LEC CUTBACKS

(SFWMM Technical Training Series)

Sept. 4, 2002
Larry Brion
(HSM, SFWMD)

SFWMM ALGORITHMS FOR SHORT-TERM WATER RESTRICTIONS IN THE LEC DEVELOPED AREA

- Need arose to incorporate District's Water Shortage Plan (SFWMD, 1991)
- Allows simulation of cutbacks to public water supply and irrigation demands in the LEC
- Required the development of 3 modules:
  - ET/Recharge model - used as a pre-processor
  - Unsaturated zone for LEC Developed Area
  - Trigger Module
- refer to pp. 152-161 of Primer to SFWMM (1999)

ET / RECHARGE MODEL

- by J. Giddings and J. Restrepo (1995)
- Developed originally to provide a more accurate method for estimating recharge component for MODFLOW
- Computes supplemental irrigation requirements, PET, unsaturated zone ET, recharge, … etc., for user-specified model grid using AFSIRS
- Input requirements:
    - Level 3 GIS Land Use
    - SCS Soil Coverage and tables
    - Model Grid
    - Reference ET (Penman-Monteith)
    - Crop and soil parameters
    - Daily rainfall
    - AFSIRS Database

AFSIRS
(Agricultural Field-Scale Irrigation Requirements Simulation Model)

- by A.G. Smajstrla of the University of Florida (1990)
- Performs crop root zone water balance on a daily-basis to compute irrigation requirements

$$\Delta STO = RAIN + NIRR - ET - DRAIN - RUNOFF$$

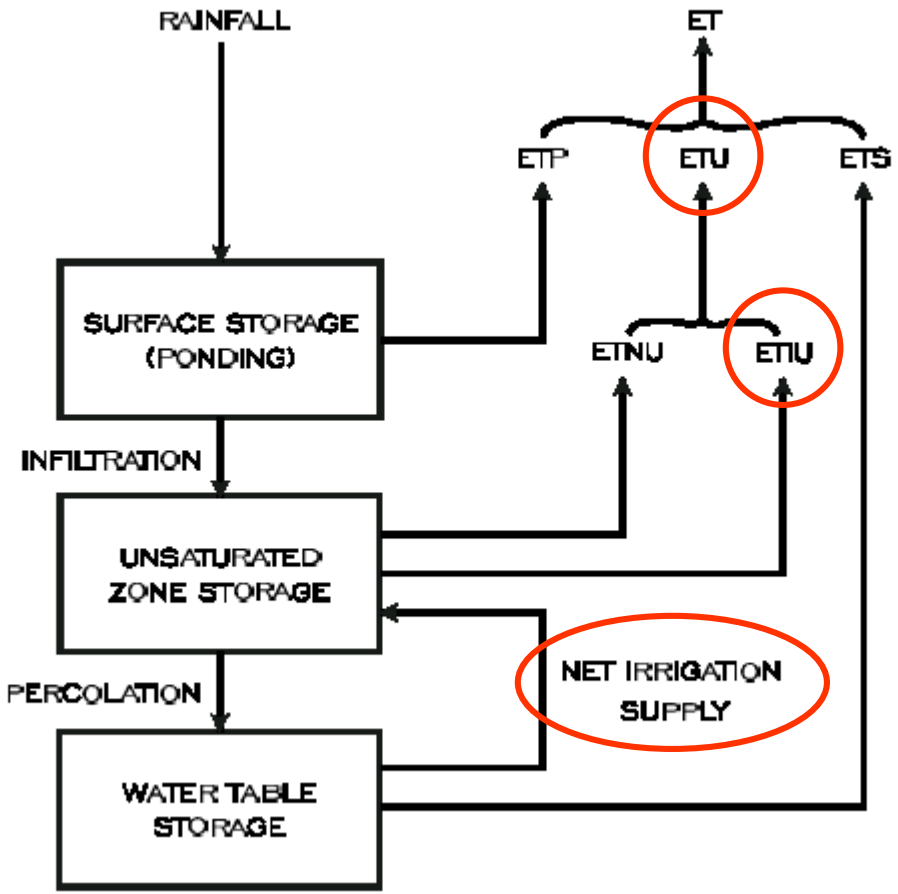
where: STO = WHC * ERZD

WHC = water holding capacity [L/L]

SFWMM Unsaturated Zone

- by C. Neidrauer, L. Brion, D. Randall & R. Santee (1993)
- Provides ability to simulate
  - unsaturated zone ET
  - irrigation demands
- Interaction of unsaturated zone with:
  - surface storage
  - water table storage
  - short-term water restrictions
  - effects of cutbacks on ET reductions

