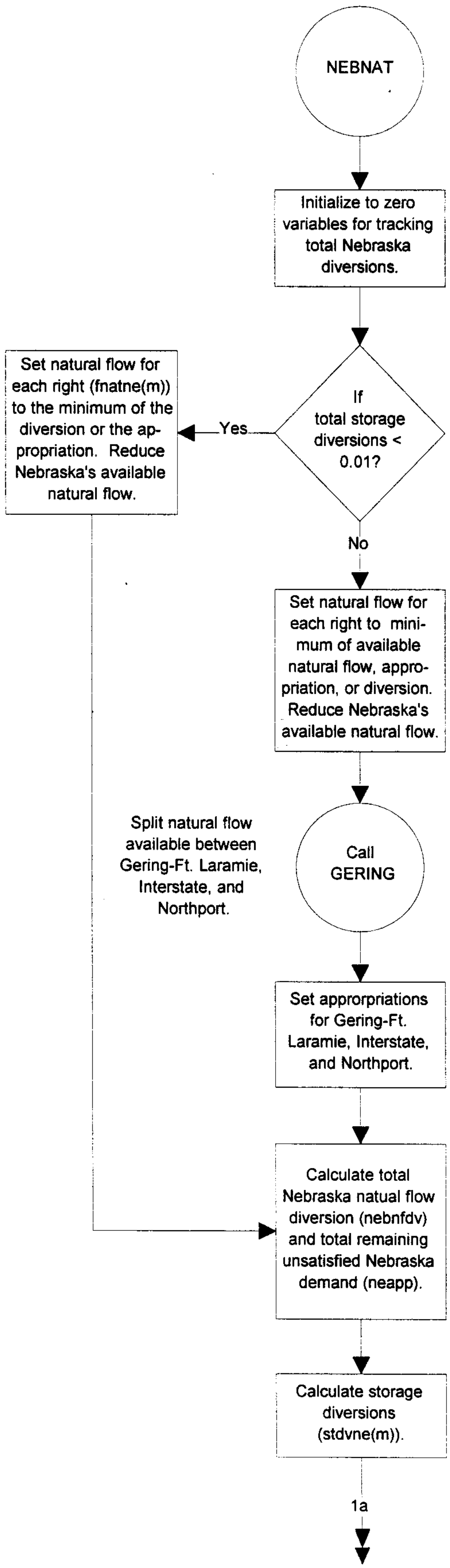


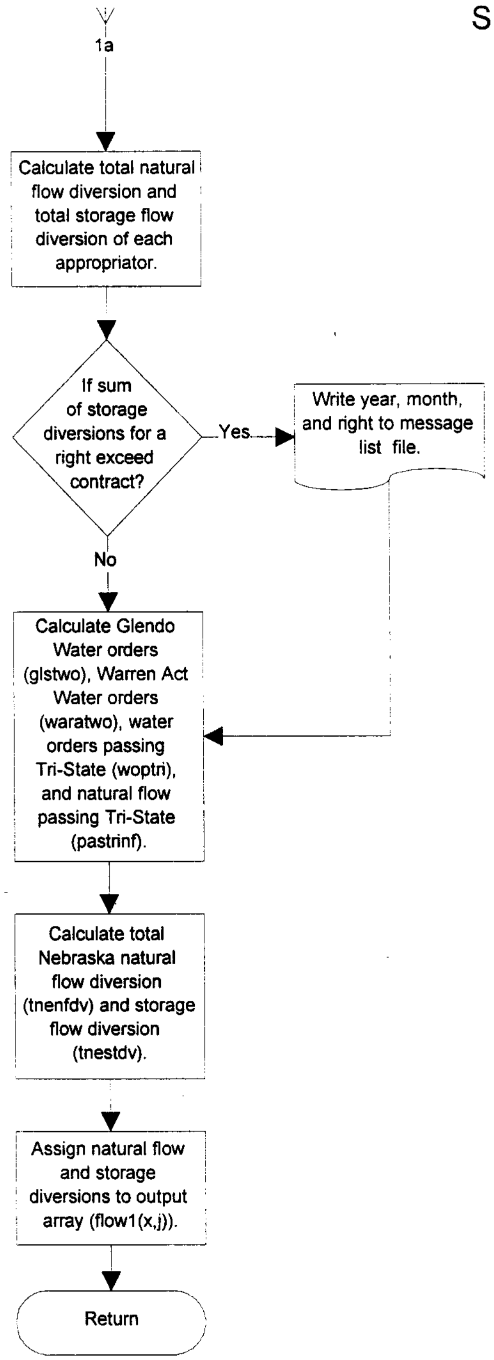
Subroutines for the Assignation of Diversions to Appropriations

(NEBDIV, WYODIV)

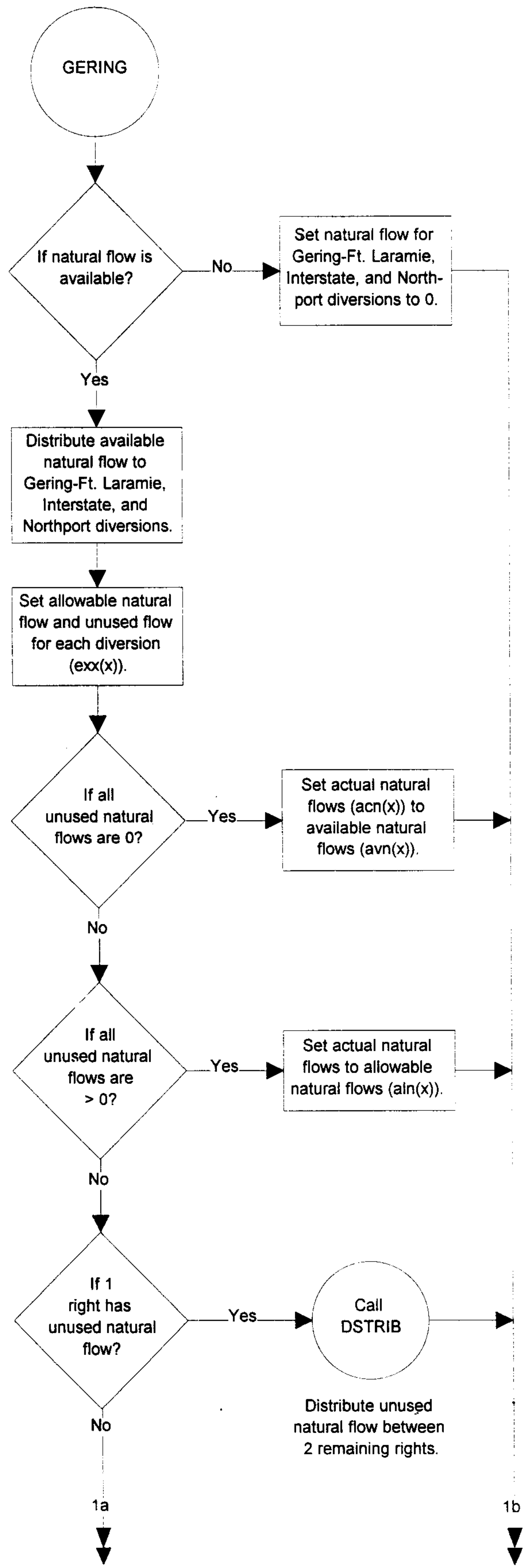


Subroutine NEBNAT

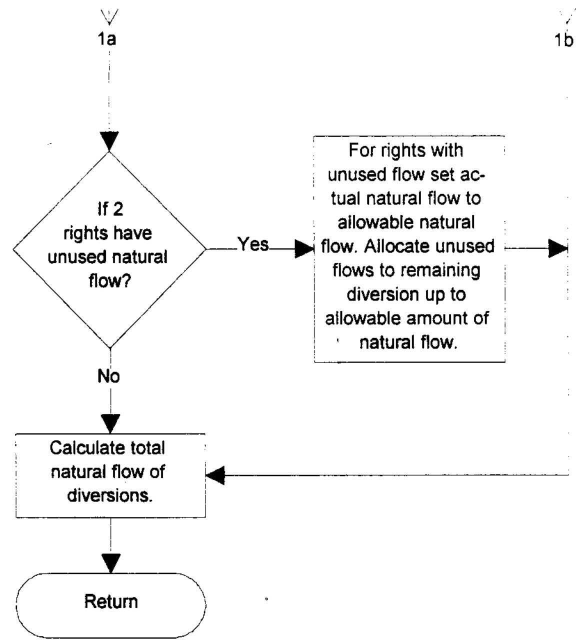



1a
Calculate total natural flow diversion and total storage flow diversion of each appropriator.
If sum of storage diversions for a right exceed contract?
Yes
Write year, month, and right to message list file.
No
Calculate Glendo Water orders (glstwo), Warren Act Water orders (waratwo), water orders passing Tri-State (woptri), and natural flow passing Tri-State (pastrinf).
Calculate total Nebraska natural flow diversion (tnenfdv) and storage flow diversion (tnestdv).
Assign natural flow and storage diversions to output array (flow1(x,j)).
Return

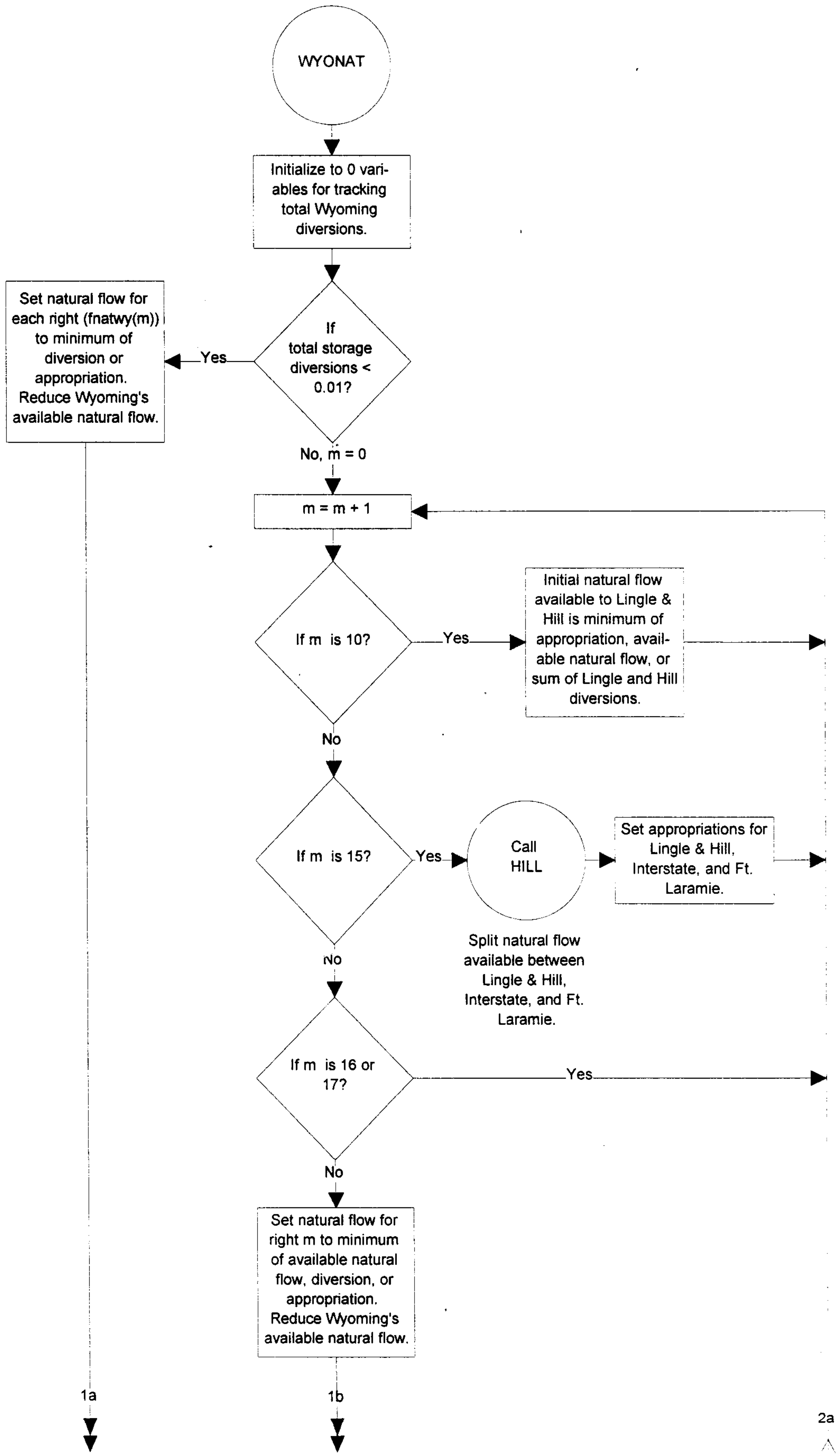
Subroutine GERING

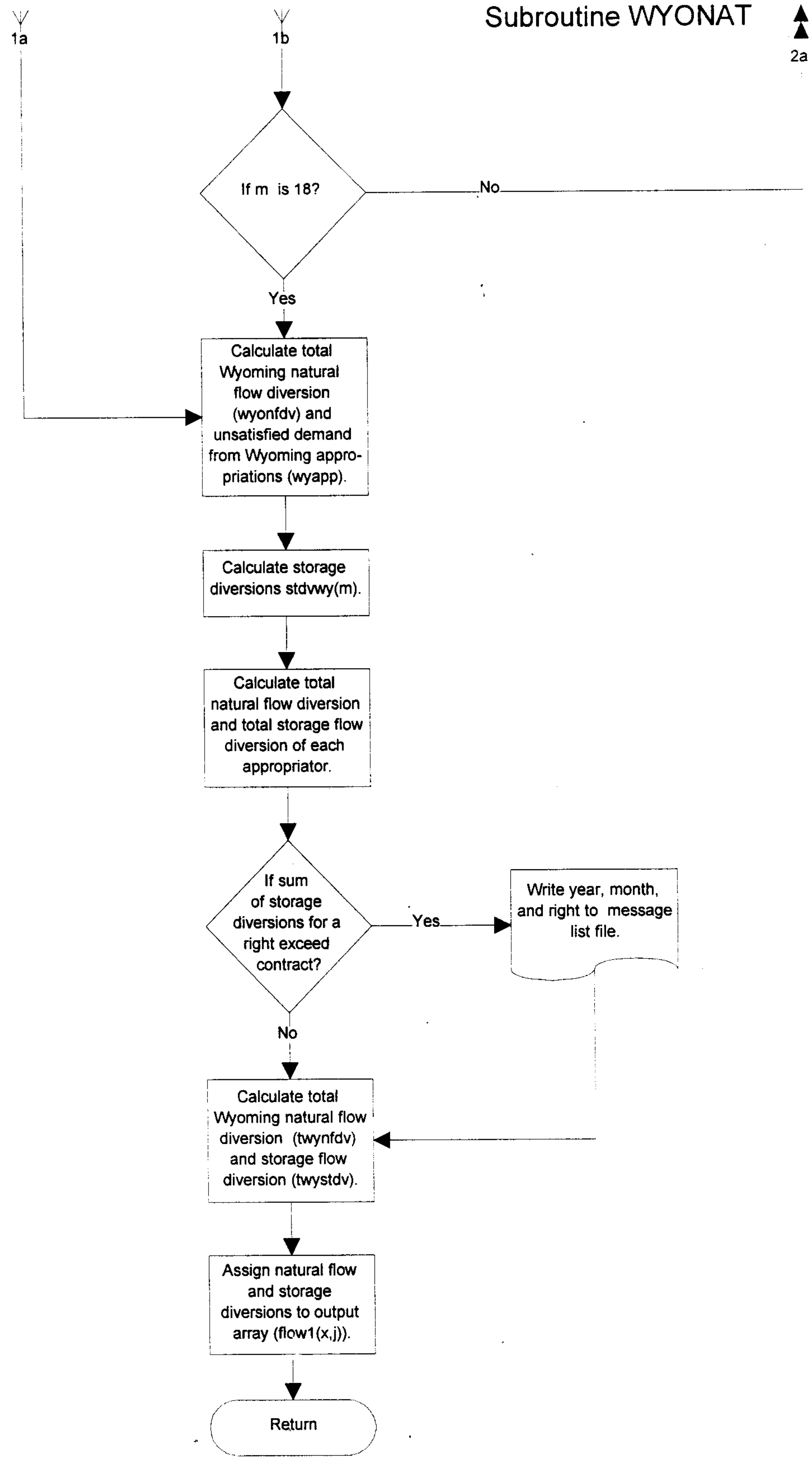


Subroutine GERING

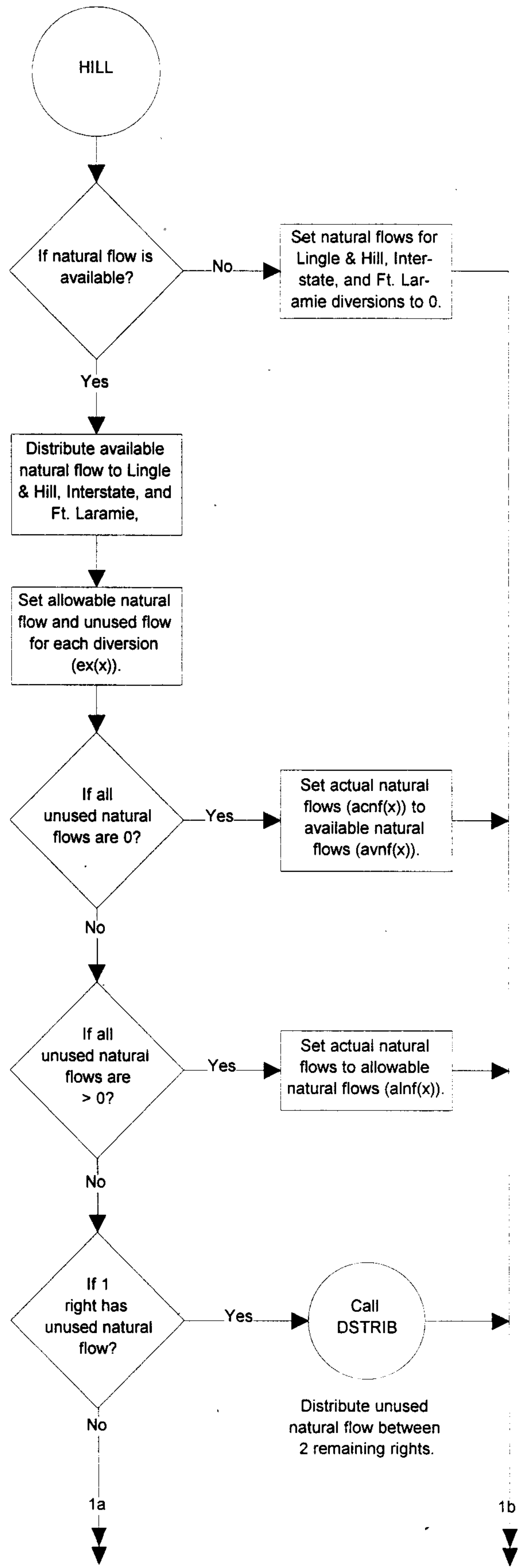


Subroutine WYONAT

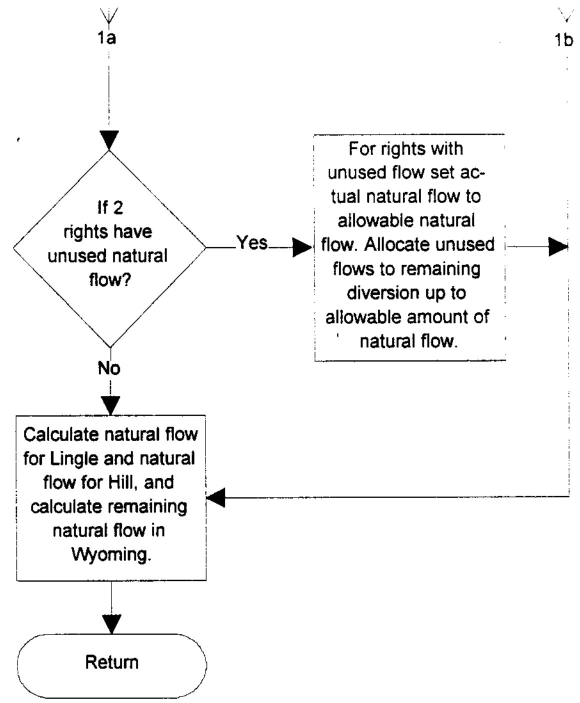



1a
1b
2a
If m is 18?
No
Yes
Calculate total Wyoming natural flow diversion (wyonfdv) and unsatisfied demand from Wyoming appro-priations (wyapp).
Calculate storage diversions stdvwy(m).
Calculate total natural flow diversion and total storage flow diversion of each appropriator.
If sum of storage diversions for a right exceed contract?
Yes
Write year, month, and right to message list file.
No
Calculate total Wyoming natural flow diversion (twynfdv) and storage flow diversion (twystdv).
Assign natural flow and storage diversions to output array (flow1(x,j)).
Return

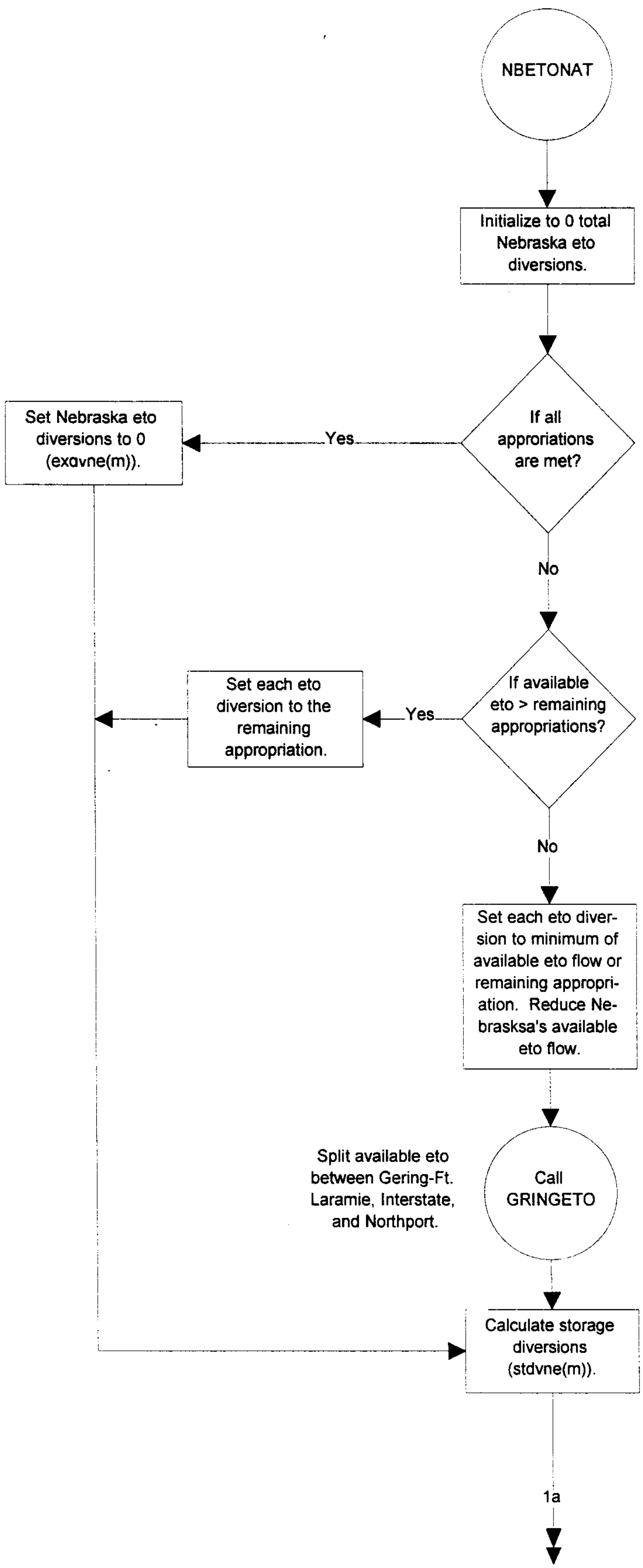
Subroutine HILL

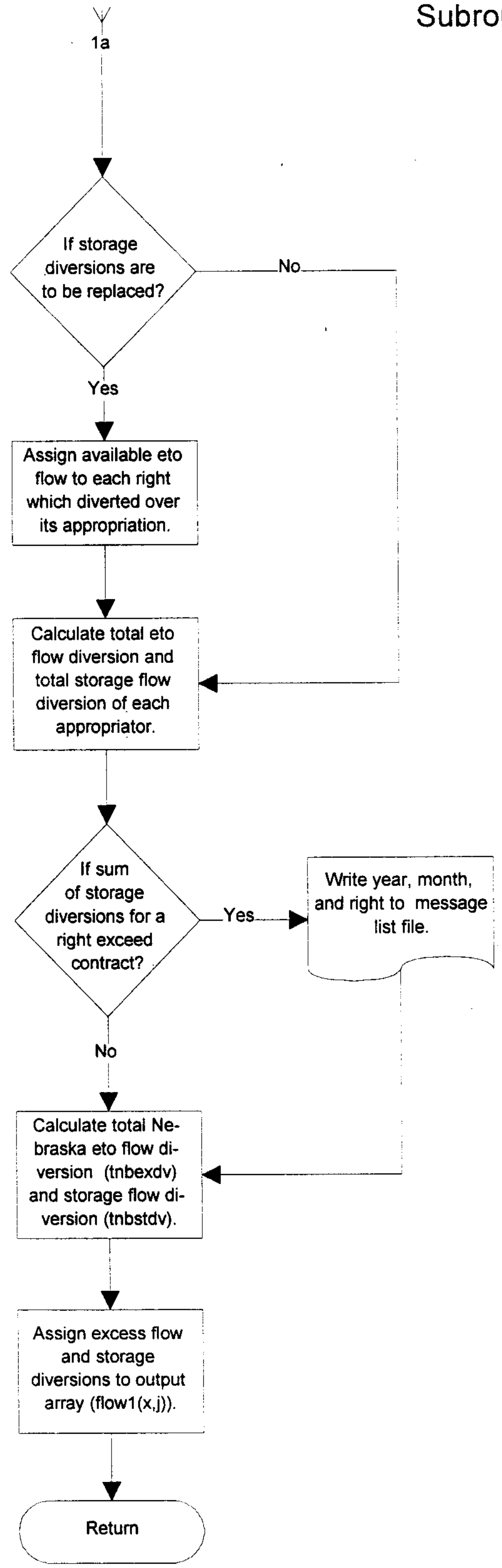


Subroutine HILL

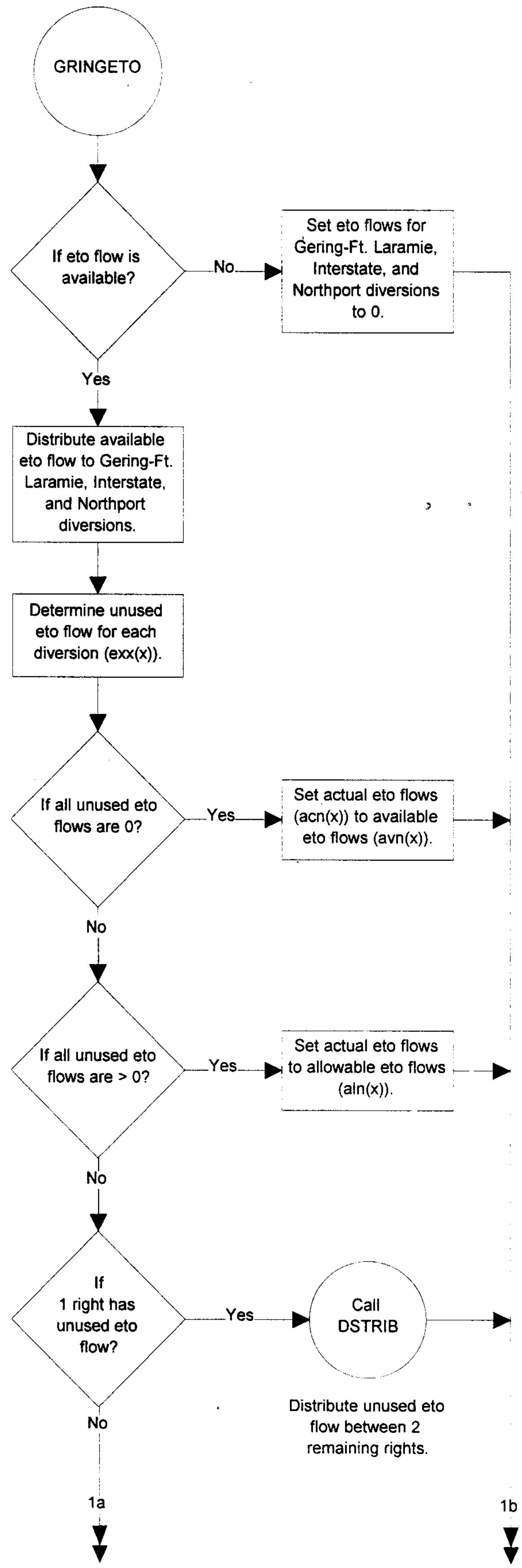


Subroutine NBETONAT

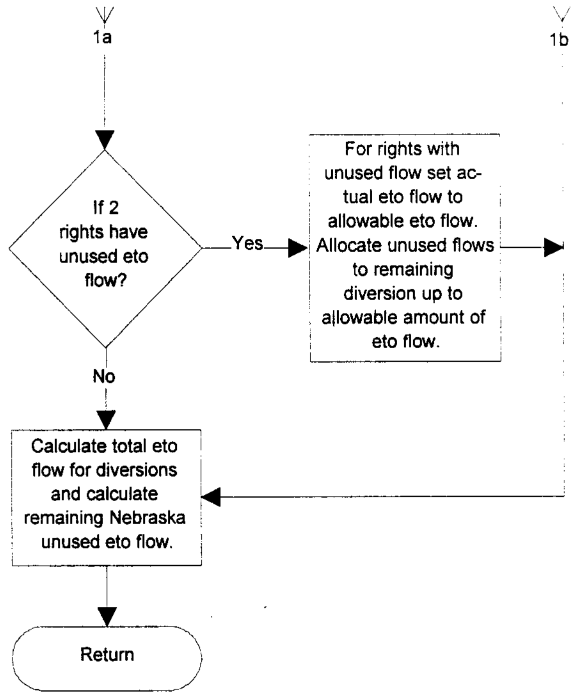



1a
If storage diversions are to be replaced?
No
Yes
Assign available eto flow to each right which diverted over its appropriation.
Calculate total eto flow diversion and total storage flow diversion of each appropriator.
If sum of storage diversions for a right exceed contract?
Yes
Write year, month, and right to message list file.
No
Calculate total Nebraska eto flow diversion (tnbexdv) and storage flow diversion (tnbstdv).
Assign excess flow and storage diversions to output array (flow1(x,j)).
Return

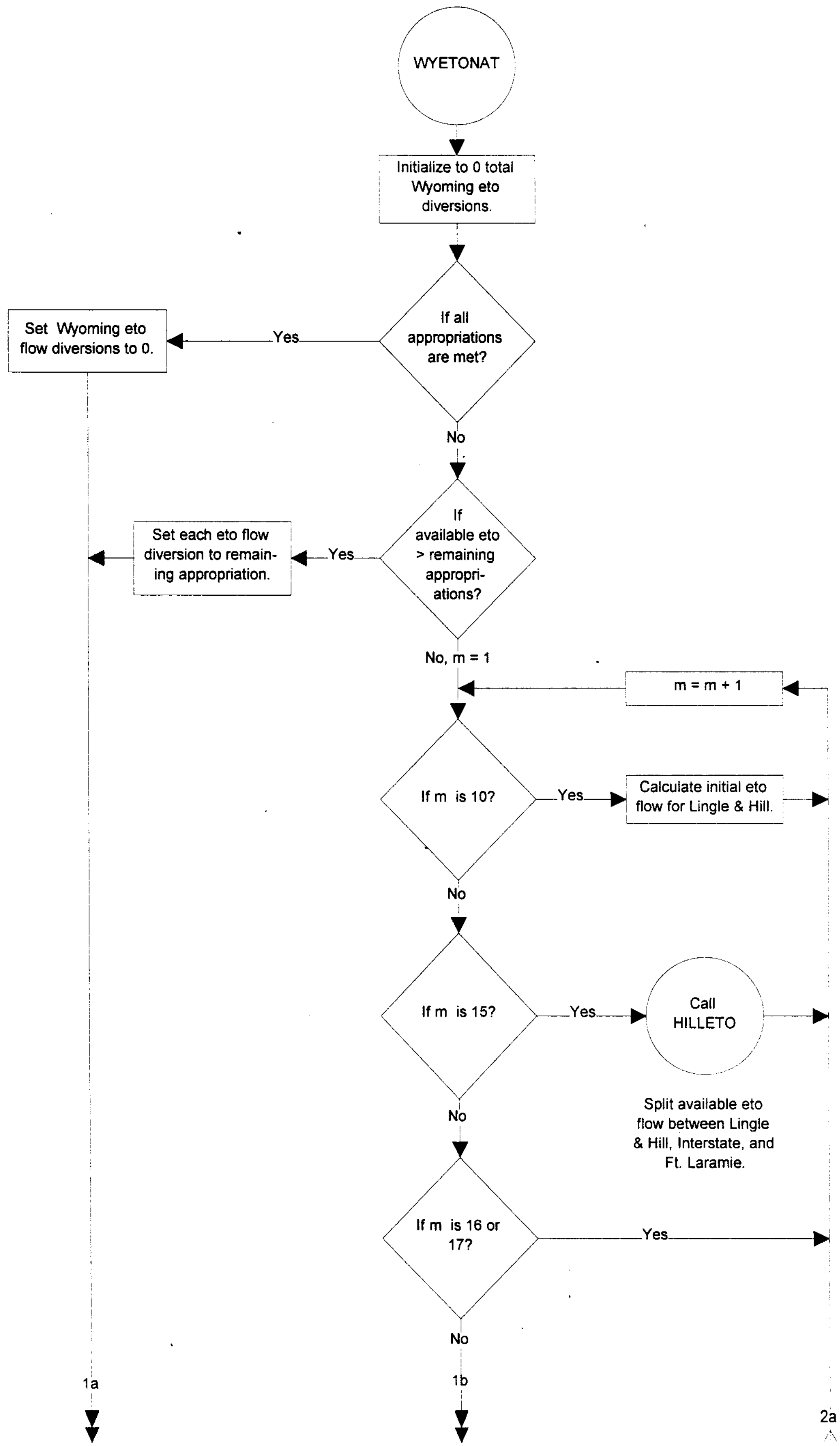
Subroutine GRINGETO

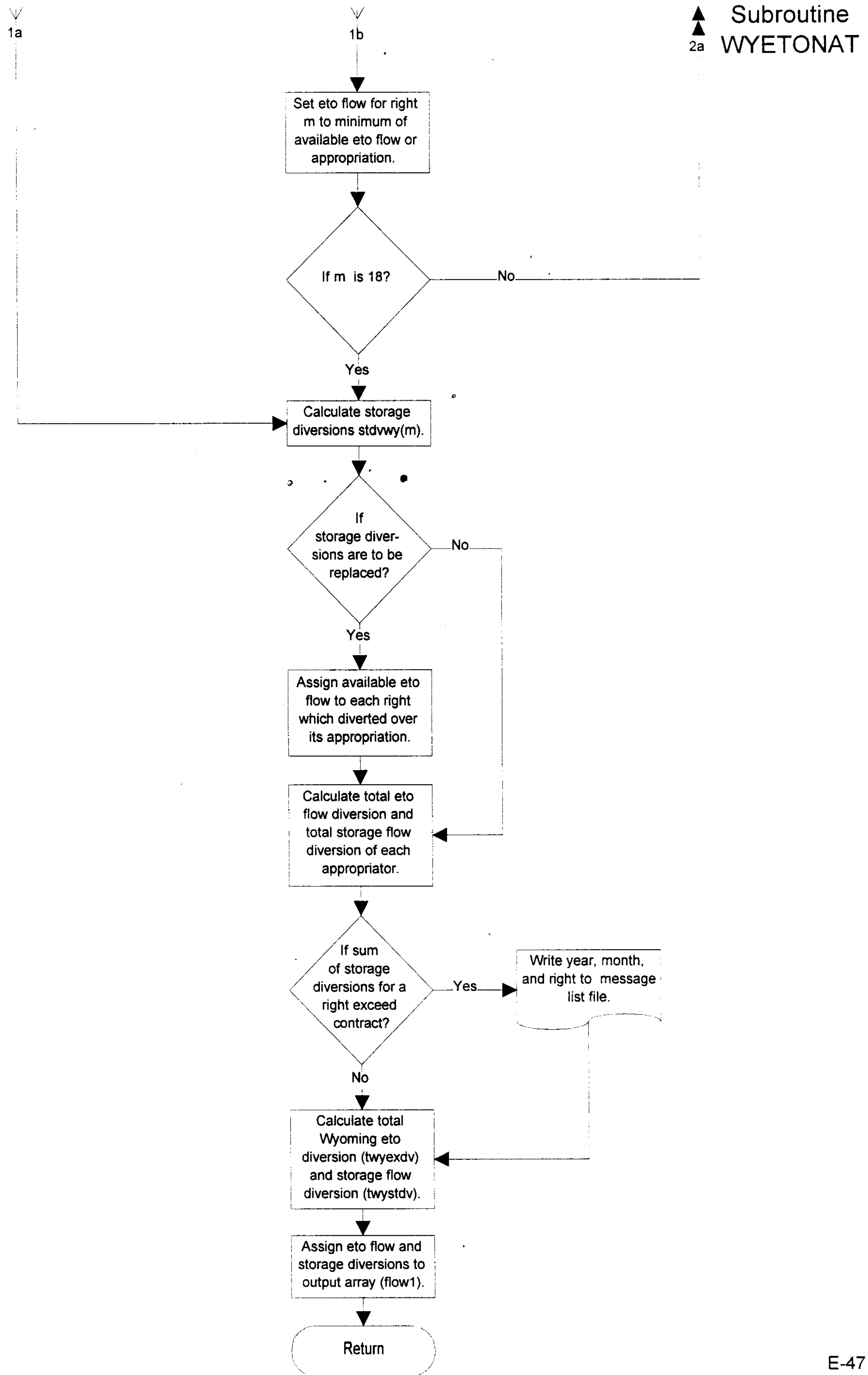


Subroutine GRINGETO



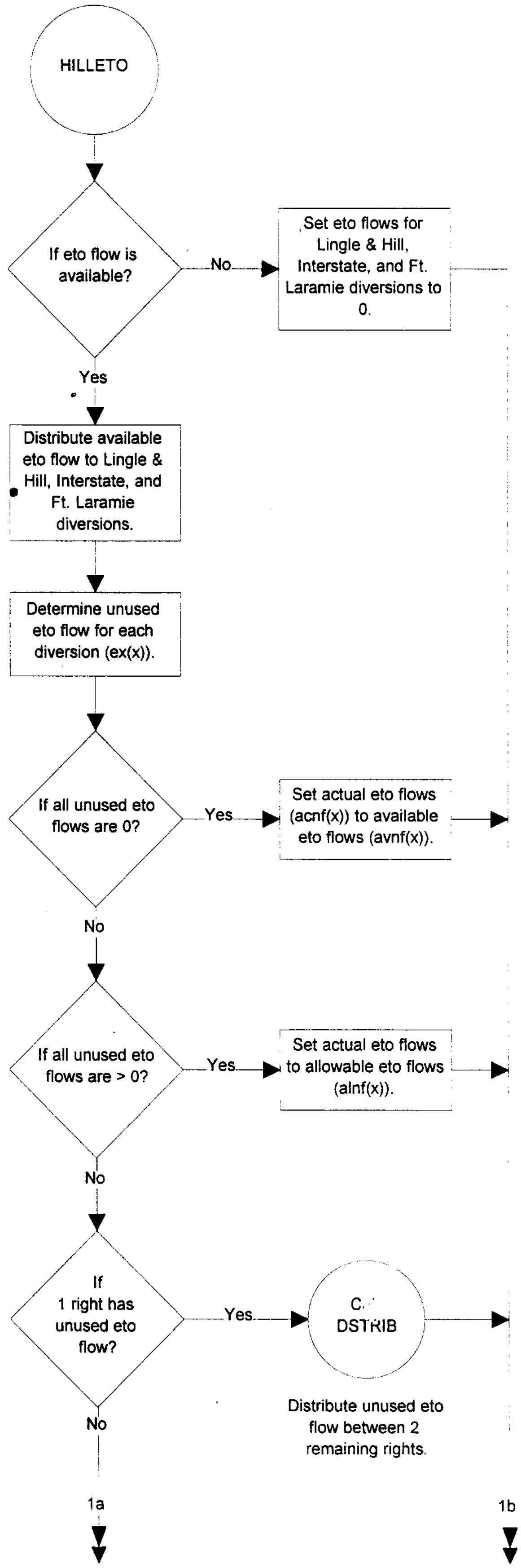
Subroutine WYETONAT



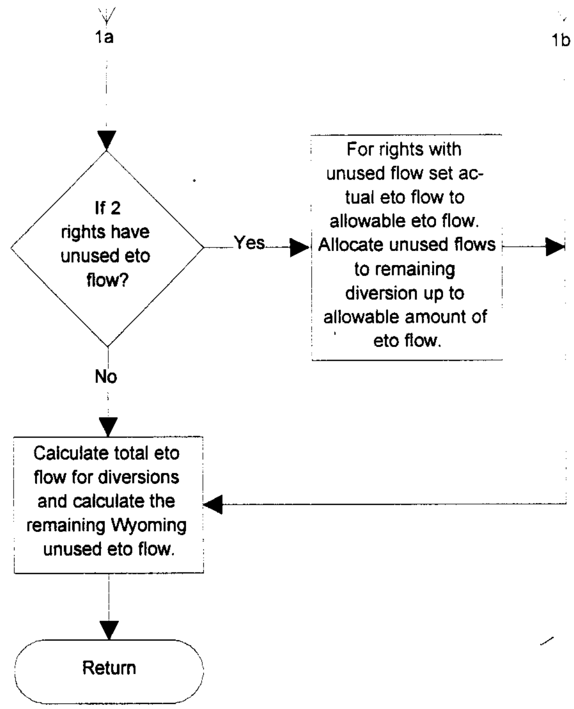


1a
1b
Subroutine
2a
WYETONAT
Set eto flow for right m to minimum of available eto flow or appropriation.
If m is 18?
No
Yes
Calculate storage diversions stdvwy(m).
If storage diversions are to be replaced?
No
Yes
Assign available eto flow to each right which diverted over its appropriation.
Calculate total eto flow diversion and total storage flow diversion of each appropriator.
If sum of storage diversions for a right exceed contract?
Yes
Write year, month, and right to message list file.
No
Calculate total Wyoming eto diversion (twyexdv) and storage flow diversion (twystdv).
Assign eto flow and storage diversions to output array (flow1).
Return

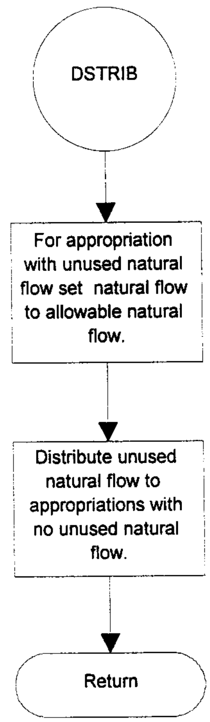
Subroutine HILLETO



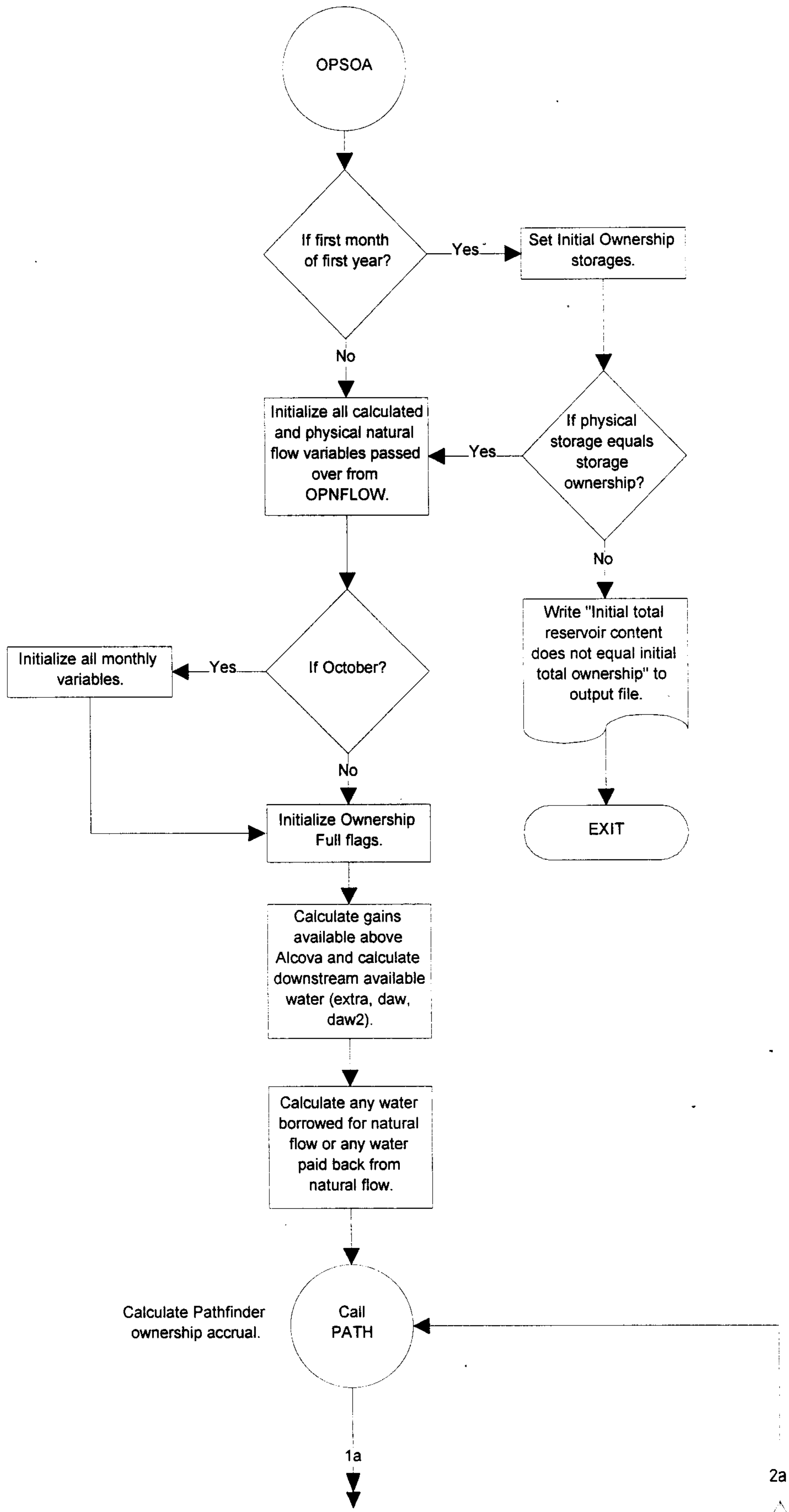
Subroutine HILLETO



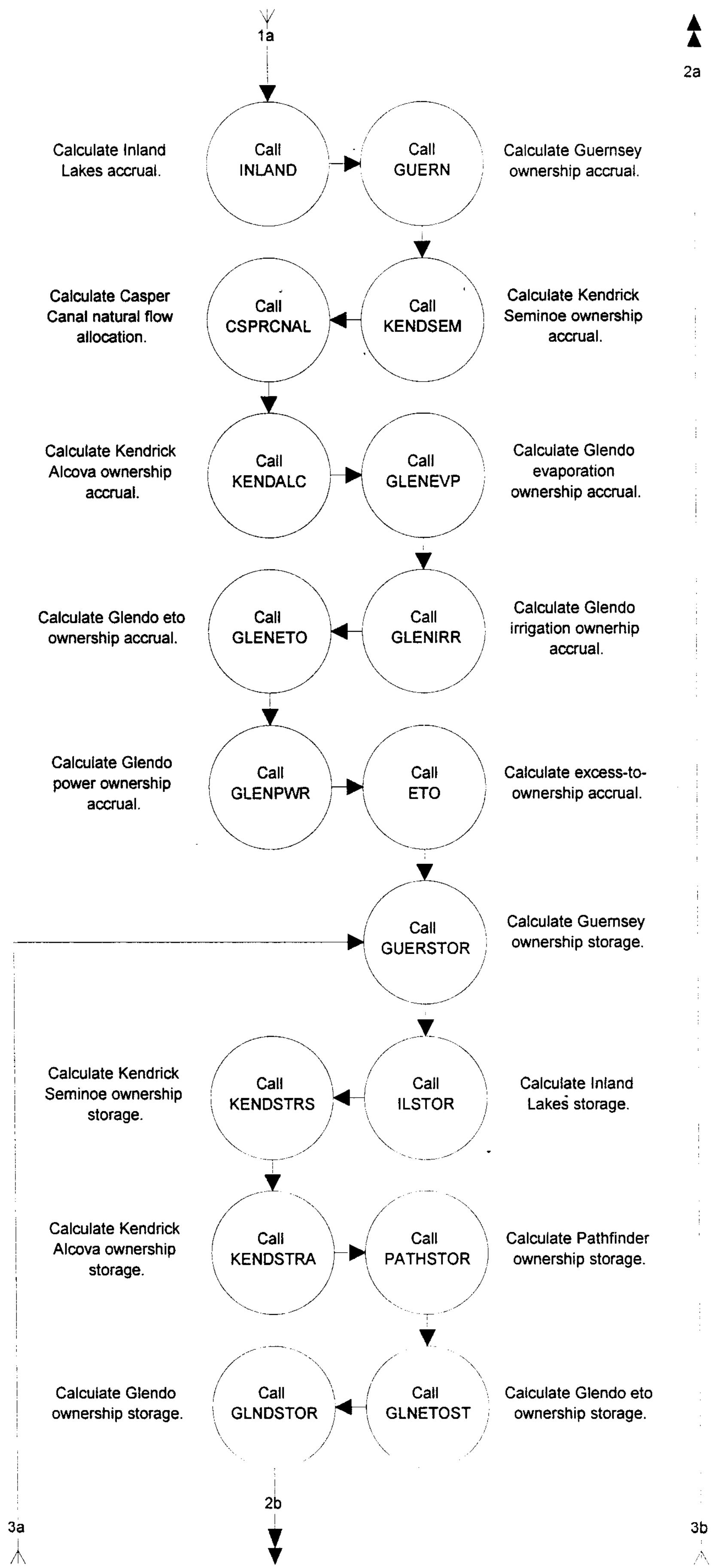
Subroutine DSTRIB

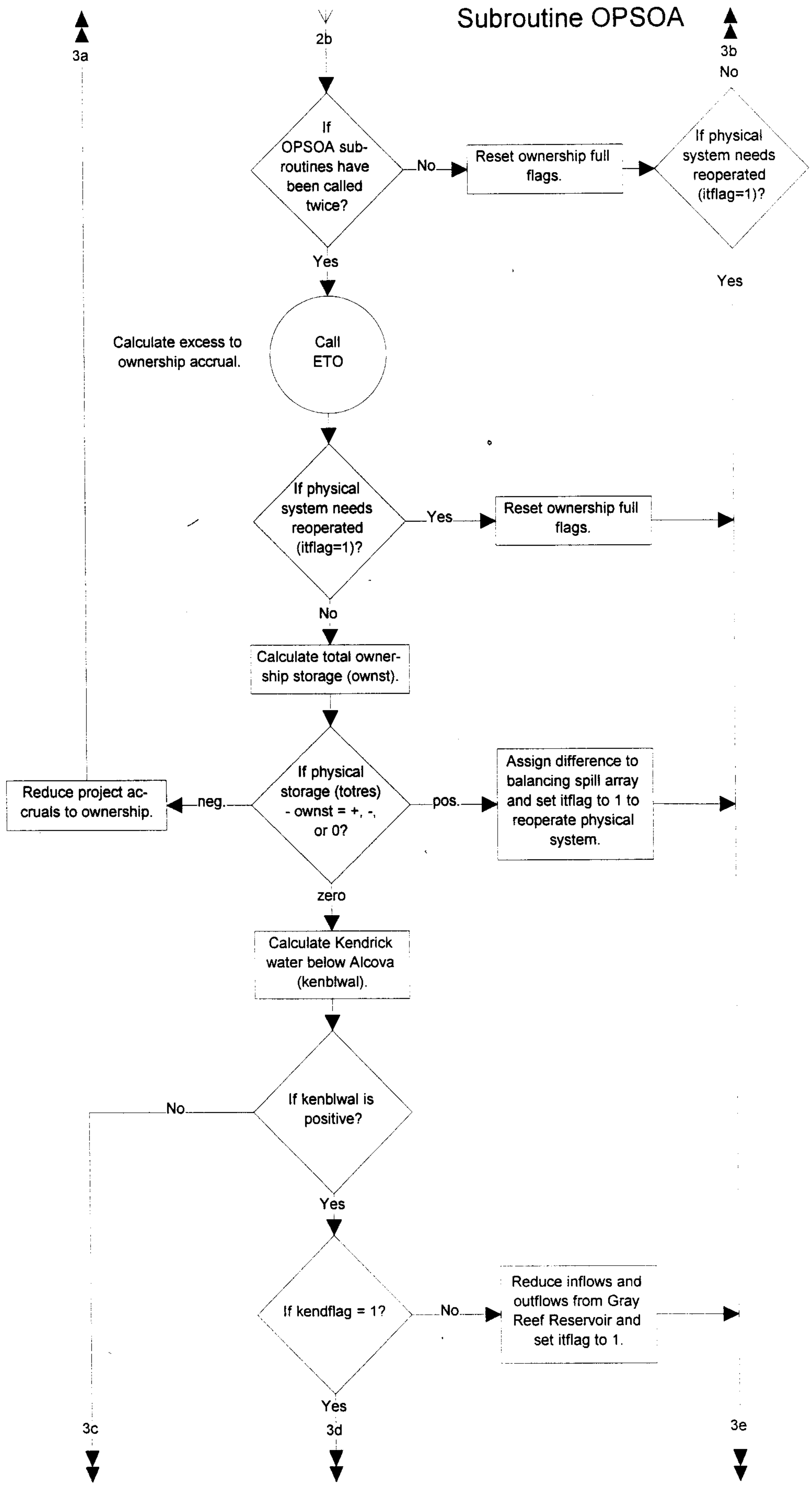


Subroutine OPSOA

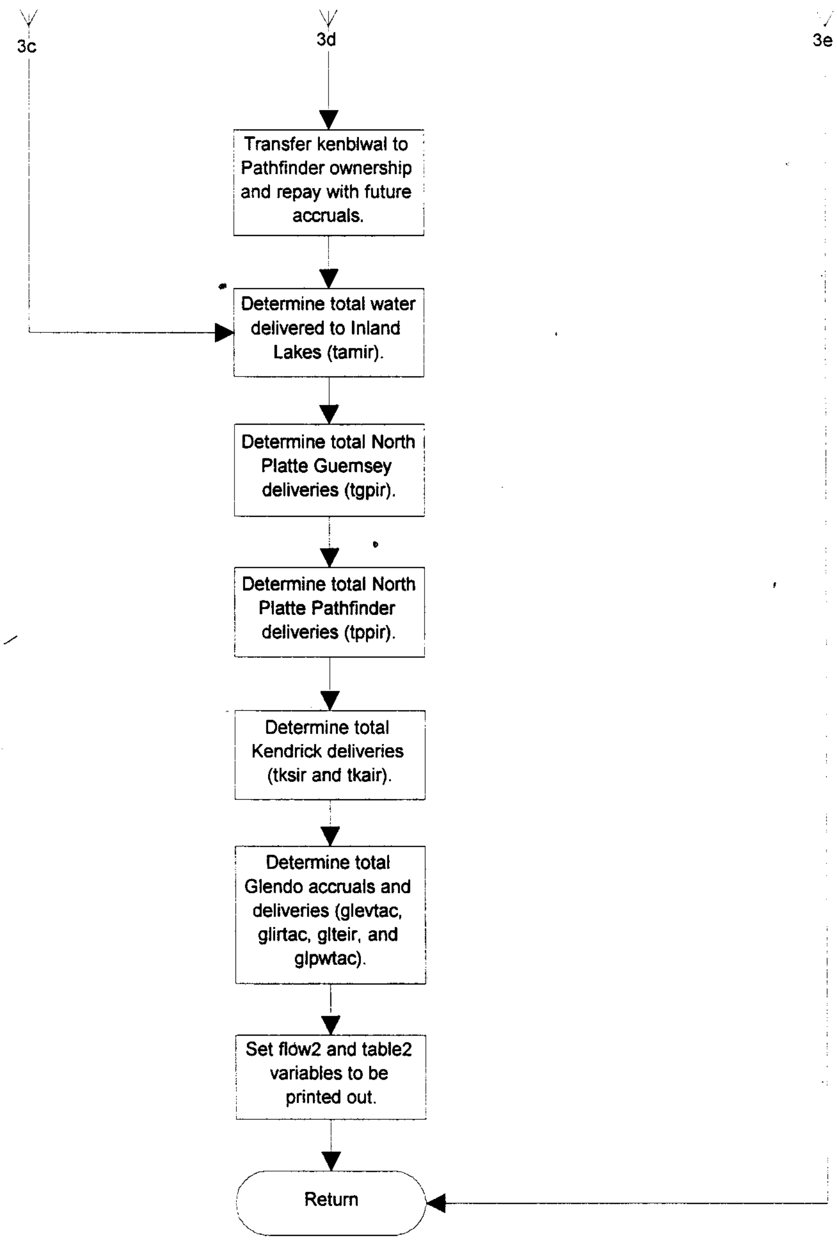


Subroutine OPSOA



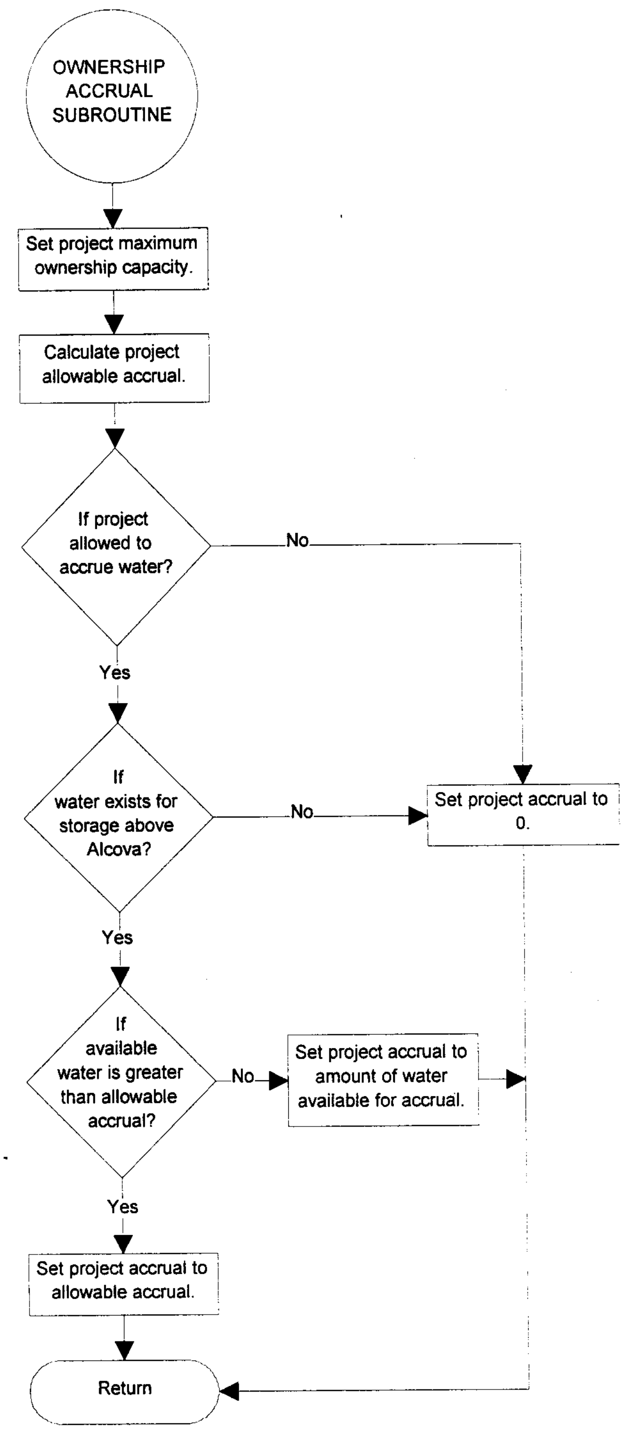

Subroutine OPSOA
3a
2b
3b
No
If OPSOA sub-routines have been called twice?
No
Reset ownership full flags.
If physical system needs reoperated (itflag=1)?
Yes
Yes
Calculate excess to ownership accrual.
Call ETO
If physical system needs reoperated (itflag=1)?
Yes
Reset ownership full flags.
No
Calculate total ownership storage (ownst).
If physical storage (totres) - ownst = +, -, or 0?
neg.
Reduce project accruals to ownership.
pos.
Assign difference to balancing spill array and set itflag to 1 to reoperate physical system.
zero
Calculate Kendrick water below Alcova (kenblwal).
If kenblwal is positive?
No
Yes
If kendflag = 1?
No
Reduce inflows and outflows from Gray Reef Reservoir and set itflag to 1.
Yes
3c
3d
3e

