

**UPPER RIO GRANDE WATER OPERATION MODEL
PHYSICAL ACCOUNTING
ABIQUIU RESERVOIR ACCOUNTING EXAMPLE**

April 5, 1995 Data

Total Content = 185,996 ac-ft
SJ-C Content = 181,069 ac-ft
RG Content = -737 ac-ft
Accumulated Sediment = 5,663 ac-ft

April 6, 1995 Data

2400 HR Pool Elevation = 6,219.24 ft
Total Content = 186,200 ac-ft (Total Area = 4,072 Ac.)
Pan Evap = 0.26 in/day
Precip Rate = 0 in/day

Outflow = 536 cfs = 1063 ac-ft
RG Outflow = 501 cfs = 994 ac-ft
SJ-C Inflow = 35 cfs = 69 ac-ft
SJ-C Outflow = 35 cfs = 69 ac-ft
Accumulated Sediment = 5667 ac-ft
Sediment = 4 ac-ft

Physical Loss & Inflow Calculation

$$\text{Evap. Loss} = \frac{\text{Pan Evap} * \text{Pan Evap Coef}}{12 \text{ in/ft}} * \text{Area}$$

(Use Pan Evaporation Coefficient = 0.7)

$$= \frac{0.26 * 0.7}{12} * 4072$$

$$= 61.76 \text{ ac-ft}$$

Since Precip Rate = 0 Precip = 0 ac-ft

Inflow = Content - Content (-1) + Outflow + Evap - Precip

$$\begin{aligned} &= 186,200 - 185,996 + 1,063 + 61.76 - 0 \\ &= 1,328.76 \text{ ac-ft} \end{aligned}$$

Preliminary Report States 1,330 ac-ft
(Rounding Difference?)

ABIQUIU RESERVOIR ACCOUNTING EXAMPLE - CONTINUED

Pre-Reservoir Loss Calc

From Pre-Res Area Table (Table is in RiverWare)

Control Area = 7,477.0 ac

Barren Area = 7,189.0 ac

Irrigated Area = 0.0 ac

Meadow Area = 0.0 ac

River Area = 288.0 ac

Pre-Res Loss = Barren Loss + Irrig Loss + Meadow Loss + River Loss

Irrig Loss & Meadow Loss = 0 ac-ft since Area = 0 ac

Barren Loss = $\frac{\text{Precip Rate}}{12 \text{ in/ft}} \times \text{Barren Area}$

$$= \frac{0}{12} \times 7189.0 = 0 \text{ ac-ft}$$

River Loss = $\frac{\text{Pan Evap} \times .7}{12 \text{ in/ft}} \times \text{River Area}$

$$= \frac{0.26 \times .7}{12} \times 288 = 4.37 \text{ ac-ft}$$

Pre-Res Loss = 0 ac-ft + 0 ac-ft + 0 ac-ft + 4.37 ac-ft

$$= 4.37 \text{ ac-ft}$$

Present Loss Calc

From Present River Area Table (Table is in RiverWare)

For Elev 6,219.24; River Area = 88 ac

Present Loss = Barren Loss + River Loss + Lake Loss

Lake Area = 4,072.0 ac

Barren Area = Control Area – Lake Area – River Area

$$= 7,477 - 4,072 - 88$$

$$= 3,317 \text{ ac}$$

ABIQUIU RESERVOIR ACCOUNTING EXAMPLE - CONTINUED

Present Loss Calc (cont)

$$\text{Barren Loss} = \frac{\text{Precip Rate}}{12} \times \text{Barren Area}$$

$$= \frac{0}{12} \times 3,317 = 0 \text{ ac-ft}$$

$$\text{Lake Loss} = \frac{\text{Pan Evap} \times .7}{12} \times \text{Lake Area}$$

$$= \frac{.26 \times .7}{12} \times 4,072.0 = 61.76 \text{ ac-ft}$$

*(same as physical loss)

$$\text{River Loss} = \frac{\text{Pan Evap} \times .7}{12} \times \text{River Area}$$

