**Flow Comparison Discussion**

1. NOAA's Reference Operation optimizes that use of the storage reservoirs for the benefit of fish.
   - Other non-power purposes are not considered constraints (except irrigation withdrawals in the Yakima and Upper Snake).
   - Reservoirs are "pre-drafted" in the winter to reduce exceedances of 120% total dissolved gas levels in the spring.
   - Reservoir drafts to meet flow targets are only limited to provide adequate water later for resident fish minimum flows.

2. The Reference Operation increases success in meeting Biological Opinion flow targets.

| | 2004 BiOp | Reference Operation |
|---|---|---|
| McNary | | |
| Spring (Apr-Jun) | 41 | 39 |
| Summer (Jul-Aug) | 18 | 39 |
| Lower Granite | | |
| Spring (Apr-Jun) | 34 | 35 |
| Summer (Jul-Aug) | 5 | 5 |

3. The Reference Operation reduces reservoir elevations throughout the year in conflict with current sensitivities and other practical limitations.

Average number of feet from full (50 water conditions).

| | | 2004 BiOp | Reference Operation |
|---|---|---|---|
| Libby | 30-Jun | 14 | 21 |
| | 31-Aug | 21 | 23 |
| | 31-Dec | 48 | 53 |
| | 31-Mar | 79 | 81 |
| Hungry Horse | 30-Jun | 3 | 27 |
| | 31-Aug | 20 | 28 |
| | 31-Dec | 27 | 54 |
| | 31-Mar | 52 | 95 |
| Grand Coulee | 30-Jun | 3 | 0 |
| | 31-Aug | 10 | 42 |
| | 31-Dec | 6 | 50 |
| | 31-Mar | 30 | 41 |
| Dworshak | 30-Jun | 2 | 6 |
| | 31-Aug | 64 | 92 |
| | 31-Dec | 65 | 100 |
| | 31-Mar | 91 | 77 |