Subroutine OPSOA

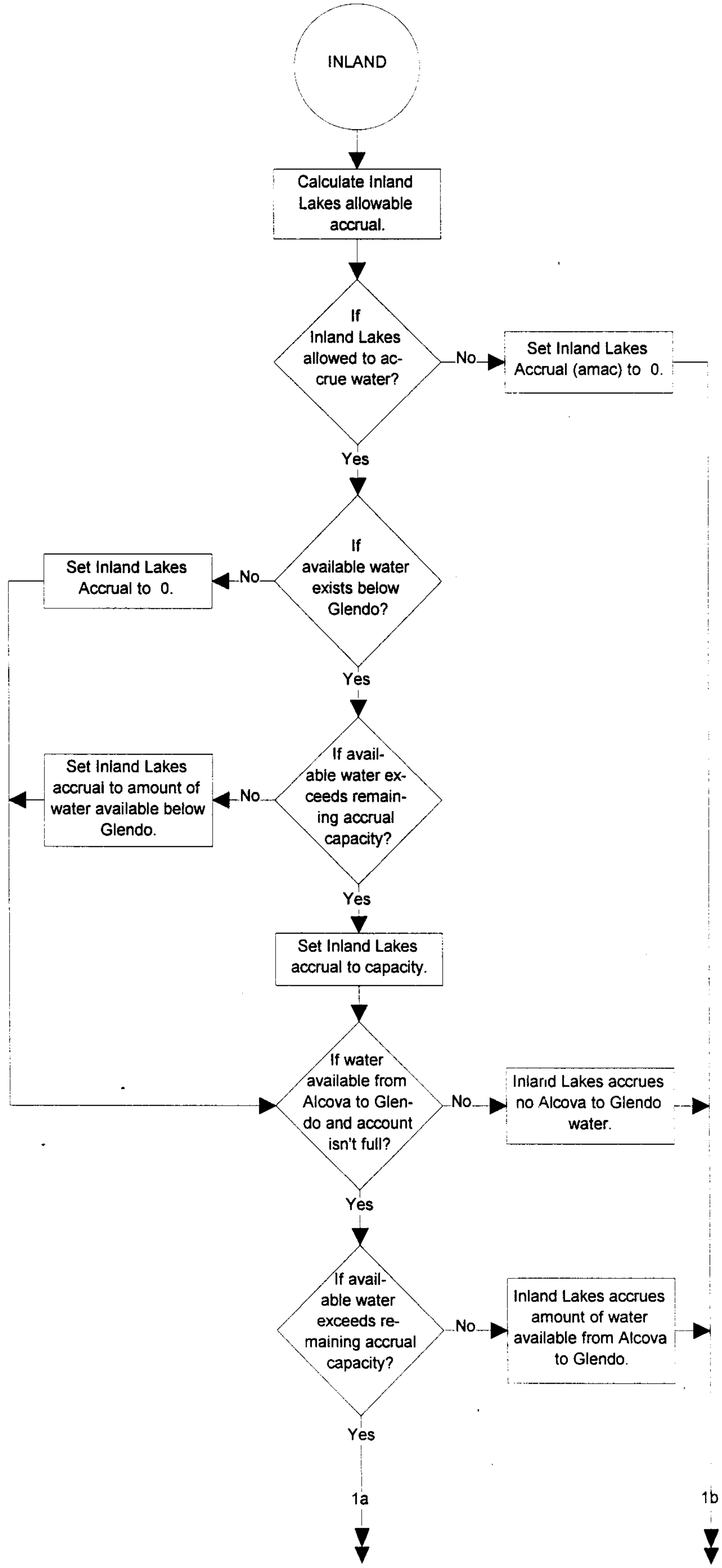


Subroutines for the Calculation of Project Ownership Accrual

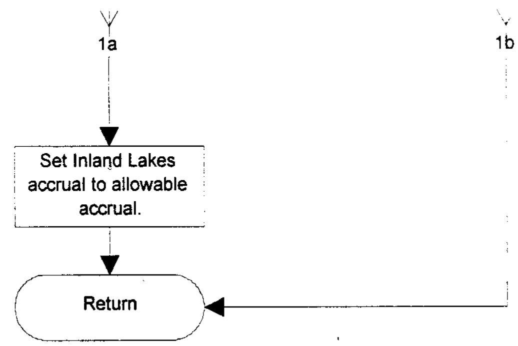
(PATH, KENDSEM, KENDALC)



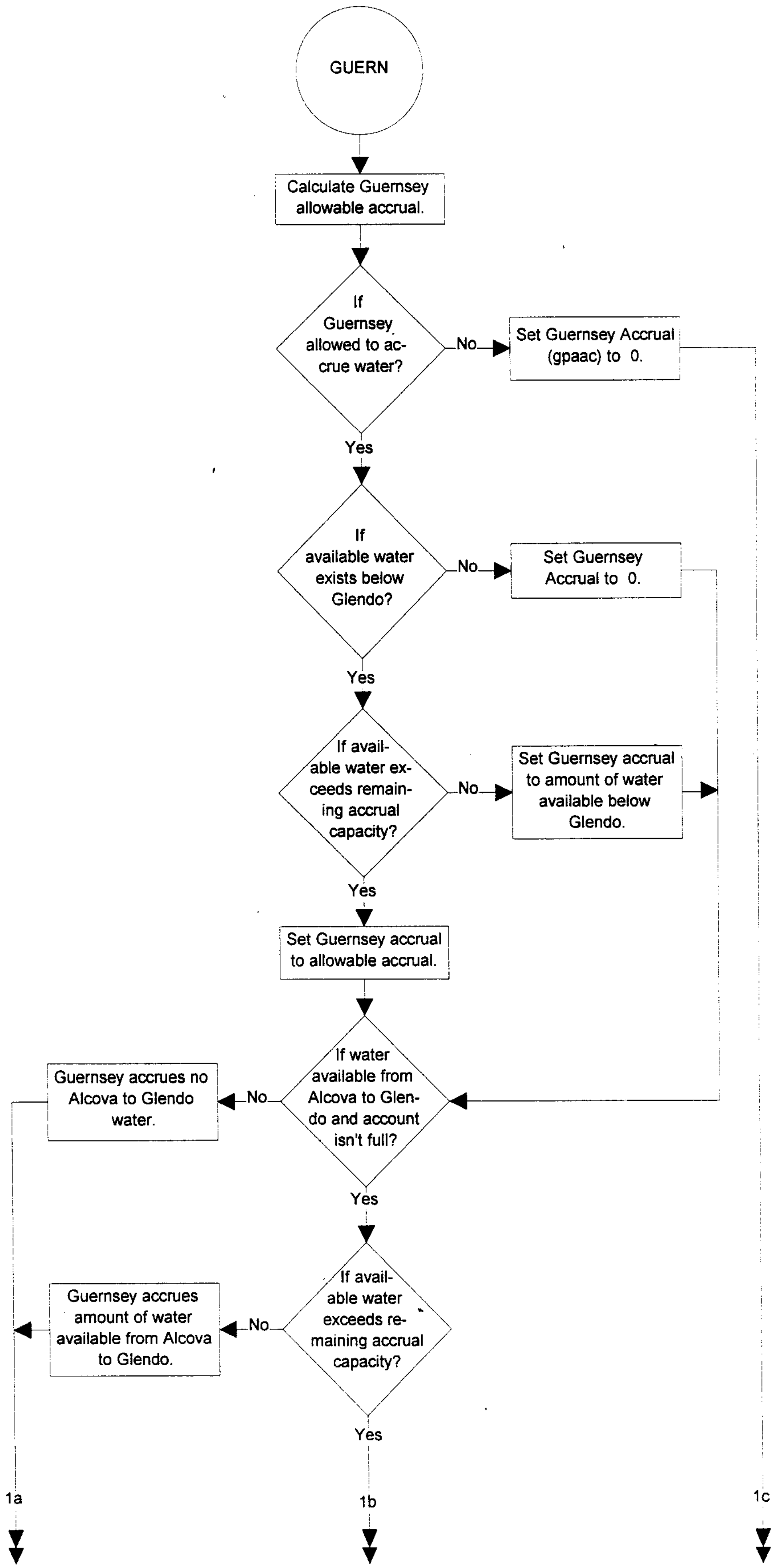
Subroutine INLAND



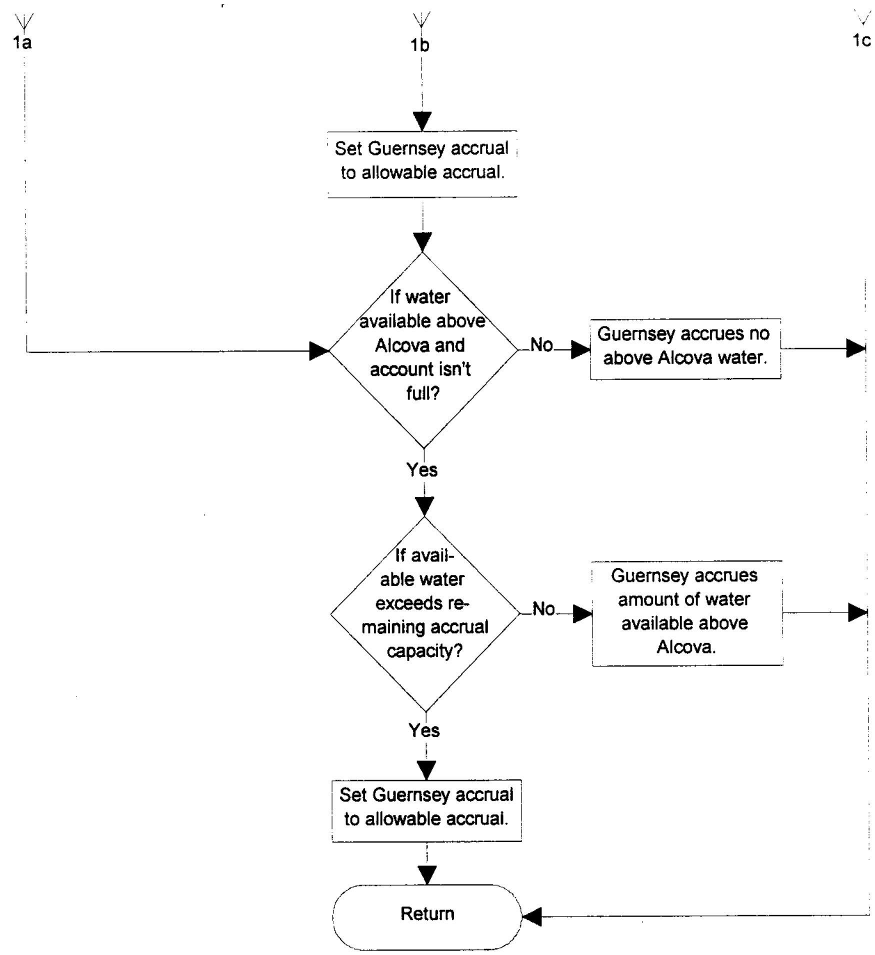
Subroutine INLAND



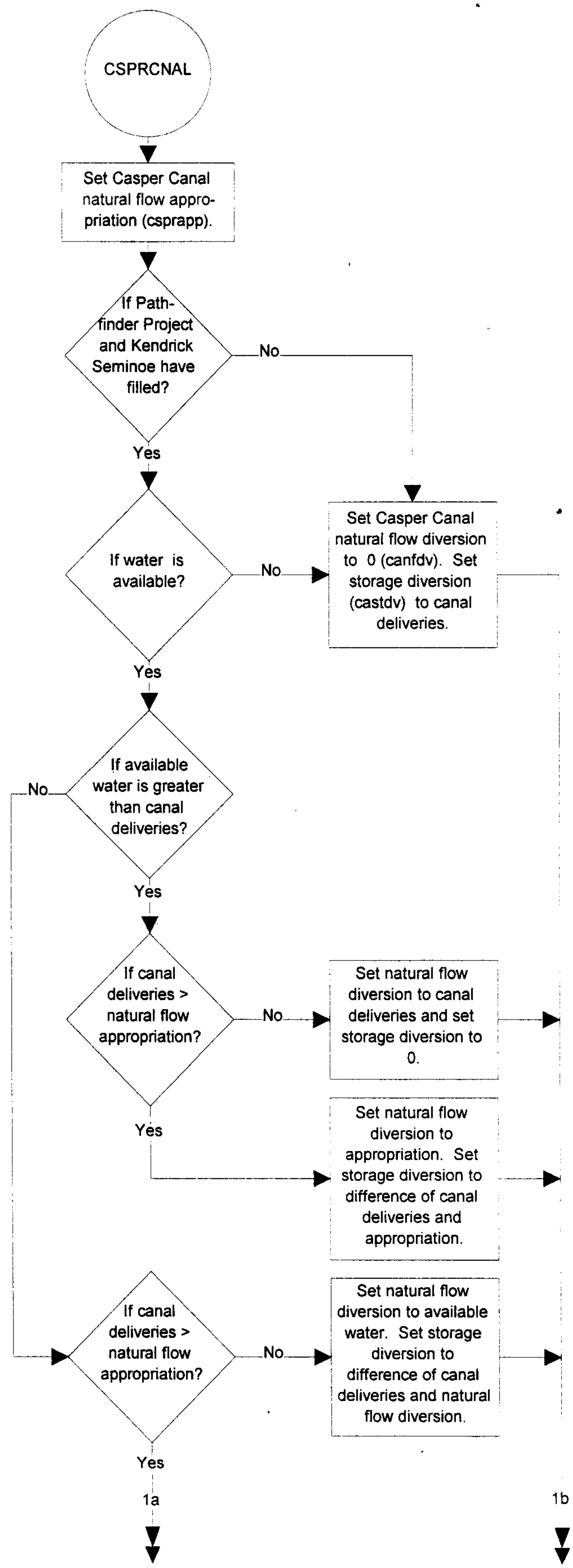
Subroutine GUERN



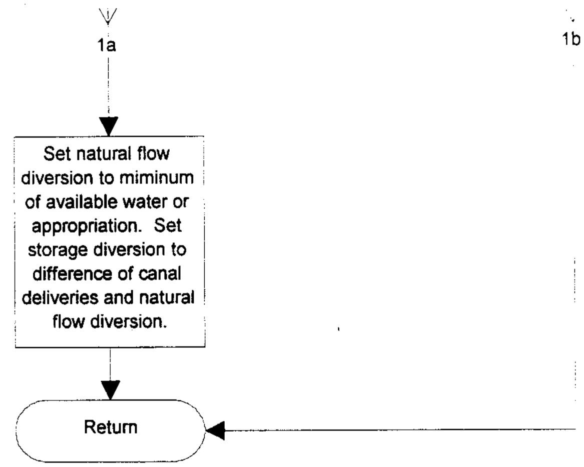
Subroutine GUERN



Subroutine CSPRCNAL

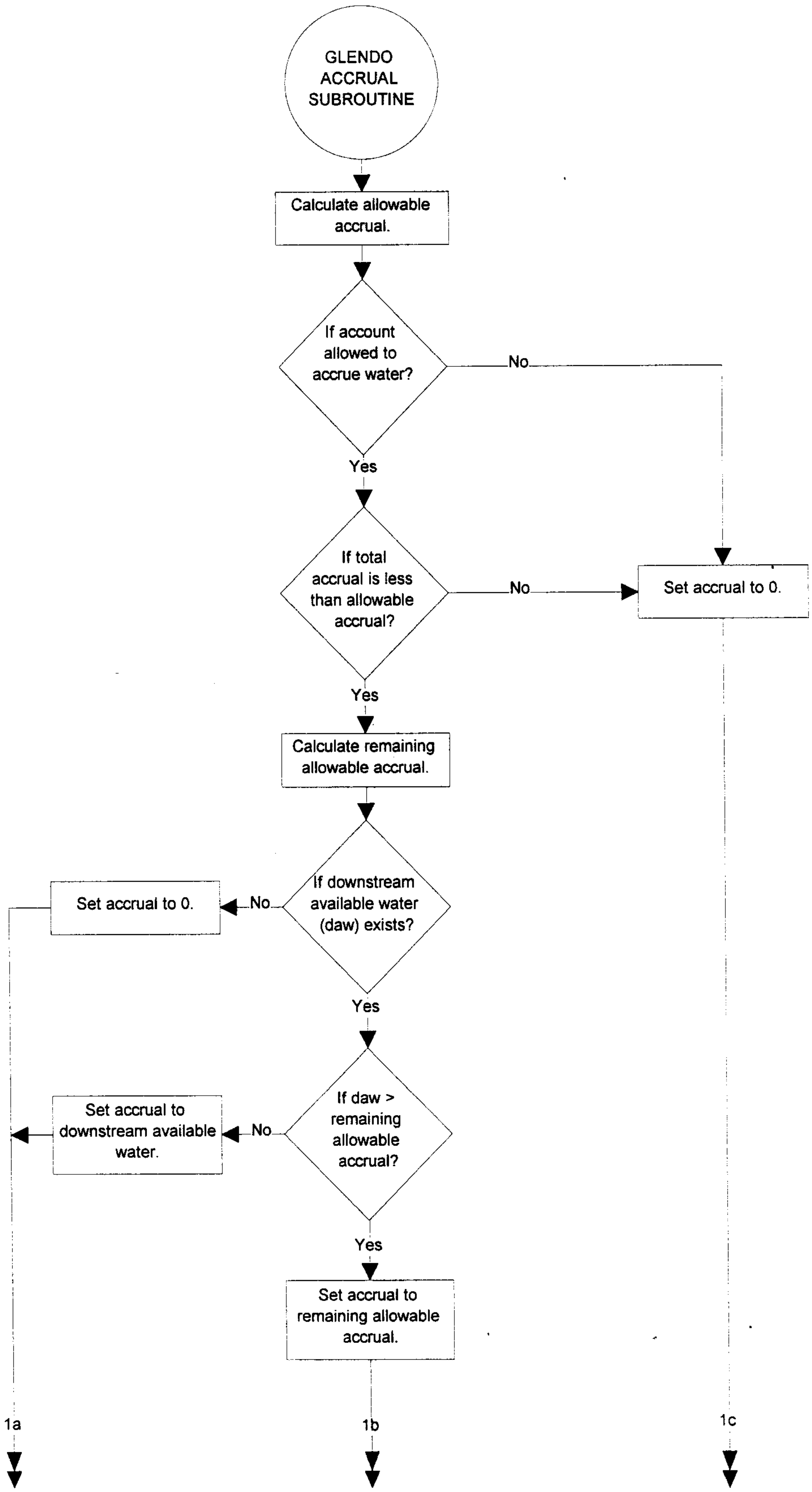


Subroutine CSPRCNAL

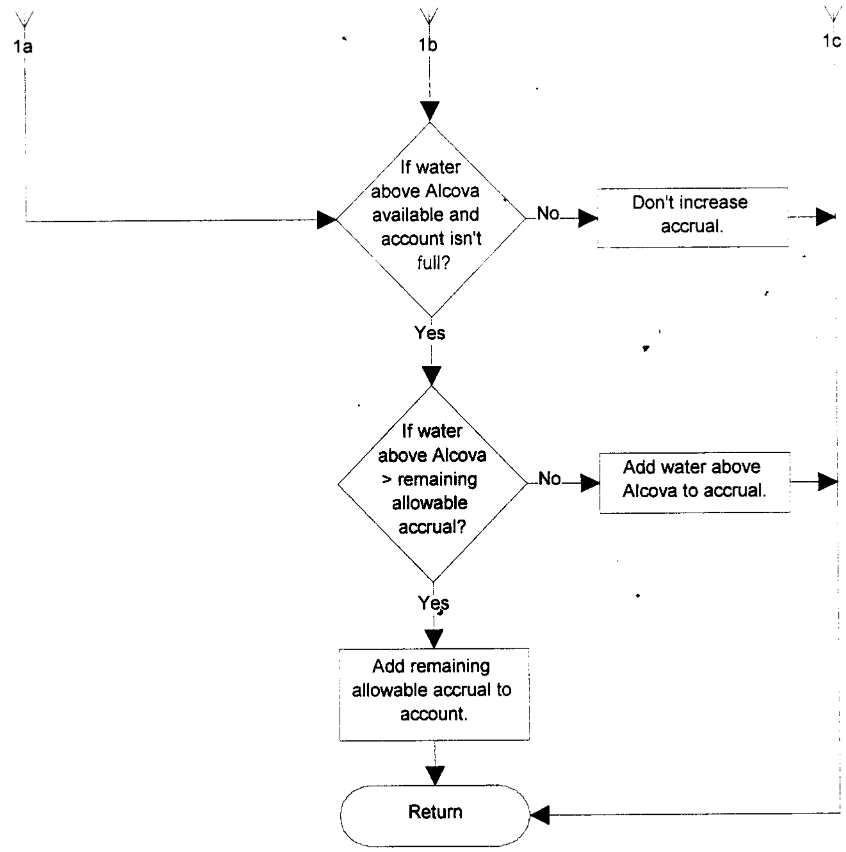


Subroutines for the Calculation of Glendo Accrual

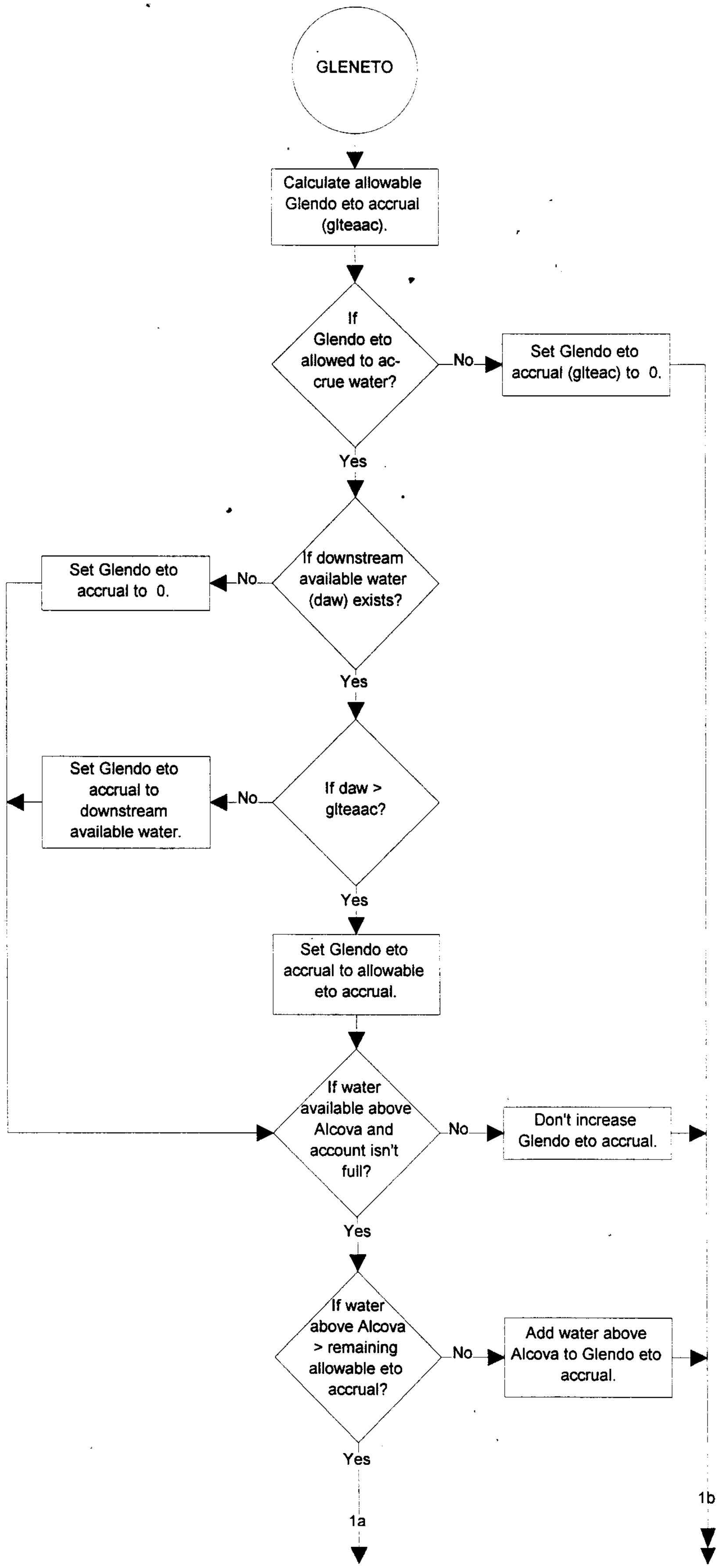
(GLENEVP, GLENIRR, GLENPWR)



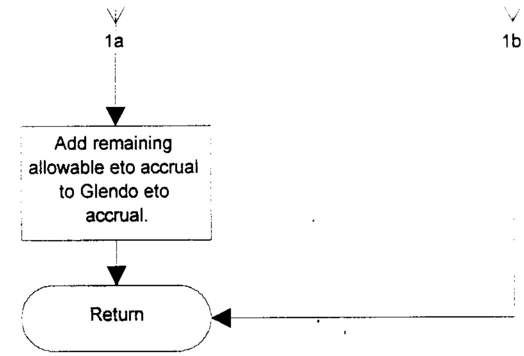
Glendo Accrual Subroutines



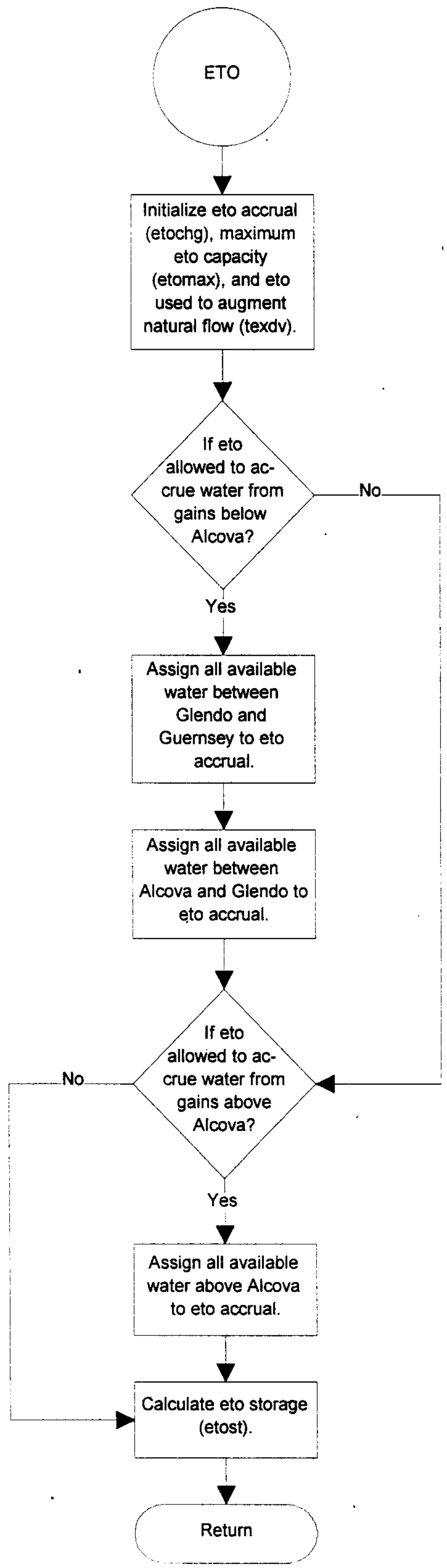
Subroutine GLENETO



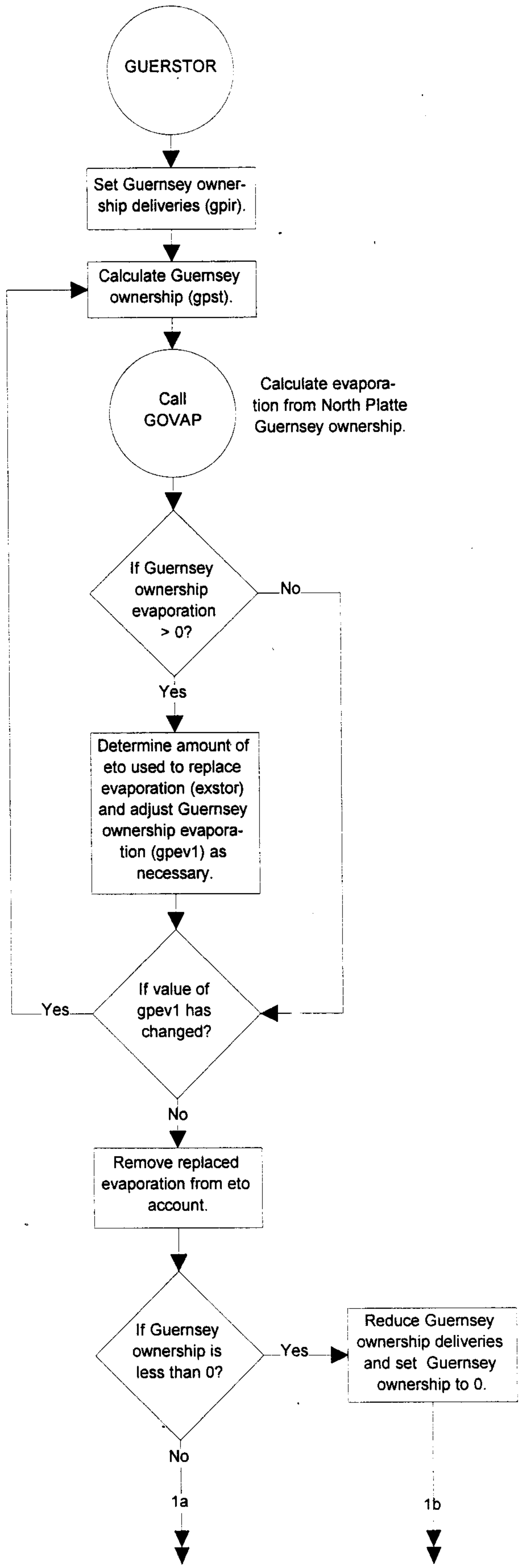
Subroutine GLENETO



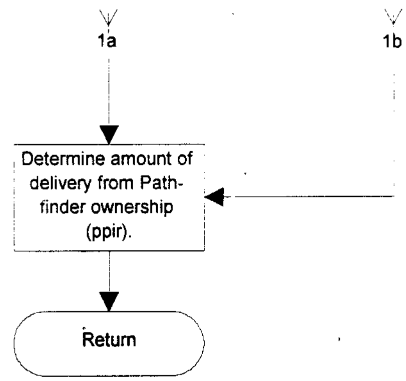
Subroutine ETO



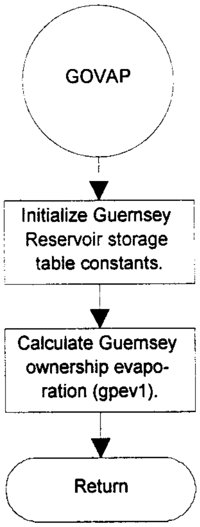
Subroutine GUERSTOR



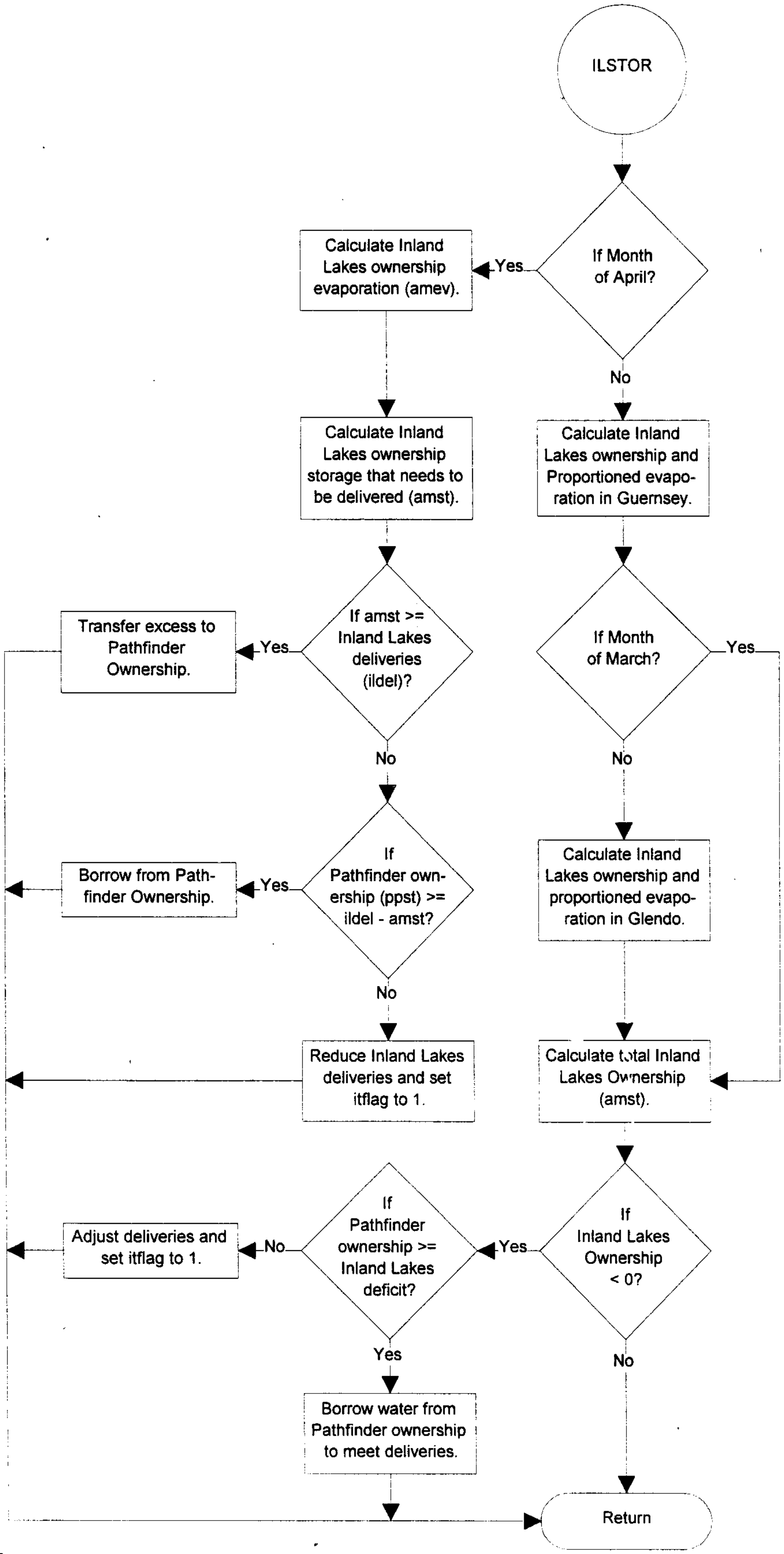
Subroutine
GUERSTOR



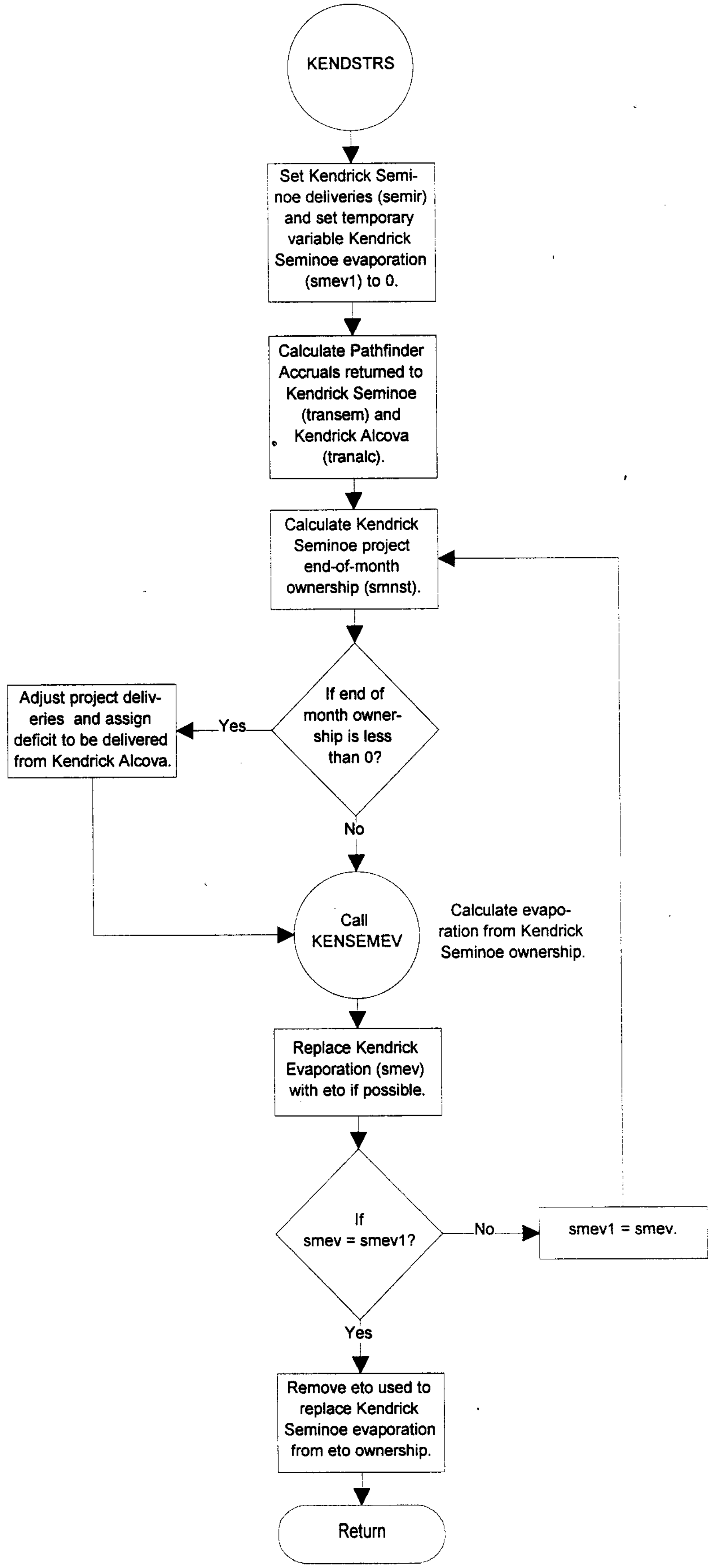
Subroutine GOVAP



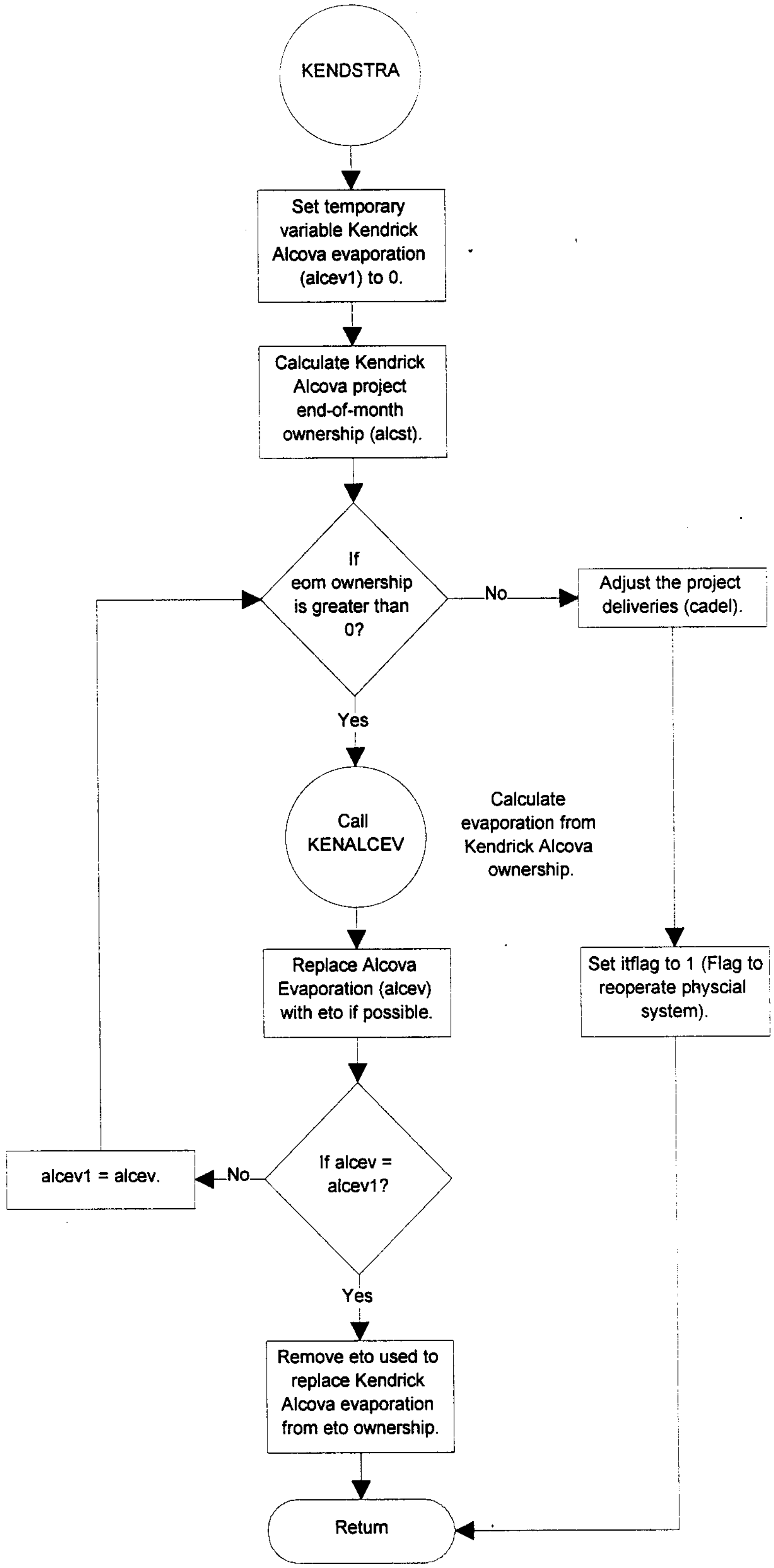
Subroutine ILSTOR



Subroutine KENDSTRS

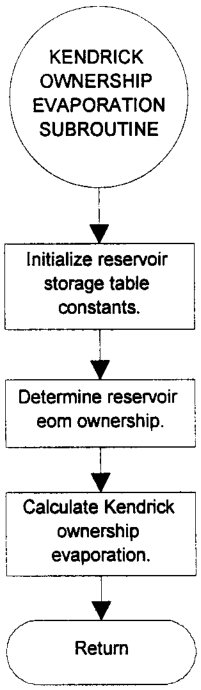


Subroutine KENDSTRA

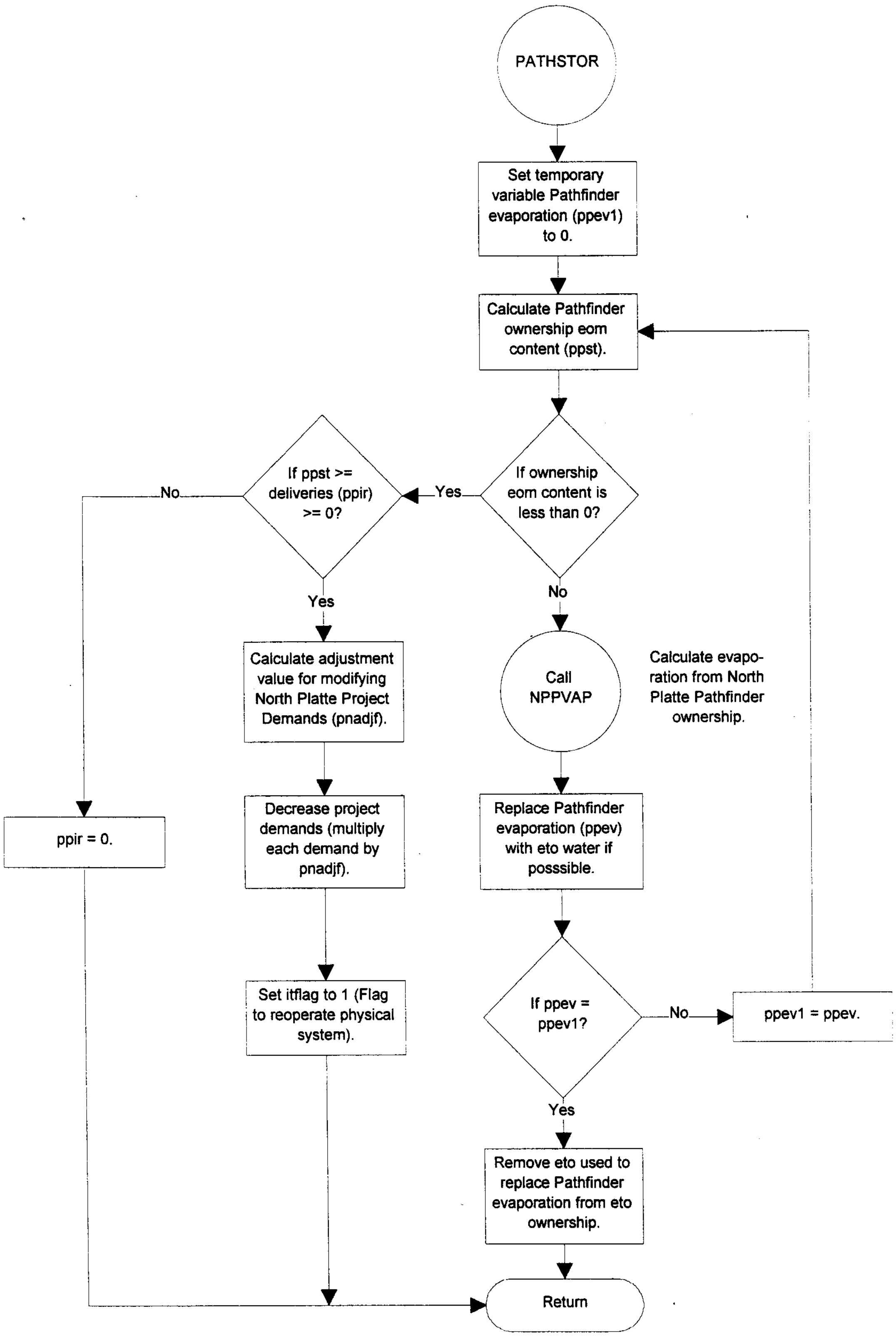


Subroutines for the Calculation of Kendrick Ownership Evaporation

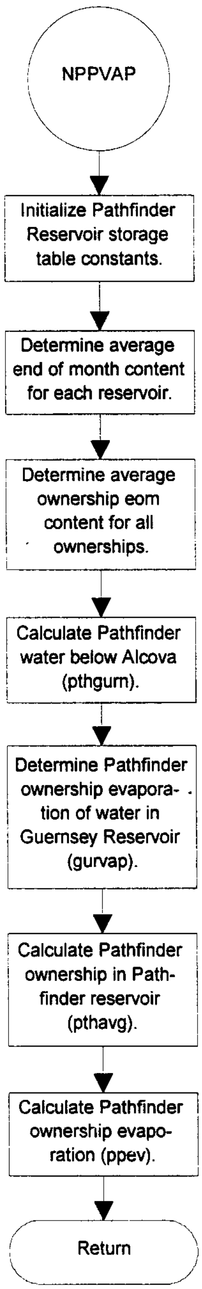
(KENSEMEV, KENALCEV)