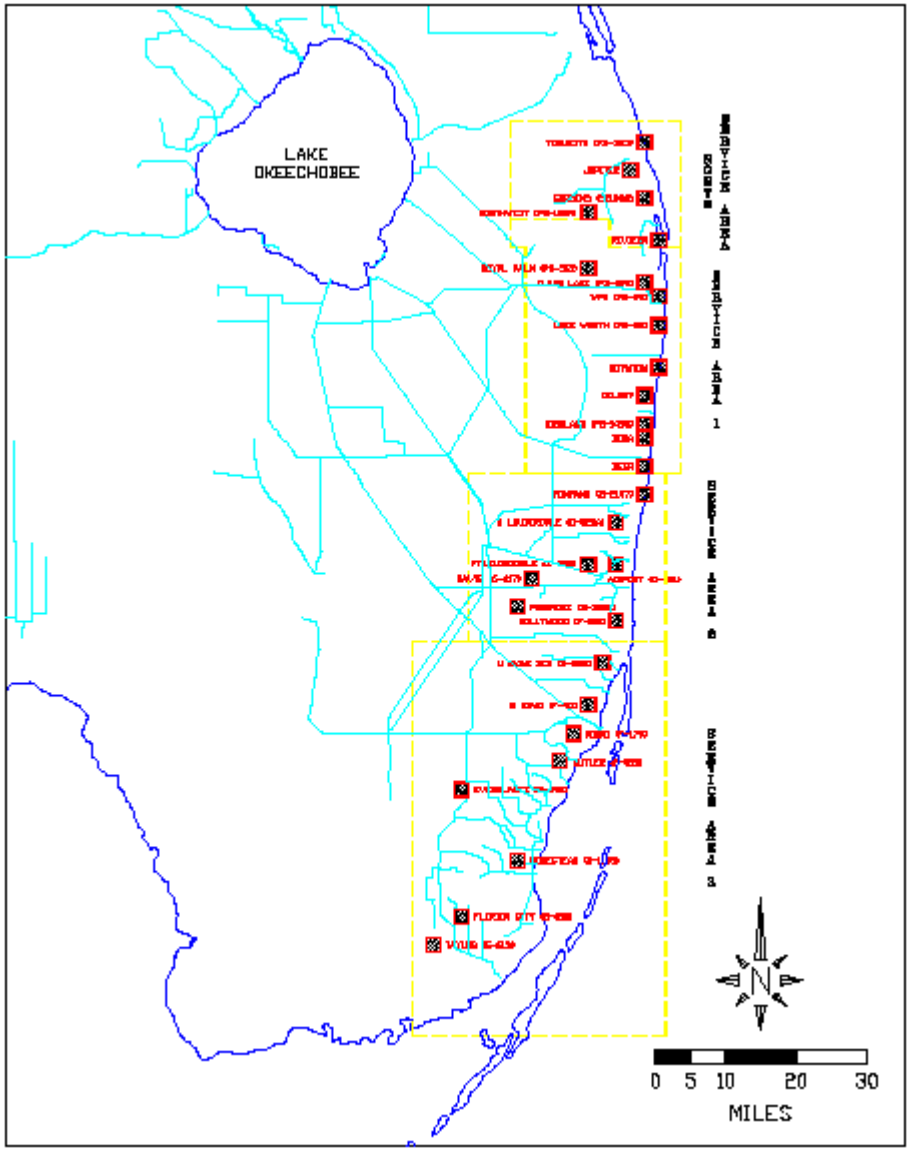
PROCESSES SIMULATED IN SFWMM FOR IRRIGATED CELLS IN THE LEC AREA



TRIGGER MODULE

- by D. Randall (WRMI), C.Neidrauer and L.Brion (1993)
- Developed to simulate short-term restrictions on water use (cutbacks)
- Heads (groundwater or canal stage) at user-defined locations (grid cells or canals) are designated as trigger locations and are compared against prescribed limits (4 levels of severity - one for each water restriction phase)
- If the head at a trigger location goes below the trigger level, then water restrictions are declared for the following month
- Cutbacks are imposed, i.e. PWS and irrigation demands are purposely not fully met
- Unsaturated zone accounting is performed with estimated effects on reducing unsaturated zone ET

TRIGGER CELL LOCATIONS IN THE LEC AREA



Procedure for Implementing the Water Shortage Plan in LEC Service Areas

- During a given month, accumulate heads at all trigger locations during trigger period.
- At the end of the month, a violation is signaled if the average heads (during the trigger period) are lower than any one of the trigger values. Also, determine the cutback amount based on the severity of violation expressed in terms of phases: phase 1 = least severe violation, phase 4 = most severe violation.
- For the following month, apply cutback, if any, for the affected zone at the appropriate trigger phase.

Other Considerations in Implementing Water Shortage Plan

- The trigger cell within a zone with the most severe violation dictates the overall trigger phase for the zone
- In addition to trigger violation (local criteria), a phase 1 cutback is also imposed in a given month if:
    - Lake Okeechobee is under supply-side management for a predetermined minimum number of days during the previous month (LOK criteria) or
    - Simulation is still in the dry season and a previous cutback was/were imposed due to trigger violation or LOK trigger (dry season criteria)

Sample Trigger Input File

```
SFWMM trigger module input file (Current Base Run)
cutbacks for public water suppliers (pws) and industrial are a fraction of total required
cutbacks for others suppliers is in terms of max inches per month
98 97  7        unit numbers for output file and echo print ; min no. of days LOK in ssm for LEC
                                                               cutbacks to be imposed next month
following table is the default cutbacks
phase         1          2          3          4
            .10        .25        .40        .55   Public Water Suppliers (PWS)
           20.0       13.3        6.7        3.3   Urban Landscape
           14.5        7.3        4.2        3.0   Nursery
            4.8        3.2        1.4         .6   Golf Course
           20.0       20.0       20.0       20.0   Agricultural Low Volume (20" represents no cb)
            6.1        6.1        3.6        3.6   Agricultural Overhead
           20.0       20.0        4.5        3.6   Agricultural Other

   6                                                Number of Zones in input
          :
          :
```