## 120% TOTAL DISSOLVED GAS CAP is exceeded in a Run-of-River Operation

**120% TDG CAP = 150 KCFS**

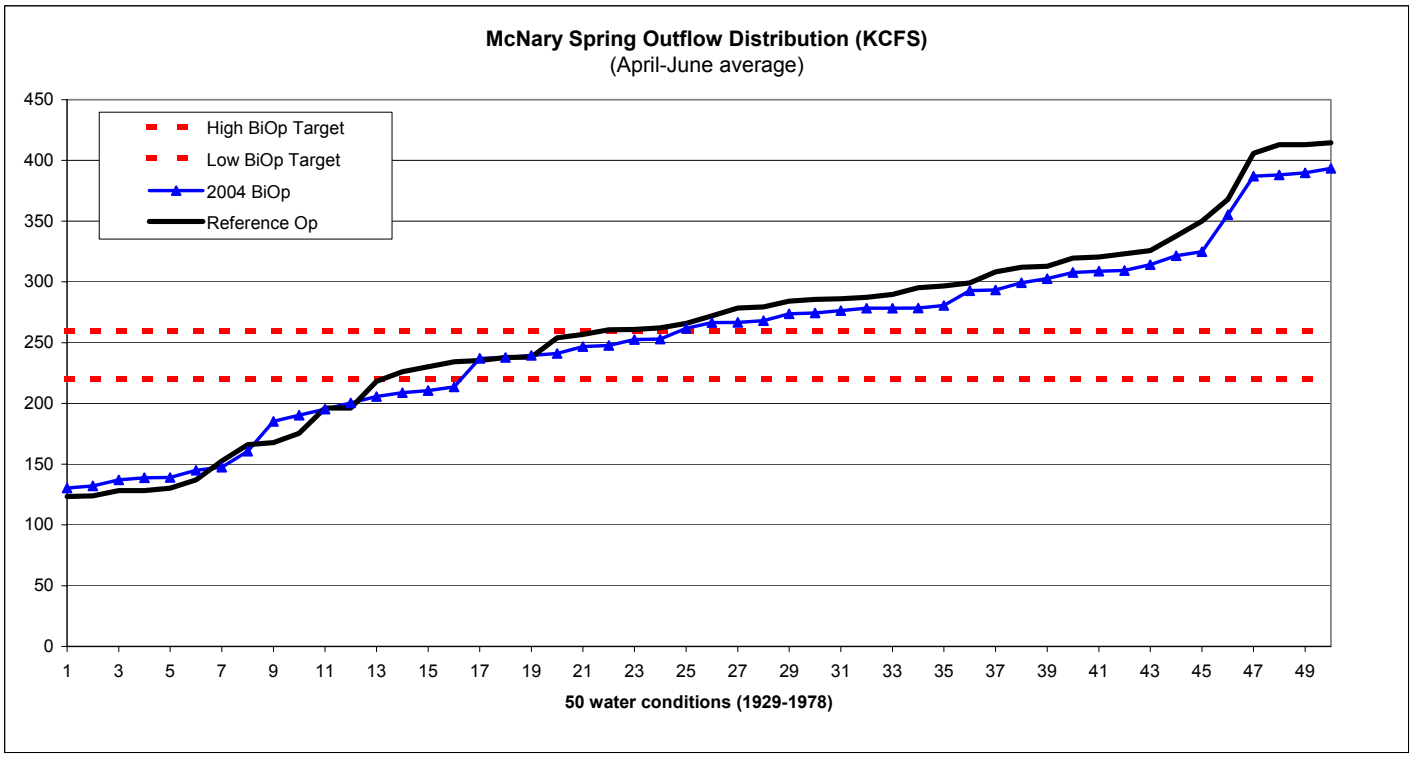
**BONNEVILLE PROJECT AS AN EXAMPLE**

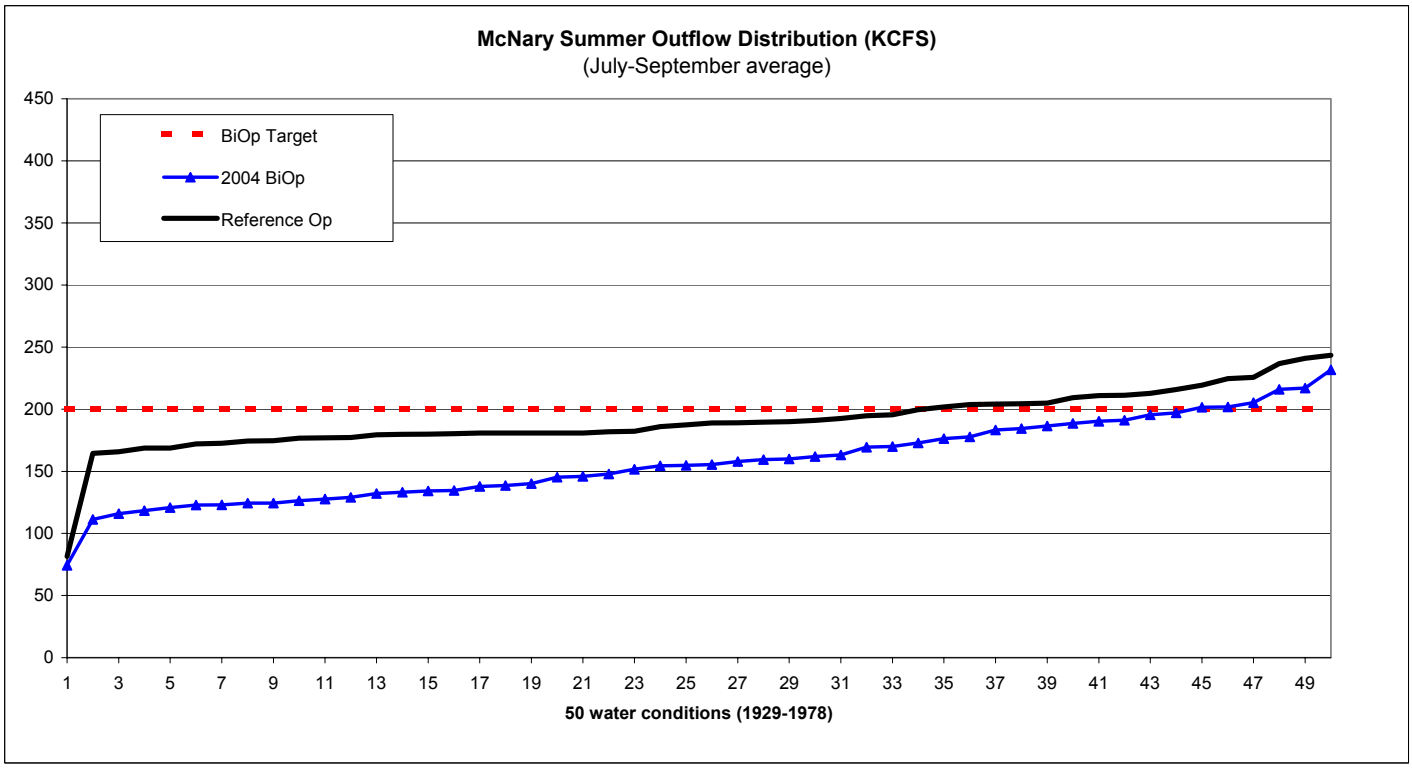
TOTAL SPILL = FORCED + BYPASS + OGEN in KCFS