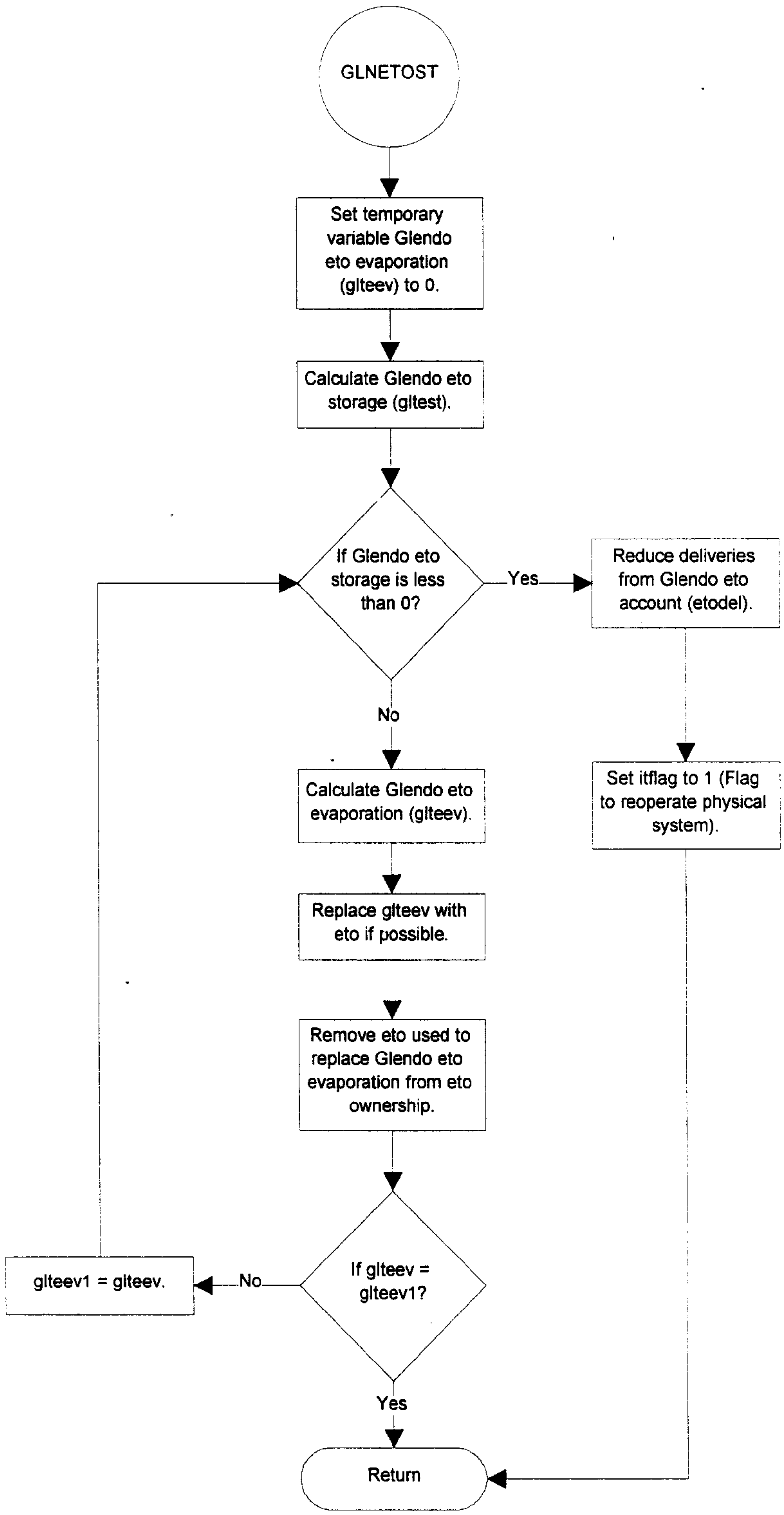
Subroutine PATHSTOR



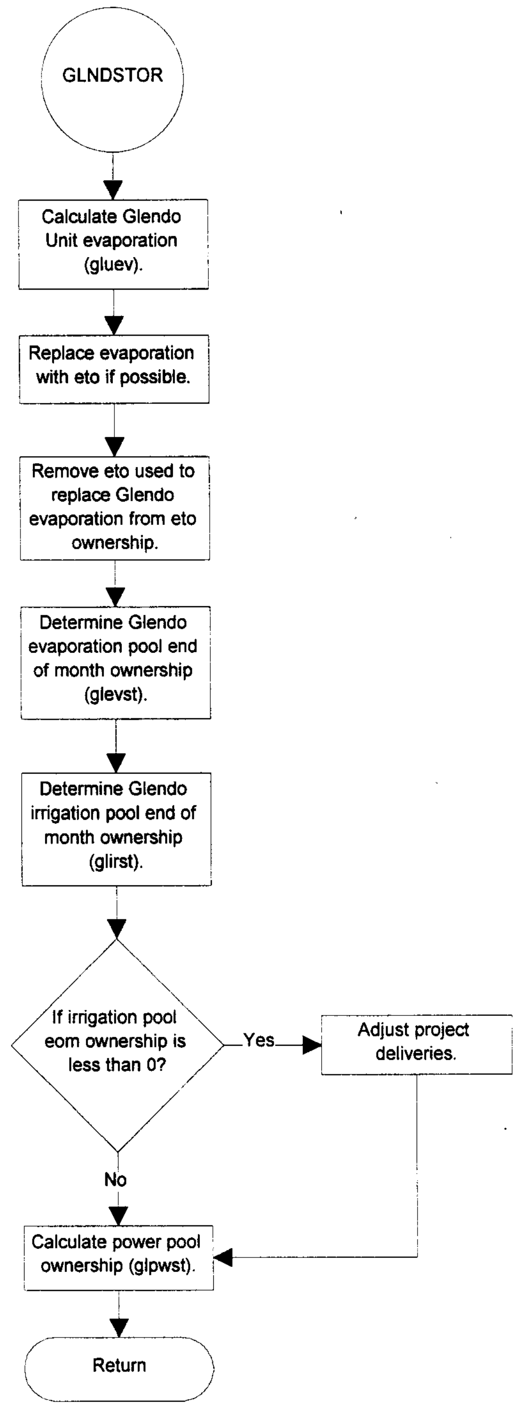
Subroutine NPPVAP



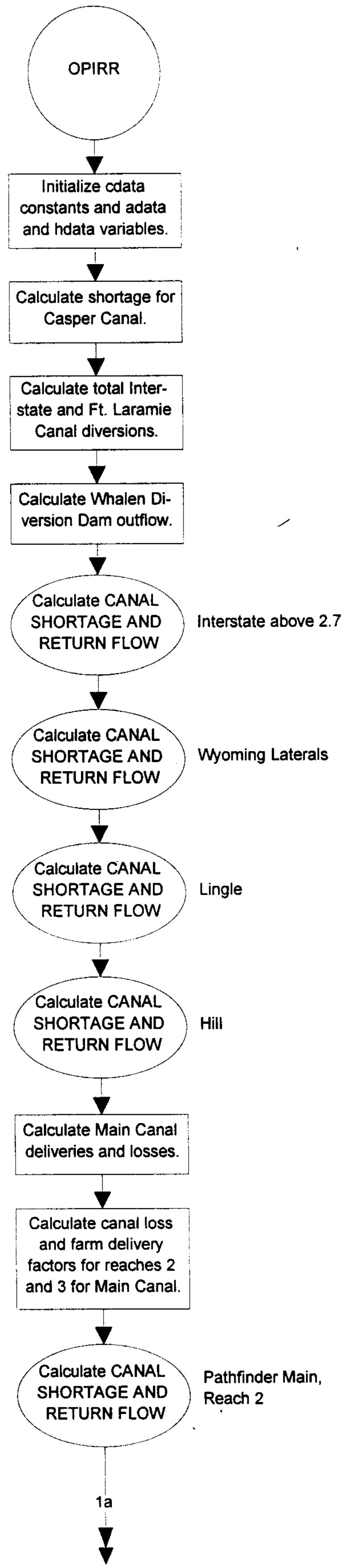
Subroutine GLNETOST



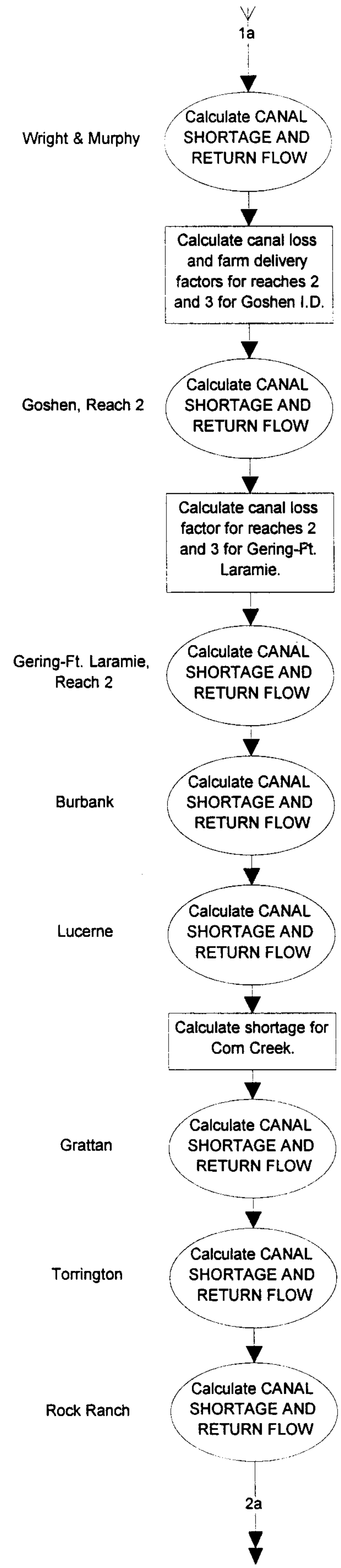
Subroutine GLNDSTOR

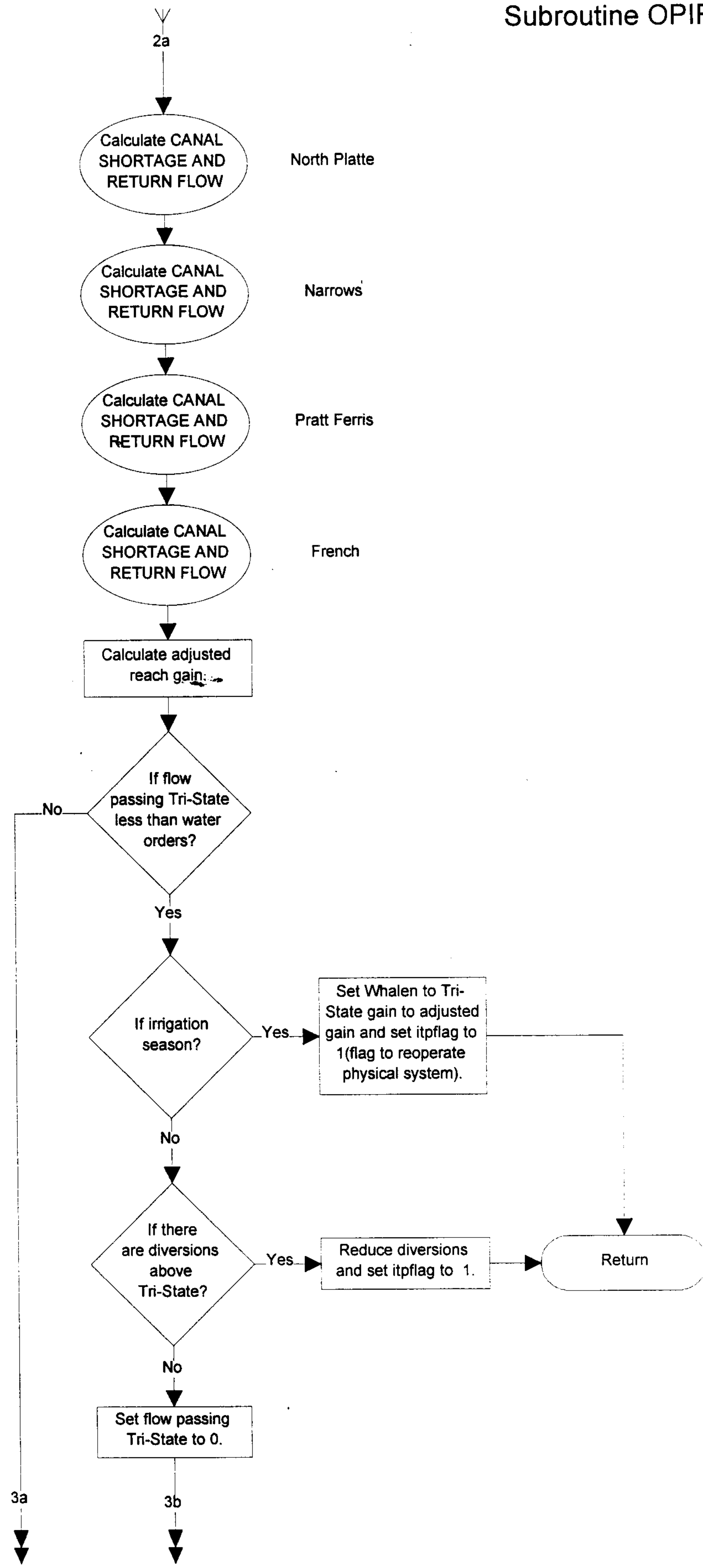


Subroutine OPIRR

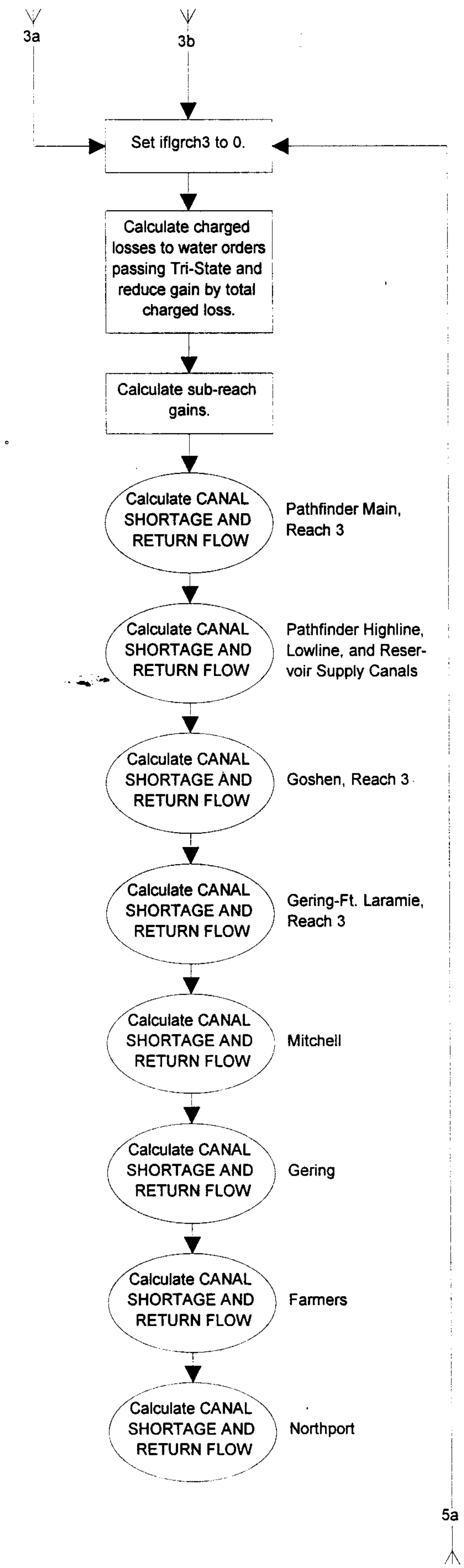


Subroutine OPIRR

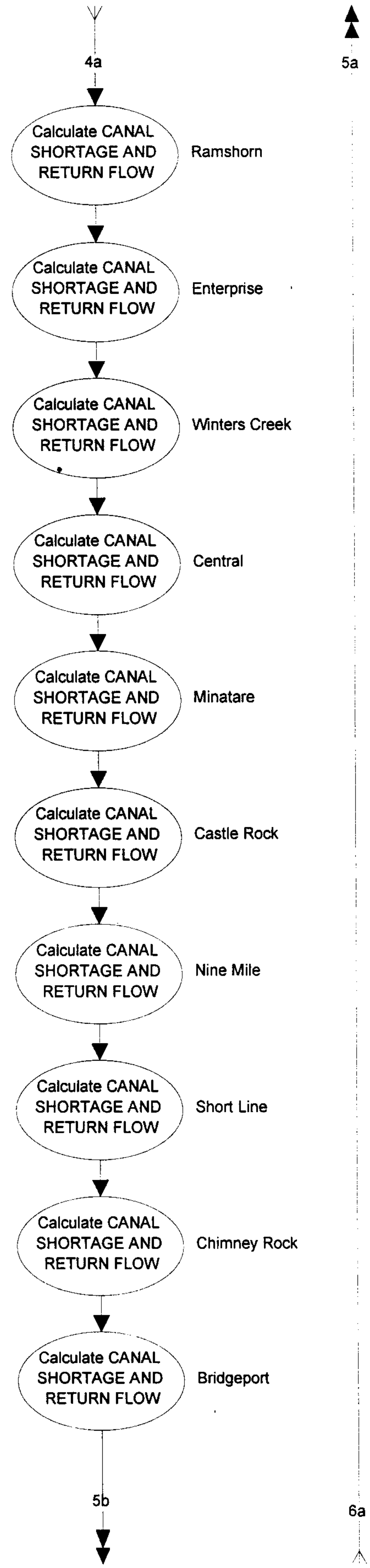



2a
Calculate CANAL SHORTAGE AND RETURN FLOW
North Platte
Calculate CANAL SHORTAGE AND RETURN FLOW
Narrows
Calculate CANAL SHORTAGE AND RETURN FLOW
Pratt Ferris
Calculate CANAL SHORTAGE AND RETURN FLOW
French
Calculate adjusted reach gain.
If flow passing Tri-State less than water orders?
No
Yes
If irrigation season?
Yes
Set Whalen to Tri-State gain to adjusted gain and set itpflag to 1(flag to reoperate physical system).
No
If there are diversions above Tri-State?
Yes
Reduce diversions and set itpflag to 1.
Return
No
Set flow passing Tri-State to 0.
3a
3b

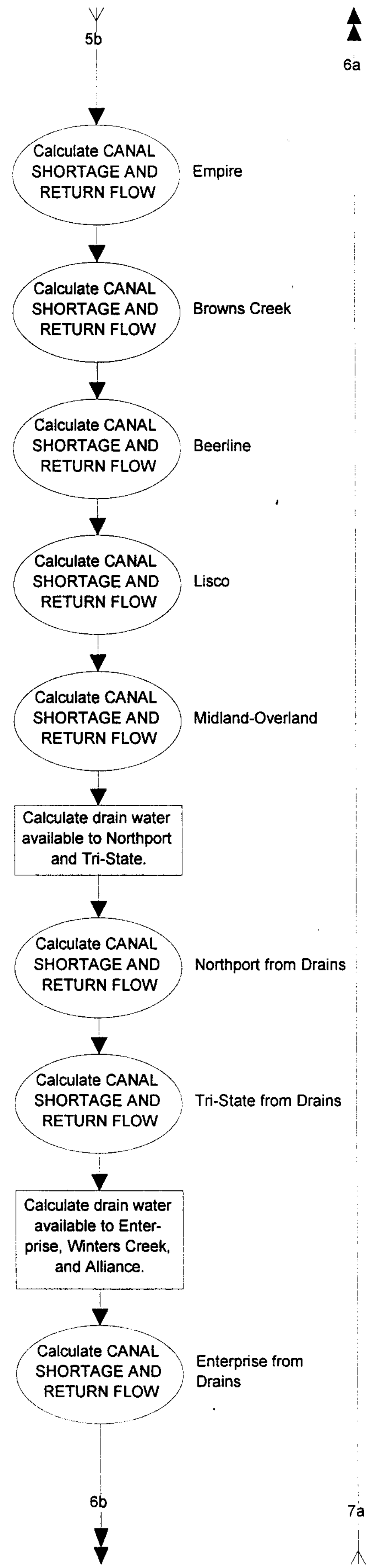
Subroutine OPIRR

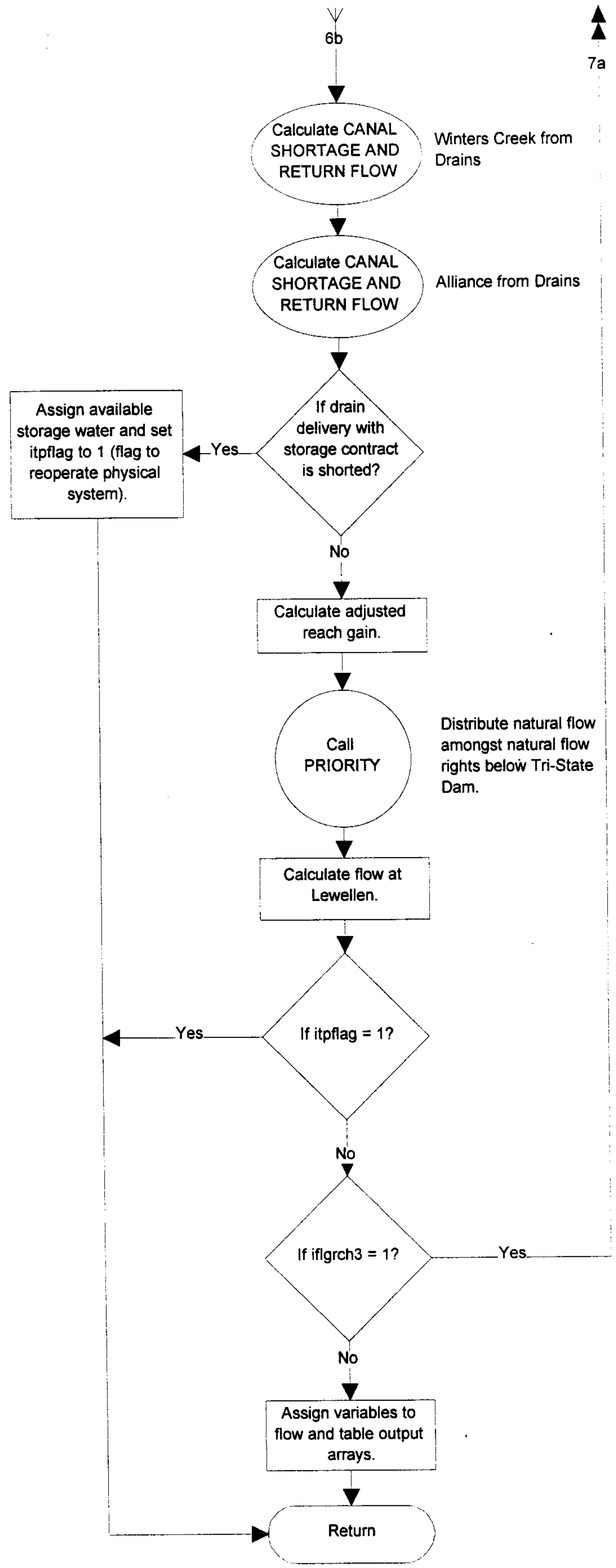


Subroutine OPIRR

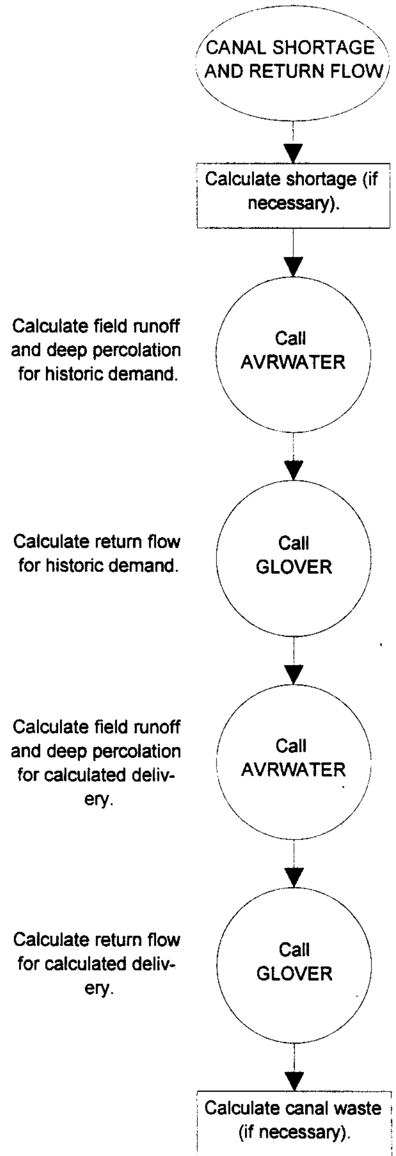


Subroutine OPIRR

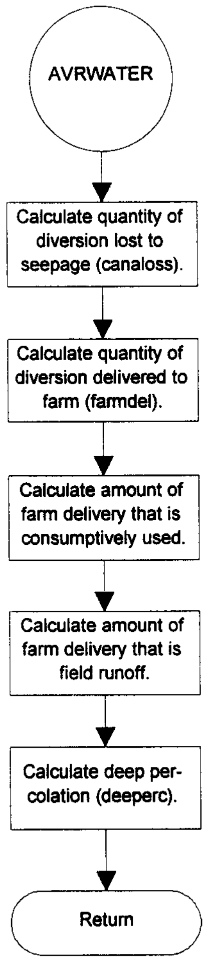



6b
7a
Calculate CANAL SHORTAGE AND RETURN FLOW
Winters Creek from Drains
Calculate CANAL SHORTAGE AND RETURN FLOW
Alliance from Drains
If drain delivery with storage contract is shorted?
Yes
Assign available storage water and set itpflag to 1 (flag to reoperate physical system).
No
Calculate adjusted reach gain.
Call PRIORITY
Distribute natural flow amongst natural flow rights below Tri-State Dam.
Calculate flow at Lewellen.
If itpflag = 1?
Yes
No
If iflgrch3 = 1?
Yes
No
Assign variables to flow and table output arrays.
Return

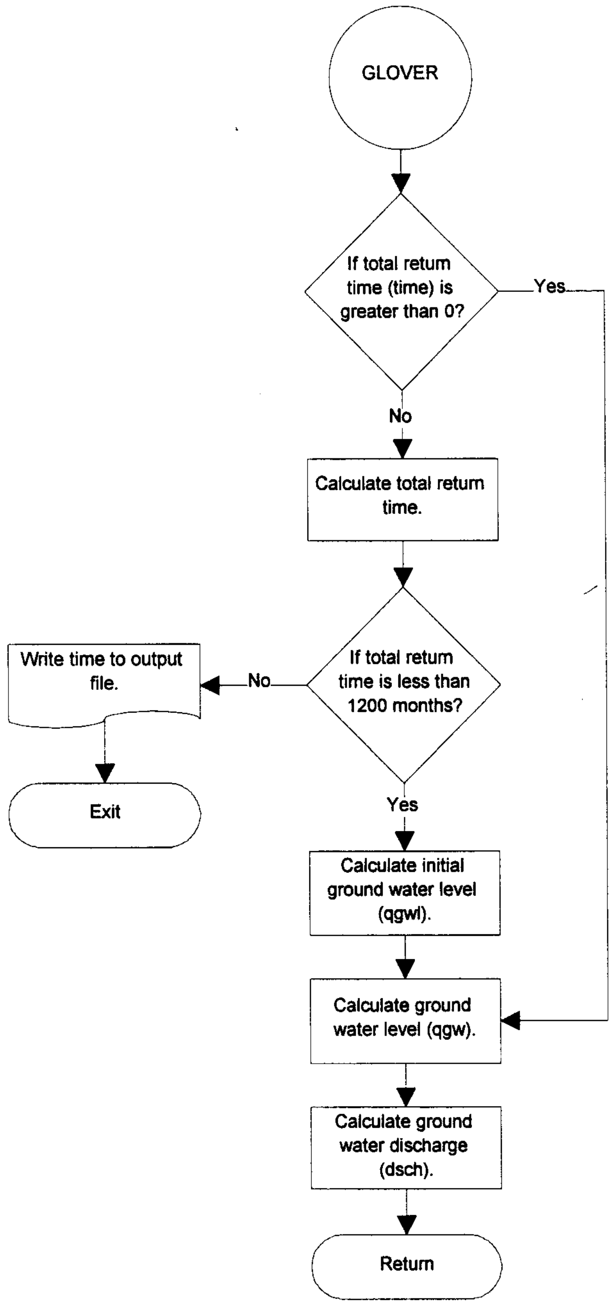
Subroutine OPIRR



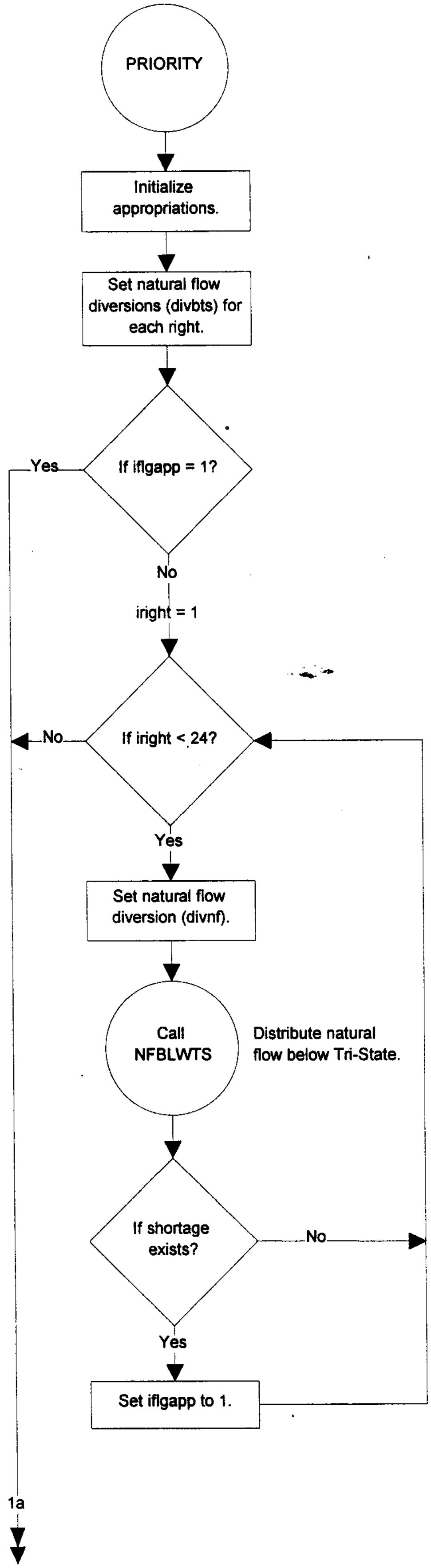
Subroutine AVRWATER



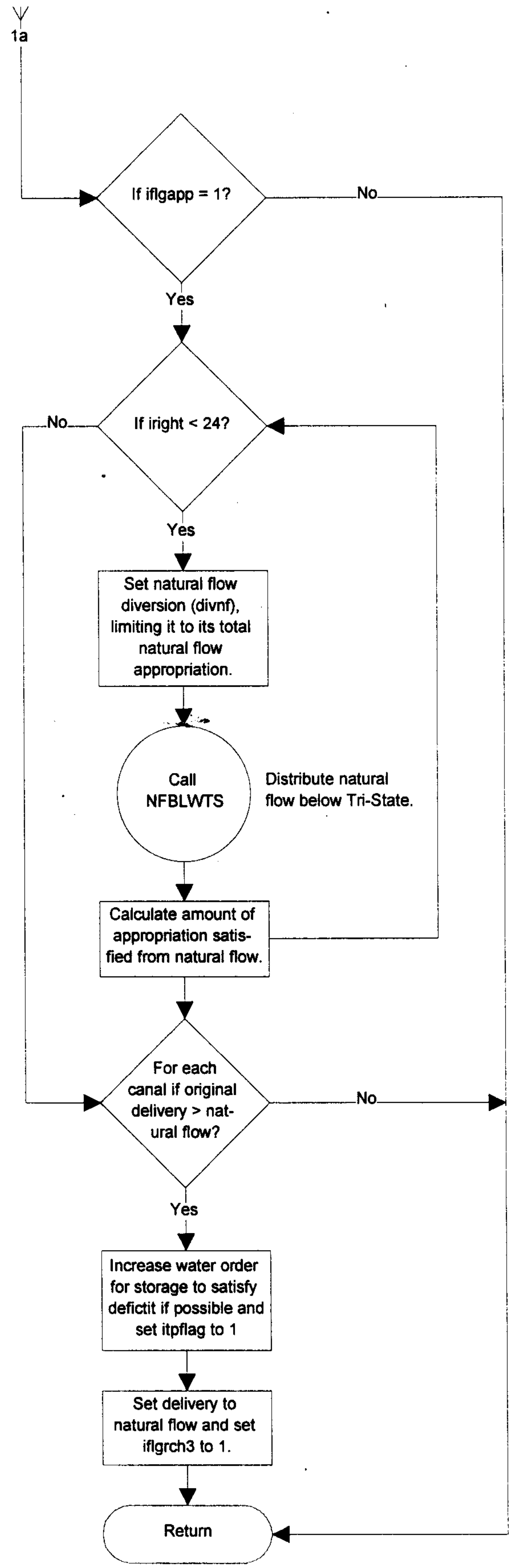
Subroutine GLOVER



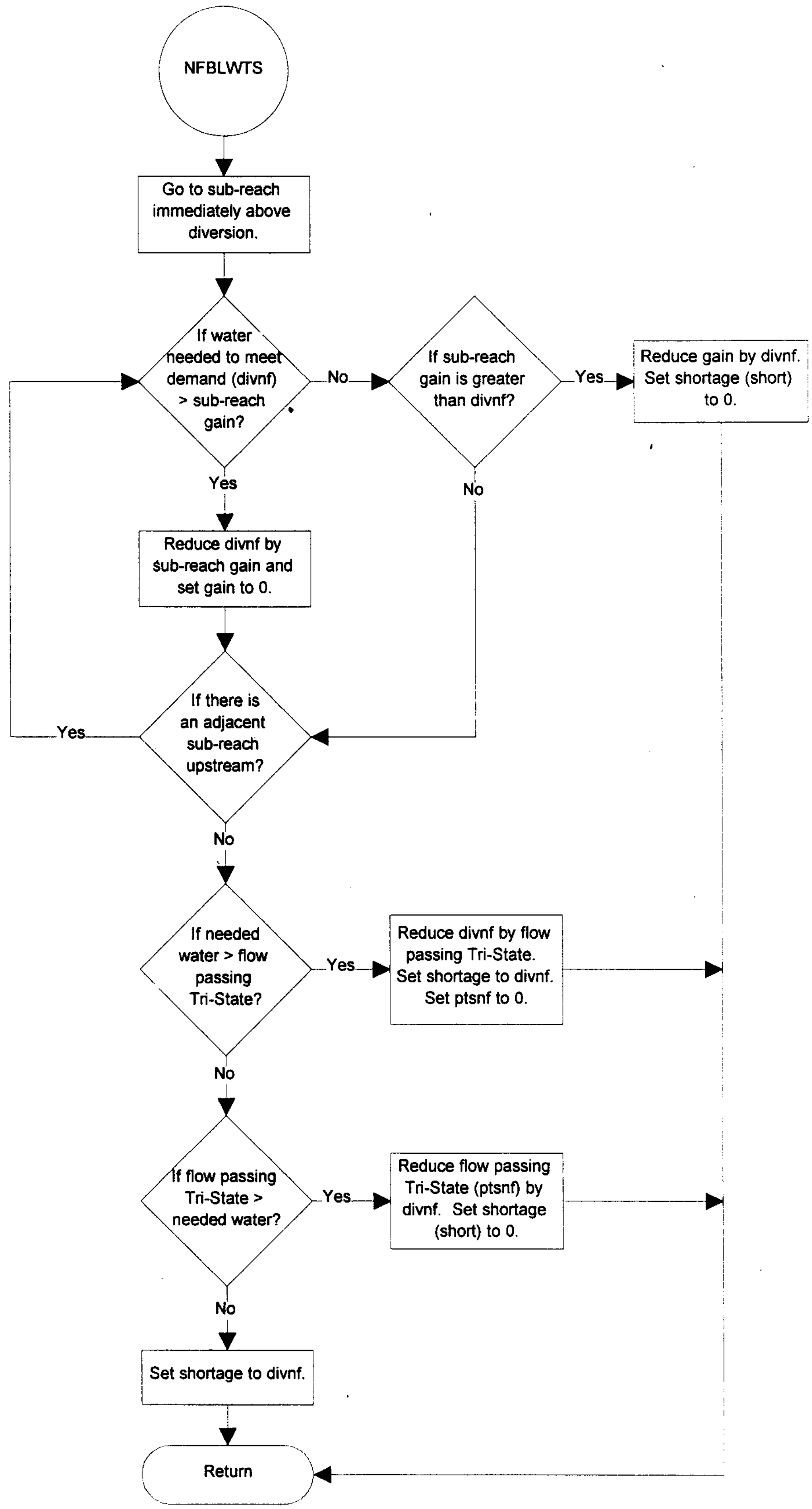
Subroutine PRIORITY



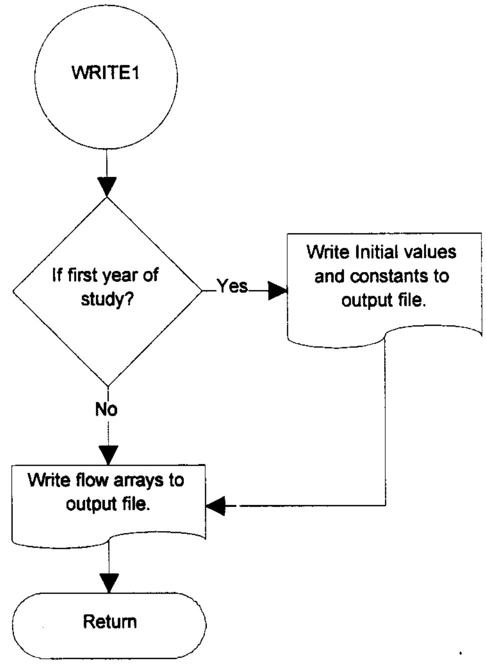
Subroutine PRIORITY



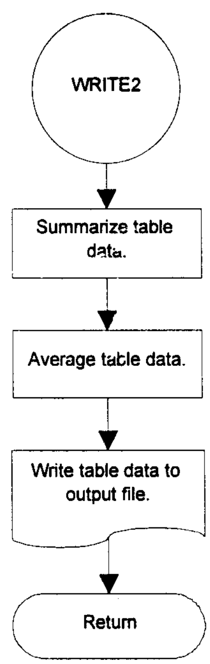
Subroutine NFBLWTS



Subroutine WRITE1



Subroutine WRITE2



APPENDIX F

Input/Output Item Descriptions

Table of Contents

1.0 DICTIONARY OF VARIABLES F-1
1.1 Reservoir Operations F-2
1.1.1 CDATA Items “.RES” Input File F-2
1.1.2 ADATA Items “.RES” Input File F-8
1.1.3 HDATA Items “.RES” Input File F-11
1.1.4 FLOW Items RESOP.LST Output File F-19
1.1.5 TABLE Items RESOP.TAB Output File F-38
1.2 Natural Flow Accounting F-40
1.2.1 CDATA1 Items “.FLO” Input File F-40
1.2.2 ADATA1 Items “.FLO” Input File F-44
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1.0 DICTIONARY OF VARIABLES

Input data for the NPRWUM are divided into three categories; physical reservoir operations, natural flow, and ownership storage. Each category is further separated into three types of data; single, monthly, and month by water year. The power generation subroutines used in the NPRWUM have been adapted from the North Platte River Annual Operating Plan (NPRAOP) model V1.0 dated December 28, 1992, developed by the Reclamation's Great Plains Region Office. These power generation subroutines use relationships in the lookup tables contained in the input file NPRAOP.TBL to calculate power generation. The reader is referred to the comments at the beginning of the NPRAOP.TBL file for further information.

Single data items are constants (i.e., maximum reservoir contents) or flags that direct the operation of the model (i.e., to allow excess-to-ownership storage). The single physical reservoir operations data are cdata items, the single natural flow data are cdata1 items, and the single ownership storage data are cdata2 items. Single items are read from the input data file in a one dimensional array and items are distinguished by a number following the item label (i.e., the first item in the physical operations data file would be cdata(1), the second cdata(2), etc. ...).

Monthly data items change each month but are constant from year to year (i.e., Alcova Reservoir targets). The monthly physical reservoir operations data are adata items, the monthly natural flow data are adata1 items, and the monthly ownership storage data are adata2 items. Monthly items are read from the input data file in a two dimensional array and items are distinguished by two numbers following the item label. The first number is the order in which the item appears in the data set and the second number (J) is the month of the water year (i.e., the first item in the physical operations data file would be adata(1,J), the second adata(2,J), etc. ...).

Month by year data items are different for every month of every year (i.e., monthly diversion amounts). The month by year physical reservoir operations data are hdata items, the month by year natural flow data are hdata1 items, and the month by year ownership storage data are hdata2 items. Month by year items are read from the input data file in a three-dimensional array and items are distinguished by three numbers following the item label. The first number is the order in which the item appears in the data set, the second number (I) is the year, and the third number (J) is the month of the year (i.e., the first item in the physical operations data file would be hdata(1,I,J), the second hdata(2,I,J), etc. ...).

The NPRWUM produces two output files for the physical operations, natural flow, and storage ownership, a ".LST" and ".TAB" output file. The ".LST" files contain the yearly output of a model run listed by station name preceded by the station's monthly values, repeated for the total number of defined stations. The ".TAB" files contain a listing of selected stations and their monthly values organized into tabular format from the beginning of the study to the end. The output files associated with the physical reservoir operations are RESOP.LST and RESOP.TAB. The output files associated with the natural flow are NATFLOW.LST and NATFLOW.TAB. The output files associated with the storage ownership are STOROWN.LST and STOROWN.TAB. Each accounting point is assigned a station name and the monthly output data for each station is assigned to a corresponding two-dimensional flow array in the NPRWUM. The first number identifies the station and the second number (J) is the month of the year (i.e., the first output item in the RESOP.LST file would be flow(1,J), the second flow(2,J), etc. ...).

The input files and associated sample output files for the NPRWUM are contained on the floppy disk included in Appendix H.

1.1 Reservoir Operations

Input files for the physical reservoir operation are designated by the file extension ".RES". For example, the reservoir operation input data are contained in the file BASELINE.RES. Described below are the CDATA, ADATA, and HDATA input items and FLOW and TABLE output items associated with the physical reservoir operation.

1.1.1 CDATA Items ".RES" Input File

1. NFFLAG - Natural Flow Flag (0 = No, 1 = Yes)
This value specifies whether to operate the Natural Flow module of the NPRWUM (1 = yes, 0 = no). The Reservoir Operations module and the Natural Flow module must be run with the same period of record.

2. SOFLAG - Storage Ownership Flag (0 = No, 1 = Yes)
This value specifies whether to operate the Storage Ownership module of the NPRWUM (1 = yes, 0 = no). It is required that the natural flow module also be activated in order to run the Storage Ownership module. All three modules (Reservoir Operations, Natural Flow, Storage Ownership) must use the same period of record.

3. SEMST(1) - Initial Seminoe Reservoir Content, kaf
This is the initial reservoir content, and can be changed as desired by the user.

4. KORTST(1) - Initial Kortes Reservoir Content, kaf
This is the initial reservoir content, and can be changed as desired by the user.

5. PATHST(1) - Initial Pathfinder Res. Content, kaf
This is the initial reservoir content, and can be changed as desired by the user.

6. ALST(1) - Initial Alcova Reservoir Content, kaf
This is the initial reservoir content, and can be changed as desired by the user.

7. GRST(1) - Initial Gray Reef Reservoir Content, kaf
This is the initial reservoir content, and can be changed as desired by the user.

8. GLST(1) - Initial Glendo Reservoir Content, kaf
This is the initial reservoir content, and can be changed as desired by the user.

9. GUST(1) - Initial Guernsey Reservoir Content, kaf
This is the initial reservoir content, and can be changed as desired by the user.

10. ILST(1) - Initial Inland Lakes Content, kaf
This is the initial reservoir content, and can be changed as desired by the user.

11. SEMCAP - Seminoe Reservoir Capacity, kaf
This value is the maximum reservoir capacity based on the most recent area-capacity table.

12. KORTCAP - Kortes Reservoir Capacity, kaf
This value is the maximum reservoir capacity based on the most recent area-capacity table.

13. PATHCAP - Pathfinder Reservoir Capacity, kaf
This value is the maximum reservoir capacity based on the most recent area-capacity table.

14. ALCCAP - Alcova Reservoir Capacity, kaf
This value is the maximum reservoir capacity based on the most recent area-capacity table.

15. GRFCAP - Gray Reef Reservoir Capacity, kaf
This value is the maximum reservoir capacity based on the most recent area-capacity table.

16. GLNCAP - Glendo Reservoir Active Capacity, kaf
This value is the maximum reservoir capacity based on the most recent area-capacity table. Glendo Reservoir flood pool is not included in this.

17. GLNFLD - Glendo Flood Pool Cap, kaf
This value is the maximum Glendo Reservoir Flood Pool Capacity.

18. GURNCAP - Guernsey Reservoir Capacity, kaf
This value is the maximum reservoir capacity based on the most recent area-capacity table.

19. INLKCAP - Inland Lakes Capacity, kaf
This value is the maximum capacity for the Idealized Inland Lakes and is equal the sum of Lake Alice, Little Lake Alice, Lake Winters Creek, and Lake Minatare capacities (74.055 kaf)

20. SEMINST - Seminoe Reservoir Minimum Storage, kaf
This value is the recommended minimum allowable content in the reservoir.

21. KOMINST - Kortes Reservoir Minimum Storage, kaf
This value is the recommended minimum allowable content in the reservoir.

22. PAMINST - Pathfinder Res Minimum Storage, kaf
This value is the recommended minimum allowable content in the reservoir.

23. ALMINST - Alcova Reservoir Minimum Storage, kaf
This value is the recommended minimum allowable content in the reservoir.

24. GRMINST - Gray Reef Reservoir Minimum Storage, kaf
This value is the recommended minimum allowable content in the reservoir.

25. GLMINST - Glendo Reservoir Minimum Storage, kaf
This value is the recommended minimum allowable content in the reservoir.

26. GUMINST - Guernsey Reservoir Minimum Storage, kaf
This value is the recommended minimum allowable content in the reservoir.

27. SEMBNKS - Seminoe-Kortes Bank Storage, %
This value is the percent of the change in storage that enters or is released from the banks of the reservoir.

28. PATHBNKS - Pathfinder-Alcova Bank Storage, %
This value is the percent of the change in storage that enters or is released from the banks of the reservoir.

29. GLENBNKS - Glendo Bank Storage, %
This value is the percent of the change in storage that enters or is released from the banks of the reservoir.

30. GURNBNKS - Guernsey Bank Storage, %
This value is the percent of the change in storage that enters or is released from the banks of the reservoir.

31. INLDBNKS - Inland Lakes Bank Storage, %
This value is the percent of the change in storage that enters or is released from the banks of the reservoir.

32. KORMIN - Minimum Flow Kortes - Pathfinder, cfs
This value is the required minimum flow below Kortes Reservoir.

33. KRTLWTRG - Low Kortes Outflow Trigger, kaf
This value is the low trigger for the winter release from Kortes Reservoir. If the Seminoe Reservoir Storage falls below this amount, the low Kortes outflow (adata1(6)) will be released.

34. KRTHITRG - High Kortes Outflow Trigger, kaf
This value is the high trigger for the winter release from Kortes Reservoir. If the Seminoe Reservoir Storage is above this amount, the high Kortes outflow (adata1(8)) will be released.

35. BALMIN - Min Sem Stor for Path/Sem Bal, kaf
This value is the minimum content in Seminoe Reservoir below which the contents of Seminoe and Pathfinder Reservoirs will be distributed equally between the reservoirs if possible.

36. KORTURMAX - Max Kortes Turbine Capacity, kaf
This value is the maximum discharge that can be made at Kortes Reservoir through the turbines.

37. CITYTRIG - City of Casper Delivery Flag (0 = separate, 1 = both)
This flag in combination with the FLAG TO OPERATE PATHFINDER ENLARGEMENT #1 OWN (cdata2(36)) controls the operation of the City of Casper storage contracts from Kendrick and the enlarged Pathfinder accounts. The table below shows the possible flag settings and the associated model operation performed.

cdata(37)	cdata2(36)	Operation Performed
0	1	Operate only the City of Casper's demand from the enlarged Pathfinder #1 Ownership. City of Casper's demand from Kendrick Ownership set to zero (0). This setting also allows the 7000 af contract for municipal water in Kendrick to be used to offset shortages from the Pathfinder #1 Ownership.
1	1	Operate both City of Casper's demand from the enlarged Pathfinder #1 Ownership and the 7000 af contract from the Kendrick Ownership. The accounts are operated independently of one another under this condition.
1	0	Operate only the City of Casper's demand from the Kendrick Ownership. City of Casper's demand from enlarged Pathfinder #1 Ownership set to zero (0).
0	0	Operate only the City of Casper's demand from the Kendrick Ownership. City of Casper's demand from enlarged Pathfinder #1 Ownership set to zero (0).

38. PTHOUTCP - Fremont Canyon Discharge Capacity, cfs
The maximum discharge capacity for Fremont Canyon power plant.

39. GRFOUT - Gray Reef Min Outflow, cfs
This value is the minimum Gray Reef outflow.

40. GLPPTRG - Glendo Power Pool Target, kaf
This value is the amount of restorage for water used to generate power during the winter months.

41. MNAVSS - Min Avg System Storage, kaf
This value is the minimum average system storage (total storage in Seminoe, Kortes, Pathfinder, Alcova, and Gray Reef Reservoirs for September 30) used to determine the Gray Reef outflow in the winter months, if CDATA(48) is set to one (1). The NPRWUM evaluates the total system storage for September at the beginning of the new water year in October and if the system storage is below the minimum value set by the model user, the NPRWUM will release the base Gray Reef Reservoir outflow (CDATA(44)) during the winter.

42. LWAVSS - Low Avg system Storage, kaf
This value is the low average system storage (total storage in Seminoe, Kortes, Pathfinder, Alcova, and Gray Reef Reservoirs for September 30) used to determine the Gray Reef outflow in the winter months, if CDATA(48) is set to one (1). The NPRWUM evaluates the total system storage for September at the beginning of the new water year in October and if the system storage is between the minimum and low system storage values set by the model user, the NPRWUM will release the low Gray Reef Reservoir outflow (CDATA(45)) during the winter.

43. MDAVSS - Med Avg System Storage, kaf
This value is the medium average system storage (total storage in Seminoe, Kortes, Pathfinder, Alcova, and Gray Reef Reservoirs for September 30) used to determine the Gray Reef outflow in the winter months, if CDATA(48) is set to one (1). The NPRWUM evaluates the total system storage for September at the beginning of the new water year in October and if the system storage is between the low and medium system storage values set by the model user, the NPRWUM will release the average Gray Reef Reservoir outflow (CDATA(46)) during the winter. If the system storage is greater than the medium system storage set by the model user, the NPRWUM will release the high Gray Reef Reservoir outflow (CDATA(47)) during the winter months.

44. MNGRREL - Base Gray Reef Release, cfs
This value is the base Gray Reef Reservoir winter outflow. It is used by the NPRWUM for the winter Gray Reef Reservoir outflow if CDATA(48) equals one (1) and the total September system storage above Gray Reef Dam is less than CDATA(41).

45. LWGRREL - Low Gray Reef Release, cfs
This value is the low Gray Reef Reservoir winter outflow. It is used by the NPRWUM for the winter Gray Reef Reservoir outflow if CDATA(48) equals one (1) and the total September system storage above Gray Reef Dam is between CDATA(41) and CDATA(42).

46. MDGRREL - Avg Gray Reef Release, cfs
This value is the average Gray Reef Reservoir winter outflow. It is used by the NPRWUM for the winter Gray Reef Reservoir outflow if CDATA(48) equals one (1) and the total September system storage above Gray Reef Dam is between CDATA(42) and CDATA(43).

47. HIGRREL - High Gray Reef Release, cfs
This value is the high Gray Reef Reservoir winter outflow. It is used by the NPRWUM for the winter Gray Reef Reservoir outflow if CDATA(48) equals one (1) and the total September system storage above Gray Reef Dam is greater than CDATA(43).

48. ISTFLG - Storage Zone Flag (0 = No, 1 = Yes)
This is the flag used to tell the NPRWUM to set the Gray Reef Reservoir winter outflow based on the minimum, low, or medium September total system storage above Gray Reef Dam. If this flag is turned "off", set to zero (0), the NPRWUM uses the Gray Reef minimum outflow CDATA(39) to control the winter Gray Reef releases.

