Water Rights Accounting

New Accounting Model

- New Technology: 1979 versus 2011
  - Faster processors
  - Faster graphics
  - Larger, faster, memory
  - Larger, faster, disk storage
- Common Application
  - Use single application to build and run different accounting models for each river basin.
- Transparency

Software and Hardware Requirements

Build an accounting model

- MS Windows XP or MS Windows 7 operating system
- ESRI ArcGIS Desktop 10
- ArcInfo license

Run an accounting model

- MS Windows XP or MS Windows 7 operating system

Modify the code

- MS Visual Studio 10

Differences

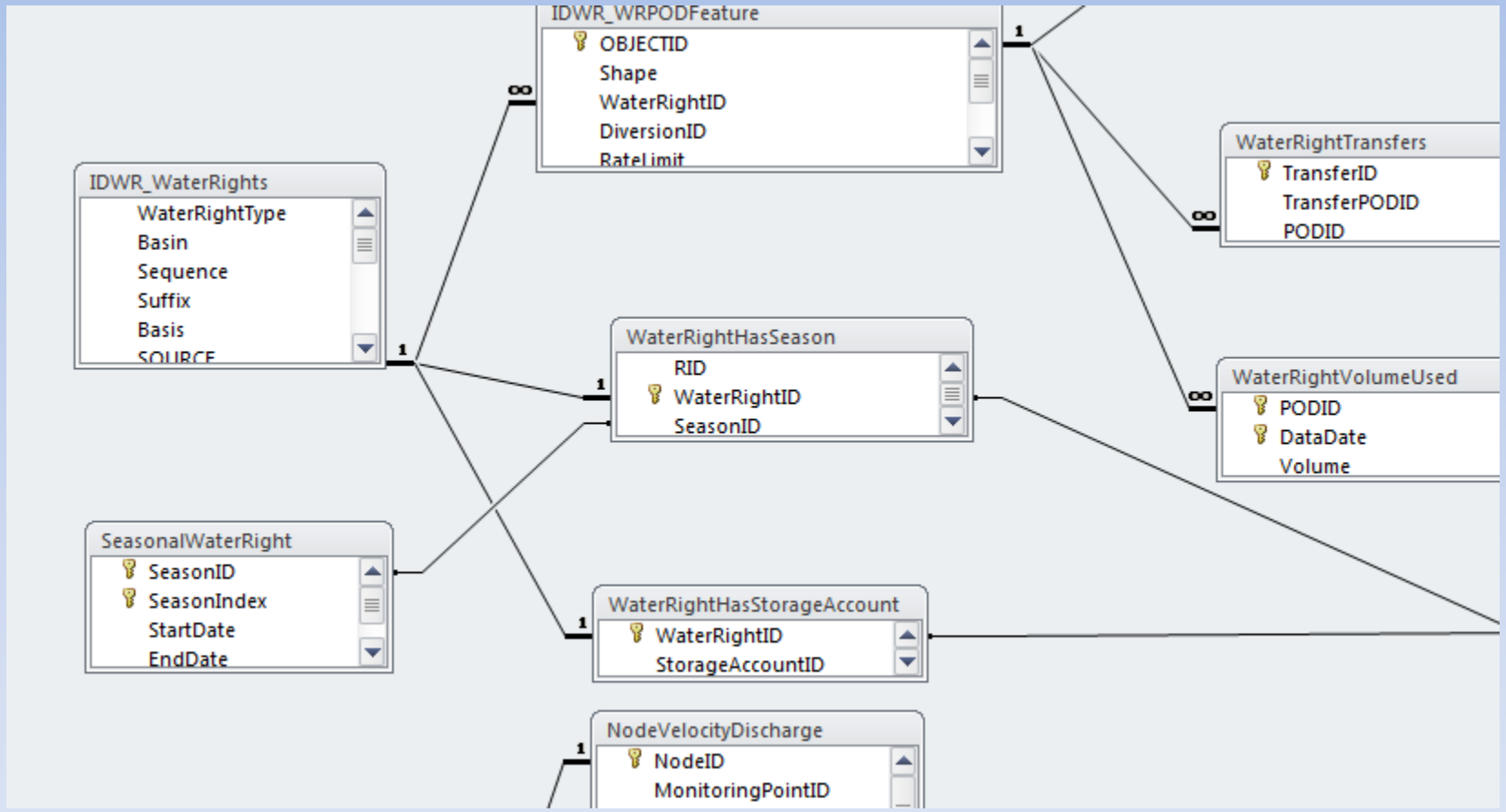
- Graphical interface
- One application, many models
- Relational database not a Text File
- C# instead of FORTRAN
- Storage model and Accounting model combined into one model

Text File

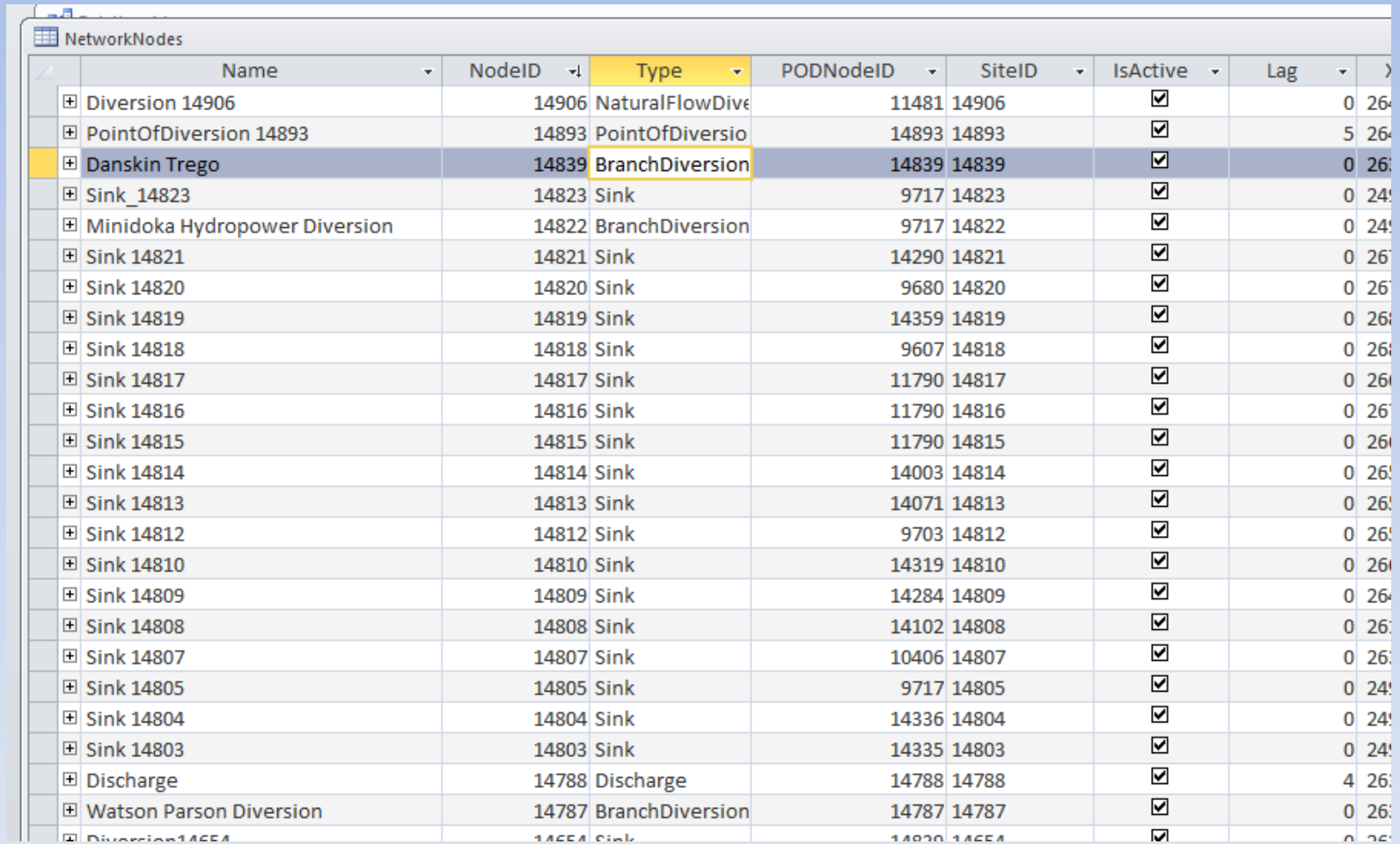
```
  355    49 1142     9   20     0     9     0    19     1    16     0     0   139    42     0
    0     0     0
    2     0     0     0
   33     3     4    32    36    22     8     9     0    20    12    13    30    15    16    17
   10    19    47    21     5    38    24    25    28     0     0    31    25    17     6    21
    2     2     2    31     0     7     7     0     0     0     0     0     0     0    20     0
    0
    1    33    34    35     2     3    37     4    32    11    12    13    30    14    15    16
   17    10    26    27    42    43    18    46    19    47    20    21     5    41    36    23
   24    29    25    28    31     6    45    44    22    38    39    40     7     8     9    48
   49
    1     2                                7     8     9           3     4           5
                                                 6


    4     4     1     4     4     4    15     7     7     4     4     4     1     4     1     1
    4     1     1     1     4     1     1     1     1     4     4     1     1     4     4     4
    1     1     1     4     4     4     1     1     1     4     4     1     1     1     1     1
    1
    0     0     0     1     0     0     0     0     0     1     0     0     0     0     0     0
    0     0     0     0     0     1     0     0     0     2     2     1     2     1     0     0
    0     0     0     1     2     0     0     2     2     2     2     2     2     2     1     2
    2
    1    33    35    34     2     3    29    37    32    11    12    13    14    15    16    26
   27    42    43    17    18    46    19    20    21    41     5    23    24    25    31     6
   45    44    38    39    40     7     8    48    49     9
   -5    -4    -4    -4    -4    -3    -1    -1     0    -5    -7    -6    -5    -5    -5    -5
   -5    -5    -5    -4    -4    -3    -4    -4    -4    -5    -5    -4    -4    -5    -3    -4
   -5    -5    -5    -4    -4    -2    -2    -2    -4    -5    -5    -3    -3    -5    -5     0
    0
   -5    -5    -4    -4    -4    -3    -2    -1     0    -5    -7    -7    -6    -5    -5    -5
   -5    -5    -5    -5    -4    -3    -4    -4    -4    -5    -5    -4    -4    -5    -4    -4
   -5    -5    -5    -4    -4    -3    -2    -2    -4    -5    -5    -3    -3    -5    -5     0
    0
   -5    -4    -7    -6    -5    -4    -1    -1     0
TO MORAN                ALPINE TO IRWIN          IRWIN TO HEISE
HEISE TO BLW DRY BED    MENAN TO NR IDAHO FALLS SHELLEY TO AT BLACKFOOT
NR BLACKFOOT TO NEELEY  NEELEY TO MINIDOKA       MINIDOKA TO MILNER
ST ANTHONY TO AB NF TETNTO HENRYS LAKE           HENRYS L TO ISLAND PARK
ISLAND PARK TO ASHTON    TO GRASSY LAKE          GRASSY LK TO ABV YELLOW
ABV YELLOW TO CHESTER   AB FALLS R TO ST ANTHONYAB S LEIGH TO ST ANTHONY
ST ANTH TO TETON FORKS  AB NF TETN TO REXBURG    LORENZO TO MENAN
AT BLKFOOT TO BLW BLKFT WILLOW CRK BLW TEX CREEKBLW TEX CREEK TO NR RIRIE
NR RIRIE TO FDWY NR UCONCROSSCUT BLW DIVSNS      CROSSCUT AT END
FDWY NR UCON TO END     EAGLE ROCK CANAL AT END ASHTON TO AB FALLS RIVER
WILLOW CRK TO SHELLEY   BLW DRY BED TO LORENZO   MORAN TO ALPINE
SALT RIVER ABV RES      GREYS RIVER ABV RES      NR ID FALLS TO AB WLW CR
DRY BED NR RIRIE        BLW BLKFT TO NR BLKFOOT PORTNUEF R AT POCATELLO
SPRING CREEK AT SHPSKN RGREAT WESTERN SPILLWAY  SOUTH BRANCH FALL R CAN
EAST TETON CANAL        RESERV CANAL AT DROP    SAND CRK AT WOLVERINE RD
NORTH FORK TETON        TETON FORKS TO MOUTH    BID DRAIN ABV SWID PUMP
BID DRAIN BLW SWID PUMP
JACKSON LAKE    PALISADES       HENRYS LAKE     ISLAND PARK     GRASSY LAKE
RIRIE           AMERICAN FALLS  LAKE WALCOTT    LAKE MILNER
```