| Wy Seq | Ag1 | Ag2 | SEP | OCT | NOV | DEC | JAN | FEB | MAR | Ap1 | Ap2 | MAY | JUN | JUL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1928-29 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 129 | 47 |
| 1929-30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 58 | 85 | 39 |
| 1930-31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 4 | 53 | 58 | 24 |
| 1931-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 69 | 115 | 270 | 260 | 106 |
| 1932-33 | 11 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 41 | 149 | 425 | 206 |
| 1933-34 | 63 | 32 | 0 | 0 | 9 | 52 | 76 | 31 | 36 | 131 | 226 | 184 | 99 | 60 |
| 1934-35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 136 | 209 | 99 |
| 1935-36 | 43 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 186 | 288 | 144 | 42 |
| 1936-37 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 89 | 115 | 53 |
| 1937-38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 36 | 151 | 264 | 275 | 89 |
| 1938-39 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 59 | 153 | 83 | 39 |
| 1939-40 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 48 | 68 | 125 | 102 | 31 |
| 1940-41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 62 | 112 | 33 |
| 1941-42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 77 | 105 | 200 | 101 |
| 1942-43 | 23 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 150 | 258 | 239 | 295 | 173 |
| 1943-44 | 50 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 81 | 34 |
| 1944-45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 142 | 192 | 67 |
| 1945-46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 38 | 142 | 299 | 243 | 108 |
| 1946-47 | 21 | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 18 | 43 | 62 | 280 | 211 | 100 |
| 1947-48 | 15 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 21 | 85 | 354 | 585 | 142 |
| 1948-49 | 47 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 54 | 128 | 348 | 195 | 40 |
| 1949-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 64 | 74 | 211 | 446 | 246 |
| 1950-51 | 61 | 27 | 0 | 0 | 2 | 4 | 14 | 46 | 7 | 75 | 119 | 340 | 248 | 140 |
| 1951-52 | 70 | 12 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 75 | 212 | 362 | 220 | 78 |
| 1952-53 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 172 | 337 | 142 |
| 1953-54 | 29 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 49 | 277 | 350 | 219 |
| 1954-55 | 99 | 60 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 110 | 346 | 220 |
| 1955-56 | 59 | 3 | 0 | 0 | 0 | 12 | 21 | 0 | 22 | 86 | 249 | 459 | 446 | 149 |
| 1956-57 | 30 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 48 | 41 | 381 | 308 | 63 |
| 1957-58 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 34 | 91 | 332 | 242 | 46 |
| 1958-59 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 59 | 62 | 198 | 349 | 192 |
| 1959-60 | 36 | 7 | 24 | 45 | 18 | 0 | 0 | 0 | 0 | 148 | 84 | 153 | 226 | 107 |
| 1960-61 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 21 | 53 | 47 | 196 | 384 | 67 |
| 1961-62 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 138 | 183 | 213 | 80 |
| 1962-63 | 21 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 28 | 153 | 172 | 91 |
| 1963-64 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 15 | 159 | 424 | 211 |
| 1964-65 | 47 | 13 | 0 | 0 | 0 | 24 | 24 | 16 | 0 | 35 | 185 | 273 | 336 | 140 |
| 1965-66 | 54 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 78 | 18 | 142 | 134 | 98 |
| 1966-67 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 13 | 147 | 450 | 183 |
| 1967-68 | 39 | 2 | 0 | 0 | 0 | 0 | 0 | 8 | 8 | 7 | 12 | 86 | 227 | 129 |
| 1968-69 | 21 | 13 | 6 | 1 | 0 | 0 | 6 | 0 | 0 | 132 | 213 | 228 | 236 | 88 |
| 1969-70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 145 | 289 | 58 |
| 1970-71 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 39 | 0 | 44 | 66 | 429 | 427 | 155 |
| 1971-72 | 66 | 8 | 0 | 0 | 0 | 0 | 0 | 21 | 117 | 133 | 43 | 327 | 529 | 206 |
| 1972-73 | 78 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 | 94 | 29 |
| 1973-74 | 0 | 0 | 0 | 0 | 0 | 0 | 89 | 33 | 20 | 96 | 163 | 318 | 570 | 269 |
| 1974-75 | 73 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 196 | 393 | 229 |
| 1975-76 | 18 | 10 | 0 | 0 | 0 | 34 | 11 | 0 | 0 | 94 | 74 | 338 | 251 | 168 |
| 1976-77 | 113 | 84 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 50 | 8 |
| 1977-78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 90 | 71 | 199 | 244 | 146 |