49. GLNRKMAX - Channel Flow to Flag-Glenrock, cfs
This value is the flow at which the model user is notified via the message file that the flow in the North Platte River is nearing the flood stage. This value is set at 5000 cfs.

50. GLNMAX - Maximum Glendo Outflow, cfs
This value is the maximum discharge through the Glendo outlet works.

51. KORTARG - Kortes Reservoir Target, kaf
This value is the Kortes Reservoir EOM content.

52. GRTARG - Gray Reef Reservoir Target, kaf
This value is the Gray Reef Reservoir EOM content.

53. BGNGLTRG - Month to Begin Assess Glendo Targ
This value is the month to begin assessing the Glendo Targets.

54. PKGLTRG - Month to Max (reach) Glendo Targ
This value is the month in which the maximum target at Glendo is to be reached.

55. ENDGLTRG - Month to Reach Min Glendo Targ
This value is the month in which the minimum target at Glendo is to be reached.

56. PCTGLTRG - Percent of Glendo Targ to Achieve
This value is the percent of the Glendo target the model user wants to be within.

57. MAXGLTRG - Maximum Glendo Target, kaf
This value is the maximum Glendo Target and should not exceed the active capacity of 517.0 kaf.

58. MINGLTRG - Minimum Glendo Target, kaf
This value is the minimum Glendo Target and must be greater than the Glendo Power Pool content of 63.1 kaf.

59. IPMFLAG - Main Cnl Del % Interstate (0 = No, 1 = Yes)
This value is a flag used to tell the NPRWUM to calculate the amount of water delivered to the Pathfinder Main Canal for irrigation as a percentage of the Pathfinder (Interstate) Diversion. The factors are located in ADATA(24,j).

60. XBENU - Non-beneficial Use Factor
This is the percentage of diversion that is assumed lost to non-beneficial uses, namely evaporation.

61. Not Used - Cdata Item Not Used

62. Not Used - Cdata Item Not Used

63. Not Used - Cdata Item Not Used

64. Not Used - Cdata Item Not Used

65. TRNSR2 - Transmissivity-Reach No. 2, gpd/ft
The average transmissivity used for Reach No. 2.

66. TRNSR3 - Transmissivity-Reach No. 3, gpd/ft
The average transmissivity used for Reach No. 3.

67. Not Used - Cdata Item Not Used

68. Not Used - Cdata Item Not Used

69. Not Used - Cdata Item Not Used

70.REHWKP - Width-Reach Kendrick Project, ft
The Reach width used for the Kendrick Project

71. RCHWR2 - Width-Reach No. 2, ft
The reach width used for Reach No. 2.

72. RCHWR3 - Width-Reach No. 3, ft
The reach width used for Reach No. 3.

73. STOCOEF - Storage Coefficient
Coefficient of storage used for the North Platte River Basin for the river below Guernsey.

74. FACCNP - Loss Factor CNPP&ID
This value is the conveyance loss factor charged to the CNPP&ID deliveries.
The amount of the CNPP&ID delivery that is lost during conveyance is equal to the CNPP&ID delivery times the loss Factor.

75. TSCAP - Tri-State Canal Capacity, cfs
This value is the maximum capacity of the Tri-State canal by month during the irrigation season.

76. GRCAP - Grattan Ditch Capacity, cfs
This value is the maximum estimated capacity of the Grattan Ditch.

77. NPCAP - N. Platte Ditch Capacity, cfs
This value is the maximum estimated capacity of the North Platte Ditch.

78. RRCAP - Rock Ranch Capacity, cfs
This value is the maximum estimated capacity of the Rock Ranch Ditch.

79. PFCAP - Pratt-Ferris Capacity, cfs
This value is the maximum estimated capacity of the Pratt-Ferris Ditch.

80. BUCAP - Burbank Ditch Capacity, cfs
This value is the maximum estimated capacity of the Burbank Ditch.

81. TOCAP - Torrington Capacity, cfs
This value is the maximum estimated capacity of the Torrington Ditch.

82. LUCAP - Lucerne Ditch Capacity, cfs
This value is the maximum estimated capacity of the Lucerne Ditch.

83. NACAP - Narrows Ditch Capacity, cfs
This value is the maximum estimated capacity of the Narrows Ditch.

84. MGCAP - Mitchell-Gering Capacity, cfs
This value is the maximum estimated capacity of the Mitchell-Gering Canal.

85. ICCAP - Interstate Canal Capacity, cfs
This value is the maximum capacity of the Interstate Canal.

86. FLCAP - Ft. Laramie Canal Capacity, cfs
This value is the maximum capacity of the Fort Laramie Canal.

87. CACAP - Casper Canal Capacity, cfs
This value is the maximum capacity of the Casper Canal.

88. BRECHR2 - Init Cond Recharge-Reach No. 2, kaf/yr
The amount of recharge from irrigation estimated to exist in Reach No. 2 area when the model run begins.

89. BRECHR3 - Init Cond Recharge-Reach No. 3, kaf/yr
The amount of recharge from irrigation estimated to exist in Reach No. 3 area when the model run begins.

90. Not Used - Cdata Item Not Used

91.IFD2ETO - Credit flood water to eto (1 = yes, 0 = no)

92. IBNKFLG - Flag to Operate Bank Storage (1 = Yes, 0 = No)
This flag controls the bank storage seepage function in the model. If IBNKFLG is set to one (1), the model calculates a reservoir's gain/loss to be the bank storage factor (cdata(27-31)) times the change in reservoir content plus the reservoir's seepage (hdata(7-11,i,j)). When IBNKFLAG is set to zero (0), the model does not account for bank storage or seepage for the reservoirs. If only the reservoir gain/loss is wanted, set back storage factors to zero, and enter reservoir gain/losses in hdata(7-11,i,j).

1.1.2 ADATA Items ".RES" Input File

1. WHUTFAC - Guernsey to Whalen Util Factor
These values are factors greater than or equal to zero (0.0) and less than or equal to one (1.0) entered by the model user to control the amount of the Guernsey to Whalen reach gain that is used to meet natural flow demands below between Guernsey Dam and Tri-State Diversion Dam. A value of less than one (1.0) reduces the amount of the gain used to meet the natural flow. These values are only used during the irrigation season.

2. TSUTFAC - Whalen to Tri-State Util Factor
These values are factors greater than or equal to zero (0.0) and less than or equal to one (1.0) entered by the model user to control the amount of the Whalen to Tri-State reach gain that is used to meet natural flow demands below between Guernsey Dam and Tri-State Diversion Dam. A value of less than one (1.0) reduces the amount of the gain used to meet the natural flow. These values are only used during the irrigation season.

3. GLSEEP - Glendo Reservoir seepage, kaf
The Glendo Reservoir seepage is the amount of water that is seeped into the river below Glendo Reservoir during the non-irrigation season (October through April).

4. GUSEEP - Guernsey Reservoir seepage, kaf
The Guernsey Reservoir seepage is the amount of water that is seeped into the river below Guernsey Reservoir.

5. ADATA(5,j) - Min Expected Inflow Seminoe Res, kaf
These values are the 1993-94 probable minimum inflows for the Seminoe Reservoir. These estimated minimum inflows, October through April, are used to establish minimum winter flows below Kortes and Gray Reef Reservoirs.

6. ADATA(6,j) - Min Expect Inflow Sweetwater Riv, kaf
These values are the 1993-94 probable minimum inflows from the Sweetwater River. These estimated minimum inflows, October through April, are used to establish minimum winter flows below Kortes and Gray Reef Reservoirs.

7. ADATA(7,j) - Min Expected Kortes to Path Gain, kaf
These values are the 1993-94 probable minimum inflows for the Kortes to Pathfinder reach gain. These estimated minimum inflows, October through April, are used to establish minimum winter flows below Kortes and Gray Reef Reservoirs.

8. PROBGAIN - Min Expected Alcova to Glendo Gain, kaf
These values are the 1993-94 probable minimum inflows for the Alcova to Glendo reach gain. These estimated minimum inflows, October through April, are used to establish minimum winter flows below Gray Reef Reservoirs.

9. PATHMIN - Pathfinder Dam Outflow Release, cfs
These values are the releases from the Pathfinder Dam Outlet works. These releases, if any, enter the river directly below the dam and bypass the Fremont Canyon Powerplant.

10. GLENMIN - Glendo Dam Low Flow Release, cfs
These values are the releases from the Glendo Dam Low Flow Outlet works. These releases enter the river directly below the dam and bypass the Glendo Powerplant. The Low Flow Outlet is capable of releasing 25 - 40 cfs of water. Currently the release is set at 25 cfs.

11. GUEOMT - Guernsey Reservoir EOM Target, kaf
These values are the end-of-month targets for Guernsey Reservoir. The NPRWUM does not use EOM targets for October through March and these values should be left at zero (0). Guernsey Reservoir inflow during this period consists of the Glendo to Guernsey Reach gain, Low Flow Releases from Glendo Dam, and water moved to Guernsey Reservoir in anticipation of Inland Lakes Deliveries. During April through September, the NPRWUM will keep Guernsey Reservoir at or above the EOM targets set by the model user.

12. ALEOMT - Alcova Reservoir EOM Target, kaf
These values are the end-of-month storage content for the Alcova Reservoir. These targets reflect the winter and summer operating contents.

13. SEPEVP - Seminoe Res Evaporation Factor, ft
These values represent the average Seminoe Reservoir evaporation factors in feet as recorded by the USBR. The Seminoe evaporation data is typically only operated during the irrigation season and is used to calculate the Seminoe and Kortes Reservoir evaporation. When not available the Pathfinder evaporation data is used to calculate the Seminoe and Kortes Reservoir evaporation. The 0.7 pan coefficient is already included in the data.

14. PAPEV2 - Pathfinder Res Evaporation Factor, ft
These values represent the average Pathfinder evaporation factors in feet as recorded and documented by the USBR. The Pathfinder evaporation data is used to calculate the Gray Reef, Alcova, and Pathfinder Reservoir evaporation. In addition, the data is used to calculate the Kortes and Seminoe Reservoir evaporation when the Seminoe evaporation data is not available. The 0.7 pan coefficient is already included in the data.

15. GLPEVP - Glendo Res Evaporation Factor, ft
These values represent the average Glendo evaporation factors in feet as recorded by the USBR. The Glendo pan evaporation data is used to calculate the Glendo Reservoir evaporation when data is available. Typically, the is pan only operated during the irrigation season. When the Glendo pan is not operated, the Whalen pan evaporation data is used to calculate the Glendo Reservoir evaporation. The 0.7 pan coefficient is already included in the data.

16. WHPEVP - Whalen Evaporation Factors, ft
These values represent the average Whalen evaporation factors in feet as recorded by the USBR. The Whalen pan evaporation data is used to calculate the Guernsey Reservoir evaporation and Glendo Reservoir evaporation (when the Glendo pan is not available). The 0.7 pan coefficient is already included in the data.

17. PSEAVF - Seminoe Turbine Availability Factor
Turbine availability is the percent of time in a month in which the powerplant is available for generation. Currently these factors are set to one (1.0).

18. PKOAVF -Kortes Turbine Availability Factor
Turbine availability is the percent of time in a month in which the powerplant is available for generation. Currently these factors are set to one (1.0).

19. PPFAVF -Fremont Turbine Availability Factor
Turbine availability is the percent of time in a month in which the powerplant is available for generation. Currently these factors are set to one (1.0).

20. PALAVF -Alcova Turbine Availability Factor
Turbine availability is the percent of time in a month in which the powerplant is available for generation. Currently these factors are set to one (1.0).

21. PGLAVF -Glendo Turbine Availability Factor
Turbine availability is the percent of time in a month in which the powerplant is available for generation. Currently these factors are set to one (1.0).

22. PGUAVF -Guernsey Turbine Availability Factor
Turbine availability is the percent of time in a month in which the powerplant is available for generation. Currently these factors are set to one (1.0).

23. P2MAINC - Fraction of Path Div to Main Canal
These values are used to determine the amount of the total Pathfinder diversion that is used to irrigate lands above the Inland Lakes. These values are not used unless the flag (CDATA(59)) to estimate Pathfinder Main Canal Deliveries as a percentage of the total Pathfinder diversion is turned "on" (set to one (1)). When the flag is "off", the Pathfinder Main Canal deliveries are read from HDATA(19,i,j).

24. P2LOSNI - Fraction of Loss for IL Delivery
These values are used to determine the amount of water delivered to the Inland Lakes in the non-irrigation season lost to canal seepage.

25. P2SRUNOF - Percent of Diversion to Surface Runoff
These values are used by the NPRWUM to quantify of the delivery contributing to surface runoff.

26. KORTLOW - Low Kortes Winter Outflow, cfs
This value is the flow maintained below Kortes reservoir if the Seminoe Reservoir Storage falls below the low trigger (cdata(33)).

27. KORTMED - Median Kortes Winter Outflow, cfs
This value is the flow maintained below Kortes reservoir if the Seminoe Reservoir Storage is not below the low Kortes winter outflow trigger (cdata(33)) or above the high Kortes winter outflow trigger (cdata(34)).

28. KORTHIGH - High Kortes Winter Outflow, cfs
This value is the flow maintained below Kortes reservoir if the Seminoe Reservoir Storage is above the high Kortes winter outflow trigger (cdata(34)).

29. BALPRCNT - Path/Sem Storage Distribution, %
This value is the decimal percentage of the distribution of water between Seminoe and Pathfinder Reservoirs during April through September. A value of 0.6 means that total storage in Seminoe and Pathfinder Reservoirs will be roughly maintained at 60 % in Seminoe Reservoir and 40 % in Pathfinder Reservoir under normal conditions.

30. ETODEL - Glendo ETO Delivery, kaf
This array is the monthly deliveries from the Glendo ETO account as entered by the model user. These monthly releases from the Glendo ETO account are made only if the GLTEACC flag (CDATA2(17)) is equal to one (1). If sufficient water does not exist in the Glendo ETO account to provide the requested release, the requested release is set equal to the remaining water in the account and delivered.

31. CITYDEL - City of Casper Demand on enlarged Pathfinder #1 Ownership, kaf
This array is the monthly City of Casper deliveries from the enlarged Pathfinder #1 Ownership as entered by the model user. If sufficient water does not exist, the requested release is set equal to the remaining water in the account and delivered.

32. PENVDEL - Demand on enlarged Pathfinder #2 Ownership, kaf
This array is the monthly deliveries from the enlarged Pathfinder #2 Ownership as entered by the model user. If sufficient water does not exist, the requested release is set equal to the remaining water in the account and delivered.

33. KENDCITY - City of Casper Demand on Kendrick Ownership
This array is the monthly City of Casper deliveries from the Kendrick Ownership as entered by the model user. If sufficient water does not exist, the requested release is set equal to the remaining water in the account and delivered.

1.1.3 HDATA Items ".RES" Input File

1. NPABSEM - North Platte River above Seminoe, kaf
This is the North Platte River above Seminoe Reservoir, near Sinclair (Parco) gaging station (USGS 06630000).

2. MBABSEM - Medicine Bow River above Seminoe, kaf
This is the Medicine Bow River above Seminoe Reservoir, near Hanna gaging station (USGS 06635000).

3. SWEET - Sweetwater River Inflow, kaf
This is the inflows to Pathfinder Reservoir from the Sweetwater River.

4. DRCKGLR - Deer Ck bl Millar Wasteway at Glenrock (kaf)
This is the Deer Creek below Millar wasteway at Glenrock gaging station (USGS 06646600).

5. LARAME - Laramie River Inflow, kaf
This is the Laramie River inflows to the North Platte River.

6. BLUECK - Blue Creek Inflow, kaf
This is the Blue Creek inflow to the North Platte River.

7. SEMSEEP - Seminoe Reservoir Seep, kaf
This is the Seminoe Reservoir seepage.

8. PATHSEEP - Pathfinder Reservoir Seep, kaf
This is the Pathfinder Reservoir seepage.

9. GLENSEEP - Glendo Reservoir Seep, kaf
This is the Glendo Reservoir seepage.

10. GURNSEEP - Guernsey Reservoir Seep, kaf
This is the Guernsey Reservoir seepage.

11. INLDSEEP - Idealized Inland Lakes Seep, kaf
This is the Idealized Inland Lakes Reservoir seepage.

12. KPAGN - Kortes-Pathfinder Gain, kaf
This data array is the Kortes to Pathfinder reach gain which does not include the Sweetwater River's inflow to Pathfinder Reservoir.

13. ALGLRKGN - Alcova-Glenrock Gain, kaf
These values are the reach gains between the Gray Reef Reservoir and Glenrock. The Alcova to Glenrock reach gain was computed by taking the flow at Glenrock and subtracting the Deer Creek inflow and the flow in the river at Alcova.

14. GLRKGLGN - Glenrock-Glendo Gain, kaf
These values are the reach gains between the Glenrock and Glendo Reservoir. These gains are equal to the Alcova to Orin reach gain minus the Alcova to Glenrock reach Gain minus Deer Creek. The Alcova to Glendo reach gain is equal to the flow at Orin minus 98% of the flow at Alcova in October through April and the flow at Orin minus the flow at Alcova in May through September.

15. GLGUGN - Glendo to Guernsey gain, kaf
The Glendo to Guernsey gain is the gain or loss in the reach of the river between Glendo and Guernsey Reservoirs. It is calculated as the Guernsey Reservoir computed inflow minus the Glendo Reservoir outflow.

16. GUWHGN - Guernsey to Whalen Dam Gain, kaf
These values are the reach gains between Guernsey Reservoir and the Whalen Diversion Dam.

17. WHTSGN - Whalen to Tri-State Gain, kaf
This is the Whalen to Tri-State gain as input into the data file by the model user.

18. TSLLGN - Tri-State to Lewellen Gain, kaf
This is the Tri-State to Lewellen gain as input into the data file by the model user.

19. PMAINC - Pathfinder Main Canal Del, kaf
This data set is the amount of the Interstate (Pathfinder) diversion that was used to irrigate Pathfinder lands above the Inland Lakes in the irrigation season.

20. CNPDEL - CNPP&ID WOPT Delivery, kaf
(WOPT = water order passing Tri-State) This hdata set is the water orders for storage passing Tri-State for CNPP&ID.

21. CNSDEL - Central WOPT Delivery, kaf
(WOPT = water order passing Tri-State) This hdata set is the water orders for storage passing Tri-State for Central. This data set has been adjusted to include the losses charged below Tri-State for the delivery of storage water.

22. BCSDEL - Browns Creek WOPT Del, kaf
(WOPT = water order passing Tri-State) This hdata set is the water orders for storage passing Tri-State for Tri-State Canal.

23. BESDEL - Beerline WOPT Delivery, kaf
(WOPT = water order passing Tri-State) This hdata set is the water orders for storage passing Tri-State for Beerline. This data set has been adjusted to include the losses charged below Tri-State for the delivery of storage water.

24. CRSDEL - Chimney Rock WOPT Delivery, kaf
(WOPT = water order passing Tri-State) This hdata set is the water orders for storage passing Tri-State for Chimney Rock. This data set has been adjusted to include the losses charged below Tri-State for the delivery of storage water.

25. CCKDEL - Corn Creek Delivery, kaf
This hdata set is the requested Corn Creek Deliveries. At this time, the Corn Creek diversion is not active and has been set to zero (0).

26. BRSDEL - Bridgeport WOPT Delivery, kaf
(WOPT = water order passing Tri-State) This hdata set is the water orders for storage passing Tri-State for Bridgeport. This data set has been adjusted to include the losses charged below Tri-State for the delivery of storage water.

27. ENSDEL - Enterprise WOPT Delivery, kaf
(WOPT = water order passing Tri-State) This hdata set is the water orders for storage passing Tri-State for Enterprise. This data set has been adjusted to include the losses charged below Tri-State for the delivery of storage water.

28. CADEL - Casper Canal Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

29. Not Used - HDATA Item Not Used
This row is not used and has been set to zero.

30. LIDEL - Lingle Canal Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

31. HIDEL - Hill Canal Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

32. INDEL - Wyoming Laterals Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set. NOTE: The Wyoming Laterals deliveries are not identified separately in the Compiled Water Records from 1941-67. They appear tobe included with the Interstate (Pathfinder) deliveries and have been set to zero for the period of 1941-67 in this input file.

33. IPDEL - Interstate (Pathfinder) Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

34. ILDEL - Inland Lakes Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

35. INLDEL - Demands on Inland Lakes, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

36. WMDEL - Wright and Murphy Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

37. GODEL - Ft. Laramie (Goshen) Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

38. GFDEL - Gering-Ft. Laramie Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

39. BUDEL - Burbank Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

40. LUDEL - Lucerne Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

41. GRDEL - Grattan Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

42. TODEL - Torrington Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

43. RRDEL - Rock Ranch Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

44. NPDEL - North Platte Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

45. NADEL - Narrows Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

46. PFDEL - Pratt-Ferris Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

47. FCHDEL - French Canal Delivery, kaf

This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set. The French Canal is not active, it ceased diverting from the North Platte River in 1953.

48. MIDEL - Mitchell Delivery, kaf

This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

49. GEDEL - Gering Delivery, kaf

This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

50. FCDEL - Farmers Canal Delivery, kaf

This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

51. NPTDEL - Northport Delivery, kaf

This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

52. RADEL - Ramshorn Delivery, kaf

This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

53. ENDEL - Enterprise Delivery, kaf

This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

54. WIDEL - Winters Creek Delivery, kaf

This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

55. CNDEL - Central Canal Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

56. MINDEL - Minatare Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

57. CASDEL - Castle Rock Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

58. NMIDEL - Nine Mile Canal Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

59. SHLDEL - Short Line Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

60. CRDEL - Chimney Rock Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

61. BRDEL - Bridgeport (Belmont) Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

62. EMPDEL - Empire Canal Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

63. TSDRNDL - Tri-State Delivery from Drains, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

64. ENDRNDL - Enterprise Delivery from Drains, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

65. NPDRNDL - Northport Delivery from Drains, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

66. WIDRNDL - Winters Creek Delivery from Drains, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

67. ALDRNDL - Alliance Delivery from Drains, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices.

68. BCDEL - Browns Creek Delivery, kaf
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

69. BLDEL - Beerline delivery, kaf (kaf)
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

70. LISDEL - Lisco delivery, kaf (kaf)
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

71. MODEL - Midland-Overland delivery, kaf (kaf)
This hdata set may be adjusted by the user to simulate a change in irrigation delivery, as opposed to meeting the historic irrigation demand. A change in irrigation delivery may result from allocations, conservation measures (canal lining, etc.), an expansion of irrigated acreage, or change in crop practices. The historic irrigation demands are contained in another hdata set.

1.1.4 FLOW Items RESOP.LST Output File

1. NPABSEM - North Platte River above Seminoe, kaf
This is the North Platte River above Seminoe Reservoir, near Sinclair (Parco) gaging station (USGS 06630000).

2. MBABSEM - Medicine Bow River above Seminoe, kaf
This is the Medicine Bow River above Seminoe Reservoir, near Hanna gaging station (USGS 06635000).

3. SEGL - Seminoe Bank Stor, Seep, kaf
This row is the combined affects of the Seminoe Reservoir bank storage and seepage.

4. SEMIN - Seminoe Reservoir Inflow, kaf
Seminoe Reservoir inflow is equal to the sum of the North Platte River above Seminoe Reservoir and the Medicine Bow River near Hanna gaging stations (NPABSEM + MBABSEM).

5. SEMEV(j) - Seminoe Reservoir Evaporation, kaf
This row is the monthly evaporation for Seminoe Reservoir.

6. TKORIN - Seminoe Res Outflow (Kortes inflow), kaf
Seminoe Reservoir outflow is equal to the Kortes Reservoir inflow.

7. SEMST(j+1) - Seminoe Reservoir EOM Storage, kaf
This row is the Seminoe Reservoir end-of-month storage and is equal to the previous end-of-month storage plus Seminoe Reservoir inflow plus any the bank storage and seepage minus evaporation minus Seminoe Reservoir outflow.

8. SEMACON - Average EOM Content, kaf
This row is the Seminoe Reservoir Average EOM content and is the sum of the previous EOM content and the current EOM divided by two (2).

9. SEMELEV(j+1) - Ave Seminoe EOM Elevation, ft
This row is the average end-of-month water surface elevation for Seminoe Reservoir based upon the average end-of-month content.

10. PSEAVF - Availability Factor
This row is the availability factor for the Seminoe Powerplant. The availability factors are set by the model user and tell the NPRWUM what portion of the month all the turbines were available for power generation. Hence, a factor of one indicates the turbines were available for power generation 100 % of the time.

11. PSEMAX - Seminoe Total Turbine Q Capacity, kaf
This value is the total powerplant volumetric discharge capacity for the month. It is obtained from the NPRAOP.TBL file, which the NPRWUM uses to find the maximum total turbine release using the average EOM content.

12. PSETUR - Seminoe Total Turbine Release, kaf
This value is the calculated total volume of water discharged through the powerplant for the month. It is equal to the smaller value of the total turbine capacity or the reservoir outflow.

13. SEMBYPS - Seminoe Turbine Bypass, kaf
This is the amount of flow which bypassed the powerplant and was released via the outlet works and/or spillway. The bypass is equal to the total calculated outflow minus the calculated turbine release. The bypass is routed through the outlet works first, up to capacity, then the over the spillway.

14. SEMOREL - Seminoe Res Outlet Release, kaf
This is the volume of water which bypassed the turbines and was released through the outlet works.

15. SEMSPIL - Seminoe Res Spillway Release, kaf
This is the volume of water which bypassed the turbines and outlet works (if any), and was released over the spillway.

16. PSEMW - Seminoe Generation Capacity (power), MW
This row is not used at this time.

17. PSEGEN - Seminoe Power Generation, GWh
The calculated gross generation, in Megawatt-hours, is calculate using the lookup tables in the NPRAOP.TBL file using the average EOM content to find the generation factor in Mwh/af. The total turbine release (kaf) is multiplied by generation factor (Mwh/af) to give the generation for the month in GWH.

18. TKORIN - Total Kortes Reservoir Inflow, kaf
This row is the total Kortes Reservoir inflow and is controlled by kortes outflow minimum flow releases, spills from Seminoe Reservoir, and maintaining a distribution of water stored in Pathfinder and Seminoe Reservoirs as set by the model user (CDATA(37)) such that Kortes end-of-month storage remains between the minimum and maximum storage capacities.

19. KOREV(j) - Kortes Reservoir Evaporation, kaf
This row is the monthly evaporation for Kortes Reservoir.

20. TKOROUT - Total Kortes Reservoir Outflow, kaf
This row is the total Kortes Reservoir outflow.

21. KORTST(j+1) - Kortes Reservoir EOM Storage, kaf
Kortes Reservoir end-of-month content is equal to the previous end-of-month content plus the Kortes inflow minus Kortes evaporation for the month minus the Kortes outflow.

22. KORACON - Average EOM Content, kaf
This row is the Kortes Reservoir Average EOM content and is the sum of the previous EOM content and the current EOM divided by two (2).

23. KRTELEV(j+1) - Average EOM Elevation, ft
This row is the average end-of-month water surface elevation for the Kortes Reservoir based upon the average end-of-month content in the reservoir.

24. KORAVF - Availability Factor
This row is the availability factor for the Kortes Powerplant. The availability factors are set by the model user and tell the NPRWUM what portion of the month all the turbines were available for power generation. Hence, a factor of one indicates the turbines were available for power generation 100 % of the time.

25. PKOMAX - Kortes Total Turbine Q Capacity, kaf
This value is the total powerplant volumetric discharge capacity for the month. It is obtained from the NPRAOP.TBL file, which the NPRWUM uses to find the maximum total turbine release using the average EOM content.

26. PKOTUR - Kortes Total Turbine Release, kaf
This value is the calculated total volume of water discharged through the powerplant for the month. It is equal to the smaller value of the total turbine capacity or the reservoir outflow.

27. KORBYPS - Kortes Turbine Bypass, kaf
This is the amount of flow which bypassed the powerplant and was released via the spillway. The bypass is equal to the total calculated outflow minus the calculated turbine release.

28. KORSPIL - Kortes Spillway Release, kaf
This is the volume of water which bypassed the turbines and was released over the spillway.

29. PKOMW - Seminoe Generation Capacity (power), MW
This row is not used at this time.

30. PKOGEN - Kortes Power Generation, GWh
The calculated gross generation, in Megawatt-hours, is calculate using the lookup tables in the NPRAOP.TBL file using the average EOM content to find the generation factor in Mwh/af. The total turbine release (kaf) is multiplied by generation factor (Mwh/af) to give the generation for the month in GWH.

31. PFGL - Pathfinder Bank Storage Seepage, kaf
This row is the combined affects of the Pathfinder Reservoir bank storage and seepage.

32. KPAGN - Kortes-Pathfinder Gain, kaf
This data array is the Kortes to Pathfinder reach gain which does not include the Sweetwater River's inflow to Pathfinder Reservoir.

33. SWEET - Sweetwater River Inflow, kaf
This row is the inflows to Pathfinder Reservoir from the Sweetwater River.

34. TPTHIN - Total Pathfinder Inflow, kaf
Total Pathfinder Reservoir inflow is equal to the sum of the Kortes Reservoir outflow, the Kortes to Pathfinder gain, the Sweetwater River inflow, and the Pathfinder bank storage and seepage.

35. PTHEVAP(j) - Pathfinder Reservoir Evaporation, kaf
This row is the monthly evaporation for Pathfinder Reservoir.

36. ALCIN(j) - Pathfinder Reservoir Outflow, kaf
This is the total Pathfinder Reservoir outflow and is also equal to the Alcova Reservoir inflow.

37. PATHST(j+1) - Pathfinder Reservoir EOM Storage, kaf
The Pathfinder Reservoir end-of-month content is equal to the previous end-of-month content plus the Pathfinder Reservoir inflow minus the Pathfinder evaporation minus the Pathfinder outflow.

38. PTHACON - Average EOM Content, kaf
This row is the Pathfinder Reservoir average EOM content and is the sum of the previous EOM content and the current EOM divided by two (2).

39. PTHELEV(j+1) - Ave Pathfinder EOM Elevation, ft
This row is the average end-of-month water surface elevation for Pathfinder Reservoir based upon the average end-of-month content.

40. PPFAVF - Availability Factor
This row is the availability factor for the Fremont Powerplant. The availability factors are set by the model user and tell the NPRWUM what portion of the month all the turbines were available for power generation. Hence, a factor of one indicates the turbines were available for power generation 100 % of the time.

41. PPFMAX - Fremont Total Turbine Q Capacity, kaf
This value is the total powerplant volumetric discharge capacity for the month. It is obtained from the NPRAOP.TBL file, which the NPRWUM uses to find the maximum total turbine release using the average EOM content.

42. PPFTUR - Fremont Total Turbine Release, kaf
This value is the calculated total volume of water discharged through the powerplant for the month. It is equal to the smaller value of the total turbine capacity or the reservoir outflow.

43. PTHBYPS - Fremont Turbine Bypass, kaf
This is the amount of flow which bypassed the powerplant and was released via the outlet works and/or spillway. The bypass is equal to the total calculated outflow minus the calculated turbine release. The bypass is routed through the outlet works first, up to capacity, then the over the spillway.

44. PTHOREL - Pathfinder Res Outlet Release, kaf
This is the volume of water which bypassed the turbines and was released through the outlet works.

45. PTHSPIL - Pathfinder Res Spillway Release, kaf
This is the volume of water which bypassed the turbines and outlet works (if any), and was released over the spillway.

46. PPFMW - Fremont Generation Capacity (power), MW
This row is not used at this time.

47. PPFGEN - Fremont Power Generation, GWh
The calculated gross generation, in Megawatt-hours, is calculate using the lookup tables in the NPRAOP.TBL file using the average EOM content to find the generation factor in Mwh/af. The total turbine release (kaf) is multiplied by generation factor (Mwh/af) to give the generation for the month in GWH.

48. ALCIN(j) - Alcova Reservoir Inflow, kaf
This is the total Pathfinder Reservoir outflow and is also equal to the Alcova Reservoir inflow.

49. ALEV(j) - Alcova Reservoir Evaporation, kaf
This row is the monthly evaporation for Alcova Reservoir.

50. CADEL - Casper Canal Delivery, kaf
This row is the total deliveries to the Casper Canal as determined by the NPRWUM.

51. CASRT - Casper Canal Shortage, kaf
This row is the shortage for the Casper Canal. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

52. TGRFIN - Alcova Reservoir Outflow, kaf
This row is the total Alcova Reservoir outflow and is also the total Gray Reef inflow.

53. ALST(j+1) - Alcova Reservoir EOM Storage, kaf
The Alcova Reservoir end-of-month content is equal to the previous end-of-month content plus the Alcova Reservoir inflow minus the Alcova Reservoir evaporation minus the Casper Canal delivery minus the Alcova outflow.

54. ALCACON - Average EOM Content, kaf
This row is the Alcova Reservoir average EOM content and is the sum of the previous EOM content and the current EOM divided by two (2).

55. ALCELEV(j+1) - Alcova Reservoir EOM Elevation, ft
This row is the average end-of-month water surface elevation for the Alcova Reservoir based upon the average end-of-month content.

56. PALAVF - Availability Factor
This row is the availability factor for the Alcova Powerplant. The availability factors are set by the model user and tell the NPRWUM what portion of the month all the turbines were available for power generation. Hence, a factor of one indicates the turbines were available for power generation 100 % of the time.

57. PALMAX - Alcova Total Turbine Q Capacity, kaf
This value is the total powerplant volumetric discharge capacity for the month. It is obtained from the NPRAOP.TBL file, which the NPRWUM uses to find the maximum total turbine release using the average EOM content.

58. PALTUR - Alcova Total Turbine Release, kaf
This value is the calculated total volume of water discharged through the powerplant for the month. It is equal to the smaller value of the total turbine capacity or the reservoir outflow.

59. ALCBYPS - Alcova Turbine Bypass, kaf
This is the amount of flow which bypassed the powerplant and was released via the outlet works and/or spillway. The bypass is equal to the total calculated outflow minus the calculated turbine release.

60. ALCSPIL - Alcova Res Spillway Release, kaf
This is the volume of water which bypassed the turbines and was released over the spillway.

61. PALMW - Alcova Generation Capacity (power), MW
This row is not used at this time.

62. PALGEN - Alcova Power Generation, GWh
The calculated gross generation, in Megawatt-hours, is calculate using the lookup tables in the NPRAOP.TBL file using the average EOM content to find the generation factor in Mwh/af. The total turbine release (kaf) is multiplied by generation factor (Mwh/af) to give the generation for the month in GWH.

63. TGRFIN - Gray Reef Reservoir Outflow, kaf
This row is the total Gray Reef Reservoir inflow. It is also equal to the total Alcova Reservoir outflow.

64. GRFEV(j) - Gray Reef Reservoir Evaporation, kaf
This row is the monthly evaporation for Gray Reef Reservoir.

65. TGRFOUT - Total Gray Reef Reservoir Outflow, kaf
This row is the total Gray Reef Reservoir outflow.

66. GRST(j+1) - Gray Reef Reservoir EOM Storage, kaf
The Gray Reef Reservoir end-of-month content is equal to the previous end-of-month content plus the Gray Reef Reservoir inflow minus the Gray Reef Reservoir evaporation minus the Gray Reef outflow.

67. ALGLRKGN - Alcova-Glenrock Gain, kaf
These values are the reach gains between the Gray Reef Reservoir and Glenrock. The Alcova to Glenrock reach gain was computed by taking the flow at Glenrock and subtracting the Deer Creek inflow and the flow in the river at Alcova.

68. FLOW(68,j) - Total Storage Water Delivered to City of Casper, kaf
This output item contains the total storage water delivered to the City of Casper from the enlarged Pathfinder #1 Ownership and Kendrick Ownership (CITYDEL + KENDCITY)

69. DRCKGLR - Deer Ck bl Millar Wasteway at Glenrock (kaf)
This is the Deer Creek below Millar wasteway at Glenrock gaging station (USGS 06646600).

70. GLRKGLGN - Glenrock-Glendo Gain, kaf
These values are the reach gains between the Glenrock and Glendo Reservoir. These gains are equal to the Alcova to Orin reach gain minus the Alcova to Glenrock reach Gain minus Deer Creek. The Alcova to Glendo reach gain is equal to the flow at Orin minus 98% of the flow at Alcova in October through April and the flow at Orin minus the flow at Alcova in May through September.

71. GLENROCK - North Platte River at Glenrock, kaf
This row is the North Platte River computed flow at Glenrock and is equal to the Gray Reef Reservoir Outflow plus the Alcova to Glenrock gain plus the inflow from Deer Creek.

72. GLGL - Glendo Bank Storage Seepage, kaf
This row is the combined affects of the Glendo Reservoir bank storage and seepage.

73. TGLIN - Total Glendo Inflow, kaf
This row is the Glendo Reservoir total inflow and is equal to the flow at Glenrock plus the Glenrock to Glendo Reservoir reach gain plus the Glendo Reservoir bank storage and seepage.

74. ALGLGN - Gray Reef to Glendo Gain,
This row is the reach gains between Gray Reef and Glendo Reservoirs. These reach gains are equal to the sum of the Alcova to Glenrock gain, the Deer Creek inflow, and the Glenrock to Glendo Reservoir gain.

75. GLEV(j) - Glendo Reservoir Evaporation, kaf
This row is the monthly evaporation for Glendo Reservoir.

76. TGLOUT - Total Glendo Reservoir Outflow, kaf
This row is the total Glendo Reservoir outflow.

77. GLST(j+1) - Glendo Reservoir EOM Storage, kaf
The Glendo Reservoir end-of-month content is equal to the previous end-of-month content plus the Glendo Reservoir inflow minus the Glendo Reservoir evaporation minus the outflow.

78. GLNACON - Average EOM Content, kaf
This row is the Glendo Reservoir Average EOM content and is the sum of the previous EOM content and the current EOM divided by two (2).

79. GLNELEV(j+1) - Ave Glendo EOM Elevation, ft
This row is the average end-of-month water surface elevation for Glendo Reservoir based upon the average end-of-month content.

80. PGLAVF - Availability Factor
This row is the availability factor for the Glendo Powerplant. The availability factors are set by the model user and tell the NPRWUM what portion of the month all the turbines were available for power generation. Hence, a factor of one indicates the turbines were available for power generation 100 % of the time.

81. PGLMAX - Glendo Total Turbine Q Capacity, kaf
This value is the total powerplant volumetric discharge capacity for the month. It is obtained from the NPRAOP.TBL file, which the NPRWUM uses to find the maximum total turbine release using the average EOM content.

82. PGLTUR - Glendo Total Turbine Release, kaf
This value is the calculated total volume of water discharged through the powerplant for the month. It is equal to the smaller value of the total turbine capacity or the reservoir outflow.

83. GLNBYPS - Glendo Turbine Bypass, kaf
This is the amount of flow which bypassed the powerplant and was released via the outlet works and/or spillway. The bypass is equal to the total calculated outflow minus the calculated turbine release. The bypass is routed through the outlet works first, up to capacity, then the over the spillway. NOTE: Releases made through the Low Flow Outlet work are include in the amount bypassed.

84. GLNOREL - Glendo Res Outlet Release, kaf
This is the volume of water which bypassed the turbines and was released through the outlet works.

85. GLNSPIL - Glendo Res Spillway Release, kaf
This is the volume of water which bypassed the turbines and outlet works (if any), and was released over the spillway.

86. PGLMW - Glendo Generation Capacity (power), MW
This row is not used at this time.

87. PGLGEN - Glendo Power Generation, GWh
The calculated gross generation, in Megawatt-hours, is calculate using the lookup tables in the NPRAOP.TBL file using the average EOM content to find the generation factor in Mwh/af. The total turbine release (kaf) is multiplied by generation factor (Mwh/af) to give the generation for the month in GWH.

88. GUGL - Guernsey Bank Storage Seepage, kaf
This row is the combined affects of the Guernsey Reservoir bank storage and seepage.

89. GLGUGN - Glendo to Guernsey gain, kaf
The Glendo to Guernsey gain is the gain or loss in the reach of the river between Glendo and Guernsey Reservoirs. It is calculated as the Guernsey Reservoir computed inflow minus the Glendo Reservoir outflow.

90. TGUIN - Total Guernsey Reservoir inflow, kaf
This row is the total Guernsey Reservoir inflow and is equal to the Glendo Reservoir Outflow plus the Glendo to Guernsey Gain plus the Guernsey Reservoir bank storage and seepage.

91. GUEV(j) - Guernsey Reservoir Evaporation, kaf
This row is the Guernsey Reservoir computed evaporation.

92. GOUT(j) - Total Guernsey Reservoir Outflow, kaf
This is the required Guernsey Reservoir outflow.

93. GUST(j + 1) - Guernsey Reservoir EOM
The Guernsey Reservoir end-of-month content is equal to the previous end-of-month content plus the inflow minus the evaporation minus the outflow.

94. GRNACON - Average EOM Content, kaf
This row is the Guernsey Reservoir Average EOM content and is the sum of the previous EOM content and the current EOM divided by two (2).

95. GRNELEV(j + 1) - Ave Guernsey EOM Elevation, ft
This row is the average end-of-month water surface elevation for the Guernsey Reservoir based upon the average end-of-month content.

96. PGUAVF - Availability Factor
This row is the availability factor for the Guernsey Powerplant. The availability factors are set by the model user and tell the NPRWUM what portion of the month all the turbines were available for power generation. Hence, a factor of one indicates the turbines were available for power generation 100 % of the time.

97. PGUMAX - Guernsey Total Turbine Q Capacity, kaf
This value is the total powerplant volumetric discharge capacity for the month. It is obtained from the NPRAOP.TBL file, which the NPRWUM uses to find the maximum total turbine release using the average EOM content.

98. PGUTUR - Guernsey Total Turbine Release, kaf
This value is the calculated total volume of water discharged through the powerplant for the month. It is equal to the smaller value of the total turbine capacity or the reservoir outflow.

99. GRNBYPS - Guernsey Turbine Bypass, kaf
This is the amount of flow which bypassed the powerplant and was released via the spillway. The bypass is equal to the total calculated outflow minus the calculated turbine release.

100. GRNSPIL - Guernsey Res Spillway Release, kaf
This is the volume of water which bypassed the turbines and was released over the spillway.

101. PGUMW - Guernsey Generation Capacity (power), MW
This row is not used at this time.

102. PGUGEN - Guernsey Power Generation, GWh
The calculated gross generation, in Megawatt-hours, is calculate using the lookup tables in the NPRAOP.TBL file using the average EOM content to find the generation factor in Mwh/af. The total turbine release (kaf) is multiplied by generation factor (Mwh/af) to give the generation for the month in GWH.

103. GOUT(j) - Total Guernsey Reservoir Outflow, kaf
This row is the Guernsey Reservoir outflow.

104. WMDEL - Wright & Murphy Delivery, kaf
This row is the total deliveries to Wright and Murphy as determined by the NPRWUM.

105. WMSRT - Wright & Murphy Shortage, kaf
This row is the shortage for Wright and Murphy. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

106. GODEL - Goshen Delivery, kaf
This row is the total deliveries to Goshen as determined by the NPRWUM.

107. GOSRT - Goshen Shortage, kaf
This row is the shortage for Goshen. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

108. GFDEL - Gering-Ft. Laramie Delivery, kaf
This row is the total deliveries to Gering-Ft. Laramie as determined by the NPRWUM.

109. GFSRT - Gering-Ft. Laramie Shortage, kaf
This row is the shortage for Gering-Ft. Laramie. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

110. FTLTEMP - Temporary Contracts, kaf
This row is temporary contracts for storage water delivered through the Fort Laramie Canal. This variable is set to zero (0).

111. TFTLDIV - Total Ft. Laramie Canal, kaf
This row is the total Fort Laramie Canal Diversions taken from the North Platte River.

112. INDEL - Wyoming Laterals Delivery, kaf
This row is the total deliveries to the Wyoming Laterals as determined by the NPRWUM. NOTE: The Wyoming Laterals deliveries are not identified separately in the Compiled Water Records from 1941-67. They appear to be included with the Interstate (Pathfinder) deliveries and have been set to zero for the period of 1941-67 in the input file.

113. WYSRT - Wyoming Laterals Shortage, kaf
This row is the shortage for the Wyoming Laterals. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

114. LIDEL - Lingle Delivery, kaf
This row is the total deliveries to Lingle as determined by the NPRWUM.

115. LISRT - Lingle Shortage, kaf
This row is the shortage for Lingle. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

116. HIDEL - Hill Delivery, kaf
This row is the total deliveries to Hill as determined by the NPRWUM.

117. HISRT - Hill Shortage, kaf
This row is the shortage for Hill. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

118. ILDEL - I.L. Delivery @ MP 2.7, kaf
This row is the total deliveries to the Idealized Inland Lakes at Mile Post 2.7 of the Interstate Canal for the non-irrigation season only.

119. IPDEL - Interstate (Pathfinder) Delivery, kaf
This row is the total deliveries to Interstate (Pathfinder) as determined by the NPRWUM.

120. PIDMDEL - PID Main Canal Delivery, kaf
This row is the amount of the total Interstate (Pathfinder) diversion that is used to irrigate lands above the Idealized Inland Lakes from the Pathfinder Main Canal as determined by the NPRWUM.

121. PATHSRT - Interstate (Pathfinder) Shortage, kaf
This row is the shortage for Pathfinder Main Canal. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

122. TINDIV - Total Interstate Canal, kaf
This row is the total Interstate Canal Diversions taken from the North Platte River.

123. ILDELL + IPDELL - Total Inflow Inland Lakes, kaf
This row is the total inflow to the Idealized Inland Lakes and consists of releases from the Inland Lakes account in the main stem and North Platte Project water.

124. ILGL - Inland Lake Bank Stor, Seep, kaf
This row is the combined affects of the Idealized Inland Lake bank storage and seepage.

125. ILEV(j) - Inland Lakes Evaporation, kaf
This row is the monthly evaporation for the Idealized Inland Lakes Reservoir.

126. INLDEL - I. L. Outflow-Irrigation Del, kaf
This row is the Idealized Inland Lakes outflow. The outflow is equal to deliveries for irrigation for the Highline, Lowline, and Reservoir Supply Canals.

127. INLSRT - Shortage, kaf
This row is the shortage for irrigation deliveries from the Idealized Inland Lakes via the Highline, Lowline, and Reservoir Supply Canal. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

128. ILST(j + 1) - Inland Lakes EOM Content, kaf
The Idealized Inland Lakes end-of-month content is equal to the previous end-of-month content plus the inflow minus the evaporation minus the outflow.

129. GUWHGN - Guernsey to Whalen Dam Gain, kaf
These values are the reach gains between Guernsey Reservoir and the Whalen Diversion Dam.

130. WHOUT(j) - Whalen Dam Outflow, kaf
This row is the amount of flow in the North Platte River Below Whalen Diversion Dam.

131. BUDEL - Burbank Delivery, kaf
This row is the total deliveries to Burbank as determined by the NPRWUM.

132. BUSRT - Shortage, kaf
This row is the shortage for Burbank. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

133. LUDEL - Lucerne Delivery, kaf
This row is the total deliveries to Lucerne as determined by the NPRWUM.

134. LUSRT - Lucerne Shortage, kaf
This row is the shortage for Lucerne. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

135. LARAME - Laramie River Inflow, kaf
This row is the Laramie River inflows to the North Platte River.

136. CCKDEL - Corn Creek Delivery, kaf
This row is the total deliveries to the Corn Creek project as determined by the NPRWUM. NOTE: The Corn Creek deliveries are set to zero (0).

137. CCKSRT - Shortage, kaf
This row is the shortage for Corn Creek. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

138. unDEL - unassigned Wy Glendo DELIVERY

139. UnSRT - unassigned Wy Glendo SHORTAGE

140. GRDEL - Grattan Delivery, kaf
This row is the total deliveries to Grattan as determined by the NPRWUM.

141. GRSRT - Grattan Shortage, kaf
This row is the shortage for Grattan. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

142. TODEL - Torrington Delivery, kaf
This row is the total deliveries to Torrington as determined by the NPRWUM.

143. TOSRT - Torrington Shortage, kaf
This row is the shortage for Torrington. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

144. RRDEL - Rock Ranch Delivery, kaf
This row is the total deliveries to Rock Ranch as determined by the NPRWUM.

145. RRSRT - Rock Ranch Shortage, kaf
This row is the shortage for Rock Ranch. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

146. NPDEL - North Platte Delivery, kaf
This row is the total deliveries to North Platte as determined by the NPRWUM.

147. NPSRT - North Platte Shortage, kaf
This row is the shortage for North Platte. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

148. NADEL - Narrows Delivery, kaf
This row is the total deliveries to Narrows as determined by the NPRWUM.

149. NASRT - Narrows Shortage, kaf
This row is the shortage for Narrows. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

150. PFDEL - Pratt Ferris Delivery, kaf
This row is the total deliveries to Pratt Ferris as determined by the NPRWUM.

151. PFSRT - Pratt Ferris Shortage, kaf
This row is the shortage for Pratt Ferris. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

152. FCHDEL - French Canal Delivery, kaf
This row is the total deliveries to French Canal as determined by the NPRWUM. NOTE: The French Canal ceased diversion from the North Platte River in 1953 and the data set has been set to zero (0) in the input file.

153. FCHSRT - French Canal Shortage, kaf
This row is the shortage for French Canal. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

154. MIDEL - Mitchell Delivery, kaf
This row is the total deliveries to Mitchell as determined by the NPRWUM.

155. MISRT - Mitchell Shortage, kaf
This row is the shortage for Mitchell. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

156. GEDEL - Gering Delivery, kaf
This row is the total deliveries to Gering as determined by the NPRWUM.

157. GESRT - Gering Shortage, kaf
This row is the shortage for Gering. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

158. TEMP2 - Temporary Contacts, kaf
This row is the temporary contracts for water in the reach, if any

159. WHTSDIV - Total Deliveries, kaf
This row is the total deliveries from the North Platte River between Whalen and Tri-State.

160. FCDEL - Farmers Delivery, kaf
This row is the total deliveries to Farmers as determined by the NPRWUM.

161. FCSRT - Farmers Shortage, kaf
This row is the shortage for Farmers. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

162. NPTDEL - Northport Delivery, kaf
This row is the total deliveries to Northport as determined by the NPRWUM.

163. NPTSRT - Northport Shortage, kaf
This row is the shortage for Northport. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

164. RADEL - Ramshorn Delivery, kaf
This row is the total deliveries to Ramshorn as determined by the NPRWUM.

165. RASRT - Ramshorn Shortage, kaf
This row is the shortage for Ramshorn. The shortage is the difference between the delivery entered by the model user in the input file and the delivery made by the NPRWUM.

166. TTRIDIV - Total Tri-State Canal, kaf
This row is the total Tri-State Canal diversions from the North Platte River.

167. CNSDEL - Central Water Order, kaf
This row is the water order for storage request by Central.

168. CNSSRT - Central Water Order Shortage, kaf
This row is the shortage for the Central Water Order. The shortage is the difference between the water order entered by the model user in the input file and the delivery made by the NPRWUM.

169. CRSDEL - Chimney Rock Water Order, kaf
This row is the water order for storage request by Chimney Rock.

170. CRSSRT - Chimney Rock Water Order Shortage, kaf
This row is the shortage for the Chimney Rock Water Order. The shortage is the difference between the water order entered by the model user in the input file and the delivery made by the NPRWUM.

171. BCSDEL - Browns Creek Water Order, kaf
This row is the water order for storage request by Browns Creek.

172. BCSSRT - Browns Creek Water Order Shortage, kaf
This row is the shortage for the Browns Creek Water Order. The shortage is the difference between the water order entered by the model user in the input file and the delivery made by the NPRWUM.

173. BESDEL - Beerline Water Order, kaf
This row is the water order for storage request by Beerline.

174. BESSRT - Beerline Water Order Shortage, kaf
This row is the shortage for the Beerline Water Order. The shortage is the difference between the water order entered by the model user in the input file and the delivery made by the NPRWUM.

175. ENSDEL - Enterprise Water Order, kaf
This row is the water order for storage request by Enterprise.

176. ENSSRT - Enterprise Water Order Shortage, kaf
This row is the shortage for the Enterprise Water Order. The shortage is the difference between the water order entered by the model user in the input file and the delivery made by the NPRWUM.

177. BRSDEL - Bridgeport Water Order, kaf
This row is the water order for storage request by Bridgeport.

178. BRSSRT - Bridgeport Water Order Shortage, kaf
This row is the shortage for the Bridgeport Water Order. The shortage is the difference between the water order entered by the model user in the input file and the delivery made by the NPRWUM.

179. CNPDEL - CNPP&ID Water Order, kaf
This row is the water order for storage request by Central Nebraska Public Power and Irrigation District (CNPP&ID).

180. CNPSRT - CNPP&ID Water Order Shortage, kaf
This row is the shortage for the CNPP&ID Water Order. The shortage is the difference between the water order entered by the model user in the input file and the delivery made by the NPRWUM.

181. TCHRGLOS - Total Loss Charged-WO, kaf
This row is the sum of the losses charged to the Warren Act and Glendo Contractors for delivery of storage water below Tri-State Diversion Dam.

182. WOPTRI - Total Water Orders, kaf
This row is the sum of all the water orders for storage passing Tri-State.

183. WHTSGN - Whalen to Tri-State Gain, kaf
this row is the Whalen to Tri-State gain as input into the data file by the model user.

184. PH2DEL - Irrigation Reuse Reach #2, kaf
This row is the amount of reuse modeled in Reach No. 2.

185. GWNET2DE - Well Irrigation Net Ground Water Recharge, kaf
This row is the amount of recharge to the ground water from well irrigation, shown as a negative number to indicate it is a depletion.

186. RFDMWT - Return Flow-Demands, kaf
This row is the return flow for the Whalen to Tri-State reach associated with the historic demands.

187. RFDLWT - Return Flow-Deliveries, kaf
This row is the return flow for the Whalen to Tri-State reach associated with the modeled deliveries.

188. WHTSGNA - Gain Reach #2, kaf
This row is the Whalen to Tri-State gain that has been adjusted to reflect any changes in the return flow. The adjusted gain is equal to the historic gain minus the change in return flows.