$$= \frac{.26 \times .7}{12} \times 88 = 1.33 \text{ ac-ft}$$

$$\begin{aligned} \text{Present Loss} &= \text{Barren Loss} + \text{River Loss} + \text{Lake Loss} \\ &= 0 \text{ ac-ft} + 1.33 \text{ ac-ft} + 61.76 \text{ ac-ft} \\ &= 63.09 \text{ ac-ft} \end{aligned}$$

$$\begin{aligned} \text{Net RG} + \text{Net SJ-C Loss} &= \text{Present Loss} - \text{Pre Res Loss} \\ &= 63.09 - 4.37 \\ &= 58.72 \text{ ac-ft} \end{aligned}$$

Hypothetical Loss Calc (Hypo)

This is an iterative calculation until the RG Content is within 0.5 ac-ft of previously computed RG Content. To start the iteration use the previous days RG Content. For Abiquiu you also need the Accumulated Sediment, which is calculated separately and is a function of inflow and reservoir elevation. From sediment calculations, the accumulated sediment is 5,667 ac-ft.

First determine Net RG Loss & Net SJ-C Loss starting with previous day's RG Content and Area.

April 5 Data:

From Hypo Area Table (Table is in RiverWare)

Based on Elevation of RG Content – 737.00, Elevation = 6,077.0 ft

River Area = 288.0 ac

Lake Area = 0.0 ac

Barren Area = Control Area – Lake Area – River Area

$$= 7,477 - 0 - 288$$

$$= 7,189 \text{ ac}$$

ABIQUIU RESERVOIR ACCOUNTING EXAMPLE - CONTINUED

Hypo Loss Calc (cont)

$$\text{Hypo Loss} = \text{Barren Loss} + \text{River Loss} + \text{Lake Loss}$$

$$\text{Barren Loss} = \frac{\text{Precip Rate}}{12} \times \text{Barren Area}$$

$$= \frac{0}{12} \times 7,189 = 0 \text{ ac-ft}$$

$$\text{River Loss} = \frac{\text{Pan Evap} \times .7}{12} \times \text{River Area}$$

$$= \frac{.26 \times .7}{12} \times 288$$

$$= 4.37 \text{ ac-ft}$$

$$\text{Lake Loss} = \frac{\text{Pan Evap} \times .7}{12} \times \text{Lake Area}$$

$$= \frac{.26 \times .7}{12} \times 0 = 0 \text{ ac-ft}$$

$$\begin{aligned} \text{Hypo Loss} &= \text{Barren loss} + \text{River Loss} + \text{Lake Loss} \\ &= 0 + 4.37 + 0 \\ &= 4.37 \text{ ac-ft} \end{aligned}$$

$$\begin{aligned} \text{Net RG Loss} &= \text{Hypo Loss} - \text{Pre-Res Loss} \\ &= 4.37 - 4.37 = 0 \text{ ac-ft} \end{aligned}$$

$$\begin{aligned} \text{Net SJ-C Loss} &= (\text{Net RG} + \text{Net SJ-C Loss}) - \text{Net RG Loss} \\ &= 58.72 - 0 = 58.72 \text{ ac-ft} \end{aligned}$$

$$\text{Current SJ-C Content} = \text{Previous SJ-C Content} - \text{Net SJ-C Loss} - \text{SJ-C Release from Storage}$$

$$\begin{aligned} \text{SJ-C Release from Storage} &= \text{SJ-C Outflow} - \text{SJ-C Inflow} \\ &= 69 \text{ ac-ft} - 69 \text{ ac-ft} \\ &= 0 \text{ ac-ft} \end{aligned}$$

$$\begin{aligned} \text{Current SJ-C Content} &= 181,069 - 58.72 - 0 \\ &= 181,010.28 \text{ ac-ft} \end{aligned}$$

$$\begin{aligned} \text{Current RG Content} &= \text{Total Content} - \text{SJ-C Content} - \text{Accum Sed} \\ &= 186,200 - 181,010.28 - 5,667 \\ &= -477.28 \text{ ac-ft} \end{aligned}$$

$$\begin{aligned} \text{Check: ABS (Current RG Content} - \text{Previous RG Content)} &> 0.5 \text{ ac-ft} \\ (-477.28 - (-737)) &= 259.72 \text{ ac-ft} > .5 \text{ ac-ft} \end{aligned}$$