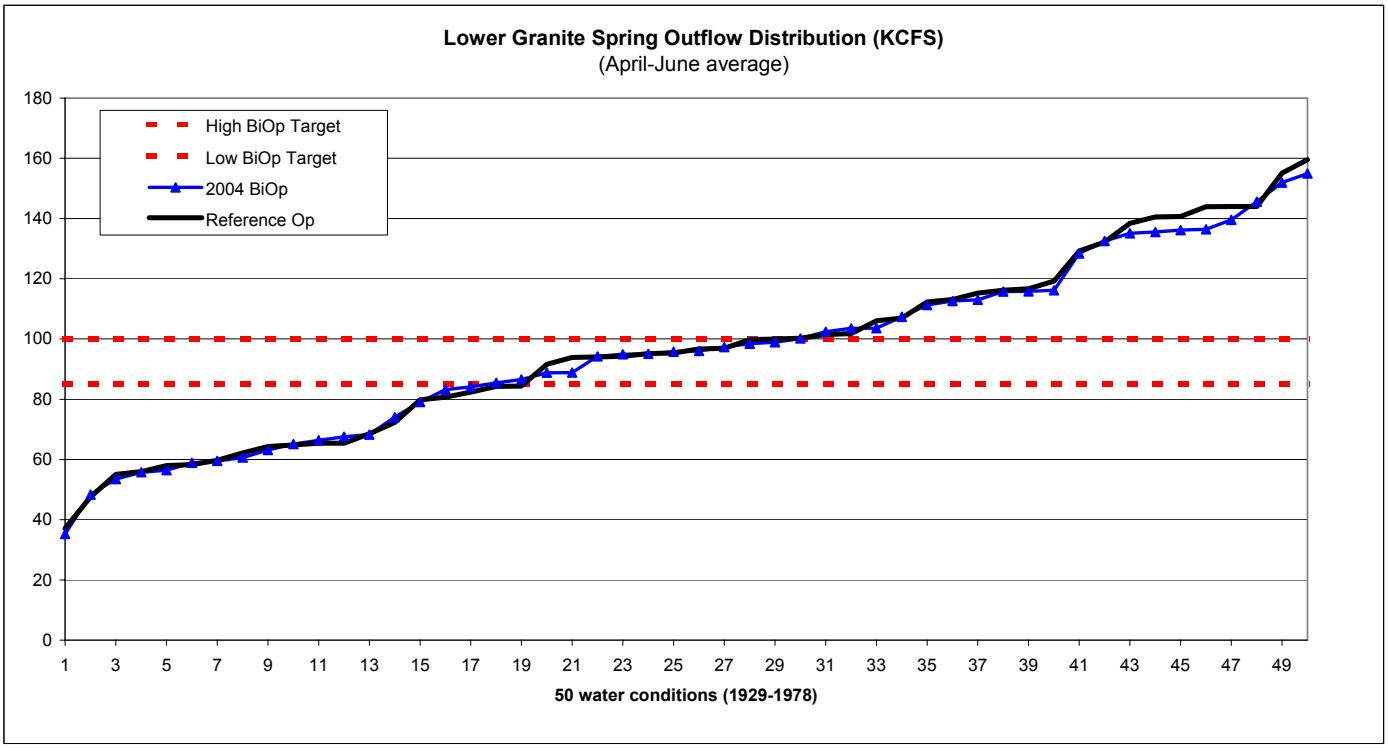
| 120% TDG Cap Exceeded by more than: | May | June |
|---|---|---|
| 40 kcfs | 50% | 72% |
| 70 kcfs | 40% | 58% |
| 100 kcfs | 36% | 44% |