Relational Database



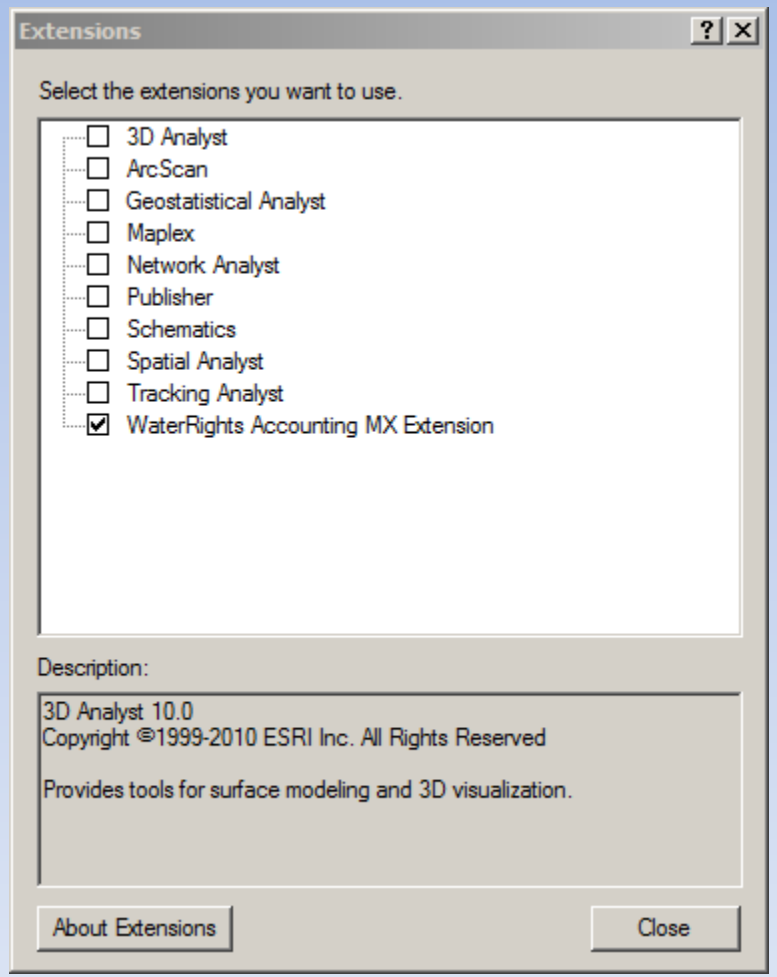
Database Table



NetworkNodes

Name	NodeID	Type	PODNodeID	SiteID	IsActive	Lag
Diversion 14906	14906	NaturalFlowDive	11481	14906	☑	0
PointOfDiversion 14893	14893	PointOfDiversio	14893	14893	☑	5
Danskin Trego	14839	BranchDiversion	14839	14839	☑	0
Sink_14823	14823	Sink	9717	14823	☑	0
Minidoka Hydropower Diversion	14822	BranchDiversion	9717	14822	☑	0
Sink 14821	14821	Sink	14290	14821	☑	0
Sink 14820	14820	Sink	9680	14820	☑	0
Sink 14819	14819	Sink	14359	14819	☑	0
Sink 14818	14818	Sink	9607	14818	☑	0
Sink 14817	14817	Sink	11790	14817	☑	0
Sink 14816	14816	Sink	11790	14816	☑	0
Sink 14815	14815	Sink	11790	14815	☑	0
Sink 14814	14814	Sink	14003	14814	☑	0
Sink 14813	14813	Sink	14071	14813	☑	0
Sink 14812	14812	Sink	9703	14812	☑	0
Sink 14810	14810	Sink	14319	14810	☑	0
Sink 14809	14809	Sink	14284	14809	☑	0
Sink 14808	14808	Sink	14102	14808	☑	0
Sink 14807	14807	Sink	10406	14807	☑	0
Sink 14805	14805	Sink	9717	14805	☑	0
Sink 14804	14804	Sink	14336	14804	☑	0
Sink 14803	14803	Sink	14335	14803	☑	0
Discharge	14788	Discharge	14788	14788	☑	4
Watson Parson Diversion	14787	BranchDiversion	14787	14787	☑	0

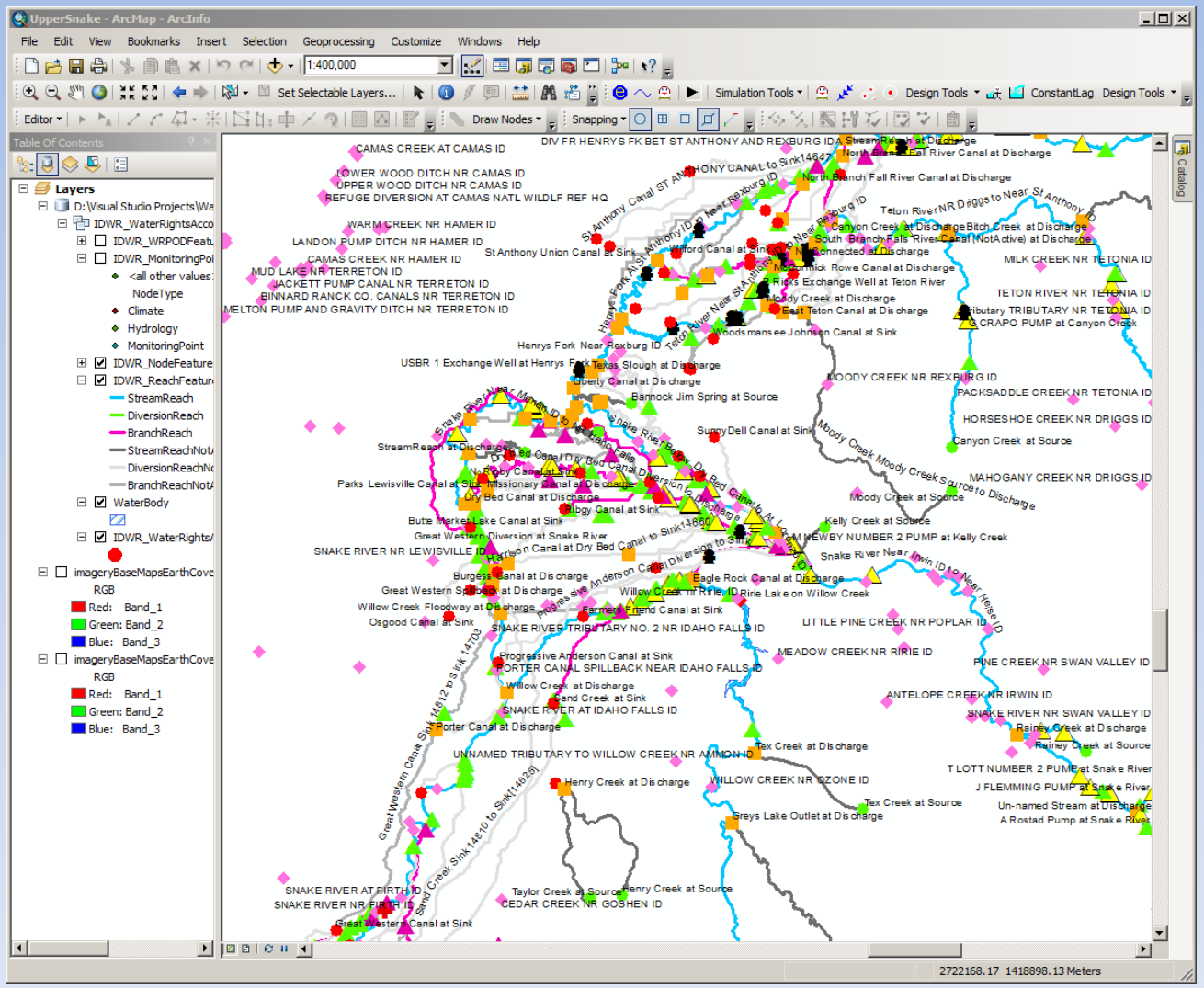
ArcMap Extension



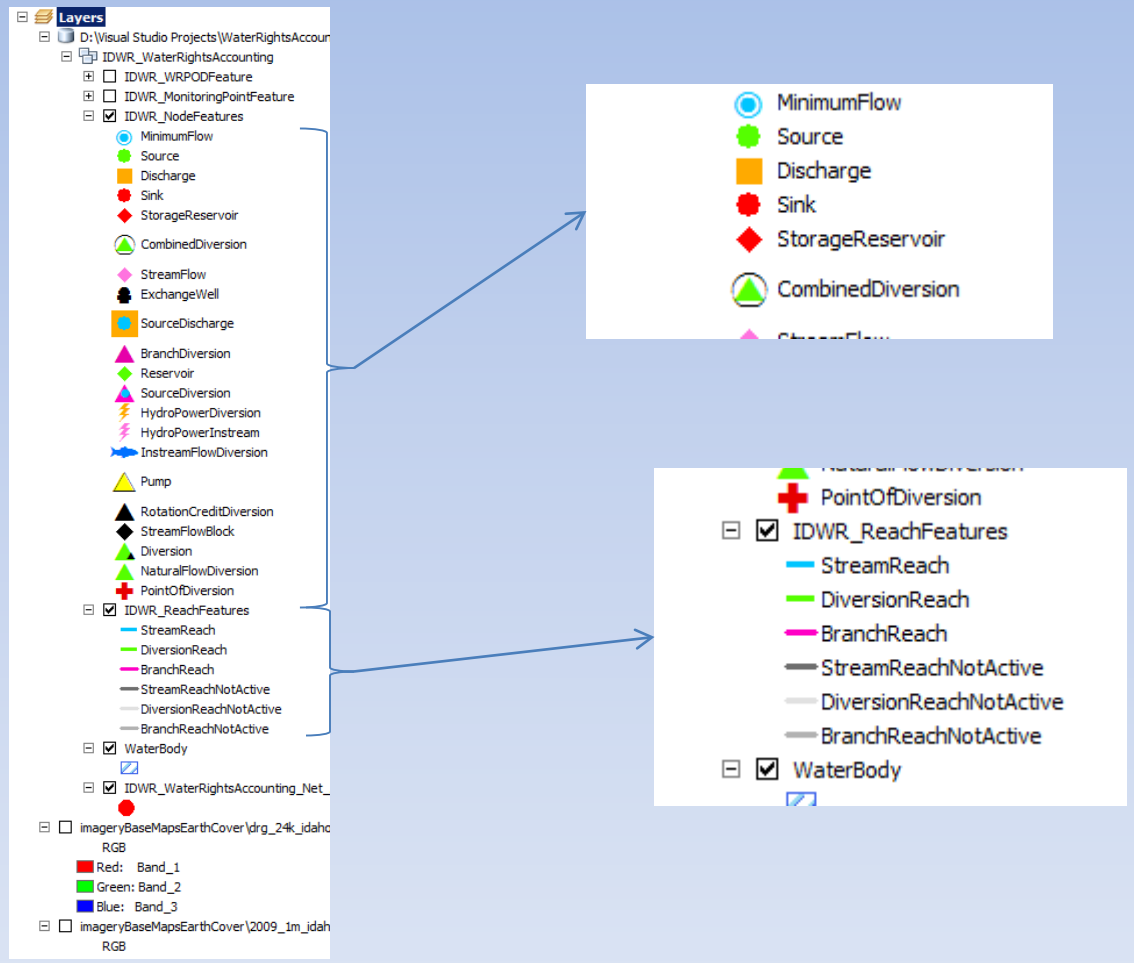
Building A Model

- ArcGIS Map is a graphical user interface used to build an image of a model.
- The image provided in the ArcGIS Personal Geodatabase is used to construct a MS Access database used to run the model.
- ArcGIS is not required to run the model.