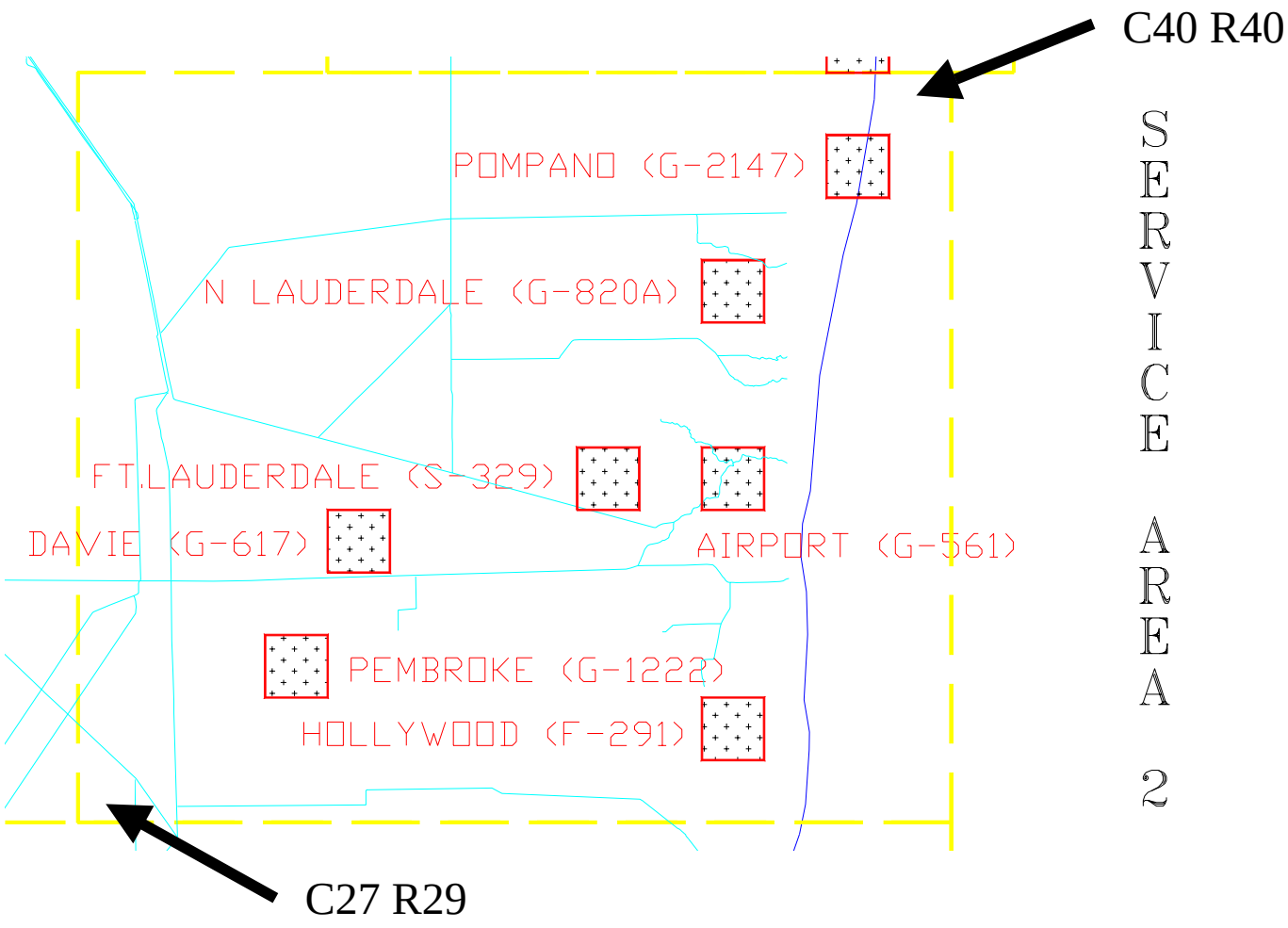
Sample Trigger Input File (Con't)

```
Lower East Coast Service Area 2
 3    zone number
      27,29    40,40                                  col,row of southwest and northeast corners
      7                                               Number of triggers in zone
gwhd
      39,39 0.75       0.25      -.25        -.75     col,row of POMPANO (G-2147) trigger, and heads
                                                       corresponding to 4 water restriction phases
              .50        .50       .25         .25    length of previous month cutback based on
default
gwhd
      37,34 1.00       0.50      0.00        -.50                AIRPORT (G-561)
              .50        .50       .25         .25
default
gwhd
      31,33 -9.0       -9.0      -9.0        -9.0                DAVIE (G-617)
              .50        .50       .25         .25
default
gwhd
      37,30 1.00       0.50      0.00        -.50                HOLLYWOOD (F-291)
              .50        .50       .25         .25
default
gwhd
      30,31 -9.0       -9.0      -9.0        -9.0                PEMBROKE (G-1222)
              .50        .50       .25         .25
default
gwhd
      35,34  .50       0.00     -0.50       -1.00                FT. LAUDERDALE (S-329)
              .50        .50       .25         .25
default
gwhd
      37,37 1.50       1.00      0.50        0.00                N LAUDERDALE (G-820A)
              .50        .50       .25         .25
default
```

Head trigger values at diff. phases

Trigger period at diff. phases

CLOSE-UP VIEW OF TRIGGER ZONE 3



Sample Trigger Output File “trigoutp”