TRUE

Therefore, repeat Calc with new RG Content (-477.28)

ABIQUIU RESERVOIR ACCOUNTING EXAMPLE - CONTINUED

Hypo Loss (cont)

When RG Content = -477.28 ac-ft, the elevation would be 6,077.0 ft
RG Lake Area = 0.0 ac

From Hypo Area Table:
River Area = 288.0 ac
Barren Area = 7,189.0 ac (see prev. calc on pg. 3)

Since the areas are the same as the previous calc (in this particular case), the Hypo Loss remains 4.37 ac-ft.

Therefore, Net RG Loss = Hypo Loss – Pre Res Loss
= 4.37 – 4.37 = 0 ac-ft

Net SJ-C Loss = (Net RG + Net SJ-C Loss) – Net RG Loss
= 58.72 – 0 = 58.72 ac-ft

SJ-C Content = Previous SJ-C Content – Net SJ-C Loss – SJ-C Release Flow Storage
= 181,069 – 58.72 – 0
= 181,010.28 ac-ft

RG Content = Total Content – SJ-C Content – Accum Sed
= 186,200 – 181,010.28 – 5,667
= -477.28 ac-ft

Check: ABS (Current RG Content – Prev RG Content)
-477.28 – (-477.28) = 0 > 0.5

NOT TRUE
THEREFORE, STOP ITERATIONS

Other Checks

SJ-C Mass Balance:
Since Net SJ-C Loss = SJ-C Pool Loss
SJ-C Content = Previous SJ-C Content + SJ-C Inflow – SJ-C Outflow – SJ-C Pool Loss
= 181,069 + 35 – 35 – 58.72
= 181,010.82 ac-ft OK

RG Mass Balance:

RG Pool Loss = Total Pool Loss – SJ-C Pool Loss + SED
(The Total Pool Loss is equivalent to the Physical Loss)
= 61.76 – 58.72 + 4
= 7.04 ac-ft

RG Content = Previous RG Content + RG Inflow – RG Outflow – RG Pool Loss
RG Inflow = Total Inflow – SJ-C Inflow
= 1,328.76 – 69
= 1,259.76 ac-ft

ABIQUIU RESERVOIR ACCOUNTING EXAMPLE - CONTINUED

$$\begin{aligned} \text{RG Content} &= -737 + 1,259.76 - 994 - 7.04 \\ &= 478.28 \text{ ac-ft OK} \end{aligned}$$

Check of Reservoir Summary Table in Daily Programs:

$$\text{Release from storage for SJ-C is defined as: } = \text{SJ-C Outflow} - \text{SJ-C Inflow (from pg. 4)} = 0 \text{ ac-ft}$$

$$\begin{aligned} \text{Release from storage for RG is defined as: } &= \text{Previous RG Storage} - \text{Current RG Storage} \\ &\quad - \text{Net RG Loss} \\ &= -737 - (-477) - 0 = -260 \text{ AC-FT} \end{aligned}$$

$$\begin{aligned} \text{SJ-C Content} &= \text{Previous SJ-C Content} - \text{SJ-C Release from Storage} - \text{Net SJ-C Loss} \\ &= 181,069 - 0 - 58.7 \\ &= 181,010.3 \text{ ac-ft OK} \end{aligned}$$

$$\begin{aligned} \text{RG Content} &= \text{Previous RG Content} - \text{RG Release from Storage} - \text{Net RG Loss} \\ &= -737 - (-259) - 0 \\ &= -478 \text{ ac-ft} \end{aligned}$$