189. PASTRI - NPR Flow Below Tri-State Dam, kaf
This row is the modeled flow below Tri-State Diversion Dam and is computed as the Whalen Dam outflow plus the Laramie River inflow plus the adjusted gain minus the diversion in the reach.

190. TRENGN - Tri-State to Enterprise Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(46,i,j)).

191. ENDEL - Enterprise Delivery, kaf
This row is the total deliveries to Enterprise as determined by the NPRWUM.

192. ENSRT - Enterprise Shortage, kaf
This row is the shortage for Enterprise. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

193. FBLWENT - NPR Below Enterprise Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

194. ENWIGN - Enterprise To Winters CK Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(47,i,j)).

195. WIDEL - Winters Creek Delivery, kaf
This row is the total deliveries to Winters Creek as determined by the NPRWUM.

196. WISRT - Winters Creek Shortage, kaf
This row is the shortage for Winters Creek. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

197. FBLWWIN - NPR Below Winters Creek Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

198. WICEGN - Winters Ck to Central Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(48,i,j)).

199. CNDEL - Central Delivery, kaf
This row is the total deliveries to Central as determined by the NPRWUM.

200. CNSRT - Central Shortage, kaf
This row is the shortage for Central. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

201. FBLWCEN - NPR Below Central Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

202. CEMIGN - Central to Minatare Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(49,i,j)).

203. MINDEL - Minatare Delivery, kaf
This row is the total deliveries to Minatare as determined by the NPRWUM.

204. MINSRT - Minatare Shortage, kaf
This row is the shortage for Minatare. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

205. FBLWMIN - NPR Below Minatare Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

206. MICAGN - Minatare to Castle Rock Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(50,i,j)).

207. CASDEL - Castle Rock Delivery, kaf
This row is the total deliveries to Castle Rock as determined by the NPRWUM.

208. CASSRT - Castle Rock Shortage, kaf
This row is the shortage for Castle Rock. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

209. FBLWCAS - NPR Below Castle Rock Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

210. CANIGN - Castle Rock to Nine Mile Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(51,i,j)).

211. NMIDEL - Nine Mile Delivery, kaf
This row is the total deliveries to Nine Mile as determined by the NPRWUM.

212. NMISRT - Nine Mile Shortage, kaf
This row is the shortage for Nine Mile. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

213. FBLWNIN - NPR Below Nine Mile Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

214. NISHGN - Nine Mile to Short Line Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(52,i,j)).

215. SHLDEL - Short Line Delivery, kaf
This row is the total deliveries to Short Line as determined by the NPRWUM.

216. SHLSRT - Short Line Shortage, kaf
This row is the shortage for Short Line. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

217. FBLWSHO - NPR Below Short Line Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

218. SHCHGN - Short Line to Chimney Rock Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(53,i,j)).

219. CRDEL - Chimney Rock Delivery, kaf
This row is the total deliveries to Chimney Rock as determined by the NPRWUM.

220. CRSRT - Chimney Rock Shortage, kaf
This row is the shortage for Chimney Rock. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

221. FBLWCHI - NPR Below Chimney Rock Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

222. CHEMGN - Chimney Rock to Empire Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(54,i,j)).

223. BRDEL - Bridgeport Delivery, kaf
This row is the total deliveries to Bridgeport as determined by the NPRWUM. Bridgeport receives its water via the Belmont Canal.

224. BRSRT - Bridgeport Shortage, kaf
This row is the shortage for Bridgeport. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

225. EMPDEL - Empire Delivery, kaf
This row is the total deliveries to Empire as determined by the NPRWUM. Empire receives its water via the Belmont Canal.

226. EMPSRT - Empire Shortage, kaf
This row is the shortage for Empire. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

227. FBLWBEL - NPR Below Belmont Canal, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

228. EMBCGN - Empire to Browns Creek Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(55,i,j)).

229. BCDEL - Browns Creek Delivery, kaf
This row is the total deliveries to Browns Creek as determined by the NPRWUM.

230. BCSRT - Browns Creek Shortage, kaf
This row is the shortage for Browns Creek. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

231. FBLWBRO - NPR Below Browns Creek Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

232. BRBEGN - Browns Creek to Beerline Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(56,i,j)).

233. BLDEL - Beerline Delivery, kaf
This row is the total deliveries to Beerline as determined by the NPRWUM.

234. BLSRT - Beerline Shortage, kaf
This row is the shortage for Beerline. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

235. FBLWBEE - NPR Below Beerline Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

236. BELIGN - Beerline to Lisco Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(57,i,j)).

237. LISDEL - Lisco Delivery, kaf
This row is the total deliveries to Lisco as determined by the NPRWUM.

238. LISSRT - Lisco Shortage, kaf
This row is the shortage for Lisco. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

239. FBLWLIS - NPR Below Lisco Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

240. LIMIGN - Lisco to Midland-Overland Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(58,i,j)).

241. MODEL - Midland-Overland Delivery, kaf
This row is the total deliveries to Midland-Overland as determined by the NPRWUM.

242. MOSRT - Midland-Overland Shortage, kaf
This row is the shortage for Midland-Overland. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

243. FBLWMID - NPR Below Midland-Overland Div, kaf
This row is the estimated amount of water in the North Platte River below the given diversion.

244. BLUECK - Blue Creek, kaf
This row is the inflows from Blue Creek.

245. MILEGN - Midland-Overland to Lewellen Subreach Gain, kaf
This row is the amount of the Tri-State to Lewellen reach gain assign to this subreach (see hdata1(59,i,j)).

246. FBLWLEW - NPR at Lewellen, kaf
This row is the modeled flow at Lewellen as determined via the subreach calculations.

247. TSLLDIV - Total Deliveries, kaf
This row is the sum of the deliveries in the Tri-State to Lewellen reach.

248. NPDRNDL - Northport Delivery fm Drains, kaf
This row is the total deliveries to Northport from the drains as determined by the NPRWUM.

249. NPDRSRT - Northport fm Drains Shortage, kaf
This row is the shortage for Northport from drains. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

250. TSDRNDL - Tri-State Delivery fm Drains, kaf
This row is the total deliveries to Tri-State from the drains as determined by the NPRWUM.

251. TSDRSRT - Tri-State fm Drains Shortage, kaf
This row is the shortage for Tri-State from drains. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

252. ENDRNDL - Enterprise Delivery fm Drains, kaf
This row is the total deliveries to Enterprise from the drains as determined by the NPRWUM.

253. ENDRSRT - Enterprise fm Drains Shortage, kaf
This row is the shortage for Enterprise from drains. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

254. WIDRNDL - Winters Creek Delivery fm Drains, kaf
This row is the total deliveries to Winters Creek from the drains as determined by the NPRWUM.

255. WIDRSRT - Winters Creek fm Drains Shortage, kaf
This row is the shortage for Winters Creek from drains. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

256. ALDRNDL - Alliance Delivery fm Drains, kaf
This row is the total deliveries to Alliance from the drains as determined by the NPRWUM.

257. ALDRSRT - Alliance fm Drains Shortage, kaf
This row is the shortage for Alliance from drains. The shortage is the difference between the delivery enter by the model user in the input file and the delivery made by the NPRWUM.

258. DIVDRDL - Total Deliveries fm Drains, kaf
This row is the total deliveries from the drains.

259. TSLLGN - Tri-State to Lewellen Gain, kaf
This row is the Tri-State to Lewellen gain as input into the data file by the model user.

260. PH3DEL - Irrigation Reuse Reach #3, kaf
This row is the amount of reuse modeled in Reach No. 3.

261. GWNET3DE - Well Irrigation Net Ground Water Recharge, kaf
This row is the amount of recharge to the ground water from well irrigation, shown as a negative number to indicate it is a depletion.

262. RFDMTL - Return Flow-Demands, kaf
This row is the return flow for the Tri-State to Lewellen reach associated with the historic demands.

263. RFDLTL - Return Flow-Deliveries, kaf
This row is the return flow for the Tri-State to Lewellen reach associated with the modeled deliveries.

264. TSLLGNA - Gain Reach #2, kaf
This row is the Tri-State to Lewellen gain that has been adjusted to reflect any changes in the return flow. The adjusted gain is equal to the historic gain minus the change in return flows.

265. BLUECK - Blue Creek, kaf
This row is the inflows from Blue Creek.

266. NPRLEW - NPR Flow at Lewellen, kaf
This row is the modeled flow at Lewellen and is computed as the Tri-State Dam outflow plus the adjusted gain minus the diversions in the reach.

267. CNPPLEW - CNPP&ID at Lewellen, kaf
This row is the CNPP&ID delivery at Lewellen

268. TOTIN - Total System Inflow, kaf
This value is the total system inflow.

269. TOTRES(j + 1) - Total System Reservoir Storage, kaf
This value is the total end-of-month storage for Guernsey, Glendo, Gray Reef, Alcova, Pathfinder, Kortes, and Seminoe Reservoirs.

270. TOTDEL - Total System Delivery, kaf
This value is the total system delivery and is the sum of all the deliveries made by the NPRWUM.

271. TOTSRT - Total System Shortage, kaf
This value is the total system shortage and is equal to the sum of all shortage.

272. HDATA(13,I,J) - Historic Alcova to Glenrock Gain, kaf
This row is the Alcova to Glenrock gain as input into the data file by the model user.

273. rfdmca - Return flow Kendrick - demand, kaf
This row is the return flow for the Alcova to Glendrock reach associated with the historic demands.

274. Rfdlca - Return flow Kendrick - delivery, kaf
This row is the return flow for the Alcova to Glenrock reach associated with the modeled deliveries.

275. alglrkgn - Adjusted Alcova to Glenrock Gain, kaf
This row is the Alcova to Glenrock gain that has been adjusted to reflect any changes in the return flow. The adjusted gain is equal to the historic gain minus the change in return flows.

1.1.5 TABLE Items RESOP.TAB Output File

1. GLST(J + 1) - Glendo EOM Content,
This table is the EOM Contents for the Glendo Reservoir.

2. PATHST(J + 1) - Path EOM Content, kaf
This table is the EOM Contents for the Pathfinder Reservoir.

3. SEMST(J + 1) - Seminoe EOM Content, kaf
This table is the EOM Contents for the Seminoe Reservoir.

4. GUST(J + 1) - Guernsey EOM Content, kaf
This table is the EOM Contents for the Guernsey Reservoir.

5. ILST(J + 1) - Inland Lakes EOM Content, kaf
This table is the EOM Content for Inland Lakes.

6. TOTRES(J + 1) - Total EOM Res Content, kaf
This table is the Total EOM Reservoir Content.

7. GOUT(J) - Guernsey Res Outflow, kaf
This table is the outflow at Guernsey Reservoir.

8. TPASTRI - Flow Past Tri-State, kaf
This table is the outflow past Tri-State.

9. NPRLEW - North Platte River at Lewellen, kaf
This table is the River flow at Lewellen.

10. TNPPDEL - North Platte Project Deliveries, kaf
This table is the total North Platte Project deliveries, inclusive of natural flow and storage.

11. TGLUDEL - Glendo Unit Deliveries, kaf
This table is the total Glendo Unit deliveries, inclusive of natural flow and storage.

12. CADEL - Kendrick Deliveries, kaf
This table is the total Kendrick Project Deliveries, inclusive of natural flow and storage.

13. PSEGEN - Seminoe Generation, GWH
This table is the Seminoe Reservoir power generation.

14. PKOGEN - Kortes Generation, GWH
This table is the Kortes Reservoir power generation.

15. PPFGEN - Fremont Canyon Generation, GWH
This table is the Pathfinder power generation.

16. PALGEN - Alcova Generation, GWH
This table is the Alcova power generation.

17. PGLGEN - Glendo Generation, GWH
This table is the Glendo power generation.

18. PGUGEN - Guernsey Generation, GWH
This table is the Guernsey power generation.

19. TOTGEN - Total Generation, GWH
This table is the total combined power generation of the system.

20. KOROUT - Kortes Reservoir Outflow, kaf
This table is the Kortes Reservoir outflows.

21. RFDLWT + RFDLTL - Total Return Flow, kaf
This table is the Total Return Flow from Guernsey to Lewellen.

22. GUWHGN + WHTSGN + TSLLGN + LARAME + BLUECK - Total Inflow Guernsey to Lewellen
This table is the Total inflow from Guernsey Reservoir to Lewellen.

23. GURNBAL - Guernsey Water Balance, kaf
This table is the water balance for Guernsey Reservoir (inflow-outflow = zero).

24. GLENBAL - Glendo Water Balance, kaf
This table is the water balance for Glendo Reservoir (inflow-outflow = zero).

25. ALST(J + 1) - Alcova EOM Content, kaf
This table is the EOM content of Alcova Reservoir.

26. ALCBAL - Alcova Water Balance, kaf
This table is the water balance for Alcova Reservoir (inflow-outflow = zero).

27. PATHBAL - Pathfinder Water Balance, kaf
This table is the water balance for Pathfinder Reservoir (inflow-outflow = zero).

28. SEMBAL - Seminoe Water Balance, kaf
This table is the water balance for Seminoe Reservoir (inflow-outflow = zero).

29. WATBAL - Water Balance, kaf
This table is the water balance for the entire upper system from the inflows to Seminoe Reservoir to the outflow of Guernsey Reservoir (inflow-outflow = zero).

30. TABLE(30,I,J) - North Platte Owner Shortages, kaf
This table is the North Platte Project shortages, calculated as WYSRT + LISRT + HISRT + PATHSRT + RRSRT + GESRT + FCSRT + NPTSRT + CNSRT + CRSRT + BCSRT + BLSRT + GOSRT + GFSRT + CNSSRT + BCSSRT + BLSSRT + CRSSRT.

31. CASRT - Caid Shortages
This table is the Kendrick Project Shortages.

32. TABLE(32,I,J) - Glendo Reservoir Shortages, kaf
This table is the Glendo Unit shortages, calculated as WMSRT + BUSRT + LUSRT + CCKSRT + GRSRT + MISRT + TOSRT + CNPSRT + ENSSRT + BRSSRT.

33. AVRDLWT + AVRDLTL - Deep Percolation below Guernsey to Lewellen, kaf
This table is the deep percolation occurring between Guernsey and Lewellen that is used as input to the GLOVER Subroutine.

34. RFLWR2DE + RFLWR3DE - Return Flow Computed by Glover, kaf
This table is the amount of water computer as return flow by the GLOVER Subroutine.

1.2 Natural Flow Accounting

The input files for the natural flow are designated by the file extension ".FLO". For example, the natural flow input data is contained in the file BASELINE.FLO. Described below are the CDATA1, ADATA1, and HDATA1 input items and FLOW1 and TABLE1 output items associated with the natural flow.

1.2.1 CDATA1 Items ".FLO" Input File

1. GR1CFS - Grattan 1st App., cfs
This value is the 11/1/82 (territorial) water right for the Grattan Ditch.

2. NPCFS - North Platte Appropr., cfs
This value is the 9/22/83 (territorial) water right for the North Platte Ditch.

3. RR1CFS - Rock Ranch App., 1st, cfs
This value is the Spring of '84 (territorial) water right for the Rock Ranch Ditch.

4. PFCFS - Pratt-Ferris Appropr., cfs
This value is the 5/22/86 (territorial) water right for the Pratt Ferris Ditch.

5. BU1CFS - Burbank 1st App., cfs
This value is the 11/6/91 water right for the Burbank Ditch.

6. TOCFS - Torrington Appropr., cfs
This value is the 11/28/91 water right for the Torrington Ditch.

7. LUCFS - Lucerne Appropriation, cfs
This value is the 2/21/93 water right for the Lucerne Ditch.

8. BU2CFS - Burbank 2nd App., cfs
This value is the 4/12/98 water right for the Burbank Ditch.

9. NACFS - Narrows Appropriation, cfs
This value is the 11/13/99 water right for the Narrows Ditch.

10. LH1CFS - Lingle/Hill 1st Appropr, cfs
This value is the 9/6/01 water right for the Lingle/Hill diversions.

11. WRCFS - Wright Appropr., cfs
This value is the 4/23/02 water right for the Wright diversion.

12. GR2CFS - Grattan 2nd App., cfs
This value is the 1/27/04 water right for the Grattan Ditch.

13. MUCFS - Murphy Appropriation, cfs
This value is the 4/2/02 water right for the Murphy diversion.

14. GR3CFS - Grattan 3rd App., cfs
This value is the 12/2/04 water right for the Grattan Ditch.

15. LH2CFS - Lingle/Hill 2nd App., cfs
This value is the 12/6/04 water right for the Lingle/Hill diversion.

16. INWCFS - Interstate (WY) App, cfs
This value is the 12/6/04 water right for the Interstate (Wyoming Laterals) diversion.

17. GOWCFS - Ft Laramie (Goshen - WY) App., cfs
This value is the 1/3/10 water right for the Ft. Laramie (Goshen) diversion.

18. RR2CFS - Rock Ranch App., 2nd, cfs
This value is the 1/3/10 water right for the Rock Ranch Ditch.

19. FC1CFS - Farmers Irr., 1st, cfs
This value is the first Nebraska water right in this part of the river.

20. MICFS - Mitchell Appropriation, cfs
This value is the second Nebraska water right in this part of the river.

21. RACFS - Ramshorn Appropr., cfs
This value is the third Nebraska water right in this part of the river.

22. GENCFS - Gering (NE) App., cfs
This value is the fourth Nebraska water right in this part of the river.

23. FC2CFS - Farmers Irr., 2nd, cfs
This value is the fifth Nebraska water right in this part of the river.

24. GFNCFS - Gering-Ft Laramie (NE), cfs
This value is the sixth Nebraska water right in this part of the river.

25. INPCFS - Interstate (Pathfinder), cfs
This value is the seventh Nebraska water right in this part of the river.

26. NPTCFS - Northport Appropr., cfs
This value is the eighth Nebraska water right in this part of the river.

27. HIWARC - Hill War. Act Cont., (af)
This value is the Warren Act Contract amount for the Hill diversion.

28. LIWARC - Lingle War Act Cont., (af)
This value is the Warren Act Contract amount for the Lingle diversion.

29. RRWARC - Rock Ranch War Cont, (af)
This value is the Warren Act Contract amount for the Rock Ranch Ditch.

30. GEWARC - Gering War. Act Cont, (af)
This value is the Warren Act Contract amount for the Gering diversion.

31. FCWARC - Farmers War Act Cont, (af)
This value is the Warren Act Contract amount for the Farmers Canal diversion.

32. CNWARC - Central War. Act Cont., (af)
This value is the Warren Act Contract amount for the Central Ditch.

33. CRWARC - Chimney Rk War. Cont, (af)
This value is the Warren Act Contract amount for the Chimney Rock Ditch.

34. BCWARC - Browns Ck War. Cont, (af)
This value is the Warren Act Contract amount for the Browns Creek Ditch.

35. BEWARC - Beerline War. Act Cont, (af)
This value is the Warren Act Contract amount for the Beerline Ditch.

36. BRGLCO - Bridgeport Glendo Cont, (af)
This value is the Glendo Unit Contract amount for the Bridgeport Ditch.

37. MIGLCO - Mitchell Glendo Cont, (af)
This value is the Glendo Unit Contract amount for the Mitchell Canal.

38. ENGLCO - Enterprise Glendo Cont, (af)
This value is the Glendo Unit Contract amount for the Enterprise Ditch.

39. GRGLCO - Grattan Glendo Cont., (af)
This value is the Glendo Unit Contract amount for the Grattan Ditch.

40. BUGLCO - Burbank Glendo Cont., (af)
This value is the Glendo Unit Contract amount for the Burbank Ditch.

41. TOGLCO - Torr. Glendo Cont., (af)
This value is the Glendo Unit Contract amount for the Torrington Ditch.

42. LUGLCO - Lucerne Glendo Cont., (af)
This value is the Glendo Unit Contract amount for the Lucerne Ditch.

43. WMGLCO - Wright-Murphy Glendo Cont,(af)
This value is the Glendo Unit Contract amount for the Wright and Murphy diversion.

44. CNPGLCO - CNPP&ID, Glendo Contract, (kaf)
This value is the Glendo Unit Contract amount for the Central Nebraska Public Power and Irrigation District.

45. CSPRAPP - Casper Canal Appropr., (kaf)
This value is the natural flow right for the Casper Canal Diversion.

46. MINCFS - Minatare Appropriation, cfs
This value is the 1/14/1888 water right for the Minatare Diversion.

47. NMI1CFS - Nine Mile 1st Appropr., cfs
This value is the 1/14/1888 water right for the Nine Mile Diversion.

48. WICFS - Winters Creek Appropr., cfs
This value is the 10/18/1888 water right for the Winters Creek Diversion.

49. ENCFS - Enterprise Appropr., cfs
This value is the 3/28/1889 water right for the Enterprise Canal Diversion.

50. CAS1CFS - Castle Rock 1st Appropr., cfs
This value is the 4/18/1889 water right for the Castle Rock Diversion.

51. BPCFS - Bridgeport Appropr., cfs
This value is the 12/19/1889 water right for the Bridgeport Diversion.

52. CNCFS - Central Appropr., cfs
This value is the 6/23/1890 water right for the Central Canal Diversion.

53. CR1CFS - Chimney Rock 1st Appropr., cfs
This value is the 12/3/1890 water right for the Chimney Rock Diversion.

54. EMP1CFS - Empire 1st Appropr., cfs
This value is the 6/25/1891 water right for the Empire Canal Diversion.

55. BCCFS - Browns Creek Appropr., cfs
This value is the 1/20/1892 water right for the Browns Creek Diversion.

56. LIS1CFS - Lisco 1st Appropr., cfs
This value is the 7/1/1893 water right for the Lisco Canal Diversion.

57. NMI2CFS - Nine Mile 2nd Appropr., cfs
This value is the 12/6/1893 water right for the Nine Mile Diversion.

58. LIS2CFS - Lisco 2nd & 3rd Appropr., cfs
This value is the combined 3/27/1894 water rights for the Lisco Diversion.

59. MO1CFS - Midland-Overland 1st & 2nd App., cfs
This value is the combined 6/9/1894 and 8/14/1894 water rights for the Midland-Overland Diversion.

60. BLCFS - Beerline Appropr., cfs
This value is the 10/13/1894 water right for the Beerline Canal Diversion.

61. MO3CFS - Midland-Overland 3rd App., cfs
This value is the 11/20/1894 water right for the Midland-Overland Diversion.

62. CAS2CFS - Castle Rock 2nd & 3rd App., cfs
This value is the combined 10/22/1894 and 10/22/1895 water rights for the Castle Rock Diversion.

63. LIS4CFS - Lisco 4th Appropr., cfs
This value is the 2/24/1896 water right for the Lisco Diversion.

64. CAS4CFS - Castle Rock 4th Appropr., cfs
This value is the 7/22/1896 water right for the Castle Rock Diversion.

65. EMP2CFS - Empire 2nd Appropr., cfs
This value is the 7/20/1907 water right for the Empire Canal Diversion.

66. LIS5CFS - Lisco 5th Appropr., cfs
This value is the 4/6/1910 water right for the Lisco Diversion.

68. CR2CFS - Chimney Rock 2nd Appropr., cfs
This value is the 2/2/1931 water right for the Chimney Rock Diversion.

69. IFLGAPP - Flag to limit NatFlow to approp. (0 = No, 1 = Yes)
This flag is only associated with the natural flow rights below Tri-State Diversion Dam. When this flag is set to 1 (yes), the NPRWUM checks the natural flow diversion below Tri-State and limits them to their natural flow appropriation as necessary. If this flag is set to 0 (no), the NPRWUM will only limited the natural flow diversions below Tri-State to their appropriation when a shortage of natural flow is identified by the NPRWUM.

1.2.2 ADATA1 Items ".FLO" Input File

1. UNGAGN - Ungaged gains above Alcova, cfs
These values are the tributary gains, in cfs, from ungaged streams near Pathfinder Reservoir as agreed upon between the USBR, the State of Wyoming, and the State of Nebraska. The tributary gains vary from month to month during the irrigation season, with no variations from one year to the next.

2. ALGLCLS - Daily carriage loss Alcova-Glendo, cfs
These values are the maximum daily carriage losses, in cfs, in the Alcova to Glendo Reservoir reach as set by the Supreme Court in the North Platte Decree. The carriage losses vary from month to month during the irrigation season, with no variations from one year to the next.

3. ORGUGN - Daily gain Orin Junction-Guernsey, cfs
These values are the daily gains, in cfs, in the Glendo Reservoir to Guernsey Reservoir reach as agreed upon between the USBR, the State of Wyoming, and the State of Nebraska. The gains vary from month to month during the irrigation season, with no variations from one year to the next.

4. GURWHCLS - Daily carriage loss Guernsey-Whalen, cfs
These values are the maximum daily carriage losses, in cfs, in the Guernsey Reservoir to Whalen Dam reach as set by the Supreme Court in the North Platte Decree. The carriage losses vary from month to month during the irrigation season, with no variations from one year to the next.

5. WHSLCLS - Daily carr. loss Whalen-State Line, cfs
These values are the maximum daily carriage losses, in cfs, in the Whalen Dam to Tri-State Dam reach as set by the Supreme Court in the North Platte Decree. The carriage losses vary from month to month during the irrigation season, with no variations from one year to the next.

1.2.3 HDATA1 Items ".FLO" Input File

1. OTHERQ - Other foreign water, (kaf)
At this time, no other foreign water is considered in the natural flow/storage flow segregation procedure. In anticipation of possible future changes in the procedure, which may incorporate the introduction of other foreign water to the system, the HDATA1(1,i,j) array was inserted in the data file. Currently, all of the HDATA1(1,i,j) values are zero. Any values in this array are to be negative.

2. CADMD - Casper Canal Demand, kaf
This data array is the historic Casper Canal deliveries.

3. Not Used - HDATA1 Item Not Used
This row is not used and has been set to zero.

4. LIDMD - Lingle Canal Demand, kaf
This data array is the historic Lingle demands (loss included). Do not make changes to this dataset.

5. HIDMD - Hill Canal Demand, kaf

This data array is the historic Hill demands (loss included). Do not make changes to this dataset.

6. INDMD - Wyoming Laterals Demand, kaf

This data array is the historic Wyoming Laterals demands (loss included). NOTE: The Wyoming Laterals deliveries are not identified separately in the Compiled Water Records from 1941-67. They appear to be included with the Interstate (Pathfinder) deliveries and have been set to zero for the period of 1941-67 in this input file. Do not make changes to this dataset.

7. IPDMD - Interstate (Pathfinder) Demand, kaf

These values are the amount of water historically diverted to the Interstate Canal in the irrigation season that are charged to the Interstate (Pathfinder) diversion. Do not make changes to this dataset.

8. ILDMD - Inland Lakes Demand from IL Acc, kaf

The Inland Lakes historic Demand represents the total water delivered from the Inland Lakes account in the main stem to the Inland Lakes. Do not make changes to this dataset.

9. INLDMD - Demand on Idealized Inland Lakes, kaf

This row is the historic demands on the Idealized Inland Lake and is equal to the sum of the irrigation demands for the Highline, Lowline, and Reservoir Supply Canals. Do not make changes to this dataset.

10. WMDMD - Wright & Murphy Demand, kaf

The Wright and Murphy diversions represent the total historic demand by the Wright and Murphy Ditch. Do not change.

11. GODMD - Ft. Laramie (Goshen) Demand, kaf

The Ft. Laramie (Goshen) diversions represent the total historic demand by Goshen. Do not Change.

12. GFDMD - Gering-Ft. Laramie Demand, kaf

The Gering-Ft. Laramie diversions represent the total historic demand by Gering-Ft. Laramie. Do not change.

13. BUDMD - Burbank Demand, kaf

The Burbank Ditch diversions represent the total historic demand by the Burbank Ditch. The Burbank Ditch headgate is located between the Whalen Diversion Dam and the Tri-State Diversion Dam. Do not Change.

14. LUDMD - Lucerne Demand, kaf

The Lucerne Ditch Diversions represent the total historic demand by the Lucerne Ditch. The Lucerne Ditch headgate is located between the Whalen Diversion Dam and the Tri-State Diversion Dam. Do not change.

15. GRDMD - Grattan Demand, kaf

The Grattan Ditch Diversions represent the total historic demand by the Grattan Ditch. The Grattan Ditch headgate is located between the Whalen Diversion Dam and the Tri-State Diversion Dam. Do not change.

16. TODMD - Torrington Demand, kaf

The Torrington Ditch Diversions represent the total historic demand by the Torrington Ditch. The Torrington Ditch headgate is located between the Whalen Diversion Dam and the Tri-State Diversion Dam. Do not change.

17. RRDMD - Rock Ranch Demand, kaf

The Rock Ranch Ditch Diversions represent the total historic demand by the Rock Ranch Ditch. The Rock Ranch Ditch headgate is located between the Whalen Diversion Dam and the Tri-State Diversion Dam. Do not change.

18. NPDMD - North Platte Demand, kaf
The North Platte Ditch Diversions represent the total historic demand by the North Platte Ditch. The North Platte Ditch headgate is located between the Whalen Diversion Dam and the Tri-State Diversion Dam. Do not change.

19. NADMD - Narrows Demand, kaf
The Narrows Ditch Diversions represent the total historic demand by the Narrows Ditch. The Narrows Ditch headgate is located between the Whalen Diversion Dam and the Tri-State Diversion Dam. Do not change.

20. PFDMD - Pratt-Ferris Demand, kaf
The Pratt-Ferris Ditch Diversions represent the total historic demand by the Pratt-Ferris Ditch. The Pratt-Ferris Ditch is located between Whalen Diversion Dam and the Tri-State Diversion Dam. Do not change.

21. FCHDMD - French Canal Demand, kaf
The French Canal Diversions represent the total historic demand by the French Canal. The French Canal is not active, it ceased diverting from the North Platte River in 1953 and has been set to zero (0). Do not change.

22. MIDMD - Mitchell Demand, kaf
The Mitchell Diversions represent the total historic demand by the Mitchell Canal. The Mitchell Canal headgate is located between the Whalen Diversion Dam and the Tri-State Diversion Dam. The Mitchell diversion is part of the Mitchell-Gering Canal. Do not change.

23. GEDMD - Gering Demand, kaf
The Gering Diversions represent the total historic demand by the Gering Canal. The Gering Canal headgate is located between Whalen Diversion Dam and the Tri-State Diversion Dam. The Gering diversion is part of the Mitchell-Gering Canal. Do not change.

24. FCDMD - Farmers Canal Demand, kaf
These values are the portion of the historic diversions to the Tri-State Canal that are for the Farmers Irrigation District. The Farmers Irrigation District is a Warren Act Contractor and receives storage water from the North Platte Project Account. Do not change.

25. NPTDMD - Northport Demand, kaf
These values are the amount of historic diversions into the Northport Canal. The Northport Canal receives storage water from the North Platte Project Account. Do not change.

26. RADMD - Ramshorn Demand, kaf
These values are the portion of the historic diversions to the Tri-State Canal that are for the Ramshorn Canal. Do not change.

27. ENDMD - Enterprise Demand, kaf
The Enterprise Canal Diversions represent the total demand by the Enterprise Canal. Do not change.

28. WIDMD - Winters Creek Demand, kaf
The Winters Creek Diversions represent the total historic demand by the Winters Creek Canal. Do not change.

29. CNDMD - Central Canal Demand, kaf
The Central Diversions represent the total historic demand by the Central Canal. Do not change.

30. MINDMD - Minatare Demand, kaf
The Minatare Diversions represent the total historic demand by the Minatare Canal. Do not change.

31. CASDMD - Castle Rock Demand, kaf
The Castle Rock Diversions represent the total historic demand by the Castle Rock Canal. Do not change.

32. NMIDMD - Nine Mile Canal Demand, kaf
The Nine Mile Canal Diversions represent the total historic demand by the Nine Mile Canal. Do not change.

33. SHLDMD - Short Line Demand, kaf
The Short Line Diversions represent the total historic demand by the Short Line Canal. Do not change.

34. CRDMD - Chimney Rock Canal Demand, kaf
The Chimney Rock Diversions represent the total historic demand by the Chimney Rock Canal. Do not change.

35. BRDMD - Bridgeport Demand, kaf
The Bridgeport Diversions represent the total historic demand by the Bridgeport District. The Bridgeport District receives water through the Belmont Canal. Do not change.

36. EMPDMD - Empire Demand, kaf
The Empire Diversions represent the total historic demand by the Empire District. The Empire District receives water through the Belmont Canal. Do not change.

37. TSDRNDM - Tri-State Demand from Drains, kaf
This value is the amount of Tri-State historic demand that is supplied from drains. Do not change.

38. ENDRNDM - Enterprise Demand from Drains, kaf
This value is the amount of Enterprise historic demand that is supplied from drains. Do not change.

39. NPDRNDM - Northport Demand from Drains, kaf
This value is the amount of Northport historic demand that is supplied from drains. Do not change.

40. WIDRNDM - Winters Creek Demand from Drains, kaf
This value is the amount of Winters Creek historic demand that is supplied from drains. Do not change.

41. ALDRNDM - Alliance Demand from Drains, kaf
This value is the amount of Alliance historic demand that is supplied from drains. Do not change.

42. BCDMD - Browns Creek Demand, kaf
The Browns Creek Diversions represent the total historic demand by the Browns Creek. Do not change.

43. BLDMD - Beerline Demand, kaf
The Beerline Diversions represent the total historic demand by the Beerline. Do not change.

44. LISDMD - Lisco Demand, kaf
The Browns Creek Diversions represent the total historic demand by the Browns Creek. Do not change.

45. MODMD - Midland-Overland demand, kaf (kaf)
The Midland-Overland Diversions represent the total historic demand by the Midland-Overland. Do not change.

46. FACTREN - Tri-State - Enterprise subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

47. FACENWI - Enterprise - Winters Ck subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

48. FACWICN - Winters Ck - Central subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

49. FACCNMI - Central - Minatare subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

50. FACMICA - Minatare - Castle Rk subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

51. FACCANI - Castle Rk - Nine Mile subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

52. FACNISH - Nine Mile - Short Line subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

53. FACSHCH - Short Line - Chimney Rk subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

54. FACCHEM - Chimney Rk - Empire subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

55. FACEMBC - Empire - Browns Ck subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

56. FACBCBE - Browns Ck - Beerline subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

57. FACBELI - Beerline - Lisco subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

58. FACLIMI - Lisco - Midland-Ovr subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

59. FACMILE - Midland-Ovr - Lewellen subreach factor
These are the factors used by the NPRWUM to determine what portion of the Tri-State to Lewellen reach gain occurs in the given subreach.

60. REUSEHR2 - Reuse Factor Reach #2 Historic
These factors are used to determine the amount of the water available for return flow from the historic deliveries that is to be reused for irrigation in Reach No. 2.

61. REUSEMR2 - Reuse Factor Reach #2 Modeled
These factors are used to determine the amount of the water available for return flow from the modeled deliveries that is to be reused for irrigation in Reach No. 2.

62. REUSEHR3 - Reuse Factor Reach #3 Historic
These factors are used to determine the amount of the water available for return flow from the historic deliveries that is to be reused for irrigation in Reach No. 3.

63. REUSEMR3 - Reuse Factor Reach #3 Modeled
These factors are used to determine the amount of the water available for return flow from the historic deliveries that is to be reused for irrigation in Reach No. 3.

64. GWNET2DM - Ground Water Net Recharge Reach #2 Historic, kaf
These values represent the amount of recharge to the ground water from well irrigation for historic deliveries in reach No. 2 (input as negative numbers to indicate depletions).

65. GWNET2DE - Ground Water Net Recharge Reach #2 Modeled, kaf
These values represent the amount of recharge to the ground water from well irrigation for historic deliveries in reach No. 2 (input as negative numbers to indicate depletions).

66. GWNET3DM - Ground Water Net Recharge Reach #3 Historic, kaf
These values represent the amount of recharge to the ground water from well irrigation for historic deliveries in reach No. 3 (input as negative numbers to indicate depletions).

67. GWNET3DE - Ground Water Net Recharge Reach #3 Modeled, kaf
These values represent the amount of recharge to the ground water from well irrigation for historic deliveries in reach No. 3 (input as negative numbers to indicate depletions).

1.2.4 FLOW1 Items NATFLOW.LST Output File

1. TNFLOW - Calculated NF abv Alcova, kaf
This row is the total calculated natural flow above Alcova.   TNFLOW = SEMIN + UNGAGN + OTHERQ

2. NPABSEM - North Platte River above Seminoe, kaf
This is the North Platte River above Seminoe Reservoir, near Sinclair (Parco) gaging station (USGS 06630000).

3. MBABSEM - Medicine Bow River above Seminoe, kaf
This is the Medicine Bow River above Seminoe Reservoir, near Hanna gaging station (USGS 06635000). Within the USBR data base, the compiled monthly values in thousands of acre feet are available from 1940 to present.

4. SWEET - Sweetwater River, kaf
This data array is the Sweetwater River near Pathfinder Reservoir gaged inflows.

5. Not Used - FLOW1 Item Not Used

6. UNGAGN - Ungaged gains above Alcova, kaf
These values are the tributary gains, in kaf, from ungaged streams near Pathfinder Reservoir as agreed upon between the USBR, the State of Wyoming, and the State of Nebraska. The tributary gains vary from month to month during the irrigation season, with no variations from one year to the next.

7. OTHERQ - Other Foreign Water, kaf
At this time, no other foreign water is considered in the natural flow/storage flow segregation procedure. In anticipation of possible future changes in the procedure, which may incorporate the introduction of other foreign water to the system, the HDATA1(1,i,j) array was inserted in the data file. Currently, all of the HDATA1(1,i,j) values are zero. Any values in this array are to be negative.

8. PNFABAL - Physical NF above Alcova, kaf
These values are the physical natural flow above Alcova and are equal to the sum of the Seminoe Reservoir inflow, Seminoe Reservoir gain/loss, Kortes to Pathfinder gain, and the Sweetwater River.

9. TGRFOUT - Total Gray Reef Reservoir Outflow, kaf
Total Gray Reef outflow is equal to the minimum required outflow plus any spill or additional release to meet downstream demands.

10. CALCGRNF - Calculated NF at Gray Reef, kaf
The calculated natural flow at Gray Reef Reservoir is equal to the lesser of the total Gray Reef Reservoir outflow (TGRFOUT) or the calculated natural flow above Alcova (TNFLOW).

11. STBGRF - Storage water below Gray, kaf
This is the storage water below Gray Reef Reservoir and is obtained by subtracting the total natural flow from the Gray Reef outflow.
STBGRF = TGRFOUT - TNFLOW

12. CITYDEL - City of Casper Delivery from enlarged Pathfinder #1 Ownership, kaf
This array is the monthly City of Casper deliveries from the enlarged Pathfinder #1 Ownership as determined by the model.

13. ALGLCLS - GR-GL Storage Loss, kaf
This row is the storage carriage losses from Gray Reef to Glendo and are calculated by dividing the storage below Gray Reef Reservoir (STBGRF) by the total Gray Reef outflow (GRFOUT) and multiplying by the court decreed carriage loss. ALGLCLS = (STBGRF/TGRFOUT) * Decreed loss.

14. PNFABAL - Physical NF above Alcova, kaf
These values are the physical natural flow above Alcova and are equal to the sum of the Seminoe Reservoir inflow, Seminoe Reservoir gain/loss, Kortes to Pathfinder gain, and the Sweetwater River. The physical natural flow available above Gray Reef is equal to the physical natural flow available above Alcova and is repeated here for output presentation.

15. ORIN - Total Orin Jct. Inflow, kaf
This row is the calculated flow of the North Platte River near Orin Junction (Glendo Reservoir Inflow). The calculated flow of the North Platte River near Orin Junction is equal to the sum of the total Gray Reef outflow (TGRFOUT), Alcova to Glendo gain/loss (ALGLGN), and the Glendo Reservoir gain/loss (GLGL).

16. ORINCNF - Orin Jct. Calculated NF, kaf
This row is calculated as the difference of the total Orin inflow (ORIN) and storage flow at Orin (ORINSTOR). It is set to zero if negative.

17. ORINSTOR - Storage Flow at Orin Jct., kaf
The storage flow at Orin is equal to the storage flow at Gray Reef (STBGRF) minus the Gray Reef to Glendo storage carriage loss (ALGLCLS), set to zero if negative.

18. ORGUGN - Orin to Guernsey NF Gain, kaf
This row is the Orin to Guernsey natural flow gain (ORGUGN) of 20.0 cfs converted to kaf.

19. ORINNF - Physical NF Avail above Orin, kaf
The physical natural flow available above Orin is equal to the sum of the physical natural flow above Alcova (PNFABAL), Alcova to Glendo gain/loss (ALGLGN), and Glendo Reservoir gain/loss (GLGL).

20. GURTOTAL - Total Guernsey Inflow, kaf
This row is the total Guernsey inflow and is equal to the Guernsey Reservoir outflow (GOUT(j)) as calculated in the OPRES subroutine.

21. GURNATF - Calculated NF at Guernsey, kaf
The calculated natural flow at Guernsey is equal to the calculated natural flow at Orin (ORINCNF) plus the Orin to Guernsey natural flow gain (ORGUGN).

22. GURSTOR - Guernsey Storage Flow, kaf
This row is the Guernsey storage flow and is equal to the total Guernsey inflow (GURTOTAL) minus the calculated natural flow at Guernsey (GURNATF).

23. GURWHCLS - Guernsey to Whalen Storage Loss, kaf
This row is the storage carriage losses from Guernsey to Whalen and are calculated by dividing the storage flow at Guernsey (GURSTOR) by the total Guernsey inflow (GURTOTAL) and multiplying by the court decreed carriage loss. GURWHCLS = (GURSTOR/GURTOTAL) * Decreed loss.

24. PNFABGUR - Physical NF above Guernsey, kaf
This row is the physical natural flow above Guernsey and is equal to the physical natural flow above Orin (ORINNF) plus the Glendo to Guernsey gain/loss (GLGUGN).

25. TINTCDIV + TFTLDIV - Interstate and Ft. Laramie Tot Div, kaf
This row is the sum of the Interstate Canal (TINTCDIV) and Ft. Laramie Canal (TFTLDIV) diversions.

26. WHOUT(j) - Total Whalen Dam outflow, kaf
This row is the total flow in the North Platte River downstream of the Whalen Diversion Dam.

27. WHTOTAL - Total inflow at Whalen, kaf
This row is the total inflow at Whalen and is equal to the sum of the Whalen outflow (WHOUT(j)), total Interstate diversion (TINTCDIV), and total Ft. Laramie Canal (TFTLDIV) diversions

28. WHNATF - Whalen Calculated NF, kaf
This row is calculated natural flow at Whalen and is the difference of the total Whalen inflow (WHTOTAL) and the Whalen storage flow (WHSTOR), set to zero if negative.

29. WHSTOR - Whalen Storage Flow, kaf
This row is the Whalen storage flow and is equal to the storage flow at Guernsey (GURSTOR) minus the Guernsey to Whalen storage carriage loss (GURWHCLS), set to zero if negative.

30. GUSLCLS - Whalen-Stateline Carriage Loss, kaf
This row is the storage carriage losses from Whalen to the State Line and are calculated by dividing the storage below at Whalen (WHSTOR) by the total Whalen inflow (WHTOTAL) and multiplying by the court decreed carriage loss. WHSLCLS = (WHSTOR/WHTOTAL) * Decreed loss.

31. PNFABWH - Physical NF above Whalen, kaf
This row is the physical natural flow available above Whalen and is equal to the physical natural flow above Guernsey (PNFABGUR) plus the Guernsey to Whalen gain/loss (GUWHGN).

32. TOTDV - Total Flow at Tri-State, kaf
This row is the total flow at Tri-State and is equal to the sum of the diversions between Guernsey and Tri-State, water orders for storage passing Tri-State, and any water spilled from Guernsey Reservoir.

33. TNFDV - Total Calculated NF Diversions, kaf
This row is the total calculated natural flow diversion and is equal to the total flow at Tri-State (TOTDV) minus the storage diversions (WHSTDV).

34. TEXDV - Total Excess Diversions, kaf
This row is the total amount of excess water used to augment natural flow from the Excess-to-Ownership.

35. WHSTDV - Total Storage Diversions, kaf
This row is the total amount of storage water used for irrigation.

36. TPHYSNF - Total Physical System NF, kaf
This row is the total physical natural flow available in the system and is equal to the sum of the physical natural flow above Whalen (PNFABWH), Whalen to Tri-State gain/loss (WHTSGN), and Laramie River inflow (LARAME).

37. GRDEL - Grattan Total Delivery, kaf
This row is the amount of water delivered to Grattan as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

38. GRNFDV - Grattan Natural Flow Diversion, kaf
This row is the natural flow taken by Grattan and is equal to its appropriation(s) met by the existing natural flow.

39. GRSTDV - Grattan Storage Diversion, kaf
This row is equal to amount of storage water taken by Grattan to meet irrigation needs. The Grattan Ditch is a Glendo Unit Contractor and receives storage water from the Glendo Unit account.

40. GREXDV - Grattan Excess Diversion, kaf
This row is equal to amount of excess water used by Grattan from the ETO account to augment natural flow.

41. NPDEL - North Platte Total Delivery, kaf
This row is equal to amount of water delivered to North Platte as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

42. NPNFDV - N. Platte Natural Flow Diversion, kaf
This row is equal to natural flow taken by North Platte and is equal to its appropriation(s) met by the existing natural flow.

43. NPSTDV - N. Platte Storage Diversion, kaf
This row is equal to amount of storage water taken by North Platte to meet irrigation needs. The North Platte Ditch had no special storage water contracts and must purchase storage water when desired.

44. NPEXDV - N. Platte Excess Diversion, kaf
This row is equal to amount of excess water used by North Platte from the ETO account to augment natural flow.

45. RRDEL - Rock Ranch Total Delivery, kaf
This row is equal to amount of water delivered to Rock Ranch as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

46. RRNFDV - Rock Ranch Natural Flow Diversion, kaf
This row is equal to natural flow taken by Rock Ranch and is equal to its appropriation(s) met by the existing natural flow.

47. RRSTDV - Rock Ranch Storage Diversion, kaf
This row is equal to amount of storage water taken by Rock Ranch to meet irrigation needs. The Rock Ranch Ditch is a Warren Act Contractor and receives storage water from the North Platte Project account.

48. RREXDV - Rock Ranch Excess Diversion, kaf
This row is equal to amount of excess water used by Rock Ranch from the ETO account to augment natural flow.

49. PFDEL - Pratt Ferris Total Delivery, kaf
This row is equal to amount of water delivered to Pratt Ferris as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

50. PFNFDV - Pratt Ferris Natural Flow Div, kaf
This row is equal to natural flow taken by Pratt Ferris and is equal to its appropriation(s) met by the existing natural flow.

51. PFSTDV - Pratt Ferris Storage Diversion, kaf
This row is equal to amount of storage water taken by Pratt Ferris to meet irrigation needs. The Pratt Ferris Ditch had no special storage water contracts and must purchase storage water when desired.

52. PFEXDV - Pratt Ferris Excess Diversion, kaf
This row is equal to amount of excess water used by Pratt Ferris from the ETO account to augment natural flow.

53. BUDEL - Burbank Total Delivery, kaf
This row is equal to amount of water delivered to Burbank as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

54. BUNFDV - Burbank Natural Flow Diversion, kaf
This row is equal to natural flow taken by Burbank and is equal to its appropriation(s) met by the existing natural flow.

55. BUSTDV - Burbank Storage Diversion, kaf
This row is equal to amount of storage water taken by Burbank to meet irrigation needs. The Burbank Ditch is a Glendo Unit Contractor and receives storage water from the Glendo Unit account.

56. BUEXDV - Burbank Excess Diversion, kaf
This row is equal to amount of excess water used by Burbank from the ETO account to augment natural flow.

57. TODEL - Torrington Total Delivery, kaf
This row is equal to amount of water delivered to Torrington as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

58. TONFDV - Torrington Natural Flow Diversion, kaf
This row is equal to natural flow taken by Torrington and is equal to its appropriation(s) met by the existing natural flow.

59. TOSTDV - Torrington Storage Diversion, kaf
This row is equal to amount of storage water taken by Torrington to meet irrigation needs. The Torrington Ditch is a Glendo Unit Contractor and receives storage water from the Glendo Unit account.

60. TOEXDV - Torrington Excess Diversion, kaf
This row is equal to amount of excess water used by Torrington from the ETO account to augment natural flow.

61. LUDEL - Lucerne Total Delivery, kaf
This row is equal to amount of water delivered to Lucerne as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

62. LUNFDV - Lucerne Natural Flow Diversion, kaf
This row is equal to natural flow taken by Lucerne and is equal to its appropriation(s) met by the existing natural flow.

63. LUSTDV - Lucerne Storage Diversion, kaf
This row is equal to amount of storage water taken by Lucerne to meet irrigation needs. The Lucerne Ditch is a Glendo Unit Contractor and receives storage water from the Glendo Unit account.

64. LUEXDV - Lucerne Excess Diversion, kaf
This row is equal to amount of excess water used by Lucerne from the ETO account to augment natural flow.

65. NADEL - Narrows Total Delivery, kaf
This row is equal to amount of water delivered to Narrows as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

66. NANFDV - Narrows Natural Flow Diversion, kaf
This row is equal to natural flow taken by Narrows and is equal to its appropriation(s) met by the existing natural flow.

67. NASTDV - Narrows Storage Diversion, kaf
This row is equal to amount of storage water taken by Narrows to meet irrigation needs. The Narrows Ditch had no special storage water contract and must purchase storage water when desired. Typically, this has been Glendo Unit water.

68. NAEXDV - Narrows Excess Diversion, kaf
This row is equal to amount of excess water used by Narrows from the ETO account to augment natural flow.

69. LIDEL - Lingle Total Delivery, kaf
This row is equal to amount of water delivered to Lingle as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate. Interstate Canal deliveries above milepost 2.7 are included with Lingle.

70. LINFDV - Lingle Natural Flow Diversion, kaf
This row is equal to natural flow taken by Lingle and is equal to its appropriation(s) met by the existing natural flow. Interstate Canal deliveries above milepost 2.7 are included with Lingle.

71. LISTDV - Lingle storage diversions (kaf)
This row is equal to amount of storage water taken by Lingle to meet irrigation needs. The Lingle Diversion is a Warren Act Contractor and receives storage water from the North Platte Project account. Interstate Canal deliveries above milepost 2.7 are included with Lingle.

72. LIEXDV - Lingle Excess Diversion, kaf
This row is equal to amount of excess water used by Lingle from the ETO account to augment natural flow. Interstate Canal deliveries above milepost 2.7 are included with Lingle.

73. HIDEL - Hill Total Delivery, kaf
This row is equal to amount of water delivered to Hill as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

74. HINFDV - Hill Natural Flow Diversion, kaf
This row is equal to natural flow taken by Hill and is equal to its appropriation(s) met by the existing natural flow.

75. HISTDV - Hill Storage Diversion, kaf
This row is equal to amount of storage water taken by Hill to meet irrigation needs. The Hill Diversion is a Warren Act Contractor and receives storage water from the North Platte Project account.

76. HIEXDV - Hill Excess Diversion, kaf
This row is equal to amount of excess water used by Hill from the ETO account to augment natural flow.

77. WMDEL - Wright/Murphy Total Delivery, kaf
This row is equal to amount of water delivered to Wright and Murphy as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

78. WMNFDV - Wright/Murphy NF Diversion, kaf
This row is equal to natural flow taken by Wright and Murphy and is equal to its appropriation(s) met by the existing natural flow.

79. WMSTDV - Wright/Murphy Storage Diversion, kaf
This row is equal to amount of storage water taken by Wright and Murphy to meet irrigation needs. The Wright and Murphy Diversion is a Glendo Unit Contractor and receives storage water from the Glendo Unit account.

80. WMEXDV - Wright/Murphy Excess Diversion, kaf
This row is equal to amount of excess water used by Wright and Murphy from the ETO account to augment natural flow.

81. INDEL - WY Laterals Total Delivery, kaf
This row is equal to amount of water delivered to Wyoming Laterals as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate. NOTE: The Wyoming Laterals deliveries are not identified separately in the Compiled Water Records from 1941-67. They appear to be included with the Interstate (Pathfinder) deliveries and have been set to zero for the period of 1941-67 in the input file.

82. WLNFDV - WY Laterals NF Diversion, kaf
This row is equal to natural flow taken by Wyoming Laterals and is equal to its appropriation(s) met by the existing natural flow.

83. WLSTDV - WY Laterals Storage Diversion, kaf
This row is equal to amount of storage water taken by Wyoming Laterals to meet irrigation needs. The Interstate (Wyoming Laterals) Diversion receives storage water from the North Platte Project account.

84. WLEXDV - WY Laterals Excess Diversion, kaf
This row is equal to amount of excess water used by Wyoming Laterals from the ETO account to augment natural flow.

85. GODEL - Ft. Laramie (Goshen) Total Delivery, kaf
This row is equal to amount of water delivered to Ft. Laramie (Goshen) as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

86. GONFDV - Goshen Natural Flow Diversion, kaf
This row is equal to natural flow taken by Ft. Laramie (Goshen) and is equal to its appropriation(s) met by the existing natural flow.

87. GOSTDV - Goshen Storage Diversion, kaf
This row is equal to amount of storage water taken by Ft. Laramie (Goshen) to meet irrigation needs. The Ft. Laramie (Goshen) Diversion receives storage water from the North Platte Project account.

88. GOEXDV - Goshen Excess Diversion, kaf
This row is equal to amount of excess water used by Ft. Laramie (Goshen) from the ETO account to augment natural flow.

89. CCKDEL - Corn Creek Total Delivery, kaf
This row is equal to amount of water delivered to Corn Creek as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

90. CCKNFDV - Corn Creek Natural Flow Diversion, kaf
The Corn Creek Diversion does not have a natural flow right from the North Platte River and is set equal to zero (0). FLOW1(90,j) = 0.0

91. CCKDEL - Corn Creek Storage Diversion, kaf
Since Corn Creek receives only storage water, this row is equal to amount of water delivered to Corn Creek as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

92. CCKEXDV - Corn Creek Excess Diversion, kaf
The Corn Creek Diversion does not get excess water and is set to zero (0). FLOW1(92,j) = 0.0

93. FCDEL - Farmers Total Delivery, kaf
This row is equal to amount of water delivered to Farmers as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

94. FCNFDV - Farmers Nat Flow Diversion, kaf
This row is equal to natural flow taken by Farmers and is equal to its appropriation(s) met by the existing natural flow.