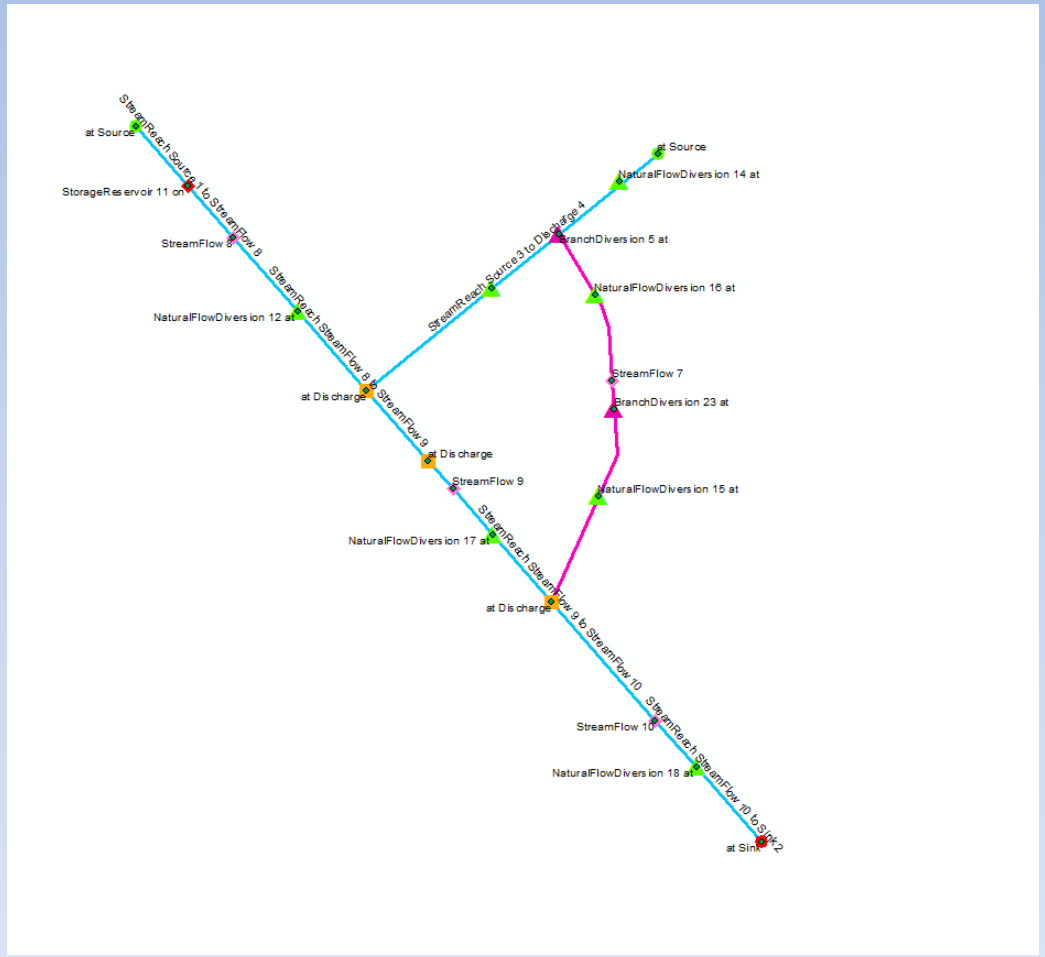
What does it look like



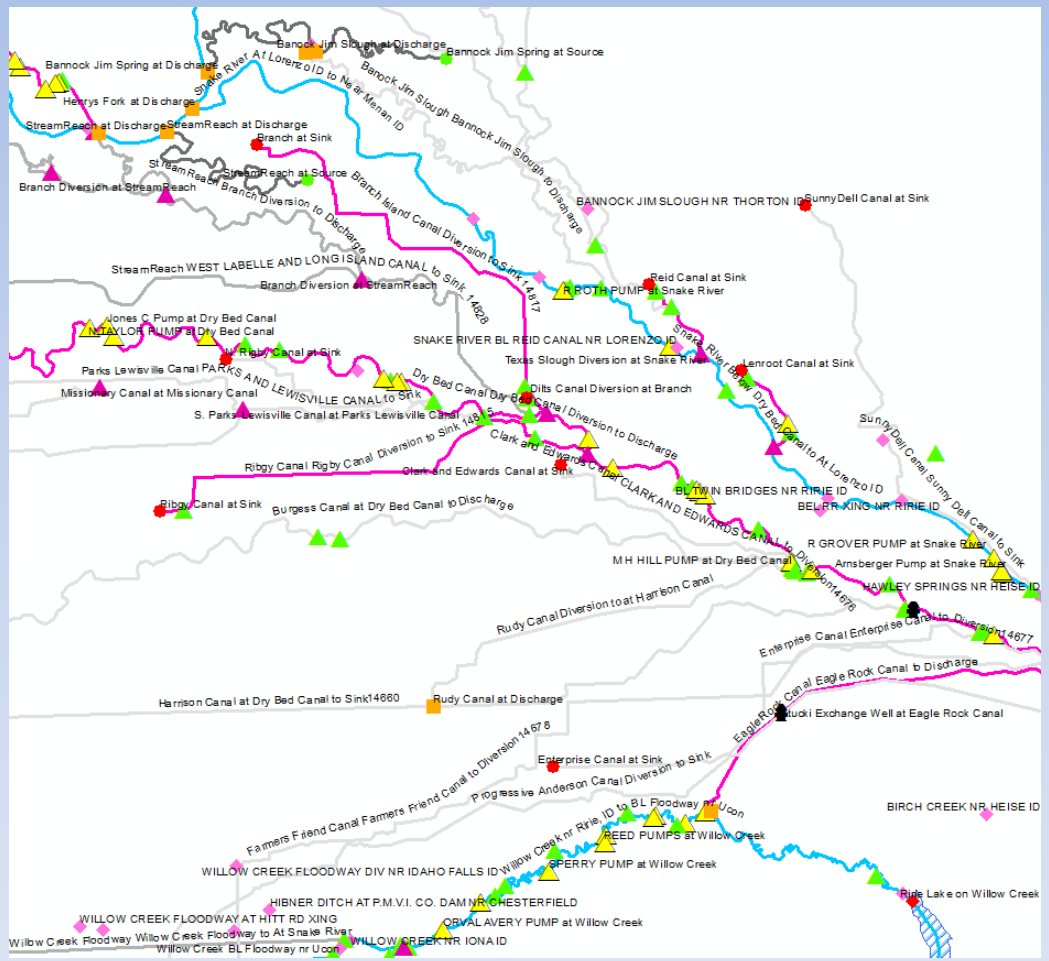
Accounting Network



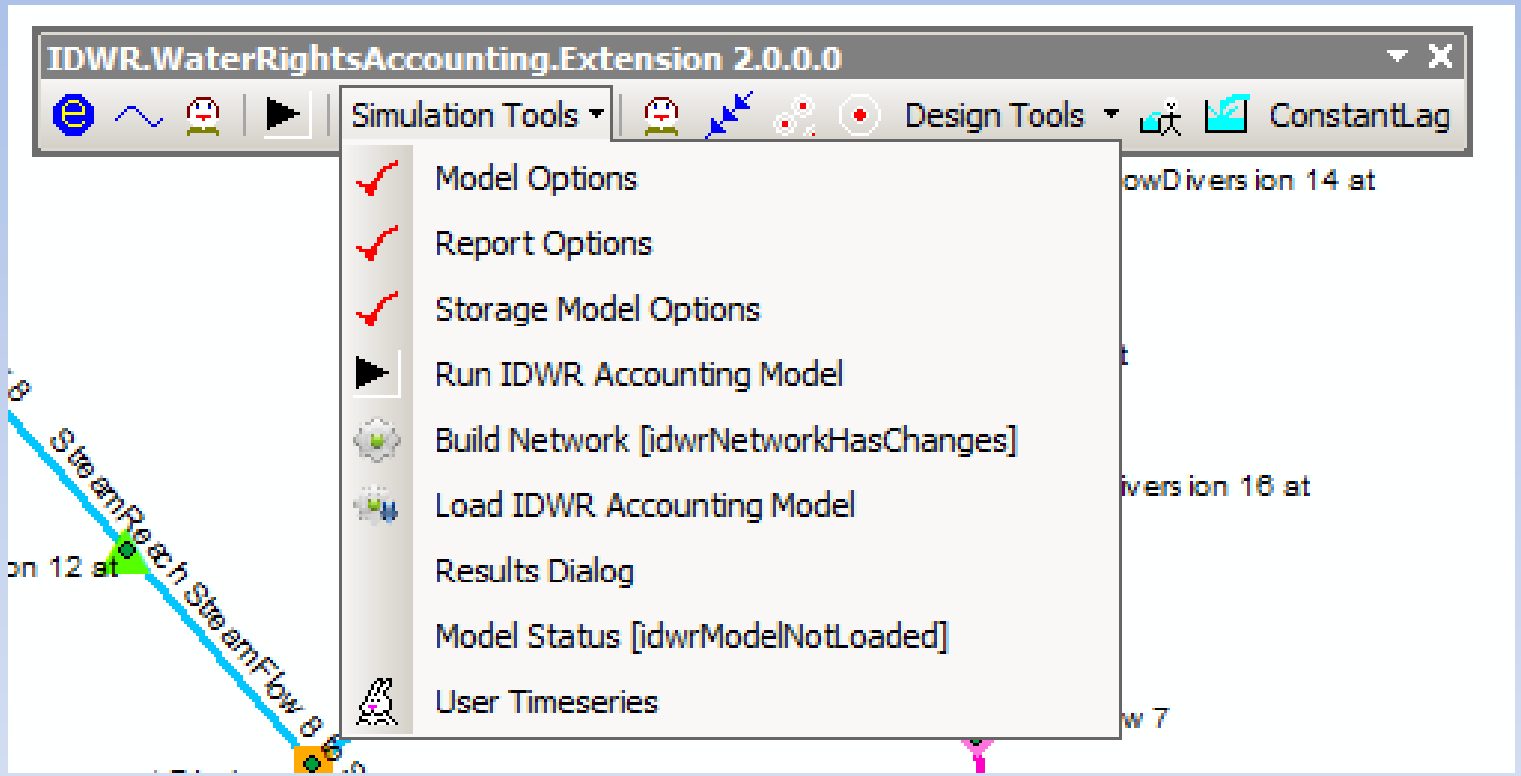
Simple Network



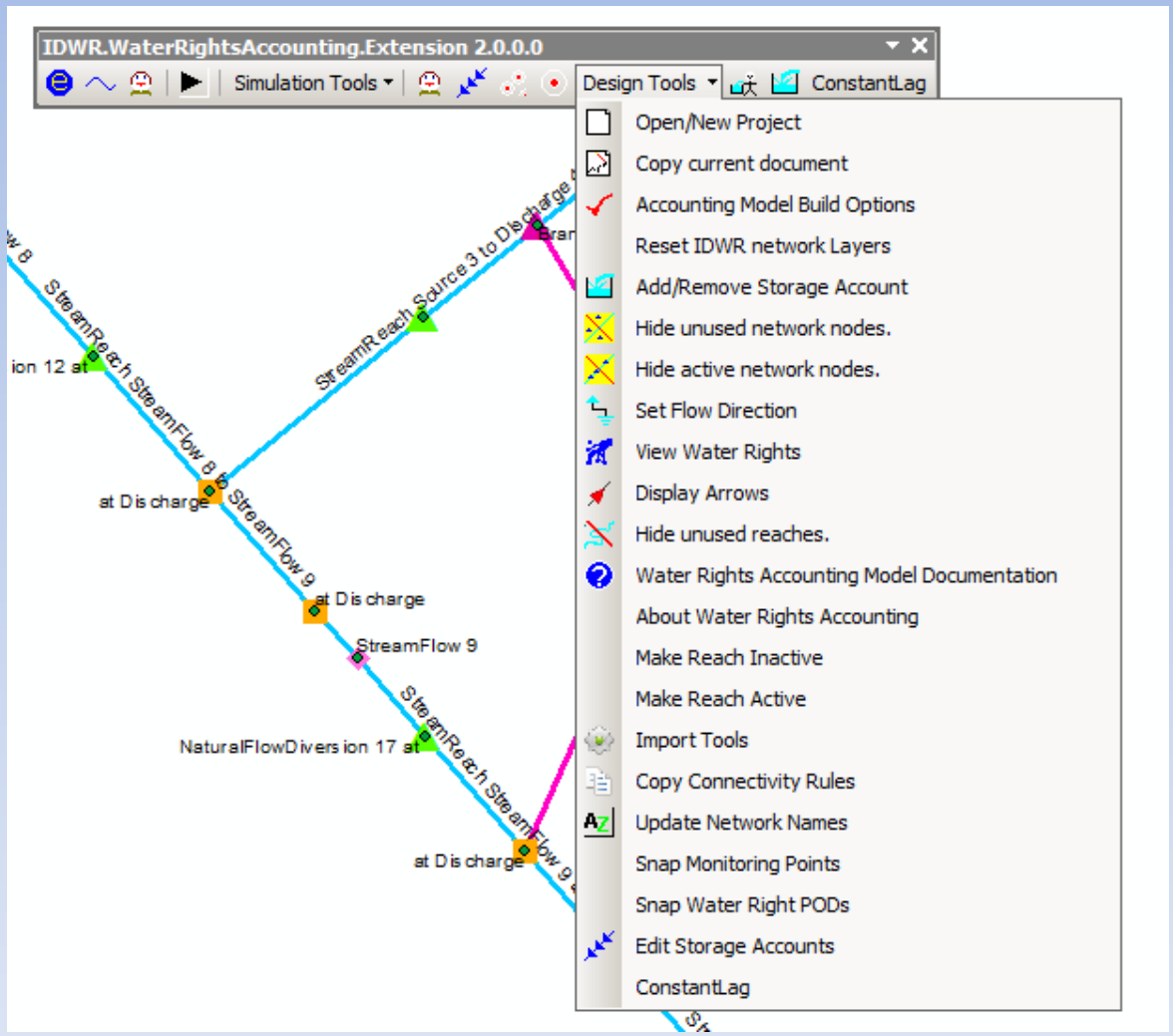
Complex Network



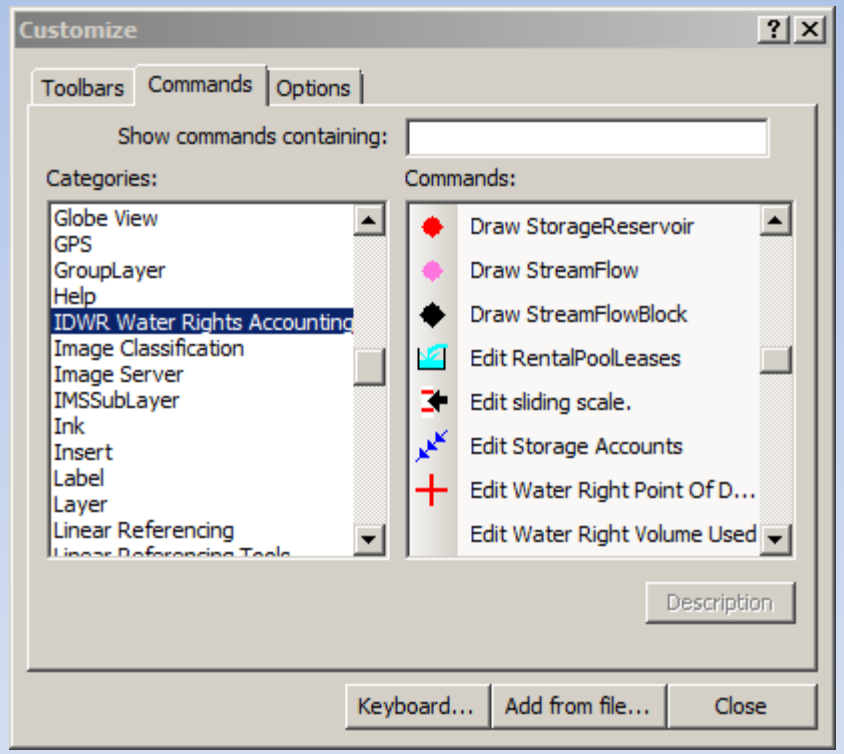
Tool Bars : Simulation



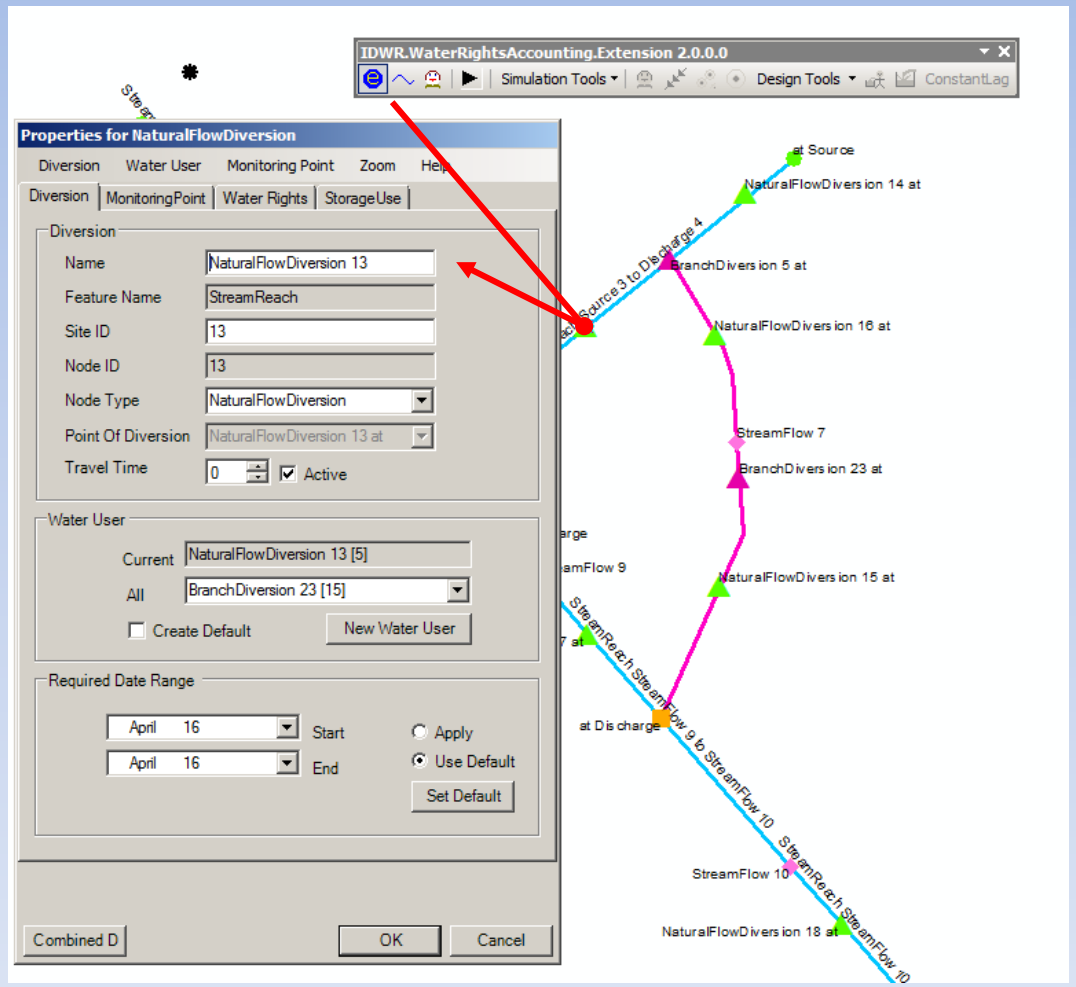
Tool Bars : Design



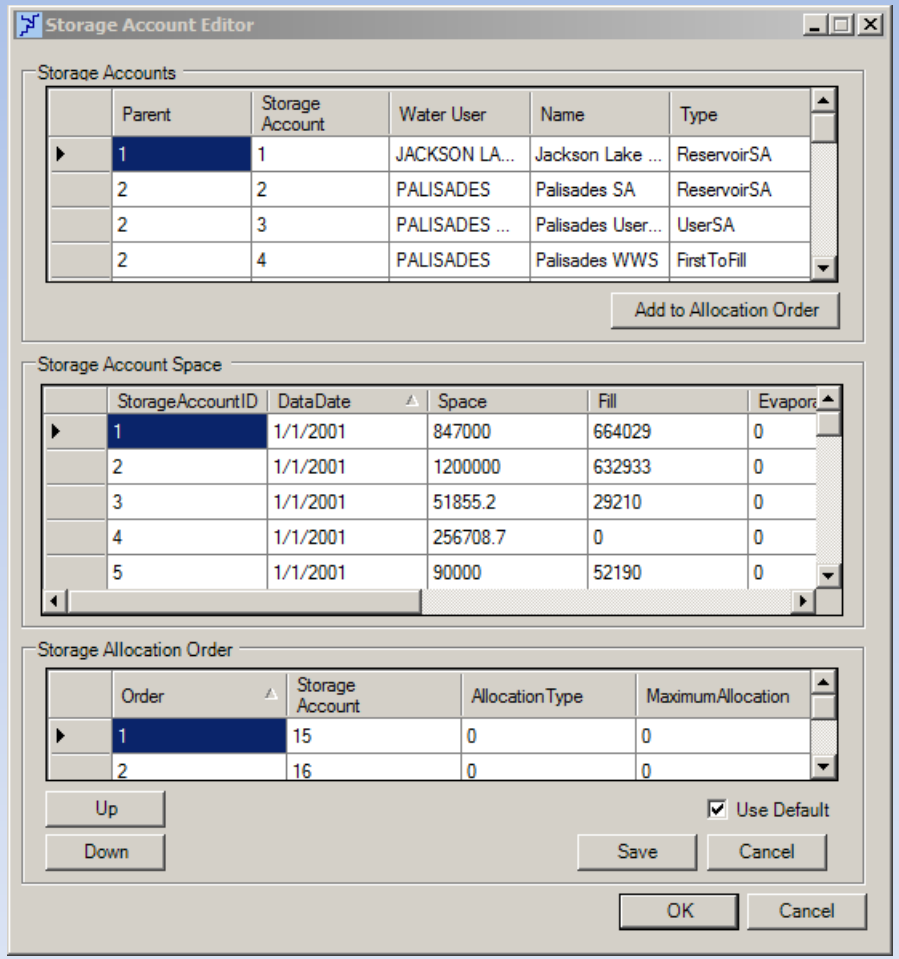
Customize


Customize
Toolbars
Commands
Options
Show commands containing:
Categories:
Commands:
Globe View
GPS
GroupLayer
Help
IDWR Water Rights Accounting
Image Classification
Image Server
IMSSubLayer
Ink
Insert
Label
Layer
Linear Referencing
Draw StorageReservoir
Draw StreamFlow
Draw StreamFlowBlock
Edit RentalPoolLeases
Edit sliding scale.
Edit Storage Accounts
Edit Water Right Point Of D...
Edit Water Right Volume Used
Description
Keyboard...
Add from file...
Close