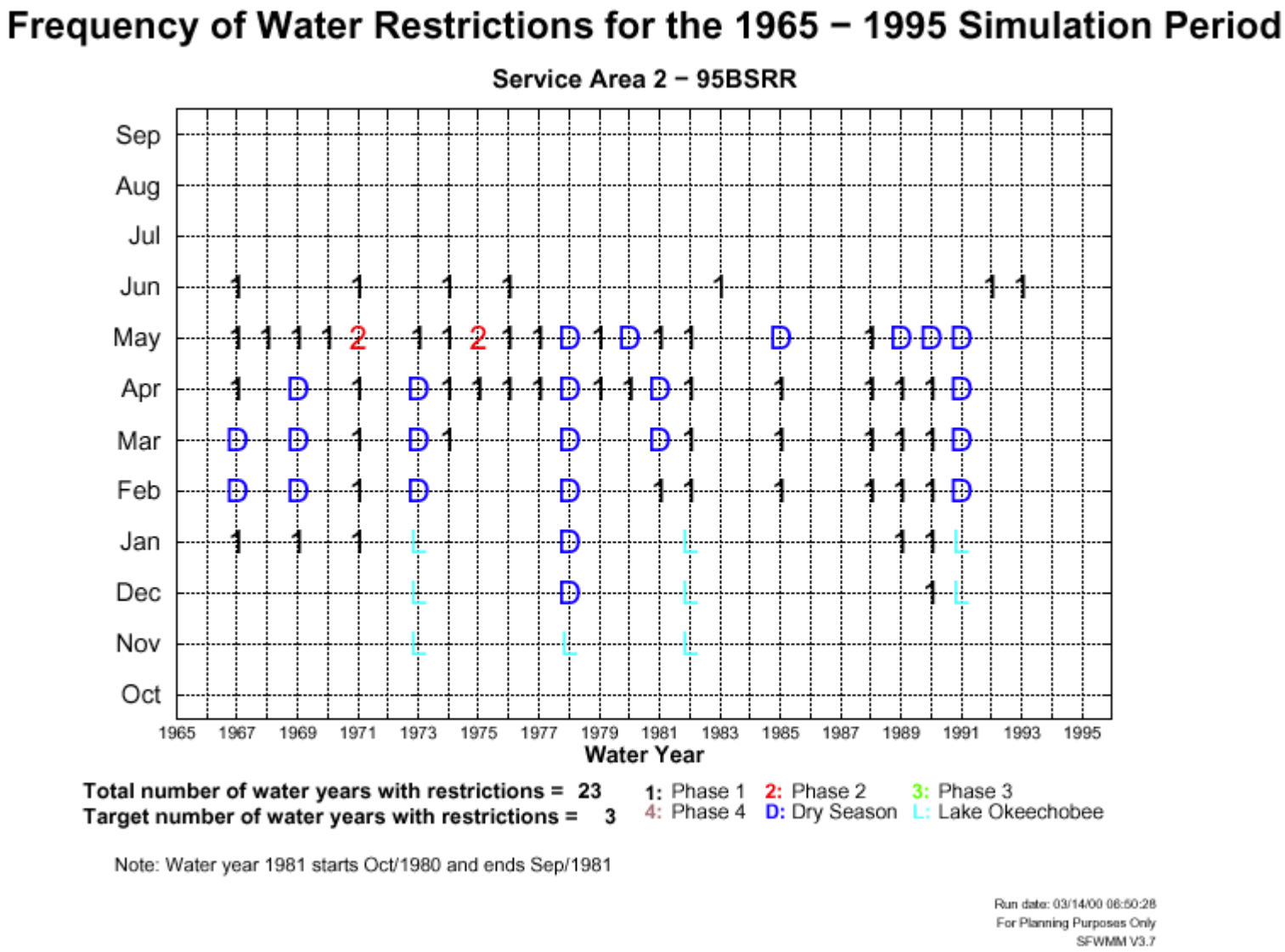
- trigoutp = contains information related to every trigger cell that’s in violation

```
Trigger module output file

             number                canal or trigger  zone simulated  trigger
year period    days zone trigger col  row   phase phase     level    level
1966     12      15    3       4  37   30       1     1      0.99     1.00
1967      1       0    3      -1   0    0       1     1
1967      2       0    3      -1   0    0       1     1
1967      3      15    3       4  37   30       1     1      0.99     1.00
1967      4      15    3       2  37   34       1     1      0.88     1.00
1967      4      15    3       4  37   30       1     1      0.85     1.00
1967      5      15    1       1  40   51       1     1      2.63     3.00
1967      5      15    2       1  40   51       1     1      2.63     3.00
1967      5      15    3       2  37   34       1     1      0.72     1.00
1967      5      15    3       4  37   30       1     1      0.66     1.00    :
:       :    :       :   :    :       :     :          :        :
```