95. FCSTDV - Farmers Storage Diversion, kaf
This row is equal to amount of storage water taken by Farmers to meet irrigation needs. The Farmers Diversion is a Warren Act Contractor and receives storage water from the North Platte Project account.

96. FCEXDV - Farmers Excess Diversion, kaf
This row is equal to amount of excess water used by Farmers from the ETO account to augment natural flow.

97. MIDEL - Mitchell Total Delivery, kaf

This row is equal to amount of water delivered to Mitchell as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate. The Mitchell Canal headgate is located between the Whalen Diversion Dam and the Tri-State Diversion Dam. The Mitchell diversion is part of the Mitchell-Gering Canal.

98. MINFDV - Mitchell Natural Flow Diversion, kaf

This row is equal to natural flow taken by Mitchell and is equal to its appropriation(s) met by the existing natural flow.

99. MISTDV - Mitchell Storage Diversion, kaf

This row is equal to amount of storage water taken by Mitchell to meet irrigation needs. The Mitchell Canal diversion is a Glendo Unit Contractor and receives storage water from the Glendo Unit account.

100. MIEXDV - Mitchell Excess Diversion, kaf

This row is equal to amount of excess water used by Mitchell from the ETO account to augment natural flow.

101. RADEL - Ramshorn Total Delivery, kaf

This row is equal to amount of water delivered to Ramshorn as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate. These values are the portion of the diversion to the Tri-State Canal that are for the Ramshorn Canal.

102. RANFDV - Ramshorn Natural Flow Diversion, kaf

This row is equal to natural flow taken by Ramshorn and is equal to its appropriation(s) met by the existing natural flow.

103. RASTDV - Ramshorn Storage Diversion, kaf

This row is equal to amount of storage water taken by Ramshorn to meet irrigation needs.

104. RAEXDV - Ramshorn Excess Diversion, kaf

This row is equal to amount of excess water used by Ramshorn from the ETO account to augment natural flow.

105. GEDEL - Gering Total Delivery, kaf

This row is equal to amount of water delivered to Gering as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate. The Gering Diversions represent the total demand by the Gering Canal. The Gering Canal headgate is located between Whalen Diversion Dam and the Tri-State Diversion Dam. The Gering diversion is part of the Mitchell-Gering Canal.

106. GENFDV - Gering Natural Flow Diversion, kaf

This row is equal to natural flow taken by Gering and is equal to its appropriation(s) met by the existing natural flow.

107. GESTDV - Gering Storage Diversion, kaf

This row is equal to amount of storage water taken by Gering to meet irrigation needs. The Gering Canal Diversion is a Warren Act Contractor and receives storage water from the North Platte Project account.

108. GEEXDV - Gering Excess Diversion, kaf

This row is equal to amount of excess water used by Gering from the ETO account to augment natural flow.

109. GFDEL - Gering-Ft. Laramie Total Delivery, kaf

This row is equal to amount of water delivered to Gering-Ft. Laramie as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

110. GFNFDV - Gering-Ft. Laramie NF Diversion, kaf
This row is equal to natural flow taken by Gering-Ft. Laramie and is equal to its appropriation(s) met by the existing natural flow.

111. GFSTDV - Gering-Ft. Laramie Storage Div, kaf
This row is equal to amount of storage water taken by Gering-Ft. Laramie to meet irrigation needs. The Gering-Ft. Laramie Canal Diversion receives storage water from the North Platte Project account.

112. GFEXDV - Gering-Ft. Laramie Excess Diversion, kaf
This row is equal to amount of excess water used by Gering-Ft. Laramie from the ETO account to augment natural flow.

113. IPDEL - Interstate (Pathfinder) Tot Del, kaf
This row is equal to amount of water delivered to Interstate (Pathfinder) as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate. The deliveries to the Inland lakes through the Interstate Canal were broken out of the Interstate-Pathfinder diversion.

114. IPNFDV - Interstate (Pathfinder) NF Div, kaf
This row is equal to natural flow taken by Interstate (Pathfinder) and is equal to its appropriation(s) met by the existing natural flow.

115. IPSTDV - Interstate (Pathfinder) Stor Div, kaf
This row is equal to amount of storage water taken by Interstate (Pathfinder) to meet irrigation needs. The Interstate (Pathfinder) Canal Diversion receives storage water from the North Platte Project account.

116. IPEXDV - Interstate (Pathfinder) Ex Div, kaf
This row is equal to amount of excess water used by Interstate (Pathfinder) from the ETO account to augment natural flow.

117. NPTDEL - Northport Total Delivery, kaf
This row is equal to amount of water delivered to Northport as determined by the computer model. It will be equal to the adjustable delivery entered by the model user in the HDATA input set, if water supply conditions were adequate.

118. NPTNFDV - Northport Natural Flow Diversion, kaf
This row is equal to natural flow taken by Northport and is equal to its appropriation(s) met by the existing natural flow.

119. NPTSTDV - Northport Storage Diversion, kaf
This row is equal to amount of storage water taken by Northport to meet irrigation needs. The Northport Canal diversion receives storage water from the North Platte Project account.

120. NPTEXDV - Northport Excess Diversion, kaf
This row is equal to amount of excess water used by Northport from the ETO account to augment natural flow.

121. TPASTRI - Total Passing Tri-State (kaf)
This row is the total volume of water passing Tri-State Dam.

122. PASTRINF - Natural flow Pass Tri-State, kaf
This row is the amount of natural flow that passes Tri-State and is equal to the total flow passing Tri-State Dam (TPASTRI) and water orders for storage below Tri-State Dam (WOPTRI).

123. WOPTRI - Storage Water Orders pass Tri-State, kaf
This row is the storage water passing Tri-State and is equal to the sum of all water orders for storage below Tri-State Dam.

124. ENSDEL - Enterprise WO Storage Diversion, kaf
This row is equal to amount of the water order for storage passing Tri-State Dam taken to meet irrigation needs.

125. CNSDEL - Central WO Storage Diversion, kaf
This row is equal to amount of the water order for storage passing Tri-State Dam taken to meet irrigation needs.

126. CRSDEL - Chimney Rk WO Storage Diversion, kaf
This row is equal to amount of the water order for storage passing Tri-State Dam taken to meet irrigation needs.

127. BRSDEL - Bridgeport WO Storage Diversion, kaf
This row is equal to amount of the water order for storage passing Tri-State Dam taken to meet irrigation needs.

128. BCSDEL - Browns Ck WO Storage Diversion, kaf
This row is equal to amount of the water order for storage passing Tri-State Dam taken to meet irrigation needs.

129. BESDEL - Beerline WO Storage Diversion, kaf
This row is equal to amount of the water order for storage passing Tri-State Dam taken to meet irrigation needs.

130. CNPDEL - CNPP&ID WO for Storage, kaf
This row is equal to amount of water delivered past Tri-State for the CNPP&ID.

131. GLSTWO - Total WO Glendo Contractors, kaf
This row is equal to amount of water delivered past Tri-State for the Glendo Contractors.

132. WARATWO - Total WO Warren Act Contractors, kaf
This row is equal to amount of water delivered past Tri-State for the Warren Act Contractors.

133. TWYDIV - Total Wyoming Diversions, kaf
This row is the total diversions made by Wyoming diversions as determined by the computer model.

134. TNEDIV - Total Nebraska Diversions, kaf
This row is the total diversions made by Nebraska diversions as determined by the computer model.

135. TWYNFDV - Total Wyoming Nat Flow, kaf
This row is the sum of the all natural flow diversions for Wyoming.

136. TNENFDV - Total Nebraska Nat Flow, kaf
This row is the sum of the all natural flow diversions for Nebraska.

137. TWYSTDV - Total Wyoming Storage Div, kaf
This row is the total storage diversions for Wyoming and is equal to the total Wyoming diversions minus the total Wyoming natural flow diversions minus the total Wyoming excess diversions.

138. TNESTDV - Total Nebraska Storage Div, kaf
This row is the total storage diversions for Nebraska and is equal to the total Nebraska diversions minus the total Nebraska natural flow diversions minus the total Nebraska excess diversions.

139. TWYEXDV - Total Wyoming Excess Diversion, kaf
This row is equal to the total amount of excess water used by Wyoming diversions from the ETO account to augment natural flow.

140. TNEEXDV - Total Nebraska Excess Diversion, kaf
This row is equal to the total amount of excess water used by Nebraska diversions from the ETO account to augment natural flow.

141. GLUDEL(j) + GLNFDV(j) - Glendo Unit Deliveries, kaf
This row is the sum of the total water delivered to the Glendo contractors and the total natural flow diversions taken by those canals/ditches associated with the Glendo Unit.

142. GLNFDV(j) - Total Calculated Glendo NF, kaf
This row is the total natural flow used by the canals/ditches associated with the Glendo Unit.

143. GLUDEL(j) - Glendo Storage Demand, kaf
This row is the sum of the total water delivered to the Glendo contractors from the Glendo irrigation pool account.

144. - PNIR(j) + NFDVNP(j)
This row is the sum of the total water delivered to the North Platte contractors and the total natural flow diversions taken by those canals/ditches associated with the North Platte Project.

145. NFDVNP(j) - Total Calculated North Platte NF, kaf
This row is the total natural flow used by the canals/ditches associated with the North Platte Project.

146. PNIR(j) - North Platte Project Storage Dem, kaf
This row is the total calculated demand for storage water from the North Platte Project account.

147. CADEL - Kendrick Project Total Deliveries, kaf
This row is the sum of the total water delivered to the Kendrick contractors (Casper Canal) and the total natural flow diversions taken by those Casper Canals.

148. CANFDV - Total Calculated Kendrick NF, kaf
This row is the total natural flow used by the Casper Canal.

149. CASTDV - Kendrick Storage Demand, kaf
This row is the total storage water delivered to the Casper Canal.

1.2.5 TABLE1 Items NATFLOW.TAB Output File

1. TNFDV - Total Calculated NF Diversions, kaf
This table is the total calculated natural flow diversion and is equal to the total flow at Tri-State (TOTDV) minus the storage diversions (WHSTDV).

2. WHSTDV - Total Storage Diversions, kaf
This table is the total amount of storage water used for irrigation.

3. NPNFDV - N. Platte Natural Flow Diversion, kaf
This table is equal to natural flow taken by North Platte and is equal to its appropriation(s) met by the existing natural flow.

4. GLNFDV(j) - Total Calculated Glendo NF, kaf
This table is the total natural flow used by the canals/ditches associated with the Glendo Unit.

5. CANFDV - Total Calculated Kendrick NF, kaf
This table is the total natural flow used by the Casper Canal.

6. TEXDV - Total Excess Diversions, kaf
This table is the total amount of excess water used to augment natural flow from the Excess-to-Ownership.

7. PNFABGUR - Physical NF above Guernsey, kaf
This table is the physical natural flow above Guernsey and is equal to the physical natural flow above Orin (ORINNF) plus the Glendo to Guernsey gain/loss (GLGUGN).

8. TABLE(8,i,j) - Total Diversions below Guernsey, kaf
This table is the total diversions below Guernsey calculated as del2il + (tnppdel-ambfpp) + tgludel in the non-irrigation season and tnppdel + tgludel + pfdel + nadel + npdel + radel during the irrigation season.

9. GRNELEV(j + 1) - Guernsey Reservoir Elevation, ft
This table is the Guernsey End-of-Month Elevation (calculated by evaporation subroutine with ielev flag = 1).

10. GLNELEV(j + 1) - Glendo Reservoir Elevation, ft
This table is the Glendo End-of-Month Elevation (calculated by evaporation subroutine with ielev flag = 1).

11. ALCELEV(j + 1) - Alcova Reservoir Elevation, ft
This table is the Alcova End-of-Month Elevation (calculated by evaporation subroutine with ielev flag = 1).

12. PTHELEV(j + 1) - Pathfinder Reservoir Elevation, ft
This table is the Pathfinder End-of-Month Elevation (calculated by evaporation subroutine with ielev flag = 1).

13. SEMELEV(j + 1) - Seminoe Reservoir Elevation, ft
This table is the Seminoe End-of-Month Elevation (calculated by evaporation subroutine with ielev flag = 1).

14. SEGL - Seminoe Gain Loss, kaf
This table is the Seminoe bank storage/seepage.

15. PFGL - Pathfinder Gain/Loss, kaf
This table is the Pathfinder bank storage/seepage.

16. GLGL - Glendo Gain/Loss, kaf
This table is the Glendo bank storage/seepage.

17. RFDMWT - Historic Return Flow Reach #2, kaf
This table is the Whalen to Tri-State Historic Return Flow.

18. RFDLWT - Modeled Return Flow Reach #2, kaf
This table is the Modeled return flow Reach #2.

19. RFDMTL - Historic Return Flow Reach #3, kaf
This table is the Tri-State to Lewellen Historic Return Flow.

20. RFDLTL - Modeled Return Flow Reach #3, kaf
This table is the Tri-State to Lewellen Modeled Return Flow.

21. FLOW(65,j) - Gray Reef Reservoir Outflow(TGRFOUT), kaf
This table is the Gray Reef Reservoir outflow.

22. SYSBGL - System Balance: Guernsey to Lewellen, kaf
This table is the water balance Guernsey to Lewellen.

23. CANDIVS - Total Canal Diversions Guernsey to Lewellen, kaf
This table is the total Canal Diversions Guernsey to Lewellen.

1.3 Storage Ownership Accounting

The input files for the storage ownership are designated by the file extension ".SOA". For example, the storage ownership input data are contained in the file BASELINE.SOA. Described below are the CDATA2, ADATA2, and HDATA2 input items and FLOW2 and TABLE2 output items associated with the storage ownership.

1.3.1 CDATA2 Items ".SOA" Input File

1. GPST(1) - N.P. Guernsey Initial Ownership, kaf
This value is the initial ownership in the North Platte Guernsey account.

2. GURNACC - N.P. Guernsey Accrual Flag (0 = No, 1 = Yes)
This value is the North Platte Guernsey accrual flag. A value of one (1) tells the NPRWUM that it can accrue water to the North Platte Guernsey account, if water is available.

3. AMST(1) - Inland Lakes Initial Ownership, kaf
This value is the initial ownership in the Inland Lakes account in the main stem.

4. AMCAP - Inland Lakes Annual Accrual, kaf
This value is the total annual allowable accrual by the Inland Lakes Account in the main stem. This value should not be changed unless a change in the operation of the ownership accounts is desired.

5. GLEVST(1) - Glendo Evap Initial Ownership, kaf
This value is the initial ownership in the Glendo Evaporation Pool.

6. GLEVMAX - Glendo Unit Annual Evap Accrual, kaf
This value is the total annual allowable evaporation accrual by the Glendo Unit Account and is set at 20.090 kaf.

7. GLEVACC - Glendo Evap Pool Acc Flag (0 = No, 1 = Yes)
This value is the Glendo Evaporation Pool accrual flag. A value of one (1) tells the NPRWUM that it can accrue water to the Evaporation Pool, if water is available.

8. GLIRST(1) - Glendo Irr Initial Ownership, kaf
This value is the initial ownership in the Glendo Irrigation Pool.

9. GLUXAC - Glendo Irr Pool Max Ownership, kaf
This value is the maximum ownership for the Glendo Irrigation Pool and is set at 100.0 kaf.

10. GLIRMAX - Glendo Irr Pool Annual Accrual, kaf
This value is the maximum annual allowable accrual for the Glendo Irrigation Pool and it is set at 40.0 kaf.

11. GLIRACC - Glendo Irr Pool Acc Flag (0 = No, 1 = Yes)
This value is the Glendo Irrigation Pool accrual flag. A value of one (1) tells the NPRWUM that it can accrue water to the Irrigation Pool, if water is available.

12. PLPWST(1) - Glendo Power Pool Init Ownership, kaf
This value is the initial ownership in the Glendo Power Pool.

13. GLPWMAX - Glendo Max Power Pool Head, kaf
This value is the maximum Glendo Reservoir Power Pool content and is set at 63.148 kaf.

14. GLPWACC - Glendo Power Pool Acc Flag (0 = No, 1 = Yes)
This value is the Glendo Power Pool accrual flag. A value of one (1) tells the NPRWUM that it can accrue water to the Power Pool, if possible. The Power Pool can only accrual water after all other ownership accounts on the system have filled and water is available.

15. GLTEST(1) - Glendo ETO Initial Ownership, kaf
This value is the initial content in the Glendo Excess-to-Ownership.

16. GLTEMAX - Glendo ETO Maximum Accrual, kaf
This value is the total annual allowable accrual by the Glendo ETO and is set at 100.0 kaf.

17. GLTEACC - Glendo ETO Accrual Flag (0 = No, 1 = Yes)
This value is the Glendo ETO accrual flag. A value of one (1) tells the NPRWUM that it can accrue water to Glendo ETO, if water is available.

18. SMNST(1) - Kendrick Seminoe Init Ownership, kaf
This value is the initial ownership in the Kendrick Seminoe account.

19. SEMACC - Kendrick Seminoe Acc flag (0 = No, 1 = Yes)
This value is the Kendrick Seminoe accrual flag. A value of one (1) tells the NPRWUM that it can accrue water to the Kendrick Seminoe account, if water is available.

20. ALST(1) - Kendrick Alcova Initial Ownership, kaf
This value is the initial ownership content in the Kendrick Alcova account.

21. ALCACC - Kendrick Alcova Acc Flag (0 = No, 1 = Yes)
This value is the Kendrick Alcova accrual flag. A value of one (1) tells the NPRWUM to accrue water to the Kendrick Alcova ownership account, if water is available.

22. KENDFLAG - Kendrick Water bl Alcova (0 = No, 1 = Yes)
This value is the flag that will allow the NPRWUM to move Kendrick water below Alcova, if the North Platte Pathfinder account has insufficient storage to meet the minimum flow through Casper. When the flag is set to zero (0), the minimum flow below Gray Reef will be violated if the North Platte Pathfinder ownership is depleted. If the flag is set to one (1), Kendrick water will be moved below Alcova and the minimum flow below Gray Reef will not be violated. Kendrick water moved below Alcova is be treated as water transferred to the North Platte Pathfinder ownership account and is transferred back to the Kendrick account as soon as possible.

23. PPST(1) - N.P. Pathfinder Initial Ownership, kaf
This value is the initial ownership in the North Platte Pathfinder account.

24. PATHACC - N.P. Pathfinder Acc Flag (0 = No, 1 = Yes)
This value is the North Platte Pathfinder accrual flag. A value of one (1) tells the NPRWUM that it can accrue water to the North Platte Pathfinder account, if water is available.

25. ETOST(1) - ETO Initial Ownership, kaf
This value is the initial ownership in the Excess-to-Ownership (ETO) account.

26. ETOFLAG - ETO Accrual Flag (0 = No, 1 = Yes)
This value is the Excess-to-Ownership accrual flag to accrue excess water below Alcova. A value of one (1) tells the NPRWUM that it can accrue water to the ETO account, if water is available.

27. ETO2FLAG - Accrue ETO in Upper Reach (0 = No, 1 = Yes)
This value is the Excess-to-Ownership accrual flag to accrue water above Alcova to the ETO account. A value of one (1) tells the NPRWUM that it can accrue water to the ETO account, if water is available.

28. REPLCEV - Replace Evap GL & GU W/ETO (0 = No, 1 = Yes)
This value is the flag used to tell the NPRWUM to use water from the Excess-to-Ownership account to replace the evaporation that occurs from the Glendo and North Platte Guernsey ownership accounts. When this value is set to one (1), ETO water replaces the North Platte Guernsey ownership evaporation first and then the Glendo ownership.

29. REPLCEV2 - Replace Evap KE & PA W/ETO (0 = No, 1 = Yes)
This value is the flag used to tell the NPRWUM to use water from the Excess-to-Ownership account to replace the evaporation that occurs from the North Platte Pathfinder, Kendrick Seminoe, and Kendrick Alcova ownership accounts. When this value is set to one (1), ETO water is used to first replace the North Platte Pathfinder ownership evaporation, then the Kendrick Seminoe ownership evaporation, and finally the Kendrick Alcova ownership evaporation. NOTE: When both the REPLCEV and REPLCEV2 flags are activated, equal to one (1), the NPRWUM will use ETO water is used to replace ownership evaporation first from the North Platte Guernsey account, then the Kendrick Seminoe account, then the Kendrick Alcova account, then the North Platte Pathfinder account, and finally the Glendo account.

30. AGMNTNF - Augment NF from ETO Account (0 = No, 1 = Yes)
This value is the flag used to tell the NPRWUM to use water from the Excess-to-Ownership account to augment the natural flow in the system. When set to one (1), the NPRWUM will augment the natural flow in the system with water from the ETO account, if needed.

31. AGMNTSTF - Augment Storage from ETO (0 = No, 1 = Yes)
This value is the flag used to tell the NPRWUM to use water from the Excess-to-Ownership account to augment the storage water in the system. When set to one (1), the NPRWUM will augment the storage flow in the system with water from the ETO account, allowing a diversion to divert water above its appropriation and charge it against the ETO account.

32. ETO3FLAG - Lim ETO Space in Glendo (0 = No, 1 = Yes)
This value is a flag that will limit the Excess-to-Ownership account to the amount of restorage space in Glendo Reservoir. NOTE: CDATA(40), must be reduced to a value below 334.24 kaf to provide storage space for the ETO account. ETO storage is the difference of maximum restorage space (334.24 kaf) and the value of CDATA(40).

33. PPNCAP - Maximum North Platte Pathfinder Ownership, kaf
This value is the maximum ownership storage for the North Platte Pathfinder account, exclusive of the Pathfinder enlargement #1 and #2 ownership accounts.

34. CCST(1) - Initial Pathfinder Enlargement #1 Ownership, kaf
This value is the initial content in the Pathfinder enlargement #1 ownership.

35. CITCAP - Maximum Pathfinder Enlargement #1 Ownership, kaf
This value is the maximum ownership storage for the Pathfinder enlargement #1 ownership.

36. CITYACC - Flag to Operate Pathfinder Enlargement #1 Own (0 = No, 1 = Yes)
This flag is used to control the operation of the Pathfinder enlargement #1 ownership. If the flag is set to one (1), the model will operate the Pathfinder enlargement #1 ownership account.

37. PEVST(1) - Initial Pathfinder Enlargement #2 Ownership, kaf
This value is the initial content in the Pathfinder enlargement #2 ownership.

38. PEVCAP - Maximum Pathfinder Enlargement #2 Ownership, kaf
This value is the maximum ownership storage for the Pathfinder enlargement #2 ownership.

39. PENVACC - Flag to Operate Pathfinder Enlargement #2 Own (0 = No, 1 = Yes)
This flag is used to control the operation of the Pathfinder enlargement #2 ownership. If the flag is set to one (1), the model will operate the Pathfinder enlargement #2 ownership account.

40. Not Used - CDATA2 Item Not Used

41. CITYMAX - Max City of Casper Kendrick Delivery, kaf
This value is the maximum delivery that can be taken by the City of Casper from the Kendrick ownership annually and reflects the current contracted amount of 7,000 acre-feet.

42. CDATA2(42) - Distribution of Guernsey Outflow
This factor is used by the model to help simulate the variations in daily inflow with respect to the monthly time step employed in the NPRWUM. Under daily operations when only natural flow is being taken, the Guernsey Reservoir outflow consists of the inflows/gains from Glendo to Guernsey, Alcova to Glendo, and above Alcova. The use of the monthly time step causes the model to under predict the amount of water that can be stored in Glendo and Guernsey Reservoirs, since it does not account for the daily distribution of the inflows. This factor makes available a portion of the inflows/gains below Alcova to be stored in Glendo and Guernsey Reservoirs under this condition.

43. BRGLCO - Bridgeport Glendo Contract, kaf
This value is Bridgeport's annual contract for storage from the Glendo ownership and is set at 2,000 acre-feet.

44. MIGLCO - Mitchell Glendo Contract, kaf
This value is Mitchell's annual contract for storage from the Glendo ownership and is set at 12,000 acre-feet.

45. ENGLCO - Enterprise Glendo Contract, kaf
This value is Enterprise's annual contract for storage from the Glendo ownership and is set at 3,000 acre-feet.

46. GRGLCO - Grattan Glendo Contract, kaf
This value is Grattan's annual contract for storage from the Glendo ownership and is set at 750 acre-feet.

47. BUGLCO - Burbank Glendo Contract, kaf
This value is Burbank's annual contract for storage from the Glendo ownership and is set at 200 acre-feet.

48. TOGLCO - Torrington Glendo Contract, kaf
This value is Torrington's annual contract for storage from the Glendo ownership and is set at 1000 acre-feet.

49. LUGLCO - Lucerne Glendo Contract, kaf
This value is Lucerne's annual contract for storage from the Glendo ownership and is set at 2,500 acre-feet.

50. WMGLCO - Wright-Murphy Glendo Contract, kaf
This value is Wright-Murphy's annual contract for storage from the Glendo ownership and is set at 200 acre-feet.

51. CNGLCO - Central Power Glendo Contract, kaf
This value is Central Power's annual contract for storage from the Glendo ownership and is set at 8,000 acre-feet.

52. CCGLCO - Corn Creek Glendo Contract, kaf
This value is Corn Creek’s annual contract for storage from the Glendo ownership and is set at 10,350 acre-feet.

53. GLNADD - Additional Glendo Water Allowed over Contract Amount (% of Contract)
Irrigators with contracts for Glendo water that were executed prior to January 1, 1982, are allowed to request water in excess of their contract provided; a) the state in which the irrigator resides has accrued water equal to 95% of its maximum storage, b) the irrigator's Glendo account has accrued water equal to 95% of its maximum storage. The factor is set at 0.125.

54. GLNEXT - Flag to Allow Release of Add. Glendo Water (% of Max Carry-over)
This flag controls the release of additional water to Glendo contractors and is set at 0.95. If the account has accrued water equal to 95% of its maximum storage, the model will allow the release of additional water.

55. GLMAX - Maximum Glendo Contract Carry-over (% of Contract)
This values (2.50) times the annual contract amount gives the maximum carry-over amount for the Glendo contractors, except for Mitchell and CNPP&ID. Part (cdata1(56)) of the maximum carry-over for CNPP&ID is given to Mitchell.

56. CDATA2(56) - Max Carry-over Assigned to Mitchell from CNPP&ID
This value (5,000 acre-feet) is the portion of CNPP&ID’s maximum carry-over amount that is assigned to the Mitchell Contract.

57. Not Used - CDATA2 Item Not Used

58. WYGLCO - Wyoming's Portion of Glendo Accrual (%)
This value is Wyoming’s portion of the water accrued to the Glendo ownership and is set at 0.375 (15,000/40,000)

59. Not Used - CDATA2 Item Not Used

1.3.2 ADATA2 Items “.SOA” Input File

1. ILGUACC - Inland Lakes Accrual Flag (0 = NO, 1 = YES)
Flag to allow Inland Lakes to accrue water. When this flag is equal to 1, the NPRWUM allows the Inland Lakes account in the main stem to accrue water in Glendo and/or Guernsey reservoirs. The accrual flag is set to yes (1) for the months of October, November, and April only.

1.3.3 HDATA2 Items “.SOA” Input File

1. EFFLI - Efficiency Lingle Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

2. EFFHI - Efficiency Hill Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

3. EFFWL - Efficiency Wyoming Laterals
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

4. EFFPM - Efficiency PID Main Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

5. EFHLR - Efficiency High, Low, Supply Canals
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

6. EFFWM - Efficiency Wright & Murphy
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

7. EFFGO - Efficiency Goshen Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

8. EFFGF - Efficiency Gering/ft. Laramie Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

9. EFFBU - Efficiency Burbank Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

10. EFFLU - Efficiency Lucerne Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

11. EFFGR - Efficiency Grattan Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

12. EFFTO - Efficiency Torrington Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

13. EFFRR - Efficiency Rock Ranch Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

14. EFNPD - Efficiency N. Platte Ditch
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

15. EFFNA - Efficiency Narrows Ditch
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

16. EFFPF - Efficiency Pratt Ferris Ditch
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

17. EFFCH - Efficiency French
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

18. EFFMI - Efficiency Mitchell Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

19. EFFGE - Efficiency Gering Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

20. EFFC - Efficiency Farmers Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

21. EFNPT - Efficiency Northport Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

22. EFFRA - Efficiency Ramshorn
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

23. EFFEN - Efficiency Enterprise Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

24. EFFWI - Efficiency Winters Creek Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

25. EFFCN - Efficiency Central Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

26. EFMIN - Efficiency Minatare Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

27. EFCAS - Efficiency Castle Rock Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

28. EFNI - Efficiency Nine Mile Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

29. EFFSH - Efficiency Short Line Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

30. EFFCR - Efficiency Chimney Rock Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

31. EFFBR - Efficiency Bridgeport Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

32. EFFEM - Efficiency Empire
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

33. EFFAL - Efficiency Alliance Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

34. EFFBC - Efficiency Browns Creek Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

35. EFFBL - Efficiency Beerline Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

36. EFLIS - Efficiency Lisco Canal
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

37. EFMID - Efficiency Midland-Overland
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

38. EFPH2 - Efficiency Phantom Div Reach #2
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

39. EFPH3 - Efficiency Phantom Div Reach #3
These values represent overall efficiency for the given modeled diversion. The NPRWUM uses the efficiency to estimate the amount of the adjustable monthly diversion (minus evaporation) that is available for return. These factors can be adjusted by the model user to other than historic conditions.

40. HEFFLI - Historic Efficiency Lingle Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

41. HEFFHI - Historic Efficiency Hill Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

42. HEFFWL - Historic Efficiency Wyoming Laterals
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

43. HEFFPM - Historic Efficiency PID Main Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

44. HEFHLR - Historic Efficiency High, Low, Supply Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

45. HEFFWM - Historic Efficiency Wright & Murphy
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

46. HEFFGO - Historic Efficiency Goshen Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

47. HEFFGF - Historic Efficiency Gering/ft. Laramie Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

48. HEFFBU - Historic Efficiency Burbank Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

49. HEFFLU - Historic Efficiency Lucerne Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

50. HEFFGR - Historic Efficiency Grattan Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

51. HEFFTO - Historic Efficiency Torrington Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

52. HEFFRR - Historic Efficiency Rock Ranch Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

53. HEFNPD - Historic Efficiency N. Platte Ditch
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

54. HEFFNA - Historic Efficiency Narrows Ditch
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

55. HEFFPF - Historic Efficiency Pratt Ferris Ditch
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

56. HEFFCH - Historic Efficiency French
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

57. HEFFMI - Historic Efficiency Mitchell Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

58. HEFFGE - Historic Efficiency Gering Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

59. HEFFC - Historic Efficiency Farmers Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

60. HEFNPT - Historic Efficiency Northport Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

61. HEFFRA - Historic Efficiency Ramshorn
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

62. HEFFEN - Historic Efficiency Enterprise Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

63. HEFFWI - Historic Efficiency Winters Creek Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

64. HEFFCN - Historic Efficiency Central Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

65. HEFMIN - Historic Efficiency Minatare Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

66. HEFCAS - Historic Efficiency Castle Rock Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

67. HEFNI - Historic Efficiency Nine Mile Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

68. HEFFSH - Historic Efficiency Short Line Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

69. HEFFCR - Historic Efficiency Chimney Rock Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

70. HEFFBR - Historic Efficiency Bridgeport Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

71. HEFFEM - Historic Efficiency Empire
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

72. HEFFAL - Historic Efficiency Alliance Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

73. HEFFBC - Historic Efficiency Browns Creek Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

74. HEFFBL - Historic Efficiency Beerline Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

75. HEFLIS - Historic Efficiency Lisco Canal
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

76. HEFMID - Historic Efficiency Midland-overland
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

77. HEFPH2 - Historic Efficiency Phantom Div Reach #2
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

78. HEFPH3 - Historic Efficiency Phantom Div Reach #3
These values represent overall efficiency for the given historic diversion. The NPRWUM uses the efficiency to estimate the amount of the historic monthly diversion (minus evaporation) that is available for return. These factors reflect historic conditions and should not be adjusted.

1.3.4 FLOW2 Items STOROWN.LST Output File

1. SEMIN + GLGL - Total Seminoe Inflow, kaf
This row is the inflow to Seminoe Reservoir from the North Platte River, Medicine Bow River, and the Seminoe Reservoir Gain/loss.

2. KPAGN + PFGL - Total Kortes to Pathfinder Gains, kaf
This row is the physical Kortes to Pathfinder reach gain.

3. SWEET - Sweetwater River Inflow, kaf
This row is the inflow into Pathfinder Reservoir from the Sweetwater River.

4. ALGLGN + GLGL - Alcova to Glendo Gain, kaf
This row is the physical Alcova to Glendo reach gain. These values are the sum of the Alcova to Glenrock reach gain, Deer Creek inflow, Glenrock to Glendo reach gain and the Glendo Reservoir gain/loss.

5. GLGUGN + GUGL - Glendo to Guernsey Gain, kaf
This row is the physical Glendo to Guernsey reach gain. These values are the sum of the Glendo to Guernsey reach gain and the Guernsey Reservoir gain/loss.

6. GOUT(j) - Guernsey Reservoir Outflow, kaf
This data array is the total Guernsey Reservoir outflow. The values were determined in the Reservoir Operations model and passed into the Storage Ownership Accounting model.

7. DELTRES(j) - Change in Reservoir Storage, kaf
This data array is the total change in reservoir storage from one month to the next. It is calculated as the current month's total reservoir storage minus last month's total reservoir storage. The value can be negative and can vary depending on the operation of the river. The total reservoir storage for each month is determined in the Reservoir Operations model and passed into the Storage Ownership Accounting model.

8. GURSPL(j) + BALSPL(j) - Spilled from System, kaf
This row is the total amount of water that was spilled from the system. Water spilled from the system is water not capable of being accrued to an ownership account.

9. TOTEV(j + 1) - Total Reservoir Evaporation, ac-ft
This data array is the total reservoir evaporation for each month. It is obtained by summing the reservoir evaporation for Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo, and Guernsey Reservoirs.

10. TRANKEND - Returned to Kendrick, kaf
This row is the amount of North Platte Pathfinder water transferred back to the Kendrick Alcova and Kendrick Seminoe accounts to repay the amount of Kendrick water moved below Alcova when the North Platte Pathfinder account was insufficient. Active when the KENDFLAG (CDATA2(22)) is set to one (1).

11. TRANPATH - Transfer from Kendrick, kaf
This row is the amount of Kendrick water transferred to the North Platte Pathfinder account and moved below Alcova Reservoir to meet flow requirements through Casper. Active when the KENDFLAG (CDATA2(22)) is set to one (1).

12. AMBFPP - Transfer to A&M, kaf
This row represents the amount of water transferred from the Pathfinder ownership to Inland Lakes ownership. The value is calculated by the model to allow historic deliveries to the Inland Lakes to be made.

13. AMTTPP - Transfer from A&M, kaf
This row represents the amount of water transferred from Inland Lakes ownership to the North Platte Pathfinder ownership. This water is accrued by the Inland Lakes Right but not needed for historic Inland Lakes deliveries.

14. FLOW2(14,j-1) + AMBFPP - Total Transfer to A&M, kaf
This row reports the accumulated amount of water that was transferred to the Inland Lakes account during the water year.

15. BRWNPP(j) - Nat Flow Borrowed from Pathfinder, kaf
This row reports the amount of natural flow borrowed from the North Platte Pathfinder ownership to offset a loss between the physical natural flow occurring in the system and the calculated natural flow.

16. RNTNPP(j) - Nat Flow Returned to Pathfinder, kaf
This row reports the amount of natural flow returned from subsequent gains to the North Platte Pathfinder ownership that was previously borrowed.

17. TBRWNPP(j+1) - Total Nat Flow Borrowed YTD, kaf
This row reports the cumulative amount of natural flow borrowed from the North Platte Pathfinder ownership year-to-date. The cumulative amount of borrowed natural flow is carried over from year to year until it is paid back from subsequent gains, at which time it is set to zero (0).

18. PPEV(j) - Calculated Evaporation, kaf
This row is the calculated North Platte Pathfinder ownership evaporation for the month.

19. FLOW2(19,j-1)+PPEV - Tot Pathfinder Ownership Evap YTD, kaf
This row is the total calculated evaporation from the North Platte Pathfinder Ownership year-to-date.

20. PPTEV1 - Pathfinder Evap Replaced by ETO, kaf
This row is the amount of the North Platte Pathfinder ownership evaporation replaced from the Excess-to-Ownership account.

21. PPIR(j) - N.P. Pathfinder Delivery, kaf
This row is the delivery from the North Platte Pathfinder ownership account to the North Platte Project and Warren Act Contracts. The deliveries to satisfy these contracts are taken first from the North Platte Guernsey ownership until depleted, then the North Platte Pathfinder ownership.

22. PPAC(j) - Calculated Accrual, kaf
This row is the calculated North Platte Pathfinder ownership accrual for the month. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

23. PPST(j+1) - Calculated Ownership, kaf
This row is the calculated North Platte Pathfinder Ownership end-of-month content. It is calculated as last month's ownership plus the project accrual minus project evaporation and minus project deliveries.

24. OWEDSEM(j+1) - Tot Trans to N.P. Pathfinder, kaf
This row reports the total amount of Kendrick Seminoe water transferred to the North Platte Pathfinder account and moved below Alcova to meet flow requirements.

25. TRANSEM - Returned from N.P. Pathfinder, kaf
This row reports the total amount of water returned to the Kendrick Seminoe account from the North Platte Pathfinder account.

26. SMEV(j) - Calculated Evaporation, kaf
This row is the calculated Kendrick Seminoe ownership evaporation for the month.

27. FLOW2(27,j-1)+SMEV(j) - Total Evaporation YTD, kaf
This row is the total calculated evaporation from the Kendrick Seminoe ownership year-to-date.

28. SMTEV1 - Evap Replaced by ETO, kaf
This row is the amount of Kendrick Seminoe ownership evaporation replaced from the Excess-to-Ownership account.

29. SEMIR(j) - Kendrick Seminoe Delivery, kaf
This row is the deliveries from the Kendrick Seminoe ownership account. The Kendrick ownership account provides storage water exclusively to the Casper Alcova Irrigation District (CAID) through the Casper Canal. It has been divided into two (2) separate accounts, the Kendrick Seminoe account and the Kendrick Alcova account. Storage deliveries to the CAID are taken first from the Kendrick Seminoe account until depleted and then the Kendrick Alcova account.

30. SEMAC(j) - Calculated Accrual, kaf
This row is the calculated Kendrick Seminoe ownership accrual. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

31. SMNST(j+1) - Calculated Ownership, kaf
This row is the calculated Kendrick Seminoe Ownership end-of-month content. It is calculated as last month's ownership plus the project accrual minus project evaporation and minus project deliveries.

32. OWEDALC(j+1) - Tot Trans to N.P. Pathfinder, kaf
This row reports the total amount of Kendrick Alcova water transferred to the North Platte Pathfinder account and moved below Alcova to meet flow requirements.

33. TRANALC - Returned from N.P. Pathfinder, kaf
This row reports the total amount of water returned to the Kendrick Alcova account from the North Platte Pathfinder account.

34. ALCEV(j) - Calculated Evaporation, kaf
This row is the calculated Kendrick Alcova ownership evaporation for the month.

35. FLOW2(35,j-1)+ALCEV(j) - Total Evaporation YTD, kaf
This row is the total calculated evaporation from the Kendrick Seminoe ownership year-to-date.

36. ALTEV1 - Evaporation Replaced by ETO, kaf
This row is the amount of Kendrick Alcova ownership evaporation replaced from the Excess-to-Ownership account.

37. ALCIR(j+1) - Kendrick Alcova Delivery, kaf
This row is the deliveries from the Kendrick Alcova ownership account. Deliveries from this account are the remaining CAID storage deliveries not met by the Kendrick Seminoe account.

38. ALCAC(j) - Calculated Accrual, kaf
This row is the calculated Kendrick Alcova ownership accrual. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

39. ALCST(j+1) - Calculated Ownership, kaf
This row is the calculated Kendrick Alcova Ownership end-of-month content. It is calculated as last month's ownership plus the project accrual minus project evaporation and minus project deliveries.

40. GLUEV(j) - Calculated Evaporation, kaf
This row is the calculated Glendo Unit Ownership evaporation. It is calculated by subtracting all of the other project evaporations from the total reservoir evaporation. The evaporation value can be negative for this account. This procedure means that the Glendo Unit account is the "slop account" for evaporation.

41. FLOW2(41,j-1)+GLUEV(j) - Total Evaporation YTD, kaf
This row is the total calculated evaporation from the Glendo Evaporation Pool year-to-date.

42. GLTEV1 - Evaporation Replaced by ETO, kaf
This row is the amount of Glendo Evaporation Pool evaporation replaced from the Excess-to-Ownership account.

43. GLEVAC - Calculated Accrual, kaf
This row is the calculated Glendo Evaporation Pool accrual.

44. GLEVST(j+1) - Calculated Ownership, kaf
This row is the calculated Glendo Evaporation Pool end-of-month content. It is calculated as last month's content plus the accrual minus the evaporation.

45. Not Used - FLOW2 Item Not Used

46. Not Used - FLOW2 Item Not Used

47. Not Used - FLOW2 Item Not Used

48. REMGLEV1 - Glendo Irr Pool Evap, kaf
This row is the amount of evaporation charged to the Glendo Irrigation Pool. Evaporation is charged to the Irrigation Pool only after the Evaporation Pool has been depleted.

49. GLUDEL(j) - Delivery Glendo Irr Pool, kaf
This row is the deliveries from the Glendo Irrigation Pool. It includes all storage deliveries made to the Glendo contractors.

50. GLIRAC(j) - Calculated Accrual, kaf
This row is the calculated accrual to the Glendo Irrigation Pool. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

51. GLIRST(J+1) - Calculated Ownership, kaf
This row is the calculated Glendo Irrigation Pool Content. It is calculated as last month's ownership plus the project accrual minus project evaporation and minus project deliveries.

52. GLTEEV(j) - Glendo ETO Evaporation, kaf
This row is the monthly evaporation for the Glendo ETO account.

53. GLTEEV1 - Evaporation Replaced by ETO, kaf
This row reports the Glendo ETO evaporation replace from the ETO account, if any.

54. ETODEL - Glendo ETO Delivery, kaf
This row is the monthly deliveries from the Glendo ETO account.

55. GLTEAC(j) - Glendo ETO Calc Accrual, kaf
This row is the calculated accrual to the Glendo ETO account.

56. GLTEST(j+1) - Glendo ETO Calc Ownership, kaf
This row is the calculated Glendo ETO Content. It is calculated as last month's content plus the project accrual minus project evaporation and minus project deliveries.

57. REMGLEV2 - Glendo Power Pool Evap, kaf
This row is the amount of evaporation charged to the Glendo Power Pool. Evaporation is charged to the Irrigation Pool only after the Evaporation Pool and the Irrigation Pool have been depleted.

58. GLPWAC(j) - Calculated Accrual, kaf

This row is the calculated accrual to the Glendo Power Pool. The Power Pool is maintained at 63.1 kaf unless serve water conditions dictate otherwise. If the Power Pool is drawn down below 63.1 kaf, it is refilled after all other ownerships have been satisfied from their respective reaches.

59. GLPWST(J+1) - Calculated Ownership, kaf

This row is the calculated Glendo Power Pool Content. It is calculated as last month's ownership plus the accrual minus the evaporation.

60. GPEV(j) - Calculated Evaporation, kaf

This row is the calculated North Platte Guernsey ownership evaporation for the month.

61. FLOW2(55,j-1)+GPTEV - Tot Pathfinder Ownership Evap YTD, kaf

This row is the total calculated evaporation from the North Platte Guernsey Ownership year-to-date.

62. GPTEV1 - Guernsey Evap Replaced by ETO, kaf

This row is the amount of the North Platte Guernsey ownership evaporation replaced from the Excess-to-Ownership account.

63. GPIR(j) - N.P. Guernsey Delivery, kaf

This row is the delivery from the North Platte Guernsey ownership account to the North Platte Project and Warren Act Contracts. The deliveries to satisfy these contracts are taken first from the North Platte Guernsey ownership until depleted, then the North Platte Pathfinder ownership.

64. GPPAC(j) - Calculated Accrual, kaf

This row is the calculated North Platte Guernsey ownership accrual for the month. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

65. GPST(j+1) - Calculated Ownership, kaf

This row is the calculated North Platte Guernsey Ownership end-of-month content. It is calculated as last month's ownership plus the project accrual minus project evaporation and minus project deliveries.

66. AMBFPP - Transferred from Pathfinder, kaf

This row corresponds to the description of TRANSFERRED TO A&M (FLOW2(12,i,j)).

67. AMTTPP - Transferred to Pathfinder, kaf

This row corresponds to the description of TRANSFERRED FROM A&M (FLOW2(13,i,j)).

68. AMEV(j) - Inland Lakes Evaporation, kaf

This item is the evaporation for the Inland Lakes ownership in the main stem.

69. FLOW2(69,j-1)+AMEV(j) - Tot Inland Lakes Ownership Evap, kaf (YTD)

Total calculated evaporation for Inland Lakes Ownership in the main stem year-to-date.

70. ILDEL - Delivery from Account, kaf

This row is the delivery to the Inland Lakes from the Inland Lakes Ownership Account in the main stem.

71. TAMIR(j+1) - Total Delivery To Date, kaf

This row is the total accumulated transfer to the Inland Lakes. It is calculated as the last month total delivery to date plus this months delivery to the Inland Lakes.

72. AMAC(j) - Calculated Accrual, kaf

This row is the calculated accrual to the Inland Lakes account in the main stem. Historically, water is allowed to accrue in October, November, and April from gains downstream of Alcova Reservoir.

73. AMST(j + 1) - Calculated Ownership, kaf

This row is the calculated ownership in the Inland Lakes account in the main stem. It is calculated as last month's ownership plus the project accrual minus project evaporation and minus project deliveries.

74. GLRESTOR - ETO Limit, kaf

This row shows the physical limit placed on the Excess-to-Ownership account by the model user if CDATA2(32) has been turn on, set to one (1). This limit is computed once at the beginning of each water year. When the ETO limit is "on", ETO is limited to the available restorage space between Glendo Reservoir's active capacity (517 kaf) and its current Ownership content as of October of the current water year. Otherwise, the ETO account will hold as much water as possible.

75. PPTEV1 + GPTEV1 + ...xxTEV1 - Used to Replace Evaporation, kaf

This row is the total amount of water used from the ETO account to replace evaporation from other ownerships.

76. FLOW2(76,j-1) + PPTEV1 + ...xxTEV1 - Tot Used to Replace Evap, kaf

This row is the total amount of water used from the ETO account to replace evaporation from other ownerships year-to-date.

77. TEXDV - Used to Augment Nat Flow, kaf

This row is the amount of water used from the ETO account to augment natural flow.

78. ETOCHG(j + 1) - ETO Calculated Accrual, kaf

This row is the calculated accrual to the ETO account.

79. ETOIR(j) - Calculated Release from ETO, kaf

This variable is not active, it is set equal to zero (0) in the NPRWUM. The only release from the ETO account are determined by the NPRWUM and are to replace evaporation and augment the flow below Guernsey Reservoir.

80. ETOST(j + 1) - Calculated Ownership ETO, kaf

This row is the calculated amount of ETO water in storage. It is calculated as last month's ownership plus this month's accrual minus releases from the account to replace evaporation and augment the natural flow.

81. TOTRES(j + 1) - Total Reservoir Storage, kaf

The sum of Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo, and Guernsey Reservoir contents from the Reservoir Operations model.

82. TOTOWN - Total Ownership Content, kaf

The sum of North Platte Pathfinder, Kendrick Seminoe, Glendo Irrigation, Power, and Evaporation Pools, Inland Lakes in the main stem, and North Platte Guernsey ownership contents.

83. TOTRES(j + 1) + TOTOWN - Attenuated Flood Water, kaf

This row is the amount of flood water held in the system due to outflow restrictions at Glendo Reservoir.

84. TOTAC - Total Ownership Accruals, kaf

This row is the total ownership accrual for the month in the system and is the sum of all the individual ownership accruals.

85. NFBRWSTR(j) - NF Borrowed from Storage, kaf

This row is the amount of natural flow that was borrowed from storage for the month.

86. TBRWSTR(j + 1) - Tot NF Borrowed YTD, kaf

This row reports the cumulative amount of natural flow borrowed from storage year-to-date. The cumulative amount of borrowed natural flow is carried over from year to year until it is paid back from subsequent gains, at which time it is set to zero (0).

87. Not Used - FLOW2 Item Not Used

88. Not Used - FLOW2 Item Not Used

89. Not Used - FLOW2 Item Not Used

90. BRWNPP(j) - NF Borrowed fm N.P., kaf
This row is the amount of natural flow that was borrowed from the North Platte storage for the month.

91. RTNNPP(j) - NF Returned to N.P., kaf
This row is the amount of borrowed natural flow that was returned to the North Platte storage for the month.

92. TBRWNPP(j+1) - Tot NF Borrowed fm N.P. YTD, kaf
This row reports the cumulative amount of natural flow borrowed from the North Platte storage. The cumulative amount of borrowed natural flow is carried over from year to year until it is paid back from subsequent gains, at which time it is set to zero (0).

93. CCEV(j) - Evaporation ~ Pathfinder Enlargement Account #1, kaf
This row is the calculated Pathfinder enlargement account #1 evaporation for the month.

94. FLOW2(94,J-1)+CCEV(j) - Total Evap Ytd ~ Pathfinder Enlargement Account #1, kaf
This row is the total calculated evaporation from the Pathfinder enlargement account #1 year-to-date.

95. CCTEV1 - Evap Replaced by Eto ~ Pathfinder Enlargement Account #1, kaf
This row is the amount of Pathfinder enlargement account #1 evaporation replaced from the Excess-to-Ownership account.

96. ADATA(31,j) - Demand ~ Pathfinder Enlargement Account #1, kaf
This row is the requested deliveries entered by the model user into the ".RES" input file for the Pathfinder enlargement account #1.

97. CCIR(j) - Delivery ~ Pathfinder Enlargement Account #1, kaf
This row is the actual deliveries made by the NPRWUM from the Pathfinder enlargement account #1.

98. ADATA(31,j)-CCIR(j) - Shortage ~ Pathfinder Enlargement Account #1, kaf
This row is the delivery shortages for the Pathfinder enlargement account #1. The shortage is the difference of the requested delivery and actual delivery.

99. CCAC - Calculated Accrual ~ Pathfinder Enlargement Account #1, kaf
This row is the calculated Pathfinder enlargement account #1 accrual. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

100. CCST(j+1) - Calculated Ownership ~ Pathfinder Enlargement Account #1, kaf
This row is the calculated Pathfinder enlargement account #1 end-of-month content. It is calculated as last month's ownership plus the project accrual minus project evaporation and minus project deliveries.

101. PENVEV(j) - Evaporation ~ Pathfinder Enlargement Account #2, kaf
This row is the calculated Pathfinder enlargement account #2 evaporation for the month.

102. FLOW2(94,j-1)+PENVEV(j) - Total Evap Ytd ~ Pathfinder Enlargement Account #2, kaf
This row is the total calculated evaporation from the Pathfinder enlargement account #2 year-to-date.

103. PEVTEV1 - Evap Replaced by Eto ~ Pathfinder Enlargement Account #2, kaf
This row is the amount of Pathfinder enlargement account #2 evaporation replaced from the Excess-to-Ownership account.

104. ADATA(32,j) - Demand ~ Pathfinder Enlargement Account #2, kaf
This row is the requested deliveries entered by the model user into the ".RES" input file for the Pathfinder enlargement account #2.

105. PEVIR(j) - Delivery ~ Pathfinder Enlargement Account #2, kaf
This row is the actual deliveries made by the NPRWUM from the Pathfinder enlargement account #2.

106. ADATA(32,j)-PEVIR(j) - Shortage ~ Pathfinder Enlargement Account #2, kaf
This row is the delivery shortages for the Pathfinder enlargement account #2. The shortage is the difference of the requested delivery and actual delivery.

107. PEVAC - Calculated Accrual ~ Pathfinder Enlargement Account #2, kaf
This row is the calculated Pathfinder enlargement account #2 accrual. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

108. PEVST(j + 1) - Calculated Ownership ~ Pathfinder Enlargement Account #2, kaf
This row is the calculated Pathfinder enlargement account #2 end-of-month content. It is calculated as last month's ownership plus the project accrual minus project evaporation and minus project deliveries.

109. GLGREVAP + GLBUEVAP + ... + GLCCEVAP - Evaporation ~ Wyoming Contractors (Glendo), kaf
This row is the calculated total monthly evaporation for the Wyoming contractors in Glendo.

110. CDATA2(46) + CDATA2(47) + ... + CDATA2(52) - Glendo Contract ~ Wyoming Contractors, kaf
This row is the sum of the individual Wyoming contracts from Glendo.

111. FLOW2(111,j) - Additional Water ~ Wyoming Contractors (Glendo), kaf
This row is the sum of the additional water deliveries made from Glendo for the Wyoming contractors.

112. GRSTDV + BUSTDV + ... + CCKDEL - Delivery ~ Wyoming Contractors (Glendo), kaf
This row is the sum of the deliveries taken by the Glendo contractors in Wyoming by month.

113. FLOW2(113,j) - Delivery Ytd ~ Wyoming Contractors (Glendo), kaf
This row is the accumulated sum of deliveries taken by the Glendo contractors in Wyoming.

114. Not Used - FLOW2 Item Not Used

115. GRGLIRAC + BUGLIRAC + ... + CCGLIRAC - Calculated Accrual ~ Wyoming Contractors (Glendo), kaf
This row is the calculated accrual for the Glendo contractors in Wyoming. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

116. FLOW2(116,j) - Account Balance ~ Wyoming Contractors (Glendo), kaf
This row is the remaining balance of storage water for the Glendo contractors in Wyoming.