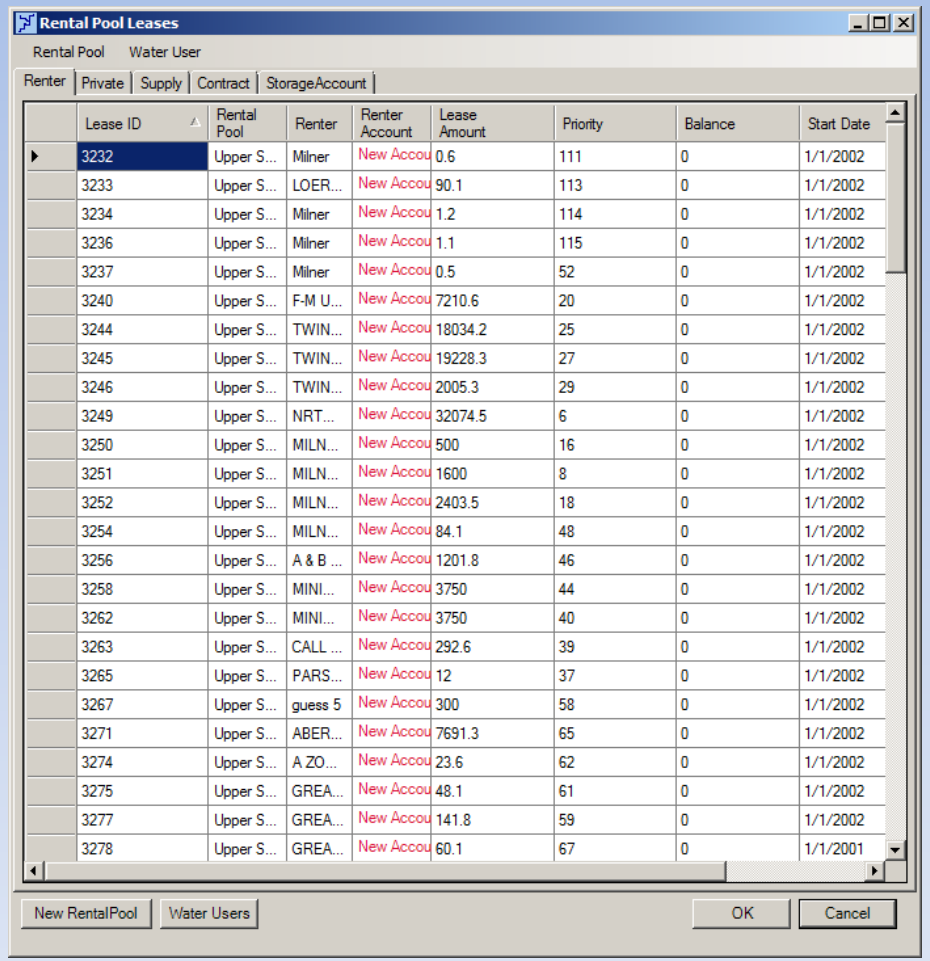
Editing Tools



Edit Storage Accounts

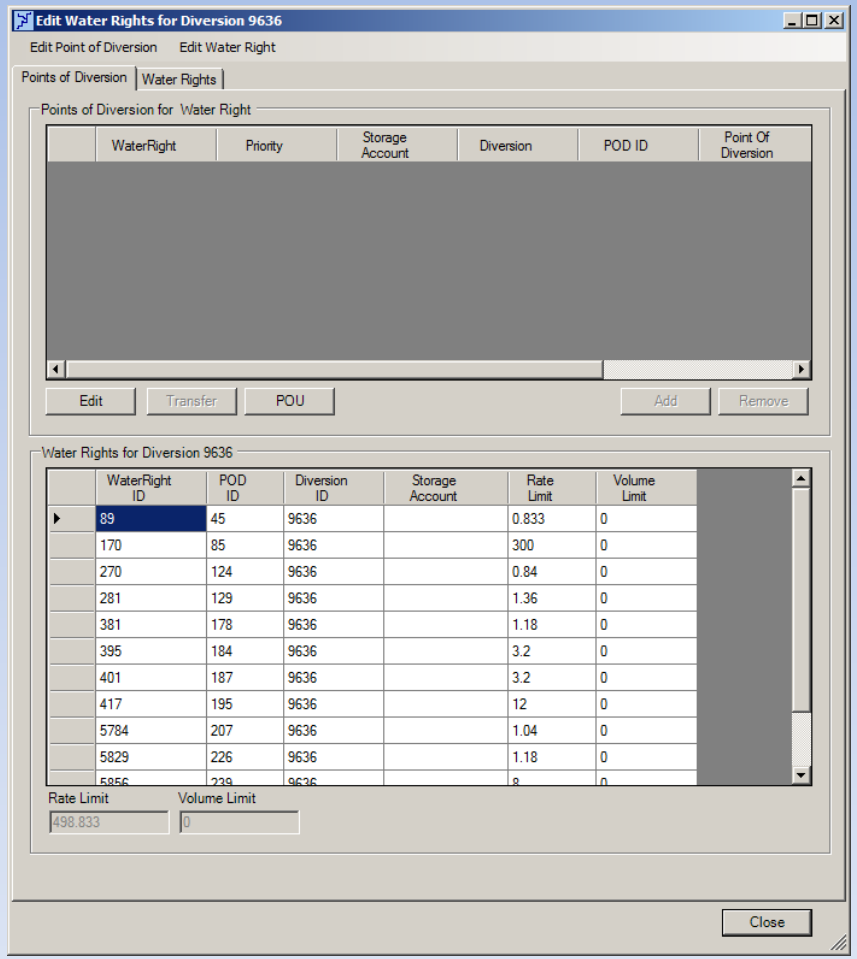


Edit Rental Pools

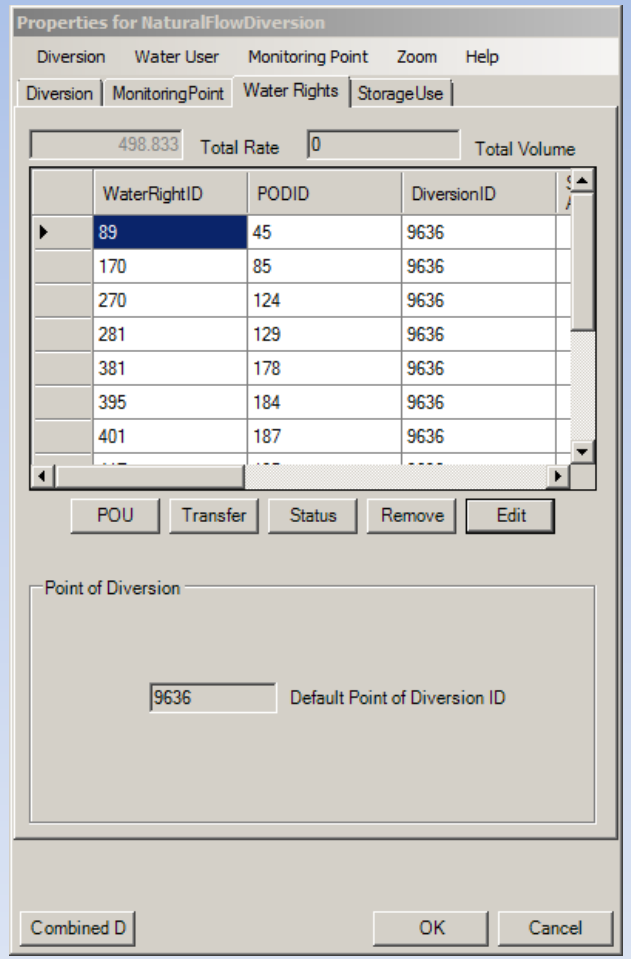


Lease ID	Rental Pool	Renter	Renter Account	Lease Amount	Priority	Balance	Start Date
3232	Upper S...	Milner	New Accou	0.6	111	0	1/1/2002
3233	Upper S...	LOER...	New Accou	90.1	113	0	1/1/2002
3234	Upper S...	Milner	New Accou	1.2	114	0	1/1/2002
3236	Upper S...	Milner	New Accou	1.1	115	0	1/1/2002
3237	Upper S...	Milner	New Accou	0.5	52	0	1/1/2002
3240	Upper S...	F-M U...	New Accou	7210.6	20	0	1/1/2002
3244	Upper S...	TWIN...	New Accou	18034.2	25	0	1/1/2002
3245	Upper S...	TWIN...	New Accou	19228.3	27	0	1/1/2002
3246	Upper S...	TWIN...	New Accou	2005.3	29	0	1/1/2002
3249	Upper S...	NRT...	New Accou	32074.5	6	0	1/1/2002
3250	Upper S...	MILN...	New Accou	500	16	0	1/1/2002
3251	Upper S...	MILN...	New Accou	1600	8	0	1/1/2002
3252	Upper S...	MILN...	New Accou	2403.5	18	0	1/1/2002
3254	Upper S...	MILN...	New Accou	84.1	48	0	1/1/2002
3256	Upper S...	A & B ...	New Accou	1201.8	46	0	1/1/2002
3258	Upper S...	MINI...	New Accou	3750	44	0	1/1/2002
3262	Upper S...	MINI...	New Accou	3750	40	0	1/1/2002
3263	Upper S...	CALL ...	New Accou	292.6	39	0	1/1/2002
3265	Upper S...	PARS...	New Accou	12	37	0	1/1/2002
3267	Upper S...	guess 5	New Accou	300	58	0	1/1/2002
3271	Upper S...	ABER...	New Accou	7691.3	65	0	1/1/2002
3274	Upper S...	A ZO...	New Accou	23.6	62	0	1/1/2002
3275	Upper S...	GREA...	New Accou	48.1	61	0	1/1/2002
3277	Upper S...	GREA...	New Accou	141.8	59	0	1/1/2002
3278	Upper S...	GREA...	New Accou	60.1	67	0	1/1/2001

Edit Water Rights



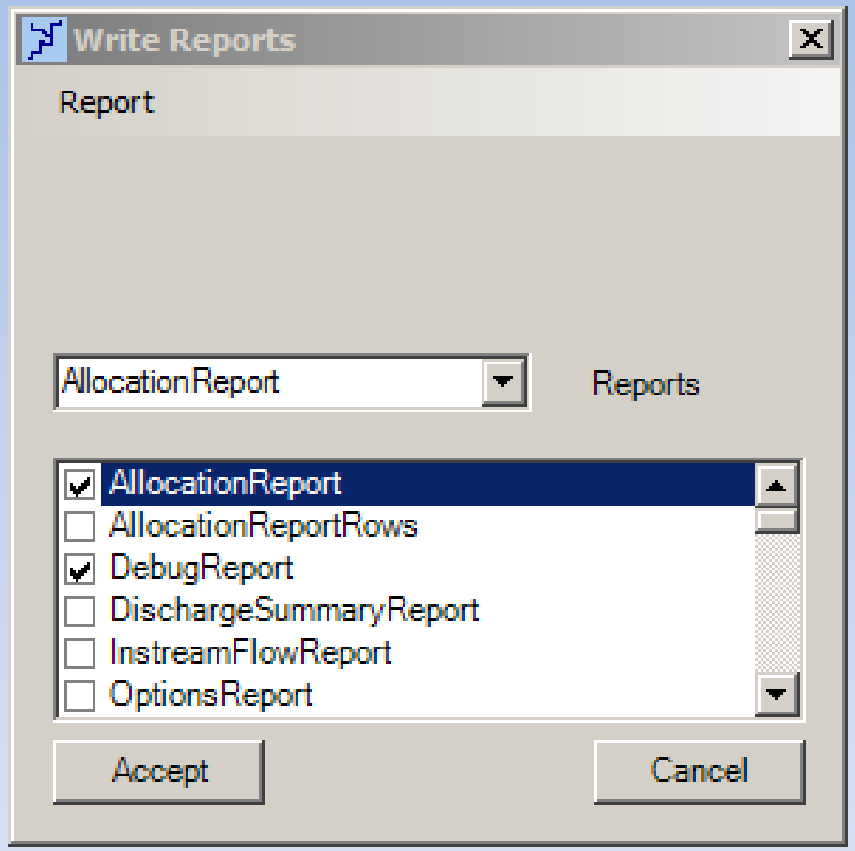
Edit Points Of Diversion

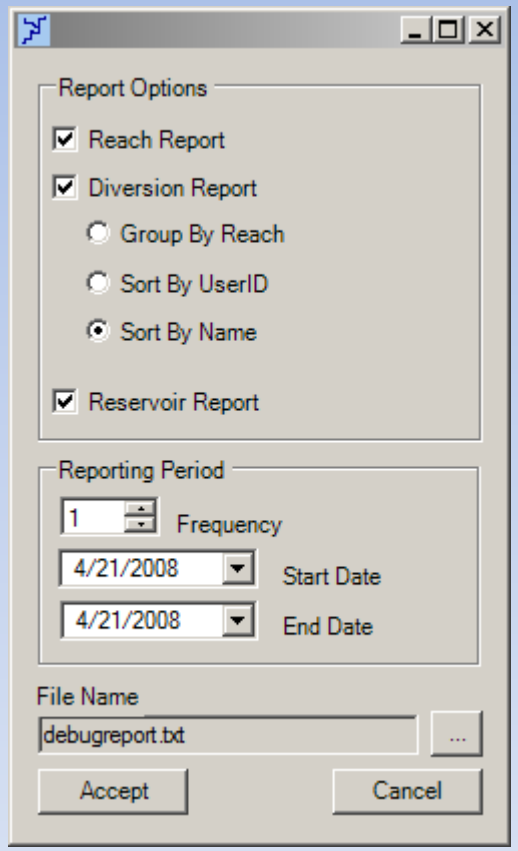


Output Options

- Choice of many different reports
- Output user selected values to a relational database
- Graph input
- Graph output
- Import data from other sources