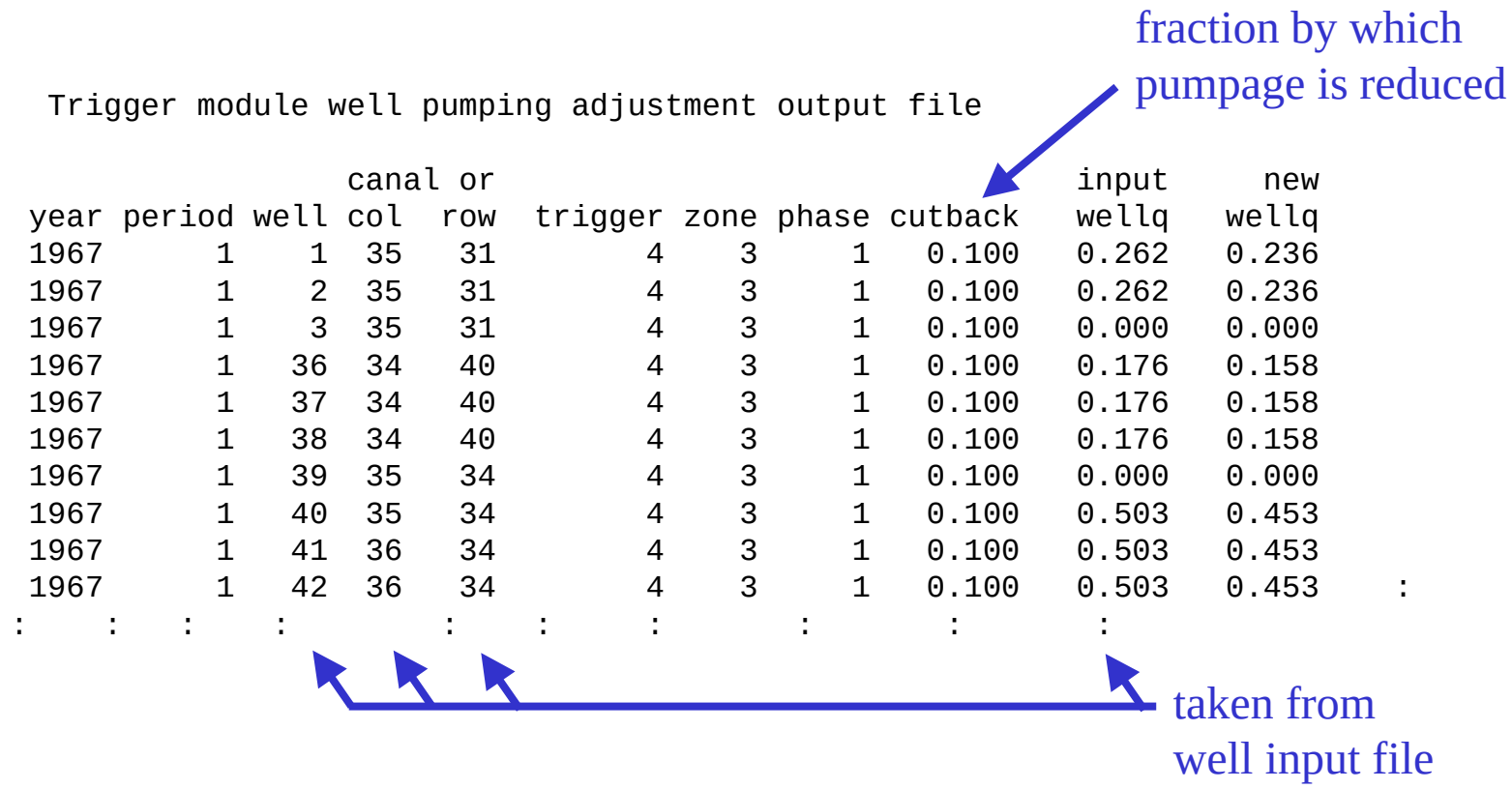
phase of the most severe violation of any trigger associated with that zone

Sample Post-Processing Output:

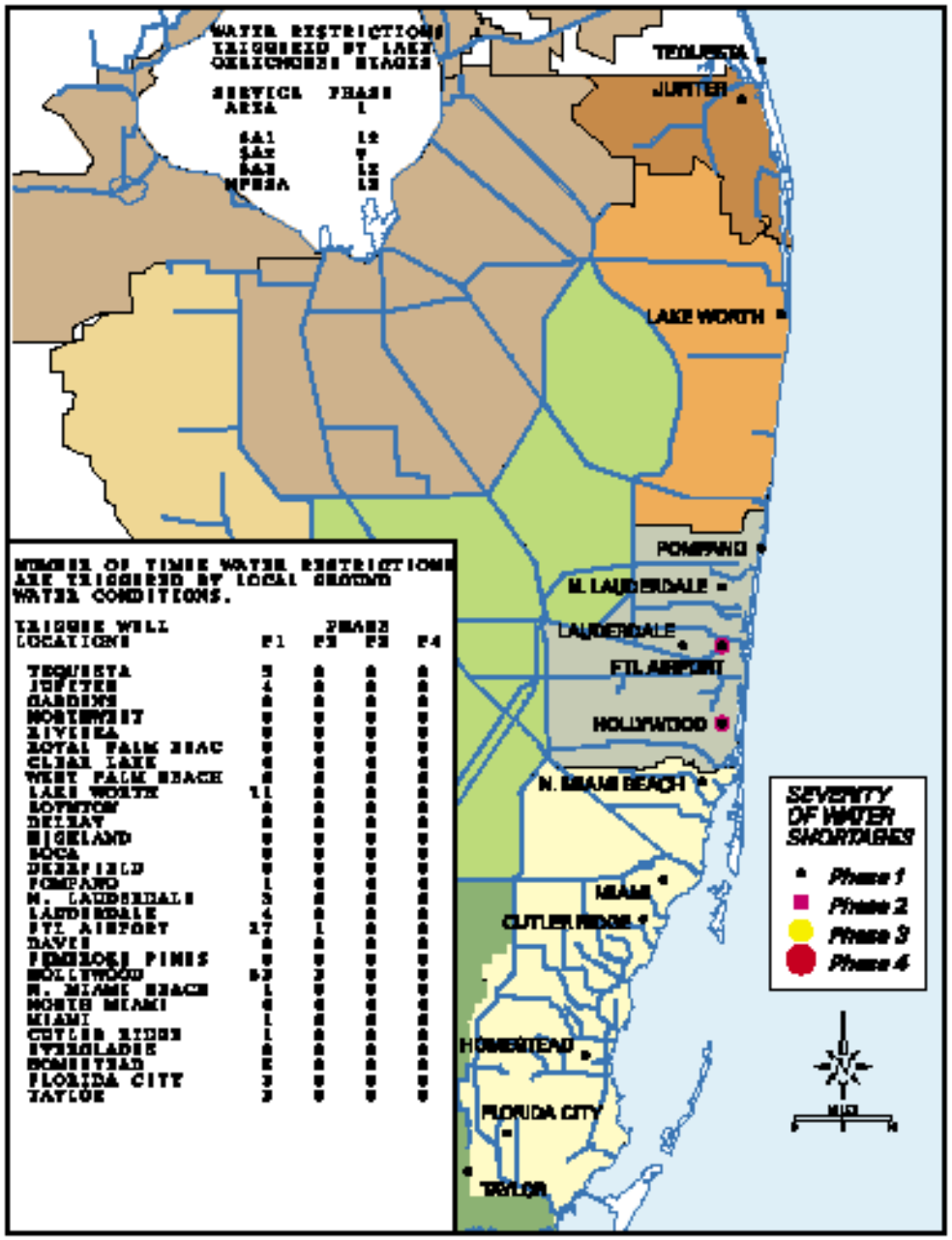


Sample Trigger Output File “trigwell”