117. GLGREVAP - Evaporation ~ Grattan Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

118. CDATA2(46) - Glendo Contract ~ Grattan, kaf
This row is the shows the contract amount for this Glendo contractor.

119. GRGLCO-CDATA2(46) - Additional Water ~ Grattan Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

120. GRSTDV - Delivery ~ Grattan Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

121. GRATSUM(j + 1) - Delivery Ytd ~ Grattan Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

122. Not Used - FLOW2 Item Not Used

123. GRGLIRAC - Calculated Accrual ~ Grattan Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

124. GRGLIRST(j + 1) - Account Balance ~ Grattan, kaf
This row is the remaining balance of storage water for this Glendo contractor.

125. GLBUEVAP - Evaporation ~ Burbank Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

126. CDATA2(47) - Glendo Contract ~ Burbank, kaf
This row is the shows the contract amount for this Glendo contractor.

127. BUGLCO-CDATA2(47) - Additional Water ~ Burbank Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

128. BUSTDV - Delivery ~ Burbank Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

129. BBNKSUM(j + 1) - Delivery Ytd ~ Burbank Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

130. Not Used - FLOW2 Item Not Used

131. BUGLIRAC - Calculated Accrual ~ Burbank Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

132. BUGLIRST(j + 1) - Account Balance ~ Burbank, kaf
This row is the remaining balance of storage water for this Glendo contractor.

133. GLTOEVAP - Evaporation ~ Torrington Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

134. CDATA2(48) - Glendo Contract ~ Torrington, kaf
This row is the shows the contract amount for this Glendo contractor.

135. TOGLCO-CDATA2(48) - Additional Water ~ Torrington Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

136. TOSTDV - Delivery ~ Torrington Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

137. TORRSUM(j+1) - Delivery Ytd ~ Torrington Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

138. Not Used - FLOW2 Item Not Used

139. TOGLIRAC - Calculated Accrual ~ Torrington Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

140. TOGLIRST(j+1) - Account Balance ~ Torrington, kaf
This row is the remaining balance of storage water for this Glendo contractor.

141. GLLUEVAP - Evaporation ~ Lucerne Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

142. CDATA2(49) - Glendo Contract ~ Lucerne, kaf
This row is the shows the contract amount for this Glendo contractor.

143. LUGLCO-CDATA2(49) - Additional Water ~ Lucerne Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

144. LUSTDV - Delivery ~ Lucerne Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

145. LUCSUM(j+1) - Delivery Ytd ~ Lucerne Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

146. Not Used - FLOW2 Item Not Used

147. LUGLIRAC - Calculated Accrual ~ Lucerne Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

148. LUGLIRST(j+1) - Account Balance ~ Lucerne, kaf
This row is the remaining balance of storage water for this Glendo contractor.

149. GLWMEVAP - Evaporation ~ Wright&Murphy Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

150. CDATA2(50) - Glendo Contract ~ Wright&Murphy, kaf
This row is the shows the contract amount for this Glendo contractor.

151. WMGLCO-CDATA2(50) - Additional Water ~ Wright&Murphy Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

152. WMSTDV - Delivery ~ Wright&Murphy Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

153. WMSUM(j+1) - Delivery Ytd ~ Wright&Murphy Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

154. Not Used - FLOW2 Item Not Used

155. WMGLIRAC - Calculated Accrual ~ Wright&Murphy Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

156. WMGLIRST(j + 1) - Account Balance ~ Wright&Murphy, kaf
This row is the remaining balance of storage water for this Glendo contractor.

157. GLCCEVAP - Evaporation ~ Corn Creek Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

158. CDATA2(52) - Glendo Contract ~ Corn Creek, kaf
This row is the shows the contract amount for this Glendo contractor.

159. CCGLCO-CDATA2(52) - Additional Water ~ Corn Creek Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

160. CCKDEL - Delivery ~ Corn Creek Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

161. CCKSUM(j + 1) - Delivery Ytd ~ Corn Creek Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

162. Not Used - FLOW2 Item Not Used

163. CCGLIRAC - Calculated Accrual ~ Corn Creek Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

164. CCGLIRST(j + 1) - Account Balance ~ Corn Creek, kaf
This row is the remaining balance of storage water for this Glendo contractor.

165. FLOW2(166,j) - Evaporation ~ Nebraska Contractors (Glendo), kaf
This row is the calculated total monthly evaporation for the Nebraska contractors in Glendo.

166. CDATA2(43) + CDATA2(44) + CDATA2(45) + CDATA2(51) - Glendo Contract ~ Nebraska Contractors, kaf
This row is the sum of the individual Nebraska contracts from Glendo.

167. FLOW2(167,j) - Additional Water ~ Nebraska Contractors (Glendo), kaf
This row is the sum of the additional water deliveries made from Glendo for the Nebraska contractors.

168. MISTDV + BRSDEL + ENSDEL + CNPDEL - Delivery ~ Nebraska Contractors (Glendo), kaf
This row is the sum of the deliveries taken by the Glendo contractors in Nebraska by month.

169. FLOW2(169,j) - Delivery Ytd ~ Nebraska Contractors (Glendo), kaf
This row is the accumulated sum of deliveries taken by the Glendo contractors in Nebraska.

170. Not Used - FLOW2 Item Not Used

171. FLOW2(171,j) - Calculated Accrual ~ Nebraska Contractors (Glendo), kaf
This row is the calculated accrual for the Glendo contractors in Nebraska. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

172. FLOW2(172,j) - Account Balance ~ Nebraska Contractors (Glendo), kaf
This row is the remaining balance of storage water for the Glendo contractors in Nebraska.

173. GLMIEVAP - Evaporation ~ Mitchell Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

174. CDATA2(44) - Glendo Contract ~ Mitchell Account, kaf
This row is the shows the contract amount for this Glendo contractor.

175. MIGLCO-CDATA2(44) - Additional Water ~ Mitchell Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

176. MISTDV - Delivery ~ Mitchell Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

177. MITSUM(j + 1) - Delivery Ytd ~ Mitchell Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

178. Not Used - FLOW2 Item Not Used

179. MIGLIRAC - Calculated Accrual ~ Mitchell Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

180. MIGLIRST(j + 1) - Account Balance ~ Mitchell, kaf
This row is the remaining balance of storage water for this Glendo contractor.

181. GLBREVAP - Evaporation ~ Bridgeport Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

182. CDATA2(43) - Glendo Contract ~ Bridgeport, kaf
This row is the shows the contract amount for this Glendo contractor.

183. BRGLCO-CDATA2(43) - Additional Water ~ Bridgeport Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

184. BRSDEL - Delivery ~ Bridgeport Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

185. BRDGSUM(j + 1) - Delivery Ytd ~ Bridgeport Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

186. Not Used - FLOW2 Item Not Used

187. BRGLIRAC - Calculated Accrual ~ Bridgeport Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

188. BRGLIRST(j + 1) - Account Balance ~ Bridgeport, kaf
This row is the remaining balance of storage water for this Glendo contractor.

189. GLENEVAP - Evaporation ~ Enterprise Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

190. CDATA2(45) - Glendo Contract ~ Enterprise, kaf
This row is the shows the contract amount for this Glendo contractor.

191. ENGLCO-CDATA2(45) - Additional Water ~ Enterprise Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

192. ENSDEL - Delivery ~ Enterprise Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

193. ENTSUM(j+1) - Delivery Ytd ~ Enterprise Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

194. Not Used - FLOW2 Item Not Used

195. ENGLIRAC - Calculated Accrual ~ Enterprise Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

196. ENGLIRST(j+1) - Account Balance ~ Enterprise, kaf
This row is the remaining balance of storage water for this Glendo contractor.

197. GLCNEVAP - Evaporation ~ CNPP&ID Account (Glendo), kaf
This row is the calculated total monthly evaporation for this Glendo contractor.

198. CDATA2(51) - Glendo Contract ~ CNPP&ID, kaf
This row is the shows the contract amount for this Glendo contractor.

199. CNGLCO-CDATA2(51) - Additional Water ~ CNPP&ID Account (Glendo), kaf
This row is the additional water deliveries made from Glendo for this Glendo contractor.

200. CNPDEL - Delivery ~ CNPP&ID Account (Glendo), kaf
This row is the deliveries taken by this Glendo contractor by month.

201. CNPSUM(j+1) - Delivery Ytd ~ CNPP&ID Account (Glendo), kaf
This row is the accumulated monthly deliveries taken by this Glendo contractor.

202. Not Used - FLOW2 Item Not Used

203. CNGLIRAC - Calculated Accrual ~ CNPP&ID Account (Glendo), kaf
This row is the calculated monthly accrual for this Glendo contractor. Accruals are allowed to be negative. A negative accrual indicates a loss that the ownership in priority is charged with.

204. CNGLIRST(j+1) - Account Balance ~ CNPP&ID, kaf
This row is the remaining balance of storage water for this Glendo contractor.

1.3.5 TABLE2 Items STOROWN.TAB Output File

1. PPST(J+1) - North Platte Pathfinder Ownership, kaf
This table is the EOM Pathfinder Ownership.

2. SMNST(J+1) - Kendrick Seminoe Ownership, kaf
This table is the EOM Kendrick Seminoe Ownership.

3. ALCST(J+1) - Kendrick Alcova Ownership, kaf
This table is the EOM Kendrick Alcova Ownership.

4. GLEVST(J + 1) - Glendo Evaporation Ownership, kaf
This table is the EOM Glendo Evaporation Ownership.

5. GLIRST(J + 1) - Glendo Irrigation Ownership, kaf
This table is the EOM Glendo Irrigation Ownership.

6. GLPWST(J + 1) - Glendo Power Ownership
This table is the EOM Glendo Power Ownership.

7. GLTEST(J + 1) - Glendo ETO Ownership, kaf
This table is the EOM Glendo ETO Ownership.

8. GPST(J + 1) - North Platte Guernsey Ownership, kaf
This table is the EOM Guernsey Ownership.

9. AMST(J + 1) - I.L. Ownership in the Main Stem, kaf
This table is the EOM Inland Lakes Ownership in the Main Stem.

10. ETOST(J + 1) - ETO Ownership, kaf
This the EOM Excess-to-Ownership.

11. TOTOWN - Total Ownership, kaf
This the Total EOM Ownership.

12. PNIR(J) + ambfpp - N.P. Storage Deliveries, kaf
This table is the total North Platte Project Storage Deliveries.

13. FLOW1 (150,J) - Kendrick Deliveries, kaf
This table is the Kendrick Storage Deliveries.

14. GLUDEL(J) - Glendo Deliveries, kaf
This table is the Glendo Storage Deliveries.

15. CCST(J + 1) - Path Enlarge #1 Ownership, kaf
This table is the Pathfinder Enlargement Account #1.

16. PPAC - N.P. Path Accrual, kaf
This table is the North Platte Pathfinder Accrual.

17. CCAC - Path Enlarge #1 Accrual, kaf
This table is the Pathfinder Enlargement #1 Accrual.

18. SEMAC - Kendrick Seminoe Accrual, kaf
This table is the Kendrick Seminoe Accrual.

19. ALCAC - Kendrick Alcova Accrual, kaf
This table is the Kendrick Alcova Accrual.

20. GLEVAC - Glendo Evap. Accrual, kaf
This table is Glendo Evaporation Accrual.

21. GLIRAC - Glendo Irr. Accrual, kaf
This table is the Glendo Irrigation Accrual.

22. GLTEAC - Glendo T&E Accrual, kaf
This table is the Glendo T&E accrual.

23. GPAC - N. P. Guern. Accrual, kaf
This table is the North Platte Guernsey Accrual.

24. AMAC - Main Stem I.L. Accrual, kaf
This table is the Main Stem Inland Lake Accrual.

25. PEVST(J + 1) - Path Enlarge #2 Ownership, kaf
This table is the Pathfinder Enlargement Account #2.

26. PEVAC - Path Enlarge #2 Accrual, kaf
This table is the Pathfinder Enlargement #2 Accrual.

27. GLPWAC - Glendo Power Pool Accrual, kaf
This table is the Glendo Power Accrual.

28. ETOCHG(J + 1) - ETO Accrual, kaf
This table is the ETO Accrual.

29. GLEVST(J + 1) + GLIRST(J + 1) + GLPWST(J + 1) + GLTEST(J + 1) - Total Glendo Ownership, kaf
This table is the Total Glendo Ownership.

30. ALCST(J + 1) + SMNST(J + 1) - Total Kendrick Ownership, kaf
This table is the Total Kendrick Ownership.

31. PEVIR(J) + ETODEL - Environmental Deliveries, kaf
This table is the environmental deliveries past Tri-State.

32. SDEL2I1 - I.L. Deliveries, kaf
This table is the Deliveries to the Inland Lakes.

33. PIRRAC - N.P. Path Alt. Accrual, kaf
This table is the Pathfinder Alternative Account Accrual.

34. PIRRST(J + 1) - Path Alt. Ownership, kaf
This table is the Pathfinder Alternative Account EOM Ownership.

35. SIRAC - Kend. Sem. Alt Accrual, kaf
This table is the Kendrick Seminoe Alternative Account Accrual.

36. SIRRST(J + 1) - Kend. Sem. Alt. Ownership, kaf
This table is the Kendrick Seminoe Alternative Account EOM Ownership.

APPENDIX G

Calibration/Validation Results

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1.0 INTRODUCTION

Appendix G contains the result of the calibration and validation of the NPRWUM. These results are displayed in both tabular and graphical form in the Tables and Figures that comprise the body of this appendix. The NPRWUM input files used to generate the output from which the tables and figures were created have also been included at the end of the appendix.

1.1 Calibration/Validation Process

The calibration/validation of the NPRWUM employed a manual process of comparing the model's output generate from historical inflows and irrigation deliveries to the historic data for:

- Natural and Storage Flow;
- Guernsey Reservoir Outflow, Flow below Tri-State Dam, and North Platte River at Lewellen;
- End-of-Month Ownership Contents;
- End-of-Month Reservoir Contents; and
- Power Generation.

The model's input data was divided into two time periods: calibration 1980-94 and Validation 1965-79. The elements listed were evaluated individually calibrated by adjusting the model's input parameters and/or code until an acceptable match of the corresponding historic data was reached. For the purpose of calibration an "acceptable match" was achieved when the modeled output followed the historical data trends, the correlation coefficient (r^2) was above 0.70, and observed anomalies explained with respect to the physical capabilities of programmed into the NPRWUM. When the calibration of an individual element was completed the parameters for the validation input file were set identical to the parameters of the calibration input file and the model was run for the validation period. The validation results were reviewed and if acceptable, the next element was added to the calibrated process. This process continued in a stepwise fashion until all elements were calibrated and validated to match the historic value as near as possible. During the calibration process it was observed that calibration of one element of the model often negatively affected the calibration of another. Hence, the results presented herein represent the best overall calibration of the NPRWUM.

1.2 Discussion of Tables and Figures

The first few tables in the appendix show the items calibrated and their regression statistics. There are two tables and two graphs for each item examined during calibration/validation process. The first table for each item contains the values produced by the model followed by the monthly and annual statistic such as the sum, average, minimum, and maximum values. The second table is the difference between the modeled and historic values. The difference is equal to the value calculated by the model minus the value historic. Thus, when the difference is negative, it signifies a negative impact to historic conditions or that the model value is less than the historic value. The values to the right and bottom of the difference table are the monthly and annual statistic such as the sum, average, minimum, and maximum values. There is a separate calibration and validation graph for each item modeled. Each graph displays the historic value, the modeled value, and the difference between the two. The differences plotted on the graphs are identical to the differences report in the Difference Tables and are equal to the modeled value minus the historic value. Appendix G also contains the tables of historic values that were used for comparison with the modeled parameters.

The tables and graphs for the calibration and validation are presented below.

1.3 Calibration/Validation Input Files

This section contains the input files for the calibration and validation runs. In most cases, a brief description of the each input parameter has been included immediately following it. These brief explanation include specific comments related to the use of the parameter, document the values used, and/or describe any adjustments made. These notes, along with the information in presented in Appendix F and Section 3.0 of the documentation can be used by the model user to gain a better understanding of how these parameter affect the operation of the NPRWUM.

1.3.1 Input File: CAL8094.RES

```
1000 1980 1994 30 275 34 92 38 71 1965 30 0 0 0 0
2 5 10 4 9 7 10 6 9 4 5 6 10 6 9 1 8 11 6 2 29 7 16 7 38 20 11 9 4 4
NORTH PLATTE RIVER WATER UTILIZATION MODEL
RESERVOIR OPERATIONS MODEL OUTPUT - CAL8094 RUN
```

CDATA ITEMS

```
1         1.  NATURAL FLOW FLAG

1         2.  STORAGE OWNERSHIP FLAG

839.1     3.  INITIAL SEMINOE RESERVOIR CONTENT (kaf)

4.7       4.  INITIAL KORTES RESERVOIR CONTENT (kaf)

526.0     5.  INITIAL PATHFINDER RESERVOIR CONTENT (kaf)

179.0     6.  INITIAL ALCOVA RESERVOIR CONTENT (kaf)

1.2       7.  INITIAL GRAY REEF RESERVOIR CONTENT (kaf)

74.6      8.  INITIAL GLENDO RESERVOIR CONTENT (kaf)

16.7      9.  INITIAL GUERNSEY RESERVOIR CONTENT (kaf)

28.5      10. INITIAL INLAND LAKES CONTENT (kaf)
       The above initial reservoir contents were obtained from Reclamation’s Complied Water
       Record and represent the September 30, 1979, EOM content.

1017.273  11. SEMINOE RES CAPACITY (kaf)
       See area-capacity tables dated December 1984. (Top of Active Conservation)

4.739     12. KORTES RES CAPACITY (kaf)
       See area-capacity tables dated January 1985. (Top of Active Conservation)

1016.507  13. PATHFINDER RES CAPACITY (kaf)
       See area-capacity tables dated March 1985. (Top of Active Conservation)

184.405   14. ALCOVA RES CAPACITY (kaf)
       See area-capacity tables dated March 1985. (Top of Active Conservation)

1.800     15. GRAY REEF RES CAPACITY (kaf)
       See area-capacity tables dated March 1985. (Top of Active Conservation)

517.485   16. GLENDO RES CAPACITY (kaf)
       See area-capacity tables dated March 1975. (Top of Active Conservation)

271.917   17. GLENDO FLOOD POOL CAPACITY (kaf)
       See area-capacity tables dated March 1975. (Top of Exclusive Flood Pool minus Top of
       Active Conservation 789,402-517,485)

45.612    18. GUERNSEY RES CAPACITY (kaf)
       See area-capacity tables dated March 1982. (Top of Active Conservation)
```

74.111 19. INLAND LAKES CAPACITY (kaf)
See area-capacity tables dated January 1991 for Lake Minatare, Lake Alice, Little Lake Alice, and Winters Creek. (Top of Active Conservation) The capacities of these lakes are respectively, 58,828 af, 11,034 af, 1166 af, and 3083 af.

.556 20. SEMINOE RES. MIN. STORAGE (kaf)
See area-capacity tables dated December 1984. (Top of Dead)

1.666 21. KORTES RES. MIN. STORAGE (kaf)
See area-capacity tables dated January 1985. (Top of Inactive) Minimum content needed for power generation.

.007 22. PATHFINDER RES. MIN. STORAGE (kaf)
See area-capacity tables dated March 1985. (Top of Dead)

137.61 23. ALCOVA RES. MIN. STORAGE (kaf)
See area-capacity tables dated March 1985. Minimum content needed for power generation.

0.056 24. GRAY REEF RES. MIN. STORAGE (kaf)
See area-capacity tables dated March 1985. (Top of Dead)

63.148 25. GLENDO RES. MIN. STORAGE (kaf)
See area-capacity tables dated March 1975. (Top of Inactive) Minimum content needed for power generation.

0.000 26. GUERNSEY RES. MIN. STORAGE (kaf)
See area-capacity tables dated March 1982. (Top of Dead)

0.00 27. SEMINOE BANK STORAGE (%)

0.00 28. PATHFINDER BANK STORAGE (%)

0.00 29. GLENDO BANK STORAGE (%)

0.00 30. GUERNSEY BANK STORAGE (%)

0.00 31. INLAND LAKES BANK STORAGE (%)
Cdata (27-37) above is the percentage of the change in storage that enters or is released from the banks of the reservoir. The percent is entered in decimal form as a number with range of 0.0 to 1.0. When the bank storage values are set to zero (0.0) as above, the bank storage function is not used in the model. However, a reservoir's gain/loss will be utilized. (See hdata items 7-11 below.)

650. 32. MINIMUM FLOW KORTES - PATHFINDER (cfs)

500. 33. LOW KORTES OUTFLOW TRIGGER (kaf)
This value is low trigger for the winter release from Kortes Reservoir. If the Seminoe Reservoir Storage falls below this content, the low Kortes outflow (hdata(28)) will be released.

800. 34. HIGH KORTES OUTFLOW TRIGGER (kaf)
This value is the high trigger for the winter release from Kortes Reservoir. If Seminoe Reservoir Storage is above this content, the high Kortes outflow (adata(28)) will be released.

300. 35. MIN SEMINOE STORAGE TO PERFORM BALANCE (kaf)
Minimum Seminoe Reservoir content above which the combined storage in Pathfinder and Seminoe Reservoir are balanced based on the percentage shown in adata(29). If Seminoe Reservoir is below the minimum content, no balance is performed.

2775. 36. MAX KORTES TURBINE CAPACITY (cfs)

0 37. CITY OF CASPER DEL FLAG (0=separate,1=both)
This flag in combination with the FLAG TO OPERATE PATHFINDER ENLARGEMENT #1 OWN (cdata(36)) controls the operation of the city of Casper storage contracts from Kendrick and the enlarged Pathfinder account #1. The table below shows the possible flag settings and the associated model operation performed.

cdata(37)	cdata2(39)	Operation Performed
0	1	Operate only the City of Casper's demand from the enlarged Pathfinder #1 Ownership. City of Casper's demand from Kendrick Ownership set to zero (0). This setting also allows the 7000 af contract for municipal water in Kendrick to be used to offset shortages from the Pathfinder #1 Ownership.
1	1	Operate both City of Casper's demand from the enlarged Pathfinder #1 Ownership and the 7000 af contract from the Kendrick Ownership. The accounts are operated independently of one another under this condition.
1	0	Operate only the City of Casper's demand from the Kendrick Ownership. City of Casper's demand from enlarged Pathfinder #1 Ownership set to zero (0).
0	0	Operate only the City of Casper's demand from the Kendrick Ownership. City of Casper's demand from enlarged Pathfinder #1 Ownership set to zero (0).

2600. 38. MAX FREMONT TURBINE CAP (cfs)

330. 39. GRAY REEF MIN OUTFLOW (cfs)

334.24 40. GLENDO POWER POOL TARGET (kaf)
This value is the amount of restorage space for water used to generate power during the winter months.

0 41. MIN AVG SYSTEM STORAGE (kaf)
This value is the minimum average system storage (total storage in Seminoe, Kortes, Pathfinder, Alcova, and Gray Reef Reservoirs for September 30) used to determine the Gray Reef outflow in the winter months, if CDATA(48) is set to one (1). The NPRWUM evaluates the total system storage for September at the beginning of the new water year in October and if the system storage is below the minimum value set by the model user, the NPRWUM will release the base Gray Reef Reservoir outflow (CDATA(44)) during the winter.

0 42. LOW AVG SYSTEM STORAGE (kaf)
This value is the low average system storage (total storage in Seminoe, Kortes, Pathfinder, Alcova, and Gray Reef Reservoirs for September 30) used to determine the Gray Reef outflow in the winter months, if CDATA(48) is set to one (1). The NPRWUM evaluates the total system storage for September at the beginning of the new water year in October and if the system storage is between the minimum and low system storage values set by the model user, the NPRWUM will release the low Gray Reef Reservoir outflow (CDATA(45)) during the winter.

1345.9 43. MED AVG SYSTEM STORAGE (kaf)
This value is the medium average system storage (total storage in Seminoe, Kortes, Pathfinder, Alcova, and Gray Reef Reservoirs for September 30) used to determine the Gray Reef outflow in the winter months, if CDATA(48) is set to one (1). The NPRWUM evaluates the total system storage for September at the beginning of the new water year in October and if the system storage is between the low and medium system storage values set by the model user, the NPRWUM will release the average Gray Reef Reservoir outflow (CDATA(46)) during the winter. If the system storage is greater than the medium system storage set by the model user, the NPRWUM will release the high Gray Reef Reservoir outflow (CDATA(47))during the winter months.

330 44. BASE GRAY REEF OUTFLOW (cfs)
This value is the base Gray Reef Reservoir winter outflow. It is used by the NPRWUM for the winter Gray Reef Reservoir outflow if CDATA(48) equals one (1) and the total September system storage above Gray Reef Dam is less than CDATA(41).

330 45. LOW GRAY REEF OUTFLOW (cfs)
This value is the low Gray Reef Reservoir winter outflow. It is used by the NPRWUM for the winter Gray Reef Reservoir outflow if CDATA(48) equals one (1) and the total September system storage above Gray Reef Dam is between CDATA(41) and CDATA(42).

330 46. AVG GRAY REEF OUTFLOW (cfs)
This value is the average Gray Reef Reservoir winter outflow. It is used by the NPRWUM for the winter Gray Reef Reservoir outflow if CDATA(48) equals one (1) and the total September system storage above Gray Reef Dam is between CDATA(42) and CDATA(43).

330 47. HIGH GRAY REEF OUTFLOW (cfs)
This value is the high Gray Reef Reservoir winter outflow. It is used by the NPRWUM for the winter Gray Reef Reservoir outflow if CDATA(48) equals one (1) and the total September system storage above Gray Reef Dam is greater than CDATA(43).

0 48. STORAGE ZONE FLAG (1=YES,0=NO)
This is the flag used to tell the NPRWUM to set the Gray Reef Reservoir winter outflow based on the minimum, low, or medium September total system storage above Gray Reef Dam. If this flag is turned "off", set to zero (0), the NPRWUM uses the Gray Reef minimum outflow CDATA(39) to control the winter Gray Reef releases.

5000. 49. CHANNEL FLOW TO FLAG AT GLENROCK (cfs)
This value is the flow at which the model user is notified via the message file that the flow in the North Platte River is nearing the flood stage. This value is set at 5000 cfs.

7000. 50. MAXIMUM GLENDO OUTFLOW (cfs)

4.554 51. KORTES RESERVOIR TARGET

1.300 52. GRAY REEF RES. TARGET

5. 53. MONTH TO BEGIN ASSESSING GLENDO TARGETS

8. 54. MONTH TO MAX (REACH) GLENDO TARGETS

12. 55. MONTH TO REACH THE MINIMUM TARGET

0.90 56. PERCENT OF GLENDO TARGET TO ACHIEVE

517. 57. MAXIMUM GLENDO TARGET

80. 58. MINIMUM GLENDO TARGET
Cdata(53-58) are used to control the physical EOM contents in Glendo Reservoir.

0 59. FLG-MAIN CNL DEL % OF INTERSTATE (1=YES ,0=NO)
If this flag is equal to one (1) amount of water delivered to the Pathfinder Main Canal for irrigation is calculate as a percentage of the Pathfinder (Interstate) Diversion. The factors are located in ADATA(24,j). Otherwise, the Pathfinder Main Canal deliveries are taken from hdata(19,i,j)

.01 60. NON-BENEFICIAL USE
Fraction of a diversion that is lost to non-beneficial uses like evaporation.

0.42 61. CITY OF CASPER EFFICIENCY FOR KENDRICK WATER
This value is the percent of the City of Casper's Kendrick Delivery that is not consumptively used and returns in the Alcova to Glendo Reach. The value was determined by reviewing the REPORT ON PROPOSED MUNICIPAL USE BY CASPER OF KENDRICK WATER SUPPLY written by Wright Water Engineers, Inc. Table 16 on page 29 of the report shows that 2992 af of the 7000 af returns to the river, approximately 42%.

31.398 62. Path EOM below which Glendo target suspended.

0.0 63. Not Used

1000 64. TRANSMISSIVITY-KENDRICK PROJECT

170000. 65. TRANSMISSIVITY-REACH #2

170000. 66. TRANSMISSIVITY-REACH #3

0.0 67. Not Used

0.0 68. Not Used

0.20 69. STORAGE COEFFICIENT-KENDRICK PROJECT

1400 70. REACH WIDTH-KENDRICK PROJECT

11700.   71. REACH WIDTH-REACH #2

11700.   72. REACH WIDTH-REACH #3

.23   73. STORAGE COEFFICIENT

0.10   74. LOSS FACTOR-CNPP&ID WO
This value represents the percentage of the CNPPID delivery that is lost during conveyance. It is set at 10 % per discussion with Jim Vasos, NE-DWR. In 1993, DWR tracked the 8000 af delivery and that of the 8000, 7271 af was delivered at MacCounghy.

1475   75. TRI-STATE CANAL CAPACITY (cfs)

24.   76. GRATTAN DITCH CAPACITY (cfs)

75.   77. NORTH PLATTE DITCH CAPACITY (cfs)

70.   78. ROCK RANCH DITCH CAPACITY (cfs)

22.   79. PRATT-FERRIS DITCH CAPACITY (cfs)

5.   80. BURBANK DITCH CAPACITY (cfs)

54.   81. TORRINGTON DITCH CAPACITY (cfs)

74.   82. LUCERNE DITCH CAPACITY (cfs)

3.3   83. NARROWS DITCH CAPACITY (cfs)

370.   84. MITCHELL-GERING CANAL CAPACITY (cfs)

2100.   85. INTERSTATE CANAL CAPACITY (cfs)

1550.   86. FORT LARAMIE CANAL CAPACITY (cfs)

600.   87. CASPER CANAL CAPACITY (cfs)

13.5   88. INIT COND RECHARGE-REACH #2

43.3   89. INIT COND RECHARGE-REACH #3

1.5   90. INIT COND RECHARGE-KENDRICK PROJECT

0   91. Credit flood water to eto (1=yes, 0=no)
This flag controls the use of attenuated flood water in the system. When the flag is zero (0), the NPRWUM releases any attenuated flood water out of the system as soon as physically possible. When the flag is one(1), the NPRWUM optimizes the use of this water by assigning it to the excess to ownership, if possible.

1   92. FLAG TO OPERATE BANK STORAGE (1=YES ,0=NO)
This flag controls the operation of the Bank Storage/Seepage function in the model. When this flag is set to 1, the model calculates the bank storage for the reservoirs using CDATA(27-31) and the seepage (gain/loss) for the reservoirs using HDATA(7-11).

ADATA ITEMS

[1] Factor for the utilization of Guernsey Reservoir to Whalen Gains
0.0 0.0 0.0 0.0 0.0 0.0 0.95 0.95 0.95 0.95 0.95 0.95
These values are factors greater than or equal to zero (0.0) and less than or equal to one (1.0) entered by the model user to control the amount of the Guernsey to Whalen reach gain that is used to meet natural flow demands below between Guernsey Dam and Tri-State Diversion Dam. A value of less than one (1.0) reduces the amount of the gain used to meet the natural flow. These values are only used during the irrigation season.

[2] Factor for the utilization of Whalen to Tri-State gains
0.0 0.0 0.0 0.0 0.0 0.0 0.90 0.90 0.90 0.90 0.90 0.90
These values are factors greater than or equal to zero (0.0) and less than or equal to one (1.0) entered by the model user to control the amount of the Whalen to Tri-State reach gain that is used to meet natural flow demands below between Guernsey Dam and Tri-State Diversion Dam. A value of less than one (1.0) reduces the amount of the gain used to meet the natural flow. These values are only used during the irrigation season.

```
[3] Seepage below Glendo Dam
   .49   .27   .22   .24   .21   .40    0.    0.    0.    0.    0.    0.

[4] Seepage below Guernsey Dam
   0.3   0.2   0.3   0.4   0.3   0.3   0.4   1.2   3.0   3.1   2.5   2.1
       The values of seepage below Glendo and Guernsey Dam were (ADATA(3-4)) taken from the input
       files used to create the Annual Operating Plans-Water Year 1993-1994, Table 3A page 2 of
       4.  NOTE: The Glendo seepage shown in this table also includes evaporation.

[5] 1993-94 Min Probable Inflow Estimates Above Seminoe Res (AFX1000)
  24.7  23.1  21.0  17.7  21.2  44.8  77.0 119.5 129.9  33.8  20.3  13.6

[6] 1993-94 Min Probable Inflow Estimates Sweetwater River (AFx1000)
   2.6   2.7   3.2   3.7   3.9   4.1   8.7   5.7   4.1   1.7   1.2   0.9

[7] 1993-94 Min Probable Inflow Estimates Kortes-Pathfinder Gain (AFx1000)
   2.7   1.3   1.4  -0.2   0.1   4.4   3.7   4.9   6.0   7.7   7.8   3.1
       ADATA items 5-7 were taken from the input files used to create the Annual Operating Plans-
       Water Year 1993-1994, Table 3B page 1 of 4.

[8] 1993-94 Most Probable Inflow Estimates Alcova-Glendo Gain (AFX1000)
  16.7  15.1   8.0   8.8  19.2  21.2  45.3  61.3  11.2  -1.1  -4.5  11.5
       ADATA item 8 was taken from the input files used to create the Annual Operating Plans-
       Water Year 1993-1994, Table 3A page 2 of 4.

[9] FLOW RELEASES FROM PATHFINDER OUTLETS (cfs)
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0

[10] LOW FLOW RELEASES FROM GLENDO (cfs)
   25.   25.   25.   25.   25.   25.   25.   25.   25.   25.   25.   25.

[11] GUERNSEY RESERVOIR TARGET EOM CONTENT (AF)(GURNEOM) 1961 1989
   0.0   0.0   0.0   0.0   0.0   0.0  35.0  35.0  35.0  30.0  30.0   2.0

[12] Alcova End-of-Month Target
 156.0 156.0 156.0 156.0 156.0 156.0 179.5 179.5 179.5 179.5 179.5 179.5

[13] SEMINOE RESERVOIR EVAP. FACTOR     (SEMREVF) 1948 1989
  0.29  0.15  0.10  0.09  0.09  0.17  0.30  0.38  0.52  0.61  0.55  0.39

[14] PATHFINDER RESERVOIR EVAP. FACTOR  (PATREVF) 1948 1989
  0.29  0.15  0.10  0.09  0.09  0.17  0.30  0.42  0.55  0.65  0.60  0.44

[15] GLENDO RESERVOIR EVAPORATION FACTOR(GLEREVF) 1958 1989
  0.24  0.12  0.11  0.12  0.11  0.19  0.31  0.45  0.56  0.67  0.62  0.44

[16] WHALEN DIV. DAM EVAPORATION FACTOR (WHALEVF) 1948 1989
  0.24  0.12  0.11  0.12  0.11  0.19  0.31  0.44  0.53  0.61  0.54  0.37

[17] SEMINOE POWER PLANT TURBINE AVAILABILITY
    .95   .93   .94   .84   .74   .81   .79   .92   .93   .96   .96   .98

[18] KORTES POWER PLANT TURBINE AVAILABILITY
    .74   .74   .77   .80   .83   .86   .84   .92   .93   .98   .97   .87

[19] FREMONT POWER PLANT TURBINE AVAILABILITY
    .66   .52   .52   .50   .52   .61   .78   .88   .90   .97   .98   .99

[20] ALCOVA POWER PLANT TURBINE AVAILABILITY
    .83   .79   .84   .58   .58   .59   .71   .89   1.0   .99   .97   .90

[21] GLENDO POWER PLANT TURBINE AVAILABILITY
    .55   .34   .54   .36   .40   .44   .93   .99   1.0   1.0   1.0   .93

[22] GUERNSEY POWER PLANT TURBINE AVAILABILITY
    .75   .80   .73   .42   .43   .69   .70   .76   .79   .98   1.0   .95
```

[23] Factor-Pathfinder water used for irrigation abv Inland Lakes May-Sep

```
   0.0   0.0   0.0   0.0   0.0   0.0   0.0  .584  .652  .830  .808  .663
```

When CDATA(59) is set to one (1) and it is the irrigation season, the irrigation diversions in the Pathfinder Main Canal are calculated as Pathfinder Diversions (HDATA(33)) times the given monthly factor. These factors are equal to the 1961-89 total monthly Pathfinder Main Canal diversions divided by the 1961-89 total monthly Pathfinder Diversions.

[24] Factor for Canal Loss of water Delivered to Inland Lakes in Oct-Apr

```
   0.2   0.5   0.5   0.5   0.5   .45   .45   0.0   0.0   0.0   0.0   0.0
```

These factors are used only during the non-irrigation season and when cdata(59) = 1. The values for October and April were estimated based on the amount of water entering the Interstate Canal divided by the amount of water diverted from the Interstate Canal (Main, Highline, Lowline, Reservoir Supply Canals) for the period 1961-89 under the Idealized Inland Lakes assumptions. The initial estimate were increase during calibration. The assumed values are used months of November through March.

[25] % Farm Delivery to Surface Runoff

```
   0.2   0.2   0.2   0.2   0.2   0.2   .20   0.2   0.2   .20   .20   .20
```

Fraction of a diversion’s non-consumptively used water that is considered to contribute to surface runoff.

[26] LOW KORTES WINTER OUTFLOW (cfs)

```
   525.  525.  675.  675.  600. 650. 950.  1075.     0     0     0     0
```

Flow maintained below Kortes reservoir if the Seminoe Reservoir Storage falls below the low trigger (cdata(33)).

[27] MEDIAN KORTES WINTER OUTFLOW (cfs)

```
   1025. 1150. 1400. 1525. 1450. 1350. 1425. 1450.     0     0     0     0
```

This value is the flow maintained below Kortes reservoir if the Seminoe Reservoir Storage is not below the low Kortes winter outflow trigger (cdata(33)) or above the high Kortes winter outflow trigger (cdata(34)).

[28] HIGH KORTES WINTER OUTFLOW (cfs)

```
   1175. 1300. 1575. 1750. 1600. 1550. 1575. 1650.     0     0     0     0
```

This value is the flow maintained below Kortes reservoir if the Seminoe Reservoir Storage is above the high Kortes winter outflow trigger (cdata(34)).

[29] % PATH+SEM STORAGE KEEP IN SEMINOE (%)

```
     0     0     0     0     0  0.50  0.50  0.50  0.52  0.55  0.58  0.60
```

This value is the decimal percentage of the distribution of water between Seminoe and Pathfinder Reservoirs during April through September. A value of 0.6 means that total storage in Seminoe and Pathfinder Reservoirs will be roughly maintained at 60 % in Seminoe Reservoir and 40 % in Pathfinder Reservoir under normal conditions. (See also cdata(35))

[30] DELIVERY FROM GLENDO ETO ACCOUNT (kaf)

```
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
```

Active only if cdata2 (17)=1.

[31] DEMAND FOR THE CITY OF CASPER FROM PATHFINDER OWNERSHIP (kaf)

```
  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  1.49  3.74  2.62  1.75
```

The sum of the City of Casper demands from Pathfinder equal the 9600 af of firm yield associated with the Deer Creek Reservoir proposal. See notes dated February 17, 1996 from Duane Stroup to Mark Spears. Activated by cdata(37) and cdata2(39).

[32] DELIVERY FROM PATHFINDER ENLARGEMENT ACCOUNT #2 (kaf)

```
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
```

Active only if cdata2(42)=1

[33] DEMAND FOR THE CITY OF CASPER FROM KENDRICK OWNERSHIP (kaf)

```
  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
```

Activated by cdata (37) and cdata2 (39).

[34] DEMAND FROM PATHFINDER ALTERNATIVE IRRIGATION OWNERSHIP (kaf)

```
  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00100.00
```

Active only if cdata2(36)=1.

[35] DEMAND FROM WYO GLENDO ALTERNATIVE IRRIGATION OWNERSHIP (kaf)

```
  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00 10.00
```

Active only if cdata2(61)>0.

[36] DEMAND FROM NEB GLENDO ALTERNATIVE IRRIGATION OWNERSHIP (kaf)
  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00
Active only if cdata2(61)>0.

[37] DEMAND FROM SEMINOE ALTERNATIVE IRRIGATION OWNERSHIP (kaf)
  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00100.00
Active only if cdata2(65)=1.

[38] Pathfinder Municipal Account Environmental Demand (kaf)
  0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
Activated by cdata(37) and cdata2(39).

HDATA ITEMS

(1)NORTH PLATTE RIVER AB SEMINOE RESERVO(NPSR300) 1941 1994
USGS gaged data (period of record 1939-Current)

(2)MEDICINE BOW RIVER AB SEMINOE RESERVO(MBAS350) 1941 1994
USGS gaged data (period of record 1939-Current)

(3)SWEETWATER RIVER NEAR ALCOVA, WY   (SRNA390) 1941 1994
(period of record 1938-Current)
USGS gaged data except for Oct through March for years 1974, 1975, 1977-81, 1983-1991, and April 1979 which was supplied by State of Wyoming, see letter IRM-5.00 dated November 4, 1994.

Eqn. $y = 1.295311e\text{-}5 * x^2 + .644 * x + 717$ cfs
x = Sweetwater River flow near Sweetwater Station (cfs)
y = Sweetwater River Near Alcova (cfs)

The above equation was used prior to 1993. After 1993, the missing winter flow data came from Reclamation's HYDROMET database.

(4)DEER CREEK BELOW MILLAR WASTEWAY AT G(DCBW466) 1941 1994
USGS gaged data from February 1961 through 1991. Data estimated from 1941 through January 1961 by setting DCBW466 equal to the USGS gage Deer Creek at Glenrock which is 0.1 mile upstream. The Deer Creek Below Millar Wasteway gage was discontinued in 1992. A regression (DEERREG.WK4) was performed for 1993 and 1994 for the months of Oct-Jul (Deer Creek below Millar Wasteway v. Deer Creek in Canyon 1986-1992). Due to poor correlation coefficients in Aug and Sep, the 1986-92 averages values were used in water years 1993-1994.

(5)LARAMIE RIVER NEAR FORT LARAMIE, WY (LRFL705) 1941 1994
USGS gaged data (period of record 1915-Current)

(6)BLUE CREEK NEAR LEWELLEN NEBRASKA   (BCNL870) 1941 1994
USGS gaged data (period of record 1931-1991)
NE-DWR data (period of record 1991-Current)

(7)SEMINOE RESERVOIR GAIN   (SEMGAIN) 1941 1994
This gain calculated as computed Seminoe Reservoir Inflow
(BDSEMI) - Sweetwater River near Alcova
(SRNA390) - Medicine Bow River Ab Seminoe Reservoir (MBAS350).
BDSEMI period of record 1939 - Current

(8)PATHFINDER & ALCOVA RESERVOIRS GAIN (PATGAIN) 1941 1994
Set to zero. The gain/loss for these reservoir are included in the Kortes to Pathfinder gain.

(9)GLENDO RESERVOIR GAIN   (GLEGAIN) 1941 1994
From 1958 to current computed as the Glendo Reservoir Computed Inflow (BDGLEI) - North Platte River At Orin (NPO520).
BDGLEI period of record 1958 - Current
NPO520 period of record 1958 - Current
Prior to 1958, set to zero - included in the Glendo to Guernsey reach gain.

(10)GUERNSEY RESERVOIR GAIN   (GUEGAIN) 1941 1994
Set to 0, the Guernsey Reservoir Gain included in the calculation of the Glendo to Guernsey gain.

(11)IDEALIZED INLAND LAKES GAIN   (INLGAIN) 1941 1994
Total outflow + total evaporation - total inflow - change in storage. Created using the files opslakes.f and inlakes.data located on the workstation loup in the directory loup:/staff/.../inland.

(12)KORTES PATHFINDER REACH GAIN (KPAGAIN) 1941 1994

KPAGAIN = BDPATI - SRNA390 - BDKROUT from 1951 through 1994

KPAGAIN = BDPATI - SRNA390 - BDSEMO from 1941 through 1950

BDPATI = Computed Inflow of Pathfinder Reservoir, reported in Compiled Water Records and/or Project History of North Platte Project.

BDKROUT = Kortes Reservoir Outflow, reported in Compiled Water Records and/or Project History of North Platte Project.

BDSEMO = Seminoe Reservoir Outflow, reported in Compiled Water Records and/or Project History of North Platte Project.

(13)ALCOVA TO GLENROCK GAIN (A2GGAIN) 1941 1994

A2GGAIN = NPG468 - DCBW466 - NPA420

NPG468 = USGS gage North Platte River near Glenrock (October 1959 through 1991). Data was estimated from January through September 1959 based on regression correlation with USGS gage North Platte River at Orin. Data was estimated from 1941 through December 1958 based on the sum of USGS gages North Platte River at Casper and Deer Creek at Glenrock. The USGS discontinued gage NPG468 in 1993, however, Reclamation monitors a gage at this site and the May 1993 and all of 1994 data was taken for Reclamations Hydromet Data Base.

NPA420 = USGS gage North Platte River at Alcova.

During calibration of the NPRWUM, it was observed that the Glendo Reservoir was not storing water in December of water year 1989 as it had historically. Upon further investigation by Duane Stroup, it was discovered that the Alcova to Glendo Reach gain in that month was small (0.1 kaf), yet Glendo took water historically. This indicates that the reach gain calculated for use in the NPRWUM is too low. The reach gain is computed using USGS published numbers at the Alcova gage and the Bureau’s Glendo Reservoirs computed inflow. The adjustment made to the Alcova gaged flow from 50.8 kaf to 59.0 kaf is the reason the gain is so small. The justification for this large adjustment to the stream flow data has not been identified. Based on the fact that Glendo did historically store water in December of water year 1989 and the real time number show a larger gain, the **Alcova to Glenrock gain in the NPRWUM data set was increased from -5.9 kaf to 5.1 kaf**. With this adjustment, the NPRWUM better matches the historic storing of water in Glendo Reservoir. The Alcova to Glenrock gain was also adjusted in the months of March from 6.5 to 7.6 kaf, April from 2.7 to 5.6 kaf, and May from -3.1 to 6.7 kaf for the same reason.

(14)GLENROCK TO ORIN GAIN (G2OGAIN) 1941 1994

G2OGAIN = A2OGAIN - A2GGAIN - DCBW466.

A2OGAIN = NPO520 - (0.98xNPA420) during the non-irrigation season.

A2OGAIN = NPO520 - NPA420 during the irrigation season.

NPO520 = USGS gage North Platte River at Orin from April 1958 to 1991.

From 1941 through March 1958 the data was estimated using the sum the USGS gages North Platte River at Douglas, Wagonhound Creek near La Bonte, and La Bonte Creek near La Bonte. Data for the North Platte River at Douglas is unavailable during the period 1941 through March 1946. This data was estimated by monthly regression equations using the sum of the North Platte River at Casper, Deer Creek at Glenrock, Box Elder Creek near Careyhurst, and La Prele Creek near Orpha as the independent variable.

(15)GLENDO TO GUERNSEY GAIN (GLGUGN) 1941 1994

GLGUGN = BDGUEI - NPBG528 from 1958 through 1994

BDGUEI = Computed Inflow of Guernsey Reservoir, reported in Compiled Water Records and/or Project History of North Platte Project.

NPBG528 = USGS gage North Platte River below Glendo Reservoir.

GLGUGN = BDGUEI - NP0520 from 1941 through 1957.

(16)GUERNSEY TO WHALEN GAIN (GWGAIN) 1941 1994

GWGAIN = NPBW570 + INTR2.7 + A768-4 + A768-3 - NPBG560.
NPBW570 = USGS gage North Platte River below Whalen Diversion Dam.
INTR2.7 = Interstate Canal above milepost 2.7. Taken from the North Platte Project Water Distribution Summary for the irrigation season found in the Compiled Water Records from 1968 through 1994. Taken from Bureau of Reclamation daily records from 1941 through 1967.
A768-4 = Interstate Canal at milepost 2.7. Taken from the North Platte Project Water Distribution Summary for the irrigation season and from the Interstate Canal Daily Diversion table for the non-irrigation season. Both sources are found in the Compiled Water Records and/or Project History of North Platte Project.
A768-3 = Ft. Laramie Canal at milepost 0.8. Taken from the North Platte Project Water Distribution Summary for the irrigation season and from the Ft. Laramie Canal Daily Diversion table for the non-irrigation season. Both sources are found in the Compiled Water Records and/or Project History of North Platte Project.
NPBG560 = USGS gage North Platte River below Guernsey Reservoir.

(17)WHALEN TO BELOW TRI-STATE DAM GAIN (WTSGAIN) 1941 1994

WTSGAIN = NPTSALL + GRTTNLM + D635LM + RKRANLM + PRATTLM + BRBNKLM + TRNGTLM + LCRNELM + NAROWLM + D1052 + A365R + D918+1 + A768-1 + D945 - LRFL705 - LPPNP - NPBW570.
NPTSALL = North Platte River Passing Tri-State Diversion Dam. From 1947 through 1991 the data was taken from State of Nebraska Department of Water Resources Hydrographic Report (NPTS746) for all discharges for May through September and for months of April and October when available. For all other months in this time period data was estimated by summing the flows from Spring Creek (0.4 kaf per month) and USGS data North Platte River at Wyoming-Nebraska State Line (NPSL745). From 1941 through 1946 the data was estimated by summing Spring Creek and NPSL745 and subtracting the total water diverted from the river at Tri-State as reported in the Compiled Water Records (TSDRCWR).
LRFL705 = Historic Laramie River flows as measured near Ft. Laramie, Wyoming.
LPPNP = Lingle Power Plant diversions from the North Platte River through the Ft. Laramie Canal. The Power Plant was abandoned in 1956. By accounting for these diversions, the gain is adjusted to a condition post Lingle Power Plant.
Note: The Lingle Power Plant received water from the Laramie River and the North Platte River via the Ft. Laramie Canal. If the Lingle Power Plant had not taken water from the Laramie River, these diverted flows would have remained in the Laramie River and reached the North Platte River just below the Whalen Diversion Dam. Even with the Power Plant in operation, the Returns from the Power Plant returned to the North Platte River near Lingle, Wyoming(USBR Compiled Water Records 1955, page 25). In order to adjust the Whalen to Tri-State gain to a historic conditions without the operation of the Lingle Power Plant, the Lingle Power Plant Diversion for the North Platte River (LPPNP) were include in the gain computation.

(18)BELOW TRI-STATE DAM TO LEWELLEN GAIN(TSLGAIN) 1941 1994

TSLGAIN = NPL875 + D920+1 + D952-1 + D962 + D919 + D921 + D925+ + D946 + D844 + D828-1 + D858 + D857 + D897 + D787R+ + D789 - BCNL870 - NPTSALL.
NPL875 = USGS gage North Platte River at Lewellen, Nebraska.
BCNL870 = USGS gage Blue Creek near Lewellen.

(19)PATHFINDER ID MAIN CANAL FM N PLATTE(MAINNET) 1941 1994

Taken from table "Monthly Water Distribution of Main Canal" found in Compiled Water Records and/or Annual Report of Pathfinder Irrigation District. Set to 0 during non-irrigation season. Non-irrigation season is accounted for in ADATA item [25]. This data set not used if cdata(59)=1.

(20)CENTRAL NE PUBLIC POWER ID DELIVERIE(CNPDEL) 1941 1990

Deliveries for the CNPPID from Glendo Ownership.

(21)CENTRAL DISTRICT WATER ORDERS (CENTWO) 1941 1994

1.28 x storage. Storage taken from the North Platte Project Water Distribution Summary.

(22)BROWNS CREEK DISTRICT WATER ORDERS (BROWWO) 1941 1994

1.4 x storage. Storage taken from the North Platte Project Water Distribution Summary.

(23)BEERLINE DISTRICT WATER ORDERS (BEERWO) 1941 1994

1.4 x storage. Storage taken from the North Platte Project Water Distribution Summary.

(24)CHIMNEY ROCK DISTRICT WATER ORDERS (CHIMWO) 1941 1994

1.28 x storage. Storage taken from the North Platte Project Water Distribution Summary.

(25)CORN CREEK PROJECT DIVERSIONS FM NPR(CCDMD) 1980 1989

This data set delivers water to the proposed Corn Creek Project. Set to Zero (0).

(26)BRIDGEPORT DISTRICT WATER ORDERS (BRIDWO) 1941 1994
1.33 x storage. Storage taken from the North Platte Project Water Distribution Summary.

(27)ENTERPRISE DISTRICT WATER ORDERS (ENTWO) 1941 1994
1.2 x storage. Storage taken from the North Platte Project Water Distribution Summary.

(28)CASPER CANAL DIVERSIONS (BDCCD) 1941 1994
Taken from Compiled Water Records.

(29)DELIVERIES FROM WY UNASSIGNED GLENDO WATER
This record accounts for the 10.6 kaf of Wyoming water that does not have a contract. The deliveries were patterned* after the other WY Glendo Contractors.

(30)LINGLE WATER USERS
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project. Includes losses as charged on Daily accounting sheets.
Note: From 1953-1968, The diversions above milepost 2.7 (INTR2.7)of the Interstate Canal are included with the Lingle Water Users diversions. INTR2.7 = Interstate Canal above milepost 2.7. Taken from the North Platte Project Water Distribution Summary for the irrigation season found in the Compiled Water Records from 1968 through 1994. Taken from Bureau of Reclamation daily records from 1953 through 1967. Set to zero (0) for 1941-52 when no records were available. The Compiled Water Records already credits 1969-94 INTR2.7 data to Lingle water users (LINGNPR). For purpose of the NPRWUM this record has been included with Lingle and removed from NPRWUM.

(31)HILL DISTRICT DIVERSIONS F N PLATTE (HILLNPR) 1941 1994 ADJUSTABLE DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project. Includes losses as charged on Daily accounting sheets.

(32)WYOMING LATERALS, LOSS INCLUDED (WYOLATS) 1941 1994 ADJUSTABLE DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project. Set to 0 from 1941 to 1967 to correspond with Compiled Water Records, Wyoming Laterals are probably(?) credited to Pathfinder Irrigation District during this time. Includes losses as charged on Daily accounting sheets.