Report Options





Debug Report

UpperSnake

01-01-02

Reach Summary For Jan 02, 2001

reach name		date	reach gain cfs	natural flow cfs	natural inflow cfs	storage inflow	loss rate	natural flow loss cfs	storage loss cfs	natural outflow cfs	storage outflow cfs	measured outflow cfs	natflow stored cfs
Conant Creek													
512 Discharge	S*	Jan 02	0.00	0.00	0.00	0.00	0.00000	0.00	0.00	0.00	0.00	0.00	0.00
Willow Creek													
524 Discharge	S*	Jan 02	0.00	0.00	0.00	0.00	0.00000	0.00	0.00	0.00	0.00	0.00	0.00
Strong Creek													
525 Discharge	S*	Jan 02	0.00	0.00	0.00	0.00	0.00000	0.00	0.00	0.00	0.00	0.00	0.00
Blue Creek													
526 Discharge	S*	Jan 02	0.00	0.00	0.00	0.00	0.00000	0.00	0.00	0.00	0.00	0.00	0.00
Snake River													
532 Near Moran WY	S	Jan 02	409.00	409.00	409.00	0.00	0.00000	0.00	0.00	0.00	409.00	409.00	409.00
813 Near Alpine WY	S	Jan 02	991.00	1400.00	991.00	409.00	0.00000	0.00	0.00	991.00	409.00	1400.00	0.00
810 Near Irwin ID	S	Jan 02	833.70	2233.70	1824.70	409.00	0.00000	0.00	0.00	1824.70	-764.70	1060.00	0.00
530 Near Heise ID	S	Jan 02	420.00	2653.70	2244.70	-764.70	0.00000	0.00	0.00	2244.70	-764.70	1480.00	0.00
527 Below Dry Bed Canal	S*	Jan 02	0.00	2653.70	2244.70	-764.70	0.00000	0.00	0.00	2244.70	-1004.70	1240.00	0.00
528 At Lorenzo ID	S	Jan 02	-490.00	1605.06	2244.70	-1004.70	0.39516	887.02	-397.02	1357.68	-607.68	750.00	0.00
448 Near Menan ID	S*	Jan 02	-1800.00	1152.43	3670.89	-1120.89	0.70588	2591.22	-791.22	1079.67	-329.67	750.00	0.00
580 NR Idaho Falls	S	Jan 02	1210.00	2362.43	2289.67	-89.67	0.00000	0.00	0.00	2289.67	-89.67	2200.00	0.00
541 near Shelley	S	Jan 02	200.00	2588.43	2500.26	-100.26	0.00000	0.00	0.00	2500.26	-100.26	2400.00	0.00
594 at Blackfoot	S	Jan 02	-400.00	2157.03	2500.26	-100.26	0.16667	416.71	-16.71	2083.55	-83.55	2000.00	0.00
551 NR Blackfoot	S	Jan 02	-100.00	2049.18	2083.55	-83.55	0.05000	104.18	-4.18	1979.37	-79.37	1900.00	0.00
552 at Neeley	S	Jan 02	2227.16	4466.33	4396.53	-79.37	0.00000	0.00	0.00	4396.53	-4019.53	377.00	0.00
1000 nr Minidoka	S	Jan 02	230.11	4696.44	4626.64	-4019.53	0.00000	0.00	0.00	0.00	500.00	500.00	4626.64
555 at Milner	S	Jan 02	-2.00	4677.66	0.00	500.00	0.00400	0.00	2.00	0.00	498.00	498.00	0.00
Un-named Stream													
535 Discharge	S*	Jan 02	0.00	0.00	0.00	0.00	0.00000	0.00	0.00	0.00	0.00	0.00	0.00
Rainey Creek													
536 Discharge	S*	Jan 02	0.00	0.00	0.00	0.00	0.00000	0.00	0.00	0.00	0.00	0.00	0.00

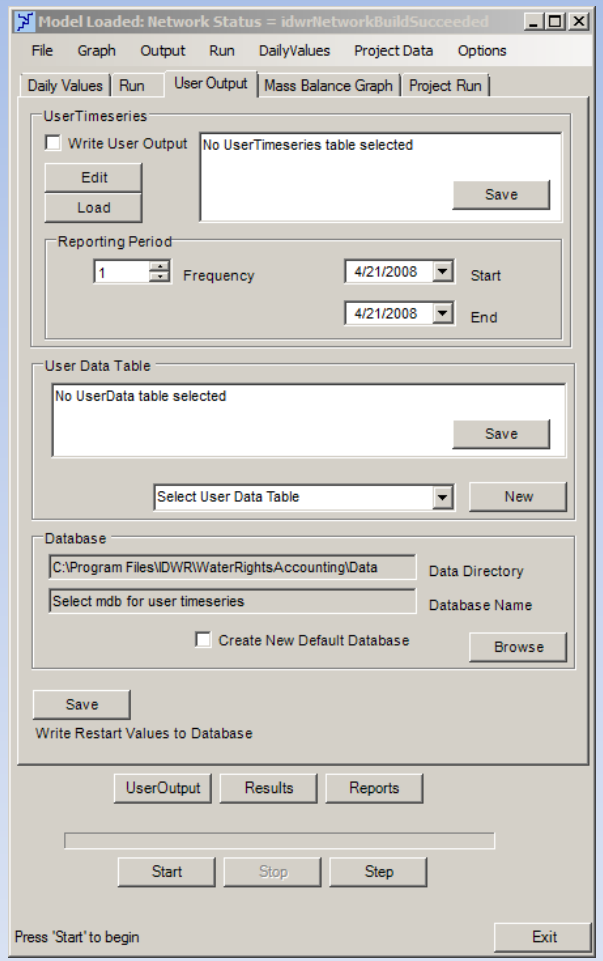
Storage Report

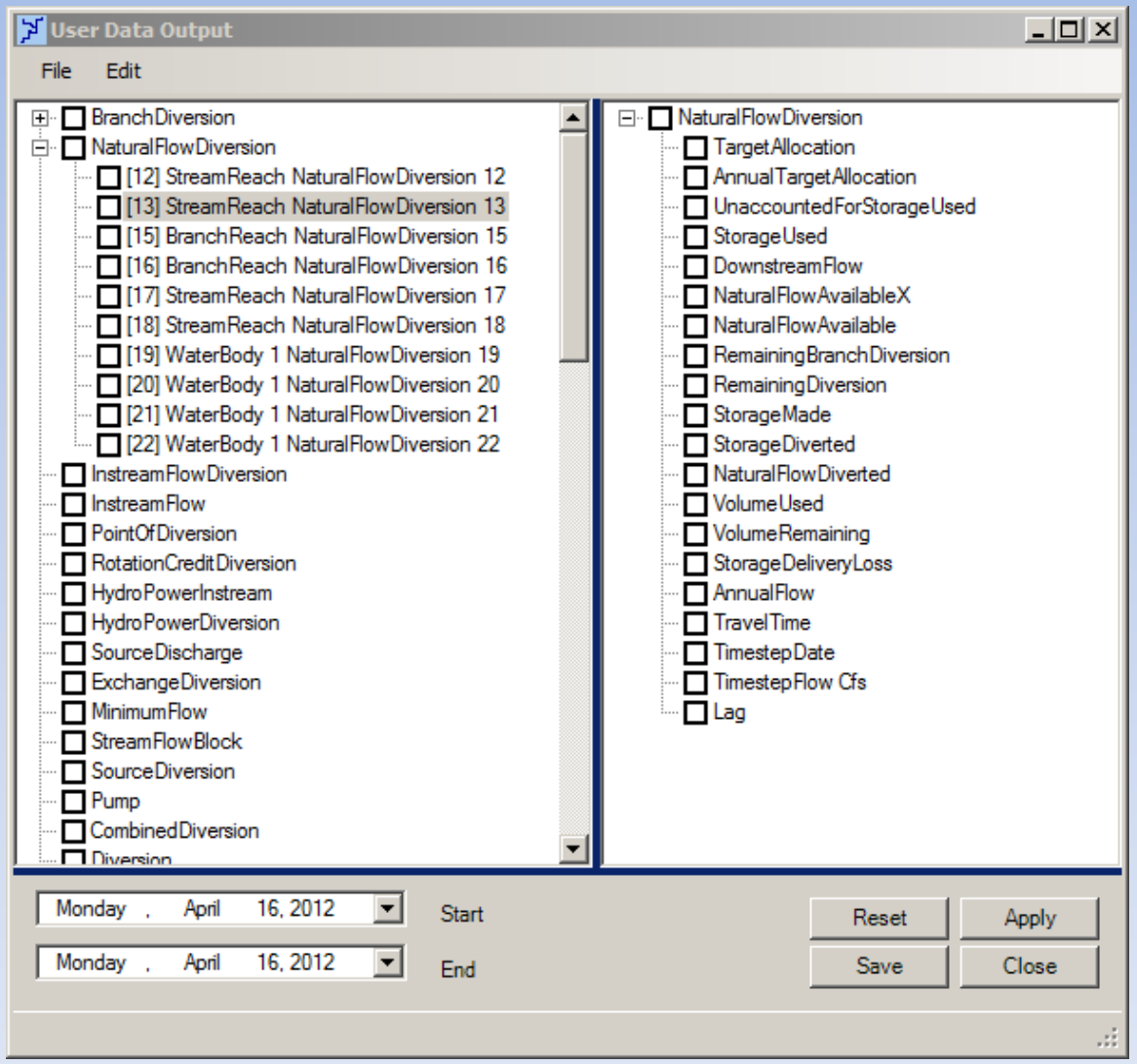
Apr 16, 2012

STORED WATER BY RESERVOIR STORAGE ACCOUNT Jan 02, 2001 (ACRE-FEET)