- trigwell = contains information related to well pumpage subject to cutback



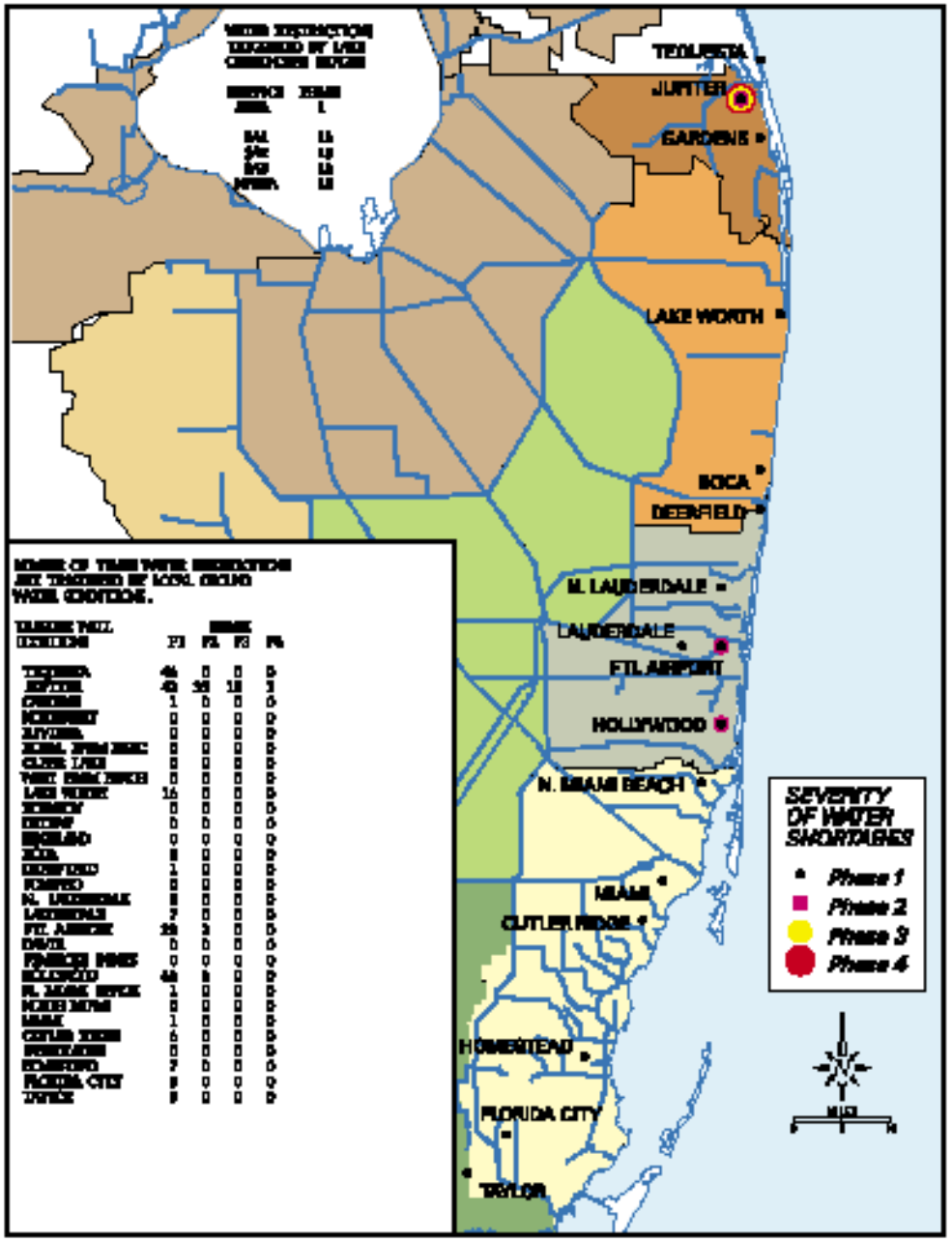
Sample Post-Processing Output: Trigger map



Frequency & Severity of Water Restriction Triggers for

SFWMM v3.7 - 95BSRR (LEC2020)