(33)PATHFINDER DISTRICT NAT & STOR FLOWS(PATHNPR) 1941 1994 ADJUSTABLE DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(34)INLAND LAKES DEL FROM INLAND L ACCT (INLKDEL) 1941 1994 ADJUSTABLE DELIVERY
Taken from A768-4 for the non-irrigation season. Several changes have been made. Based on reported numbers for Guernsey Outflow and Pathfinder Irrigation District we believe that A768-4 is in error for the months of December 1955, October 1958, and October 1959. For these months the data has been changed to match the data reported by Pathfinder Irrigation District.

(35)DEMANDS ON INLAND LAKES HIGH+LOW+RES(INLDEL) 1941 1994 ADJUSTABLE DELIVERY
Sum of Highline, Reservoir Supply, and Lowline Canals. Taken from Compiled Water Records and/or Annual Report of Pathfinder Irrigation District.

(36)WRIGHT & MURPHY FLOW FROM N PLATTE R(WMFNPR) 1941 1994 ADJUSTABLE DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(37)GOSHEN DISTRICT FLOW FM N PLATTE RIV(GOSFNPR) 1941 1994 ADJUSTABLE DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(38)GERING-FT LARAMIE FLOW FM N PLATTE R(GFLFNPR) 1941 1994 ADJUSTABLE DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(39)BURBANK DITCH DIVERSIONS (BRBNKLM) 1941 1994 ADJUSTABLE DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(40)LUCERNE CANAL & POWER DIVERSIONS (LCRNELM) 1941 1994 ADJUSTABLE DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

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(41)NEW GRATTAN DITCH DIVERSIONS        (GRTTNLM) 1941 1994 ADJUSTABLE DELIVERY
       Taken from the North Platte Project Water Distribution of the Water Season summary found
       in Compiled Water Records and/or Project History of North Platte Project.

(42)TORRINGTON DISTRICT DIVERSIONS      (TRNGTLM) 1941 1994 ADJUSTABLE DELIVERY
       Taken from the North Platte Project Water Distribution of the Water Season summary found
       in Compiled Water Records and/or Project History of North Platte Project.

(43)ROCK RANCH DISTRICT DIVERSIONS      (RKRANLM) 1941 1994 ADJUSTABLE DELIVERY
       Taken from the North Platte Project Water Distribution of the Water Season summary found
       in Compiled Water Records and/or Project History of North Platte Project.

(44)NORTH PLATTE DITCH DIVERSIONS       (D635LM ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from the North Platte Project Water Distribution of the Water Season summary found
       in Compiled Water Records and/or Project History of North Platte Project.

(45)NARROWS DISTRICT DIVERSIONS         (NAROWLM) 1941 1994 ADJUSTABLE DELIVERY
       Taken from the North Platte Project Water Distribution of the Water Season summary found
       in Compiled Water Records and/or Project History of North Platte Project.

(46)PRATT FERRIS DITCH DIVERSIONS       (PRATTLM) 1941 1994 ADJUSTABLE DELIVERY
       Taken from the North Platte Project Water Distribution of the Water Season summary found
       in Compiled Water Records and/or Project History of North Platte Project.

(47)FRENCH CANAL DIVERSIONS             (A1433LM) 1941 1994 ADJUSTABLE DELIVERY
       Set to 0.

(48)MITCHELL CANAL FROM NORTH PLATTE RIV(D1052  ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(49)GERING CANAL FROM NORTH PLATTE RIVER(A365R  ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(50)TRI-STATE CANAL FROM NPR FOR FARMERS(D918+1 ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(51)NORTHPORT CANAL FROM NORTH PLATTE RI(A768-1 ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(52)RAMSHORN CANAL FROM NORTH PLATTE RIV(D945   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(53)ENTERPRISE CANAL FROM NORTH PLATTE R(D920+1 ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(54)WINTERS CREEK CANAL FM NORTH PLATTE (D952-1 ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(55)CENTRAL CANAL FROM NORTH PLATTE RIVE(D962   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(56)MINATARE CANAL FROM NORTH PLATTE RIV(D919   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(57)CASTLE ROCK CANAL FROM NORTH PLATTE (D921   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(58)NINE MILE CANAL FROM NORTH PLATTE RI(D925+  ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(59)SHORTLINE CANAL FROM NORTH PLATTE RI(D946   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(60)CHIMNEY ROCK CANAL FROM NORTH PLATTE(D844   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(61)BELMONT (BRIDGEPORT) CANAL FROM NPR (D828-1 ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(62)EMPIRE CANAL FROM NORTH PLATTE RIVER(D858   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.
```

```
(63)FARMERS DISTRICT FROM DRAINS        (TSDRND1) 1941 1994 ADJUSTABLE DELIVERY
       TSDRND1 = Sum of Drains (Akers Draw, Sheep Creek, Dry Spottedtail Creek, Wet Spottedtail
       Creek, Tub Springs, and Alliance Drain), 1941 and 1942.
       TSDRND1 = D918+T - D918+1, 1943-89.
       D918+T = Tri-State Canal total for Farmers ID.  Taken from State of Nebraska Department of
       Water Resources Hydrographic Report. Taken from Compiled Water Records 1990-91.

(64)ENTERPRISE DISTRICT FROM DRAINS     (ENDRND1) 1941 1994 ADJUSTABLE DELIVERY
       ENDRND1 = D920+T - D920+1
              D920+T = Enterprise Canal Total.  Taken from State of Nebraska Department of Water
              Resources Hydrographic Report.

(65)NORTHPORT CANAL FROM DRAINS         (A768-2 ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report 1941-89.
       Taken from Compiled Water Records 1990-91.

(66)WINTERS CREEK CANAL FM WINTERS CREEK(D952-2 ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(67)ALLIANCE CANAL FROM DRAINS          (ALDRND1) 1941 1994 ADJUSTABLE DELIVERY
       ALDRND1 = D874+1 + D874+2.
              D874+1 = Alliance Canal from Bayard Sugar Factory Drain.  Taken from State of
              Nebraska Department of Water Resources Hydrographic Report.
              D874+2 = Alliance Canal from Red Willow Creek.  Taken from State of Nebraska
              Department of Water Resources Hydrographic Report.

(68)BROWNS CREEK CANAL FM NORTH PLATTE R(D857   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(69)BEERLINE CANAL FM NORTH PLATTE RIVER(D897   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(70)LISCO CANAL FROM NORTH PLATTE RIVER (D787R+ ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(71)MIDLAND-OVERLAND CANAL FM N PLATTE R(D789   ) 1941 1994 ADJUSTABLE DELIVERY
       Taken from State of Nebraska Department of Water Resources Hydrographic Report.
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1.3.2 Input File: CAL8094.FLO

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1000 1980 1994 13 150 23 69 5 67 1965 30 0 0 0 0
8,6,5,5,7,5,44,13,40,8,3,3,3
NORTH PLATTE RIVER WATER UTILIZATION MODEL
NATURAL FLOW ACCOUNTING MODEL OUTPUT - CAL8094 RUN
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CDATA1 ITEMS

```
8.74      (1)  GRATTAN 1ST APPROPRIATION, CFS

53.38     (2)  NORTH PLATTE APPROPRIATION, CFS

37.07     (3)  ROCK RANCH APPROP., 1ST RIGHT, CFS

22.01     (4)  PRATT-FERRIS APPROPRIATION, CFS

4.43      (5)  BURBANK 1ST APPROPRIATION, CFS

34.88     (6)  TORRINGTON APPROPRIATION, CFS

63.19     (7)  LUCERNE APPROPRIATION, CFS

0.71      (8)  BURBANK 2ND APPROPRIATION, CFS

2.25      (9)  NARROWS APPROPRIATION, CFS

164.0     (10) LINGLE/HILL 1ST APPROPRIATION, CFS

2.38      (11) WRIGHT APPROPRIATION, CFS

1.00      (12) GRATTAN 2ND APPROPRIATION, CFS
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1.47	(13) MURPHY APPROPRIATION, CFS
9.13	(14) GRATTAN 3RD APPROPRIATION, CFS
33.0	(15) LINGLE/HILL 2ND APPROPRIATION, CFS
33.0	(16) INTERSTATE(WYO.) APPROPRIATION, CFS
731.83	(17) FT LARAMIE(WYO.) APPROPRIATION, CFS
13.8	(18) ROCK RANCH APPROP., 2ND RIGHT, CFS
859.0	(19) FARMER'S IRR., 1ST RIGHT, CFS
194.0	(20) MITCHELL APPROPRIATION, CFS
14.0	(21) RAMSHORN APPROPRIATION, CFS
193.0	(22) GERING(NEB.) APPROPRIATION, CFS
42.0	(23) FARMER'S IRR., 2ND RIGHT, CFS
784.0	(24) GERING-FT. LARAMIE(NEB) RIGHT, CFS
1596.0	(25) INTERSTATE(PATHFINDER) RIGHT, CFS
230.0	(26) NORTHPORT APPROPRIATION, CFS
13.522	(27) HILL WARREN ACT CONTRACT (KAF)
40.048	(28) LINGLE WARREN ACT CONTRACT (KAF)
1.941	(29) ROCK RANCH WARREN ACT CONTRACT (KAF)
35.500	(30) GERING WARREN ACT CONTRACT (KAF)
180.000	(31) FARMERS WARREN ACT CONTRACT (KAF)
4.050	(32) CENTRAL WARREN ACT CONTRACT (KAF)
10.300	(33) CHIMNEY ROCK WARREN CONTRACT (KAF)
19.900	(34) BROWNS CREEK WARREN CONTRACT (KAF)
1.636	(35) BEERLINE WARREN ACT CONTRACT (KAF)
0.0	(36) not used
0.0	(37) not used
0.0	(38) not used
0.0	(39) not used
0.0	(40) not used
0.0	(41) not used
0.0	(42) not used
0.0	(43) not used
0.0	(44) not used
20.4	(45) CASPER CANAL N.F. APPROPRIATION (KAF)
247.15	(46) MINATARE APPROPRIATION (CFS)
2.28	(47) NINE MILE 1ST APPROPRIATION (CFS)
124.29	(48) WINTERS CREEK APPROPRIATION (CFS)
138.68	(49) ENTERPRISE APPROPRIATION (CFS)

82.57 (50) CASTLE ROCK 1ST APPROPRIATION (CFS)

265.98 (51) BRIDGEPORT APPROPRIATION (CFS)

36.0 (52) CENTRAL APPROPRIATION (CFS)

60.0 (53) CHIMNEY ROCK 1ST APP. (CFS)

28.57 (54) EMPIRE 1ST APPROPRIATION (CFS)

188.71 (55) BROWNS CREEK APPROPRIATION (CFS)

19.87 (56) LISCO 1ST APPROPRIATION (CFS)

200.0 (57) NINE MILE 2ND APPROPRIATION (CFS)

17.86 (58) LISCO 2ND & 3RD APP. (CFS)

23.2 (59) MIDLAND-OVERLAND 1ST&2ND APP. (CFS)

30.0 (60) BEERLINE APPROPRIATION (CFS)

1.25 (61) MIDLAND-OVERLAND 3RD APP. (CFS)

15.0 (62) CASTLE ROCK 2ND & 3RD APP. (CFS)

11.43 (63) LISCO 4TH APPROPRIATION (CFS)

0.86 (64) CASTLE ROCK 4TH APP. (CFS)

1.0 (65) EMPIRE 2ND APPROPRIATION (CFS)

3.0 (66) LISCO 5TH APPROPRIATION (CFS)

65.57 (67) SHORTLINE APPROPRIATION (CFS)

0.67 (68) CHIMNEY ROCK 2ND APP. (CFS)
Nebraska appropriations below Tri-State (cdata(48-68)) were provided by the Nebraska Department of Water Resources in 1995.

0 (69) always appropriate tri to lew NF(1=yes)
This flag controls the appropriation of natural flow below Tri-State. A value of one (1) cause the NPRWUM to always appropriate the natural flow in accordance with the natural flow rights. Otherwise, the NPRWUM only perform a strict appropriation when a shortage of water is identified.

ADATA ITEMS

[1] DAILY TRIBUTARY GAINS FROM UNGAGED STREAMS NEAR PATHFINDER, CFS

0	0	0	0	0	0	0	90.0	45.0	40.0	35.0	35.0

[2] DAILY CARRIAGE LOSSES FROM ALCOVA TO GLENDO RESERVOIR, CFS

0	0	0	0	0	0	0	43.0	61.0	70.0	61.0	45.0

[3] DAILY GAINS FOR ORIN JUNCTION TO GUERNSEY DAM, CFS

0	0	0	0	0	0	0	20.0	20.0	20.0	20.0	20.0

[4] DAILY CARRIAGE LOSSES FROM GUERNSEY RES. TO WHALEN DIV DAM, CFS

0	0	0	0	0	0	0	4.0	5.0	6.0	5.0	4.0

[5] DAILY CARRIAGE LOSSES FROM WHALEN DIV DAM TO STATE LINE, CFS

0	0	0	0	0	0	0	16.0	22.0	25.0	22.0	16.0

HDATA1 ITEMS

(1) OTHER FOREIGN WATER PASSING INFLOW STATIONS (AFX1000)
Set to zero (0.0)

(2)CASPER CANAL DIVERSIONS (BDCCD) 1941 1994 HISTORIC DELIVERY
Taken from Compiled Water Records.

(3) deliveries from wy unassigned glendo water
Historic deliveries uncontracted Wyoming Glendo Water. Set to 0.0.

(4)LINGLE WATER USERS DIV FM N PLATTE R(LINGNPR) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project. Includes losses as charged on Daily accounting sheets.
Note: INTERSTATE CANAL DELIVERIES AB 2.7 (INTR2.7) 1941 1994
Taken from Bureau of Reclamation daily records from 1953 through 1967. Data is set to 0 from 1968 through 1994 when Compiled Water Records credits INTR2.7 to Lingle water users (LINGNPR). For purposes of the NPRWUM this record has been include with Lingle and remove from the NPRWUM.

(5)HILL DISTRICT DIVERSIONS F N PLATTE (HILLNPR) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project. Includes losses as charged on Daily accounting sheets.

(6)WYOMING LATERALS, LOSS INCLUDED (WYOLATS) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project. Set to 0 from 1941 to 1967 to correspond with Compiled Water Records, Wyoming Laterals are probably(?) credited to Pathfinder Irrigation District during this time. Includes losses as charged on Daily accounting sheets.

(7)PATHFINDER DISTRICT NAT & STOR FLOWS(PATHNPR) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(8)INLAND LAKES DEL FROM INLAND L ACCT (INLKDEL) 1941 1994 HISTORIC DELIVERY
Taken from A768-4 for the non-irrigation season. Several changes have been made. Based on reported numbers for Guernsey Outflow and Pathfinder Irrigation District we believe that A768-4 is in error for the months of December 1955, October 1958, and October 1959. For these months the data has been changed to match the data reported by Pathfinder Irrigation District.

(9)DEMANDS ON INLAND LAKES HIGH+LOW+RES(INLDEL) 1941 1994 HISTORIC DELIVERY
Sum of Highline, Reservoir Supply, and Lowline Canals. Taken from Compiled Water Records and/or Annual Report of Pathfinder Irrigation District.

(10)WRIGHT & MURPHY FLOW FROM N PLATTE R(WMFNPR) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(11)GOSHEN DISTRICT FLOW FM N PLATTE RIV(GOSFNPR) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(12)GERING-FT LARAMIE FLOW FM N PLATTE R(GFLFNPR) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(13)BURBANK DITCH DIVERSIONS (BRBNKLM) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(14)LUCERNE CANAL & POWER DIVERSIONS (LCRNELM) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(15)NEW GRATTAN DITCH DIVERSIONS (GRTTNLM) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(16)TORRINGTON DISTRICT DIVERSIONS (TRNGTLM) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(17)ROCK RANCH DISTRICT DIVERSIONS (RKRANLM) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(18)NORTH PLATTE DITCH DIVERSIONS (D635LM) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(19)NARROWS DISTRICT DIVERSIONS (NAROWLM) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(20)PRATT FERRIS DITCH DIVERSIONS (PRATTLM) 1941 1994 HISTORIC DELIVERY
Taken from the North Platte Project Water Distribution of the Water Season summary found in Compiled Water Records and/or Project History of North Platte Project.

(21)FRENCH CANAL DIVERSIONS (A1433LM) 1941 1994 HISTORIC DELIVERY
Set to 0.

(22)MITCHELL CANAL FROM NORTH PLATTE RIV(D1052) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(23)GERING CANAL FROM NORTH PLATTE RIVER(A365R) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(24)TRI-STATE CANAL FROM NPR FOR FARMERS(D918+1) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(25)NORTHPORT CANAL FROM NORTH PLATTE RI(A768-1) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(26)RAMSHORN CANAL FROM NORTH PLATTE RIV(D945) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(27)ENTERPRISE CANAL FROM NORTH PLATTE R(D920+1) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(28)WINTERS CREEK CANAL FM NORTH PLATTE (D952-1) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(29)CENTRAL CANAL FROM NORTH PLATTE RIVE(D962) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(30)MINATARE CANAL FROM NORTH PLATTE RIV(D919) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(31)CASTLE ROCK CANAL FROM NORTH PLATTE (D921) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(32)NINE MILE CANAL FROM NORTH PLATTE RI(D925+) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(33)SHORTLINE CANAL FROM NORTH PLATTE RI(D946) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(34)CHIMNEY ROCK CANAL FROM NORTH PLATTE(D844) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(35)BELMONT (BRIDGEPORT) CANAL FROM NPR (D828-1) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(36)EMPIRE CANAL FROM NORTH PLATTE RIVER(D858) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(37)FARMERS DISTRICT FROM DRAINS (TSDRND1) 1941 1994 HISTORIC DELIVERY
TSDRND1 = Sum of Drains (Akers Draw, Sheep Creek, Dry Spottedtail Creek, Wet Spottedtail Creek, Tub Springs, and Alliance Drain), 1941 and 1942.
TSDRND1 = D918+T - D918+1, 1943-89.
D918+T = Tri-State Canal total for Farmers ID. Taken from State of Nebraska Department of Water Resources Hydrographic Report. Taken from Compiled Water Records 1990-91.

(38)ENTERPRISE DISTRICT FROM DRAINS (ENDRND1) 1941 1994 HISTORIC DELIVERY
ENDRND1 = D920+T - D920+1
D920+T = Enterprise Canal Total. Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(39)NORTHPORT CANAL FROM DRAINS (A768-2) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report 1941-89.
Taken from Compiled Water Records 1990-91.

(40)WINTERS CREEK CANAL FM WINTERS CREEK(D952-2) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(41)ALLIANCE CANAL FROM DRAINS (ALDRND1) 1941 1994 HISTORIC DELIVERY
ALDRND1 = D874+1 + D874+2.
D874+1 = Alliance Canal from Bayard Sugar Factory Drain. Taken from State of Nebraska Department of Water Resources Hydrographic Report.
D874+2 = Alliance Canal from Red Willow Creek. Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(42)BROWNS CREEK CANAL FM NORTH PLATTE R(D857) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(43)BEERLINE CANAL FM NORTH PLATTE RIVER(D897) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(44)LISCO CANAL FROM NORTH PLATTE RIVER (D787R+) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(45)MIDLAND-OVERLAND CANAL FM N PLATTE R(D789) 1941 1994 HISTORIC DELIVERY
Taken from State of Nebraska Department of Water Resources Hydrographic Report.

(46)% OF TSLGAIN BETWEEN NPTSALL AND D920+1 (TRENGN) 1941 1994

(47)% OF TSLGAIN BETWEEN D920+1 AND D952-1 (ENWCGN) 1941 1994

(48)% OF TSLGAIN BETWEEN D952-1 AND D962 (WCCEGN) 1941 1994

(49)% OF TSLGAIN BETWEEN D962 AND D919 (CEMIGN) 1941 1994

(50)% OF TSLGAIN BETWEEN D919 AND D921 (MICRGN) 1941 1994

(51)% OF TSLGAIN BETWEEN D921 AND D925+ (CRNMGN) 1941 1994

(52)% OF TSLGAIN BETWEEN D925+ AND D946 (NMSHGN) 1941 1994

(53)% OF TSLGAIN BETWEEN D946 AND D844 (SHCHGN) 1941 1994

(54)% OF TSLGAIN BETWEEN D844 AND D828-1 (CHBEGN) 1941 1994

(55)% OF TSLGAIN BETWEEN D858 AND D857 (EMBCGN) 1941 1994

(56)% OF TSLGAIN BETWEEN D857 AND D897 (BCBEGN) 1941 1994

(57)% OF TSLGAIN BETWEEN D897 AND D787R+ (BELIGN) 1941 1994

(58)% OF TSLGAIN BETWEEN D787R+ AND D789 (LIMOGN) 1941 1994

(59)% OF TSLGAIN BETWEEN D789 AND NPL875 (MOLEGN) 1941 1994

(60)Reuse Factors-Historic Ret Flow Reach #2(RUSEHR2) 1941 1994 Historic
A factor between 0 and 1 that the model user chooses to represent the historic irrigation reuse in the reach. For example, a factor of .25 would be used to reuse 25% of the returnable water in the reach. Irrigation reuse option is set to zero (0) and is not used for this run.

(61)Reuse Factors-Modeled Ret Flow Reach #2(RUSEMR2) 1941 1994 Adjustable
A factor between 0 and 1 that the model user chooses to represent the irrigation reuse in the reach. For example, a factor of .25 would be used to reuse 25% of the returnable water in the reach. Irrigation reuse option is set to zero (0) and is not used for this run.

(62)Reuse Factors-Historic Ret Flow Reach #3(RUSEHR3) 1941 1994 Historic
A factor between 0 and 1 that the model user chooses to represent the historic irrigation reuse in the reach. For example, a factor of .25 would be used to reuse 25% of the returnable water in the reach. Irrigation reuse option is set to zero (0) and is not used for this run.

(63)Reuse Factors-Modeled Ret Flow Reach #3(RUSEMR3) 1941 1994 Adjustable
A factor between 0 and 1 that the model user chooses to represent the irrigation reuse in the reach. For example, a factor of .25 would be used to reuse 25% of the returnable water in the reach. Irrigation reuse option is set to zero (0) and is not used for this run.

(64) Ground water net Recharge(kaf) Reach #2   Non-Adjustable
Recharge to ground water from well irrigation for the historic condition. Negative values represent depletions, Positive values represent recharge. This option is set to zero (0) and is not used for this run.

(65) Ground water net Recharge(kaf) Reach #2   Adjustable
Recharge to ground water from well irrigation for the modeled condition. Negative values represent depletions, Positive values represent recharge. This option is set to zero (0) and is not used for this run.

(66) Ground water net Recharge(kaf) Reach #3   Non-Adjustable
Recharge to ground water from well irrigation for the historic condition. Negative values represent depletions, Positive values represent recharge. This option is set to zero (0) and is not used for this run.

(67) Ground water net Recharge(kaf) Reach #3   Adjustable
Recharge to ground water from well irrigation for the modeled condition. Negative values represent depletions, Positive values represent recharge. This option is set to zero (0) and is not used for this run.

1.3.3 Input File: CAL8094.SOA

```
1000 1980 1994 33 229 36 66 2 80 1965 30 0 0 0 0
9 14 8 8 5 4 5 3 6 8 7 4 5 8 9 8 7 7 7 7 7 7 7 7 7 7 7 7 7 7 6 6 8
NORTH PLATTE RIVER WATER UTILIZATION MODEL
STORAGE OWNERSHIP ACCOUNTING MODEL OUTPUT - CAL8094 RUN
```

CDATA2 ITEMS

0 (1) GUERNSEY PROJECT INITIAL OWNERSHIP
This value taken from the North Platte storage Ownership Accounting sheet dated September 10, 1979.

1 (2) GUERNSEY ACCRUAL FLAG (0=NO, 1=YES)

0 (3) INLAND LAKES INITIAL OWNERSHIP
This value taken from the North Platte storage Ownership Accounting sheet dated September 10, 1979.

46.000 (4) INLAND LAKES ANNUAL ACCRUAL

0 (5) GLENDO EVAP INITIAL OWNERSHIP

20.09 (6) GLENDO MAX ANNUAL EVAP ACCRUAL

1 (7) GLENDO EVAP ACCRUAL FLAG (0=NO, 1=YES)

74.152 (8) GLENDO IRR INITIAL OWNERSHIP
This value taken from the North Platte storage Ownership Accounting sheet dated September 10, 1979. Initial irrigation pool + initial power pool (74.152 + 63.148 = 137.300). This value rounded from 137.286 af.

100. (9) GLENDO IRR MAXIMUM OWNERSHIP (kaf)

40. (10) GLENDO IRR ANNUAL ALLOWABLE ACCRUAL (kaf)

1 (11) GLENDO IRR ACCRUAL FLAG (0=NO, 1=YES)

63.148 (12) GLENDO POWER INITIAL OWNERSHIP (kaf)
See cdata(8)

63.148 (13) GLENDO MAX POWER HEAD POOL

1 (14) GLENDO POWER ACCRUAL FLAG (0=NO, 1=YES)

0.   (15) GLENDO ETO INITIAL OWNERSHIP (kaf)

100.   (16) GLENDO ETO MAXIMUM ACCRUAL (kaf)

0   (17) GLENDO ETO ACCRUAL FLAG (0=NO, 1=YES)

829.295   (18) KENDRICK SEMINOE INITIAL OWNERSHIP
This value taken from the North Platte storage Ownership Accounting sheet dated September 10, 1979. The initial Kendrick Ownership of 829.295 af was divided between the Kendrick Seminoe and Kendrick Alcova ownership by assuming Kendrick Alcova to be full 184.405 af and with the difference put into the Kendrick Seminoe ownership. (184.405 + 829.295 = 1,013.700)

1   (19) KENDRICK SEMINOE ACCRUAL FLAG (0=NO, 1=YES)

184.405   (20) KENDRICK ALCOVA INITIAL OWNERSHIP
See cdata(18)

1   (21) KENDRICK ALCOVA ACCRUAL FLAG (0=NO, 1=YES)

0   (22) ALLOW KENDRICK WATER BELOW ALCOVA (0=NO, 1=YES)

490.3   (23) PATHFINDER INITIAL OWNERSHIP
This value taken from the North Platte storage Ownership Accounting sheet dated September 10, 1979. Adjusted until the physical initial EOM equals the Ownership initial EOM (839.1 + 4.7 + 526.0 + 179.0 + 1.2 + 74.6 + 16.7 = 490.3 + 184.405 + 829.295 + 63.148 + 74.152).

1   (24) PATHFINDER ACCRUAL FLAG (0=NO, 1=YES)

0.0   (25) ETO WATER INITIAL OWNERSHIP

1   (26) EXCESS TO OWNERSHIP ACCRUAL FLAG (0=NO, 1=YES)

0   (27) ACCRUE ETO IN UPPER REACH (0=NO, 1=YES)

1   (28) REPLACE EVAP IN GL & GUR W/ETO (0=NO, 1=YES)

1   (29) REPLACE EVAP IN KEND & PATH W/ETO (0=NO, 1=YES)

1   (30) AUGMENT NF W/ETO (0=NO, 1=YES)

1   (31) AUGMENT STORAGE FLOW W/ETO (0=NO, 1=YES)

0   (32) LIMIT ETO TO SPACE IN GLENDO FLAG (0=NO, 1=YES)

1016.507 (33) MAXIMUM NORTH PLATTE PATHFINDER OWNERSHIP (kaf)
See area-capacity tables dated March 1985. (Top of Active Conservation)

0.   (34) INITIAL NP PATHFINDER ALTERNATIVE OWN (kaf)

050.0000 (35) MAXIMUM NP PATHFINDER ALTERNATIVE OWN (kaf)

0   (36) FLAG TO OPERATE NP PATHFINDER ALTERNATIVE OWN (0=NO, 1=YES)

0.   (37) INITIAL PATHFINDER ENLARGEMENT #1 OWNERSHIP (kaf)

20.000   (38) MAXIMUM PATHFINDER ENLARGEMENT #1 OWNERSHIP (kaf)

0   (39) FLAG TO OPERATE PATHFINDER ENLARGEMENT #1 OWN (0=NO, 1=YES)

0   (40) INITIAL PATHFINDER ENLARGEMENT #2 OWNERSHIP (kaf)

33.907   (41) MAXIMUM PATHFINDER ENLARGEMENT #2 OWNERSHIP (kaf)

0   (42) FLAG TO OPERATE PATHFINDER ENLARGEMENT #2 OWN (0=NO, 1=YES)

1   (43) LOSS DISTRIBUTION FLAG

7.000   (44) MAX CITY OF CASPER KENDRICK DELIVERY (kaf)

0.500   (45) GRATTAN GLENDO CONTRACT (KAF)

0.200   (46) BURBANK GLENDO CONTRACT (KAF)

1.000 (47) TORRINGTON GLENDO CONTRACT (KAF)

2.500 (48) LUCERNE GLENDO CONTRACT (KAF)

0.200 (49) WRIGHT-MURPHY GLENDO CONTRACT (KAF)

0.000 (50) CORN CREEK GLENDO CONTRACT (KAF)

10.600 (51) UNASSIGNED WY-GLENDO WATER

12.000 (52) MITCHELL GLENDO CONTRACT (KAF)

2.0 (53) BRIDGEPORT GLENDO CONTRACT (KAF)

3.000 (54) ENTERPRISE GLENDO CONTRACT (KAF)

8.000 (55) CENTRAL POWER GLENDO CONTRACT (KAF)

0.125 (56) ADDITIONAL GLENDO WATER ALLOWED OVER CONTRACT AMOUNT (% OF CONTRACT)

0.95 (57) FLAG TO ALLOW RELEASE OF ADD. GLENDO WATER (% OF MAX CARRY-OVER)

2.50 (58) MAXIMUM GLENDO CONTRACT CARRY-OVER (% OF CONTRACT)

5. (59) MAX CARRY-OVER ASSIGNED TO MITCHEL FROM CNPP&ID

0.375 (60) WYOMING'S PORTION OF GLENDO ACCRUAL (%)

0.00 (61) PERCENT OWN FOR GLENDO ALT ACCOUNT (%)

1017.273 (62) MAXIMUM KENDRICK SEMINOE OWNERSHIP (kaf)
See area-capacity tables dated December 1984. (Top of Active Conservation)

0. (63) INITIAL KEN SEMINOE ALTERNATIVE OWN (kaf)

050.0000 (64) MAXIMUM KEN SEMINOE ALTERNATIVE OWN (kaf)

0 (65) FLAG TO OPERATE KEN SEM ALTERNATIVE OWN (0=NO, 1=YES)

0 (66) FLAG: Augment unassigned WY Glendo Cont w/excess (0=NO, 1=YES)

ADATA2 ITEMS

[1] ALLOW INLAND LAKES TO ACCRUE WATER (0=NO, 1=YES)
1 1 0 0 0 0 1 0 0 0 0 0
Accrual flags for the Inland Lakes in the main stem. Set to accrue in October, November, and April.

[2] DISTRIBUTION OF GUERNSEY OUTFLOW
0. 0. 0. 0. 0. 0. 0. 0.35 0.30 0.25 0.25 0.25
These factors are used only during the irrigation season and control the amount of the Alcova to Glendo Gain that is used to meet natural flow demands. A factor of .25 indicates that 25% of the Alcova to Glendo Gain in not used to meet Natural Flow Demands. Applied only for non-iterative conditions.

HDATA2 ITEMS

(1) Efficiency Lingle Canal (effli) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(2) Efficiency Hill Canal (effhi) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(3) Efficiency Wyoming Laterals (effwl) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(4) Efficiency PID MAIN CANAL (effpm) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(5) Efficiency HIGH, LOW, SUPPLY CANALS(efhlr) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(6) Efficiency Wright & Murphy (effwm) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(7) Efficiency GOSHEN CANAL (effgo) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(8) Efficiency GERING/FT. LARAMIE CANAL(effgf) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(9) Efficiency Burbank Canal (effbu) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(10) Efficiency LUCERNE CANAL (efflu) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(11) Efficiency GRATTAN CANAL (effgr) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(12) Efficiency TORRINGTON CANAL (effto) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(13) Efficiency ROCK RANCH CANAL (effrr) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(14) Efficiency N. Platte Ditch (efnpd) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(15) Efficiency Narrows Ditch (effna) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(16) Efficiency Pratt Ferris Ditch (effpf) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(17) Efficiency French (effch) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(18) Efficiency MITCHELL CANAL (effmi) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(19) Efficiency GERING CANAL (effge) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(20) Efficiency FARMERS CANAL (effc) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(21) Efficiency NORTHPORT CANAL (efnpt) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(22) Efficiency Ramshorn (effra) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(23) Efficiency ENTERPRISE CANAL (effen) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(24) Efficiency Winters Creek Canal (effwi) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(25) Efficiency CENTRAL CANAL (effcn) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(26) Efficiency Minatare Canal (efmin) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(27) Efficiency Castle Rock Canal (efcas) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(28) Efficiency Nine Mile Canal (efni) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(29) Efficiency Short Line Canal (effsh) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(30) Efficiency CHIMNEY ROCK CANAL (effcr) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(31) Efficiency BRIDGEPORT CANAL (effbr) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(32) Efficiency Empire (effem) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(33) Efficiency Alliance Canal (effal) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(34) Efficiency BROWNS CREEK CANAL (effbc) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(35) Efficiency BEERLINE CANAL (effbl) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(36) Efficiency Lisco Canal (eflis) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(37) Efficiency Midland-Overland (efmid) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(38) Efficiency Phantom Div Reach #2 (efph2) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(39) Efficiency Phantom Div Reach #3 (efph3) 1941 1994 ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(40) Efficiency Lingle Canal (heffli) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(41) Efficiency Hill Canal (heffhi) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(42) Efficiency Wyoming Laterals (heffwl) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(43) Efficiency PID MAIN CANAL (heffpm) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(44) Efficiency HIGH, LOW, SUPPLY CANAL(hefhlr) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(45) Efficiency Wright & Murphy (heffwm) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

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(46) Efficiency GOSHEN CANAL           (heffgo ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(47) Efficiency GERING/FT. LARAMIE CANA(heffgf ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(48) Efficiency Burbank Canal          (heffbu ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(49) Efficiency LUCERNE CANAL          (hefflu ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(50) Efficiency GRATTAN CANAL          (heffgr ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(51) Efficiency TORRINGTON CANAL       (heffto ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(52) Efficiency ROCK RANCH CANAL       (heffrr ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(53) Efficiency N. Platte Ditch        (hefnpd ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(54) Efficiency Narrows Ditch          (heffna ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(55) Efficiency Pratt Ferris Ditch     (heffpf ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(56) Efficiency French                 (heffch ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(57) Efficiency MITCHELL CANAL         (heffmi ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(58) Efficiency GERING CANAL           (heffge ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.

(59) Efficiency FARMERS CANAL          (heffc  ) 1941 1994 HISTORIC
       These values represent the diversion efficiency for the canal and are taken from the basin
       wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation.  These
       values represent the historic condition and should not be changed.
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(60) Efficiency NORTHPORT CANAL (hefnpt) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(61) Efficiency Ramshorn (heffra) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(62) Efficiency ENTERPRISE CANAL (heffen) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(63) Efficiency Winters Creek Canal (heffwi) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(64) Efficiency CENTRAL CANAL (heffcn) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(65) Efficiency Minatare Canal (hefmin) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(66) Efficiency Castle Rock Canal (hefcas) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(67) Efficiency Nine Mile Canal (hefni) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(68) Efficiency Short Line Canal (heffsh) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(69) Efficiency CHIMNEY ROCK CANAL (heffcr) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(70) Efficiency BRIDGEPORT CANAL (heffbr) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(71) Efficiency Empire (heffem) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(72) Efficiency Alliance Canal (heffal) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(73) Efficiency BROWNS CREEK CANAL (heffbc) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(74) Efficiency BEERLINE CANAL (heffbl) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(75) Efficiency Lisco Canal (heflis) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(76) Efficiency Midland-Overland (hefmid) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(77) Efficiency Phantom Div Reach #2 (hefph2) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(78) Efficiency Phantom Div Reach #3 (hefph3) 1941 1994 HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(79) Efficiency unassigned WY Glendo delivery ADJUSTABLE
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values can be adjusted as desired to modeled other than historic conditions.

(80) Efficiency unassigned WY Glendo delivery HISTORIC
These values represent the diversion efficiency for the canal and are taken from the basin wide diversion efficiency as detailed in Appendix C of the NPRWUM Documentation. These values represent the historic condition and should not be changed.

(81) Efficiency Casper Canal Delivery ADJUSTABLE
These values represent the diversion efficiency for the Casper Canal and have been set at an assumed value of 0.50.
These values can be adjusted as desired to modeled other than historic conditions.

(82) Efficiency Casper Canal Delivery HISTORIC
These values represent the diversion efficiency for the Casper Canal and have been set at an assumed value of 0.50.
These values represent the historic condition and should not be changed.

1.3.4 Input File: VAL6579.RES

The val6579.res input file is identical to the cal8094.res input file except for the run period. The val6579.res input file covers water years 1965-1979. Therefore, the initial End-of-Month content values for the reservoirs are from September 30, 1964. (See description of cal8094.res)

1.3.5 Input File: VAL6579.FLO

The val6579.flo input file is identical to the cal8094.flo input file except for the run period. The val6579.flo input file covers water years 1965-1979. (See description of cal8094.res)

1.3.6 Input File: VAL6579.SOA

The val6579.soa input file is identical to the cal8094.soa input file except for the run period. The val6579.soa input file covers water years 1965-1979. Therefore, the initial End-of-Month content values for the ownerships are from September 30, 1964. (See description of cal8094.res)

APPENDIX H

NPRWUM Source Code, Executable, Input/Output Files, and List of Variables

NPRWUM Source Code, Executable, Input/Output Files, and List of Variables

This appendix contains all the necessary computer files needed to run the North Platte River Water Utilization Model (NPRWUM). These files are located on the 3.5 inch floppy diskette entitled *NPRWUM USBR-WYAO* at the end of the appendix. The following text gives the reader the names of the files on the diskette, instructions for installing the files, and instructions to determine that the model is running correctly on the target computer.

The diskette contains two (2) files: README and WUMZIP.EXE. The README file is a condensed version of the information contained in this appendix and is in ASCII format. The WUMZIP.EXE file is a self inflating compressed file containing:

1) NPRWUM executable model;
2) NPRWUM Fortran source code ready for compiling;
3) NPRWUM Fortran source code listing with page breaks and line numbers;
4) NPRWUM complete listing of variables by subroutine;
5) Input/output files for calibration (1980-94); and
6) Input/output files for validation (1965-79).

The WUMZIP.EXE file contains all the files needed to run the NPRWUM. Below are the instructions to install and uncompress this file on your hard drive. These instructions assume that the C: DRIVE is the HARD DISK DRIVE and there are at least 20 MBytes of available disk space.

- Go to the DOS prompt (C:\)
- Type CD \ and press Enter (to get to the root directory).
- Type MKDIR NPR and press Enter (to create NPR subdirectory).
- Type CD NPR and press Enter. (change directory to NPR)
- Place the diskette into drive A.
- Type COPY A:WUMZIP.EXE and press Enter. (copy WUMZIP.EXE file to the hard drive)
- Type WUMZIP and press Enter. (Extracts the files)

Note: The WUMZIP.EXE file can be installed from any floppy drive, not just the A: drive. To install from a different drive, simply follow the above example, substituting the letter of your drive for A:.

The WUMZIP.EXE file will "inflate" and place the following files on your HARD DISK in the NPR subdirectory:

```
NPRWUM.FOR . . . . . NPRWUM source code
NPRWUM.EXE . . . . . NPRWUM executable code
NPRWUM.LST . . . . . NPRWUM source code with line numbers & page breaks
NPRWUM.XRF . . . . . NPRWUM listing of variables by subroutine
NPRAOP.TBL . . . . . Lookup tables for power generation routines

CAL8094.RES  . . . . Input file: Reservoir operation (calibration)
CAL8094.FLO  . . . . Input file: Natural flow (calibration)
CAL8094.SOA  . . . . Input file: Storage/ownership (calibration)
RES_8094.CAL . . . . Output file: Reservoir operation (calibration)
NAT_8094.CAL . . . . Output file: Natural flow (calibration)
STO_8094.CAL . . . . Output file: Storage/ownership (calibration)
```

```
VAL6579.RES  . . . . Input file: Reservoir operation (validation)
VAL6579.FLO  . . . . Input file: Natural flow (validation)
VAL6579.SOA  . . . . Input file: Storage/ownership (validation)
RES_6579.VAL . . . . Output file: Reservoir operation (validation)
NAT_6579.VAL . . . . Output file: Natural flow (validation)
STO_6579.VAL . . . . Output file: Storage/ownership (validation)
```

Note: The NPRWUM.EXE is an executable file in binary format, all the other files are in ASCII format.

Once the files are loaded on the hard drive, the model is ready to run. The model was compiled using the Lahey™ Fortran Compiler (F77L-EM32) on a Pentium (80586) PC. An 80486 PC with at least four (4) Mbytes RAM is required to run the NPRWUM. To run the NPRWUM, type NPRWUM at the DOS prompt and press enter. The model will prompt for the names of the reservoir operation input file, natural flow input file, and storage ownership input file. The reservoir operation input files for the calibration and validation runs are CAL8094.RES and VAL6579.RES, respectively. The natural flow input files for the calibration and validation runs are CAL8094.FLO and VAL6579.FLO, respectively. The storage ownership input files for the calibration and validation runs are CAL8094.SOA and VAL6579.SOA, respectively. The model automatically assigns the reservoir operation output file, message file, natural flow output file, and storage ownership output file to RESOP.LST, MESSAGE.LST, NATFLOW.LST, and STOROWN.LST, respectively. The following example demonstrates how to run the model and recreate the calibration output files. (Bolded text is required input by the model user.)

```
Prompt> NPRWUM ↩
        +------------------------------------------------+
        |      32-bit Power for Lahey Computer Systems    |
        |    Phar Lap's 386|DOS-Extender(tm) Version 5.1  |
        |   Copyright © 1986-93 Phar Lap Software, Inc.   |
        |           Available Memory = xxxxx Kb           |
        +------------------------------------------------+
WHAT IS THE NAME OF THE RESERVOIR OPERATION INPUT FILE? CAL8094.RES ↩

WHAT IS THE NAME OF THE NATURAL FLOW INPUT FILE? CAL8094.FLO ↩

WHAT IS THE NAME OF THE STORAGE OWNERSHIP INPUT FILE? CAL8094.SOA ↩

YEAR,MONTH =      1980      1
YEAR,MONTH =      1980      2
YEAR,MONTH =      1980      3
YEAR,MONTH =      1980      4
YEAR,MONTH =      1980      5
      •             •        •
      •             •        •
      •             •        •
YEAR,MONTH =      1994     12

RESERVOIR OPERATIONS OUTPUT IS IN
RESOP.LST
NATURAL FLOW OPERATIONS OUTPUT IS IN
NATFLOW.LST
STORAGE OWNERSHIP OUTPUT IS IN
STOROWN.LST
.TAB FILES CONTAIN TABLES OF SELECTED INFORMATION
WARNING MESSAGES FROM OPERATIONS ARE IN MESSAGE.LST

Prompt>
```

When the model has finished execution, check to verify that the RESOP.LST, RESOP.TAB, MESSAGE.LST, NATFLOW.LST, NATLOW.TAB, STOROWN.LST, and STOROWN.TAB files have been created on your hard drive. Each time the model is run, any existing ".LST" or ".TAB" files listed above will be over written and replace by the data from the current run. These files must be renamed by the model user before making another run, if the model user wishes to save them for later reference. The ".LST" files contain the yearly output of a model run listed by station name preceded by the station's monthly values, repeated for the total number of defined stations. The ".TAB" files contain a listing of selected stations and their monthly values organized into tabular format from the beginning of the study to the end. To verify that the model is running correctly, use the DOS "FC" (File Compare) command to compare an output file sent with the documentation to an output file just created by the model. (ie. *Prompt>* FC RESOP.LST RES_8094.CAL | MORE ↩)

CALIBRATION/VALIDATION RUNS

The calibration run was performed using the period beginning with water year 1980 and ending with water year 1994. The initial physical EOM contents for the reservoirs are the historic EOM contents from September 1979. The initial ownership contents are the historic September 1979 EOM ownership contents, adjusted such that the total physical system storage equaled the total system ownership.

The validation run was performed using the period beginning with water year 1965 and ending with water year 1979. The initial physical EOM contents for the reservoirs are the historic EOM contents from September 1964. The initial ownership contents are the historic September 1964 EOM ownership contents, adjusted such that the total physical system storage equaled the total system ownership.

APPENDIX I

GLENDO RESERVOIR OPERATING POLICY AND MARKETING PRINCIPLES

December 7, 1982

GLENDO RESERVOIR OPERATING POLICY AND MARKETING PRINCIPLES

BACKGROUND

Glendo Unit Authorization

The Glendo Unit was authorized by the Flood Control Act of 1944 (58 Stat. 887). The unit was constructed under a modified plan as presented in the Definite Plan Report of December 1952, approved by the Act of July 16, 1954 (68 Stat. 486, Public Law 503, 83d Congress 2d session).

During the formulation of the Glendo Unit of the Pick-Sloan Missouri Basin Program, in response to expressed interests of the States of Nebraska and Wyoming, the plan of development was modified to include 100,000 acre-feet of capacity for the storage of water for irrigation use. A stipulation to the United States Supreme Court Decree for the North Platte River was agreed to by the States of Nebraska, Wyoming, and Colorado and the United States and provides:

> Such storage water shall be disposed of in accordance with contracts to be hereafter executed, and it may be used for the irrigation of lands in the basin of the North Platte River in western Nebraska to the extent of 25,000 acre-feet annually and for the irrigation of lands in the basin of the North Platte River in southeastern Wyoming below Guernsey Reservoir to the extent of 15,000 acre-feet annually, Provided, That it shall not be used as a substitute for storage water contracted for under any existing permanent arrangement....

The Stipulation further provides:

> It is FURTHER STIPULATED AND AGREED that this stipulation will become effective when:
>
> 1. By appropriate legislative and official action the State of Wyoming has approved a permit for the construction and operation of Glendo Dam and Reservoir in substantial conformity with the Bureau of Reclamation Definite Plan Report for the Glendo Unit, dated December 1952; and
>
> 2. The appropriate authorities of the States of Nebraska, Wyoming, and Colorado and the United States have approved this stipulation; and

3. The States of Nebraska, Wyoming, and Colorado have submitted to the Secretary of the Interior comments approving the Bureau of Reclamation Definite Plan Report for the Glendo Unit, dated December 1952; Provided, That this stipulation shall be without effect unless it is executed by the parties, and the three foregoing conditions met, on or before June 1, 1953.

Status

Construction of the Glendo Dam and Reservoir was completed in 1958 and long-term water service contracts have been entered into as follows:

Nebraska

	Entitlement
Bridgeport Irrigation District	2,000 acre-ft
Enterprise Irrigation District	3,000 acre-ft
Mitchell Irrigation District	12,000 acre-ft
Subtotal	17,000 acre-ft
Uncommitted Nebraska entitlement	8,000 acre-ft
Total	25,000 acre-ft

Wyoming

	Entitlement
Burbank Ditch	200 acre-ft
Lucerne Canal and Power Company	2,500 acre-ft
New Grattan Ditch Company	500 acre-ft
Torrington Irrigation District	1,000 acre-ft
Wright & Murphy Ditch	200 acre-ft
Subtotal	4,400 acre-ft
Uncommitted Wyoming entitlement	10,600 acre-ft
Total	15,000 acre-ft

Each existing contract entitles the contractor to divert a proportionate share (i.e., contract amount/40,000 acre-ft) of the annual available Glendo irrigation water supply.

By letter dated July 12, 1979, the CNPPID (Central Nebraska Public Power and Irrigation District) requested to negotiate a contract for the uncommitted 8,000 acre-feet of Nebraska's entitlement. The district proposes to utilize the water to provide five irrigation districts, diverting from the North Platte River, with storage water to supplement their natural flow rights.

Corn Creek Irrigation District and Earl Michaels, a private irrigator, have requested to contract for the uncommitted Wyoming entitlement.

In addition, several prior requests for Glendo water have been received in past years.

As a result of comments received on the proposed contract with CNPPID, and after consultation with other interested parties and a review of pertinent information, including the Glendo Definite Plan Report, North Platte Decree and Stipulation, Bureau files, and operational studies, the following operating policy and marketing principles have been established for the Glendo Unit irrigation function.

OPERATING POLICY

1. Separate accounts for Glendo Unit (irrigation) ownership will be established for each state. Individual contractor accounts within each state may be established upon request. Such accounting will include accruals, releases, evaporation, additional water purchases, and carryover storage. Water will accrue to each state account on a proportionate basis. Should either state carryover storage account fill, the remaining available annual accrual will be credited to the other state account. Deficit evaporation will be allowed in any given year; however, all deficits must be made up prior to delivery of water from the respective account in each subsequent year.

2. The area of primary use of irrigation water form the Glendo Unit as intended by the DPR is generally downstream from Guernsey, Wyoming, west of the city of Bridgeport, Nebraska. The United States has been unable to contract for the use of all Glendo irrigation water within this primary area. Therefore, water for irrigation purposes is available for use in other areas within the North Platte Basin.

3. Existing Glendo Unit storage water contractors(contractors with long-term contracts executed prior to January 1, 1982) will continue to be allowed to purchase quantities of "additional" water as provided for in their contracts. Such amounts, proportionate to a contractor's share of the Glendo water supply, can only be purchased when determined by the Secretary to be available within the same state as the requesting contractor. Such determination will be made on or before August 1 of each year. The Secretary shall establish, on a contractor-by-contractor basis, limits on those quantities of additional water that may be purchased in any year (see table 1).

The intent of these limits is to protect the individual carryover storage amounts from being made available for sale to other contractors.

Additional water will be determined available for purchase within a state in any year that an individual or state account has accrued in excess of 95 percent of the maximum carry over storage amount during the water year. Sale of additional water will be limited so as not to exceed each state's stipulated share in any year. Individual contractors desiring additional water will first be required to purchase such additional water form their own carryover storage account. If sufficient water is not available from the individual contractor's carryover storage account, additional water may be purchased from other accounts as determined available by the Secretary.

4. Each year, after August 1, the Secretary will determine that quantity of water by states, if any, which is surplus to the contract entitlement of the Glendo Unit. The quantity of surplus water determined available each year will be based on the quantity of water utilized to date, the quantity of water utilized to date, the quantity of water requested for use during the remainder of the irrigation season, the quantity of water remaining in storage, and forecasted inflow conditions prior to the following irrigation season. Such surplus water, if any, will be available for purchase on a annual basis.

Sale of surplus water will be limited so as not to exceed each state's stipulated share in any year. Glendo Unit surplus water may be restored for later use.

5. Glendo Unit irrigation storage water will only be delivered during the period May 1 through September 30 of each year and must be used as a supplemental supply. Such water may only be delivered on a direct or replacement basis and may only be restored for a period of time not to exceed 30 days to allow for efficient use.

6. This operating policy will be reviewed by the Bureau at least every 5 years and amended as necessary following consultation with the States of Nebraska and Wyoming.

MARKETING PRINCIPLES

1. Terms and conditions of existing Glendo users contracts shall remain in effect until termination or renegotiation at the end of 1998.

2. All new contracts will be consistent with current departmental contracting policy.

3. The term of all new water service and repayment contracts for Glendo Unit storage water will terminate at the end of 1998 which is consistent with existing Glendo contracts.

IMMEDIATE PLAN OF IMPLEMENTATION

1. Mitchell Irrigation District will be given a one-time opportunity to obtain a supplemental contract for 5,000 acre-feet of Nebraska's uncontracted share of Glendo carryover storage capacity (see column 2 of table 1).

A proposed basis for negotiation for this supplemental contract will be prepared and will include:

a. An annual charge which is independent of the amount of water delivered.

b. The 5,000 acre-feet of additional carry over storage capacity will be filled with water accrued under Mitchell Irrigation District's existing contract for Glendo water. The delivery of water from the 5,000 acre-feet of carryover storage will also be via Mitchell's existing contract.

2. Contract negotiations with CNPPID for the uncommitted share of Nebraska's Glendo irrigation water will be continued. An amended proposed basis of negotiation will be prepared and will include the following:

a. The maximum amount of water that may be purchased by the district under their long-term contract in a given year, will be limited to 8,000 acre-feet. Purchase of surplus water under separate contract would be allowed on an annual basis.

b. Water is to be diverted east of Bridgeport, Nebraska.

c. Water will be released to the district on a direct or replacement basis only, i.e., in amounts equal to those amounts delivered to subcontractors, taking into account appropriate transportation losses.

3. A proposed basis of negotiation will be prepared for contracting the remaining Wyoming uncommitted water entitlement to Corn Creek Irrigation District and Earl Michaels of Torrington, Wyoming.

4. Should negotiations be unsuccessful with any of the above contractors, that portion of the Glendo irrigation water entitlement remaining uncontracted for will be made available for other potential contractors within the appropriate state.

Table 1.--Glendo Unit - Irrigation
Carryover Storage and Additional Water

	(1) Contract amount Acre-ft	(2) Maximum carryover storage Acre-ft 1/ 2/	(3) Additional water Maximum amount Acre-ft	(4) Protected carryover storage Acre-ft 2/
		NEBRASKA		
Mitchell	12,000	35,000	1,500	33,500
Enterprise	3,000	7,500	375	7,125
Bridgeport	2,000	5,000	250	4,750
Central Nebraska	8,000	15,000	350	14,650
Subtotal	25,000	62,500		
		WYOMING		
Lucerne	2,500	6,250	312.5	5,937.5
Burbank	200	500	25	475
Wright & Murphy	200	500	25	475
New Grattan	500	1,250	62.5	1,787.5
Torrington	1,000	2,500	125	2,375
Corn Creek	10,100	25,250	1,262.5	23,987.5
Earl Michaels	500	1,250	62.5	1,187.5
Subtotal	15,000	37,500		
Total	40,000	100,000		

1/ Includes contract amount. Carryover storage for Mitchell includes supplemental contract.

2/ Maximum carryover storage and protected carryover storage apply to existing Glendo contractors selecting individual accounts