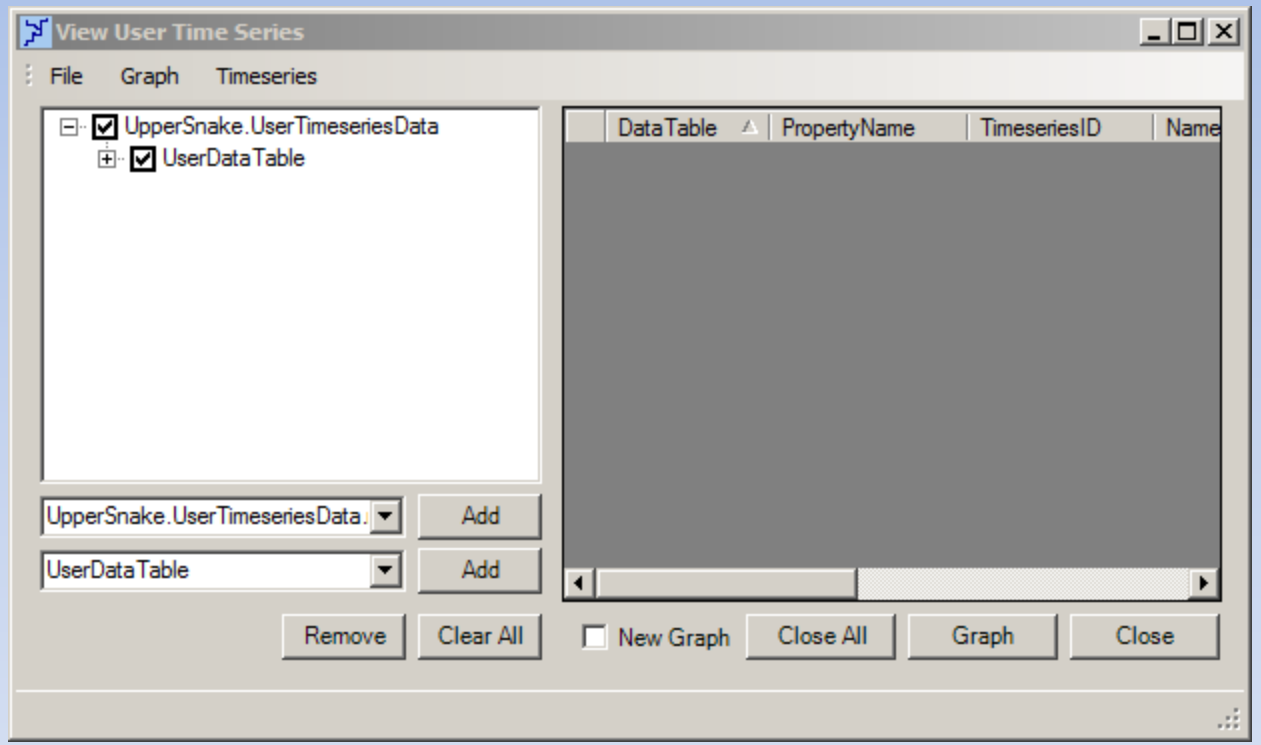
Storage Acccount		SPACE	ALLOCATION	STORAGE USE	EVAPORATION	FILL
100	EXCESS USE	0.0	0.0	0.0	0.0	0.0
100	USER STORAGE	0.0	0.0	0.0	0.0	0.0
98	UNACCOUNTED FOR STOR	0.0	1138.5	1138.5	0.0	0.0
98	USER STORAGE	0.0	0.0	0.0	0.0	0.0
1	JACKSON LAKE SA	847000.0	665204.1	10.8	10.8	665193.2
1	USER STORAGE	847000.0	665204.1	10.8	0.0	665193.2
14	JACKSON LAKE LTF	0.0	0.0	0.0	0.0	0.0
2	PALISADES SA	1200000.0	633279.4	10.3	10.3	633269.1
2	USER STORAGE	891436.1	603723.0	9.8	0.0	603713.2
3	PALISADES USERS SA	51855.2	29210.0	0.5	0.0	29209.5
4	PALISADES WWS	256708.7	346.4	0.0	0.0	346.4
12	PALISADES LTF	0.0	0.0	0.0	0.0	0.0
5	HENRYS LAKE SA	90000.0	52218.3	545.5	0.0	51672.8
5	USER STORAGE	90000.0	52218.3	545.5	0.0	51672.8
6	ISLAND PARK SA	150204.0	66813.5	115.0	0.0	66698.4
6	USER STORAGE	150204.0	66813.5	115.0	0.0	66698.4
7	GRASSY LAKE SA	15204.0	9206.0	0.0	0.0	9206.0
7	USER STORAGE	15204.0	9206.0	0.0	0.0	9206.0
8	RIRIE LAKE SA	80500.0	27794.2	0.5	0.5	27793.7
8	USER STORAGE	80500.0	27794.2	0.5	0.0	27793.7
9	AMERICAN FALLS	1672590.0	698316.9	11.3	11.3	698305.6
9	USER STORAGE	1672590.0	698316.9	11.3	0.0	698305.6
11	AMERICAN FALLS LTF	0.0	0.0	0.0	0.0	0.0
10	LAKE WALCOTT	95200.0	45724.8	0.7	0.7	45724.1
10	USER STORAGE	95200.0	45724.8	0.7	0.0	45724.1
15	UPPER SNAKE RENTAL P	0.0	0.0	0.0	0.0	0.0
15	USER STORAGE	0.0	0.0	0.0	0.0	0.0
16	FREMONT-MADISON RENT	0.0	0.0	0.0	0.0	0.0
16	USER STORAGE	0.0	0.0	0.0	0.0	0.0
	TOTAL	4150698.0	2199695.6	1832.6	33.6	2197863.0

User Output

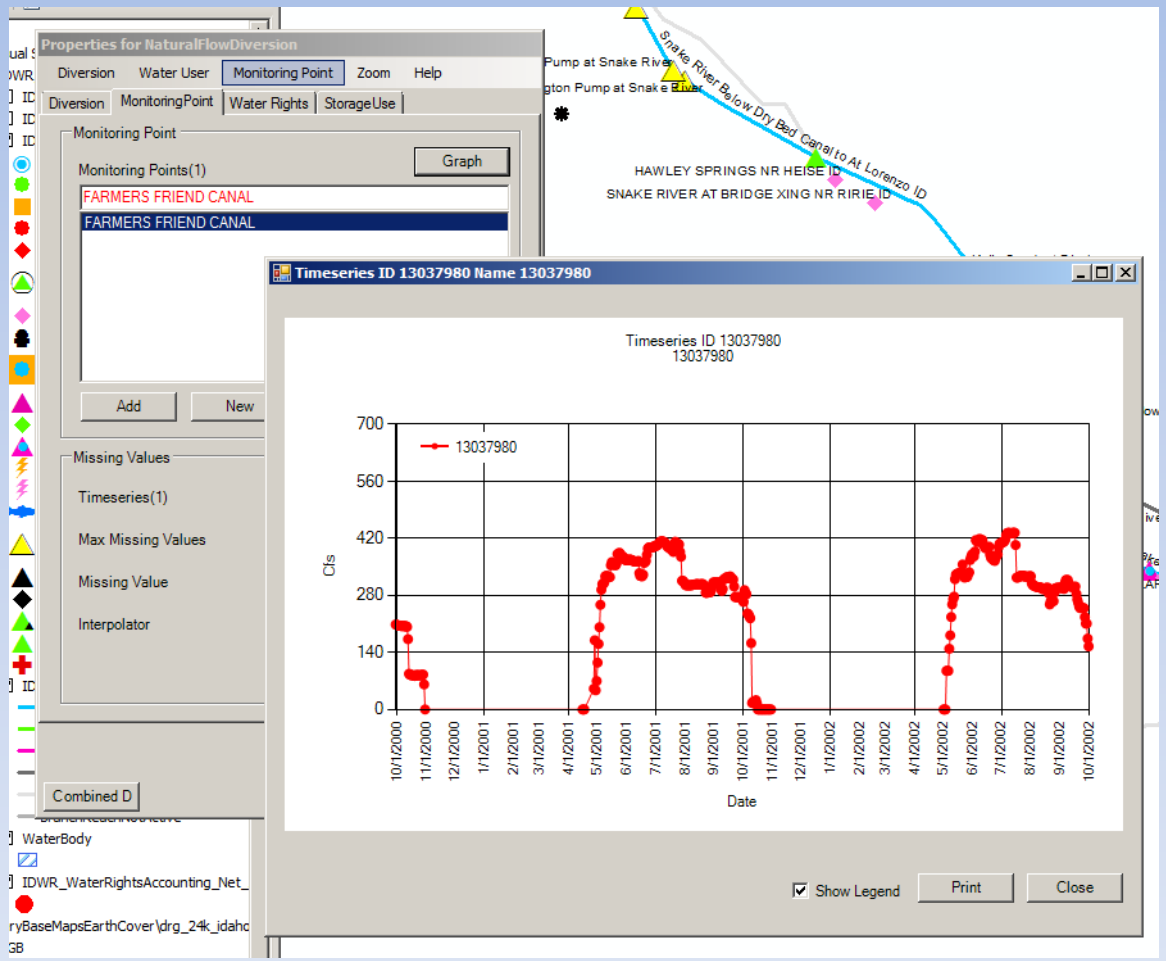

Model Loaded: Network Status = idwrNetworkBuildSucceeded
File
Graph
Output
Run
DailyValues
Project Data
Options
Daily Values
Run
User Output
Mass Balance Graph
Project Run
UserTimeseries
Write User Output
No UserTimeseries table selected
Edit
Load
Save
Reporting Period
1
Frequency
4/21/2008
Start
4/21/2008
End
User Data Table
No UserData table selected
Save
Select User Data Table
New
Database
C:\Program Files\IDWR\WaterRightsAccounting\Data
Data Directory
Select mdb for user timeseries
Database Name
Create New Default Database
Browse
Save
Write Restart Values to Database
UserOutput
Results
Reports
Start
Stop
Step
Press 'Start' to begin
Exit


User Data Output
File
Edit
BranchDiversion
NaturalFlowDiversion
[12] StreamReach NaturalFlowDiversion 12
[13] StreamReach NaturalFlowDiversion 13
[15] BranchReach NaturalFlowDiversion 15
[16] BranchReach NaturalFlowDiversion 16
[17] StreamReach NaturalFlowDiversion 17
[18] StreamReach NaturalFlowDiversion 18
[19] WaterBody 1 NaturalFlowDiversion 19
[20] WaterBody 1 NaturalFlowDiversion 20
[21] WaterBody 1 NaturalFlowDiversion 21
[22] WaterBody 1 NaturalFlowDiversion 22
InstreamFlowDiversion
InstreamFlow
PointOfDiversion
RotationCreditDiversion
HydroPowerInstream
HydroPowerDiversion
SourceDischarge
ExchangeDiversion
MinimumFlow
StreamFlowBlock
SourceDiversion
Pump
CombinedDiversion
NaturalFlowDiversion
TargetAllocation
AnnualTargetAllocation
UnaccountedForStorageUsed
StorageUsed
DownstreamFlow
NaturalFlowAvailableX
NaturalFlowAvailable
RemainingBranchDiversion
RemainingDiversion
StorageMade
StorageDiverted
NaturalFlowDiverted
VolumeUsed
VolumeRemaining
StorageDeliveryLoss
AnnualFlow
TravelTime
TimestepDate
TimestepFlow Cfs
Lag
Monday , April 16, 2012
Start
Monday , April 16, 2012
End
Reset
Apply
Save
Close