Sample Post-Processing Output: Trigger map

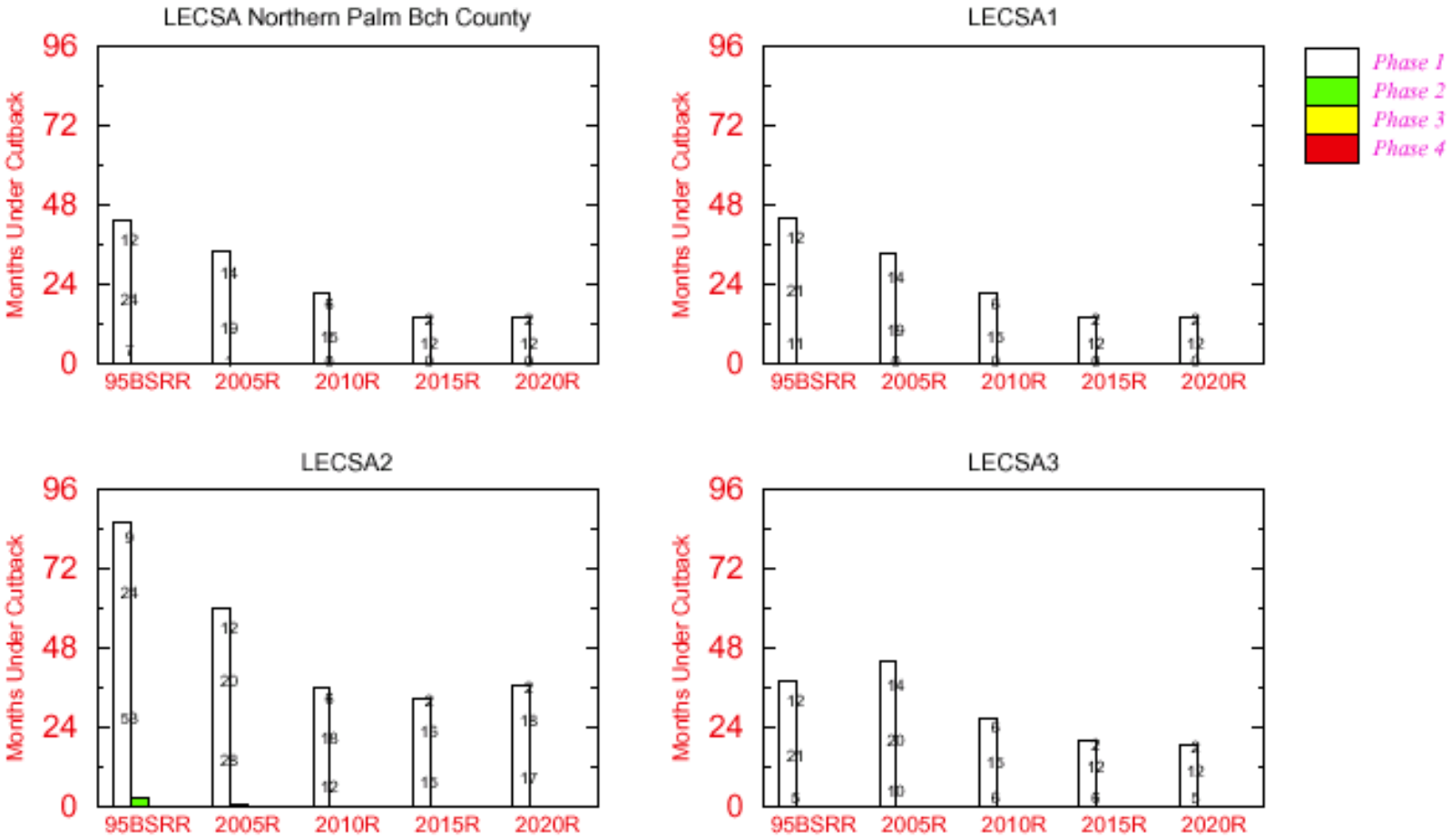


Frequency & Severity of Water Restriction Triggers for
'v3.7 - Permitted 2'