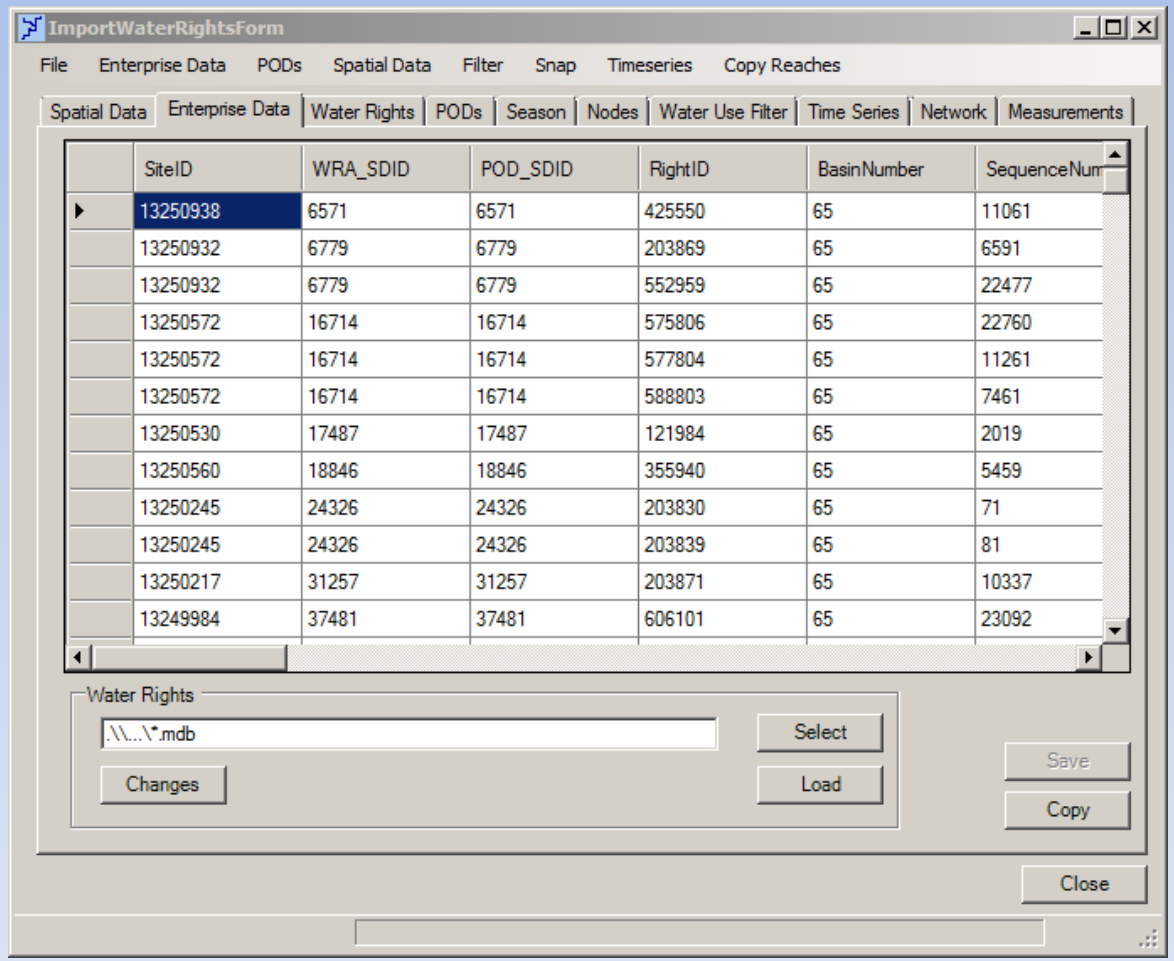
Graphical Output



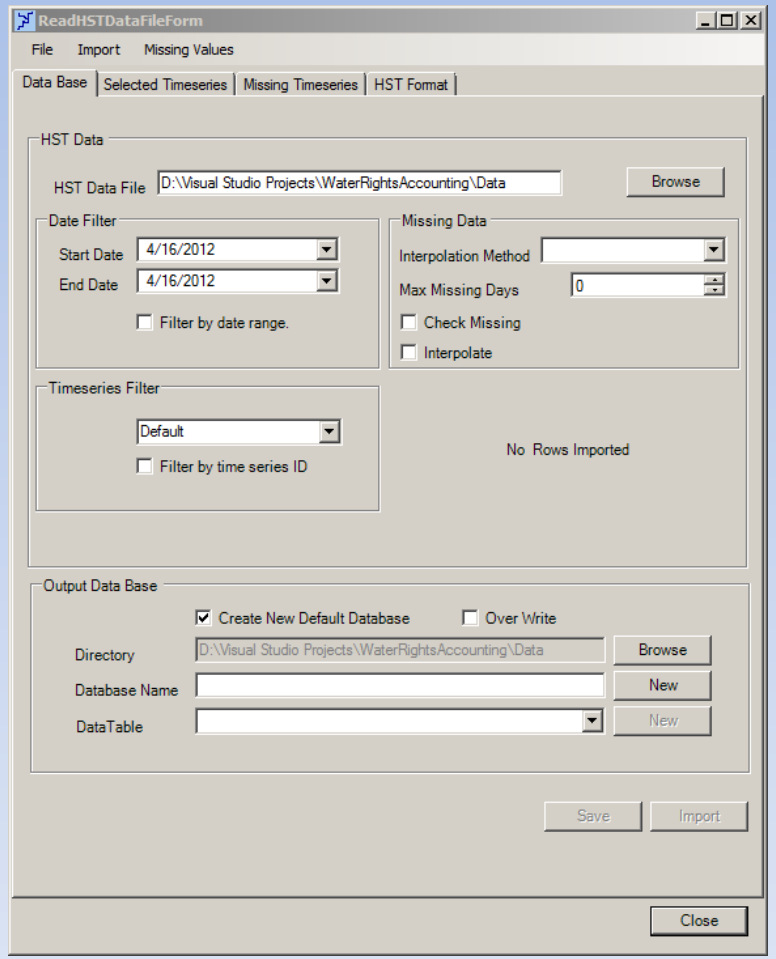
Graph Input


Properties for NaturalFlowDiversion
Diversion
Water User
Monitoring Point
Zoom
Help
Diversion
MonitoringPoint
Water Rights
StorageUse
Monitoring Point
Monitoring Points(1)
Graph
FARMERS FRIEND CANAL
FARMERS FRIEND CANAL
Add
New
Missing Values
Timeseries(1)
Max Missing Values
Missing Value
Interpolator
Combined D
WaterBody
IDWR_WaterRightsAccounting_Net_
Pump at Snake River
Snake River Below Dry Bed Canal to At Lorenzo ID
HAWLEY SPRINGS NR HEISE ID
SNAKE RIVER AT BRIDGE XING NR RIRIE ID
Timeseries ID 13037980 Name 13037980
Timeseries ID 13037980
13037980
13037980
Cfs
Date
Show Legend
Print
Close

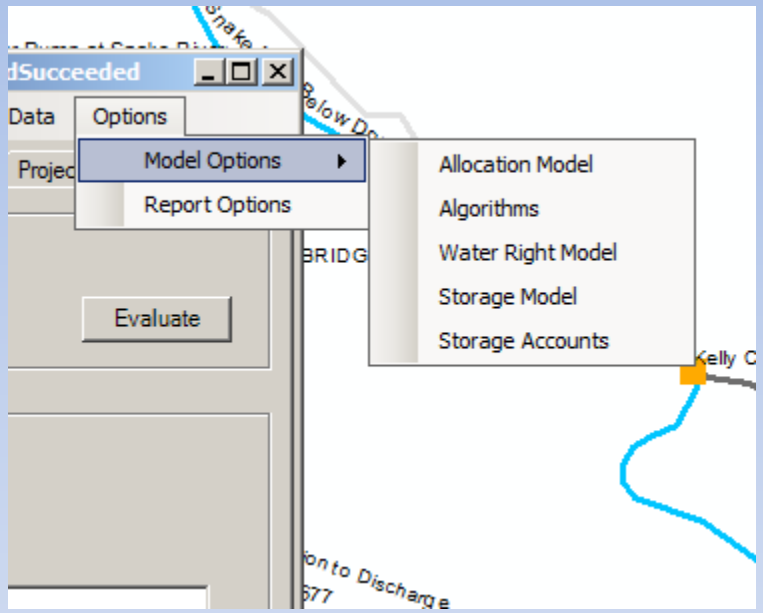
Import Tools

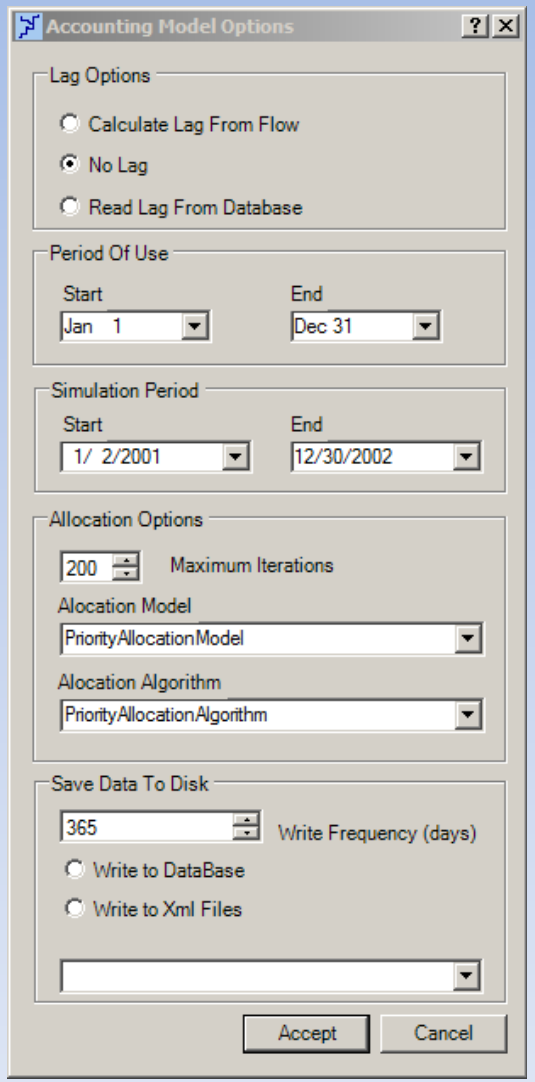


Import Old Accounting Model Data

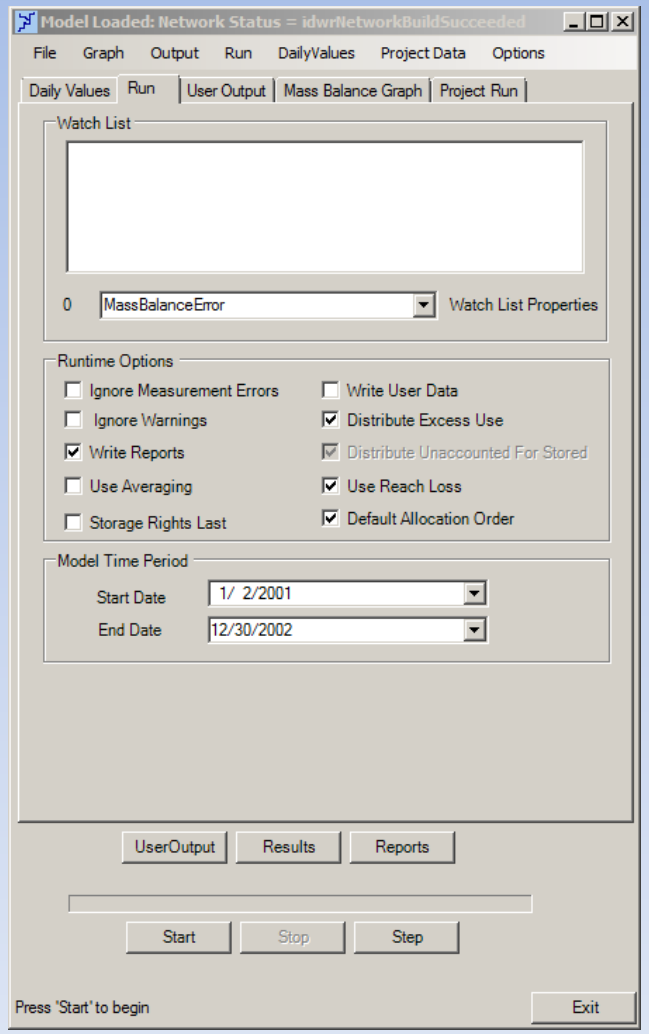
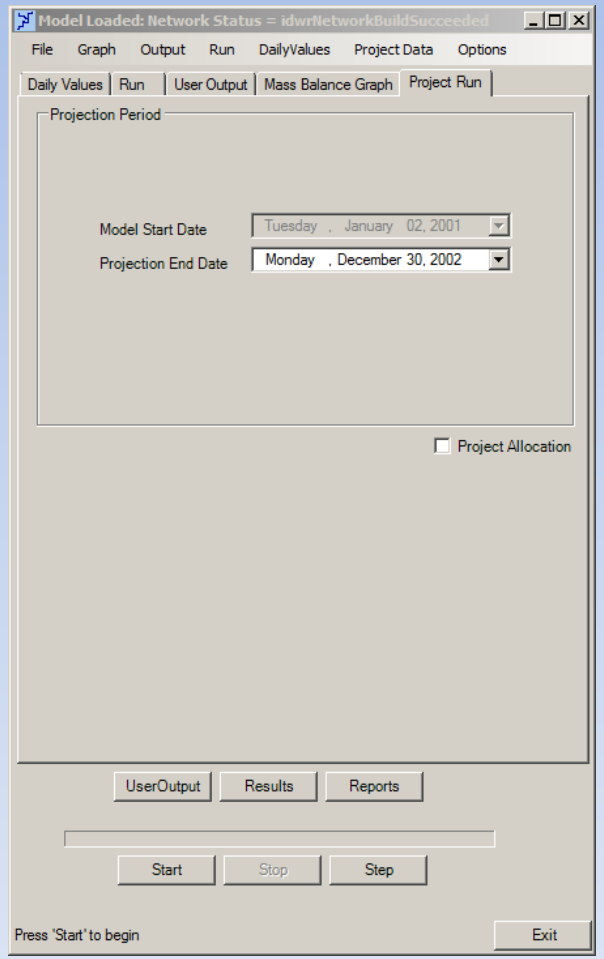


Water Right Model Options





Run Options


Model Loaded: Network Status = idwrNetworkBuildSucceeded
File
Graph
Output
Run
DailyValues
Project Data
Options
Daily Values
Run
User Output
Mass Balance Graph
Project Run
Watch List
0
MassBalanceError
Watch List Properties
Runtime Options
Ignore Measurement Errors
Ignore Warnings
Write Reports
Use Averaging
Storage Rights Last
Write User Data
Distribute Excess Use
Distribute Unaccounted For Stored
Use Reach Loss
Default Allocation Order
Model Time Period
Start Date
1/ 2/2001
End Date
12/30/2002
UserOutput
Results
Reports
Start
Stop
Step
Press 'Start' to begin
Exit

Projected Data