Performance Measure Graphics Associated with LEC Water Restrictions

Number of Months of Simulated Water Supply Cutbacks

for the 1965 − 1995 Simulation Period

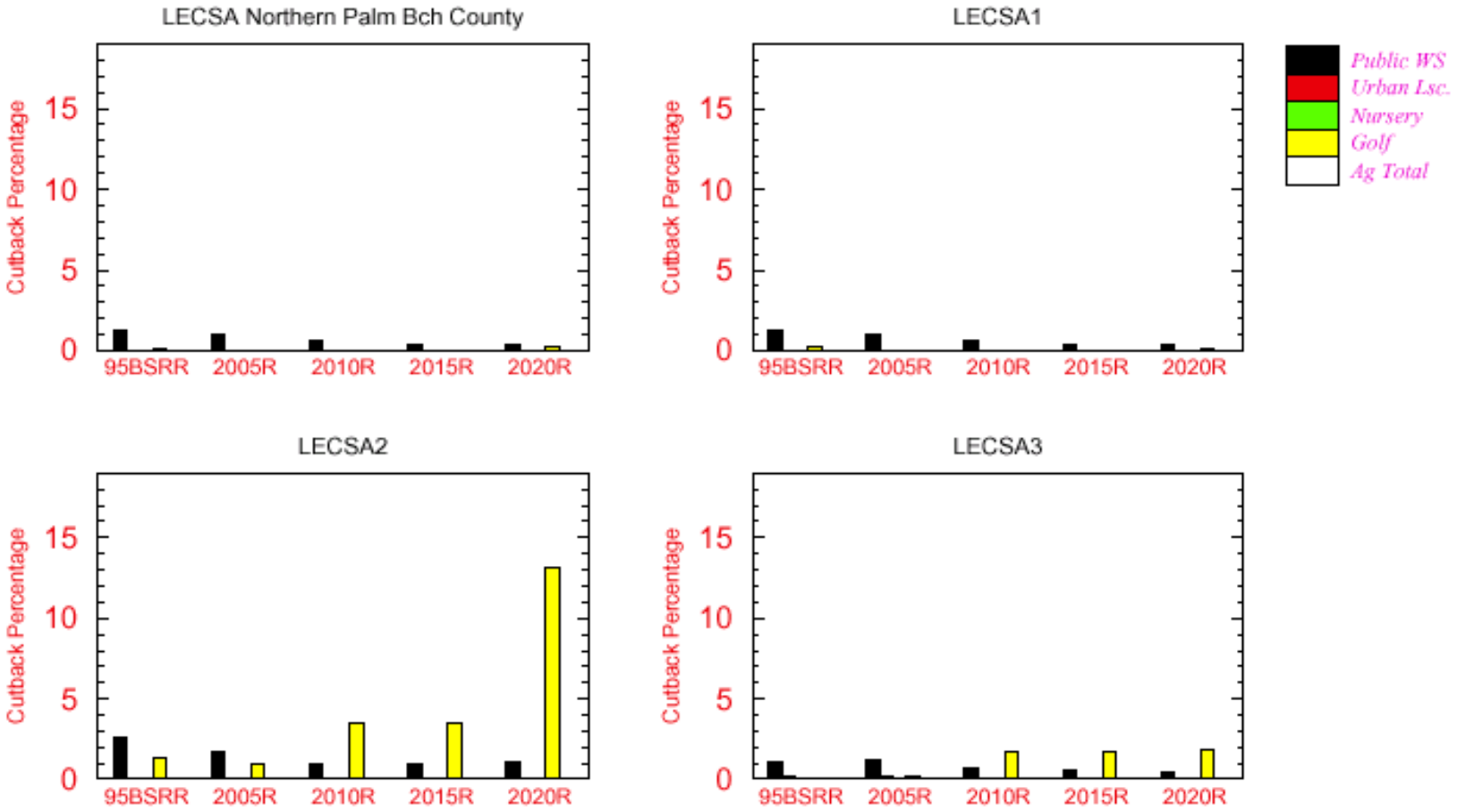


Note: Phase 1 water restrictions could be induced by a) Lake stage in Supply Side Management Zone (indicated by upper data label), b) Local Trigger well stages (lower data label), and c) Dry season criteria (indicated by middle data label).

Run date: 03/14/00 06:23:18
For Planning Purposes Only
SFWMM V3.7

Percentage of Simulated Water Supply Cutbacks by Use−Type

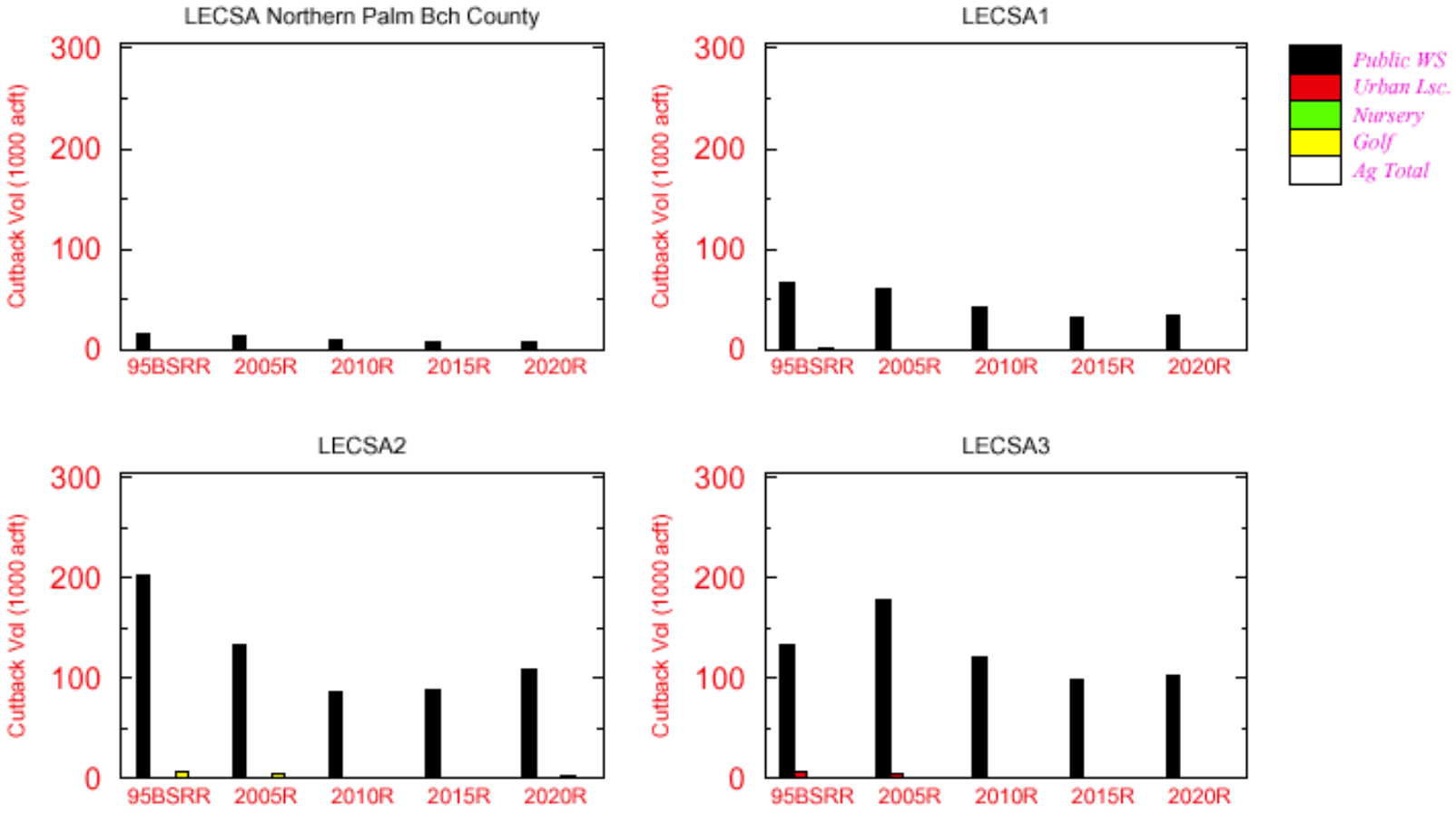
for the 1965 − 1995 Simulation Period



Run date: 03/14/00 08:25:06
For Planning Purposes Only
SFWMM V3.7

Volume of Simulated Water Supply Cutbacks by Use−Type

for the 1965 − 1995 Simulation Period



Run date: 03/14/00 08:25:06
For Planning Purposes Only
SFWMM V3.7

THANKS !

(SFWMM Technical Training Series)

Sept. 4, 2002

Larry Brion
(HSM, SFWMD)