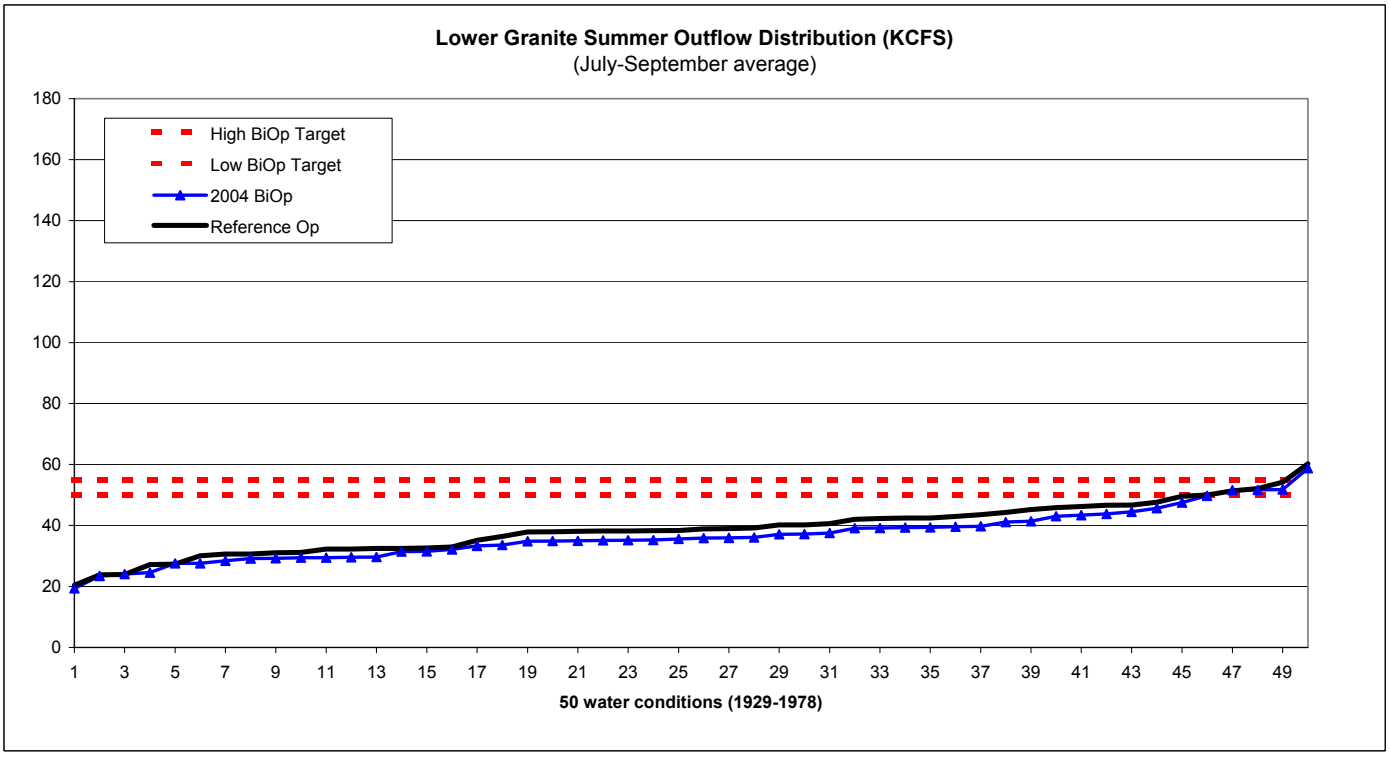
**Background for #2: Success Meeting BiOp Flow Augmentation Targets.**



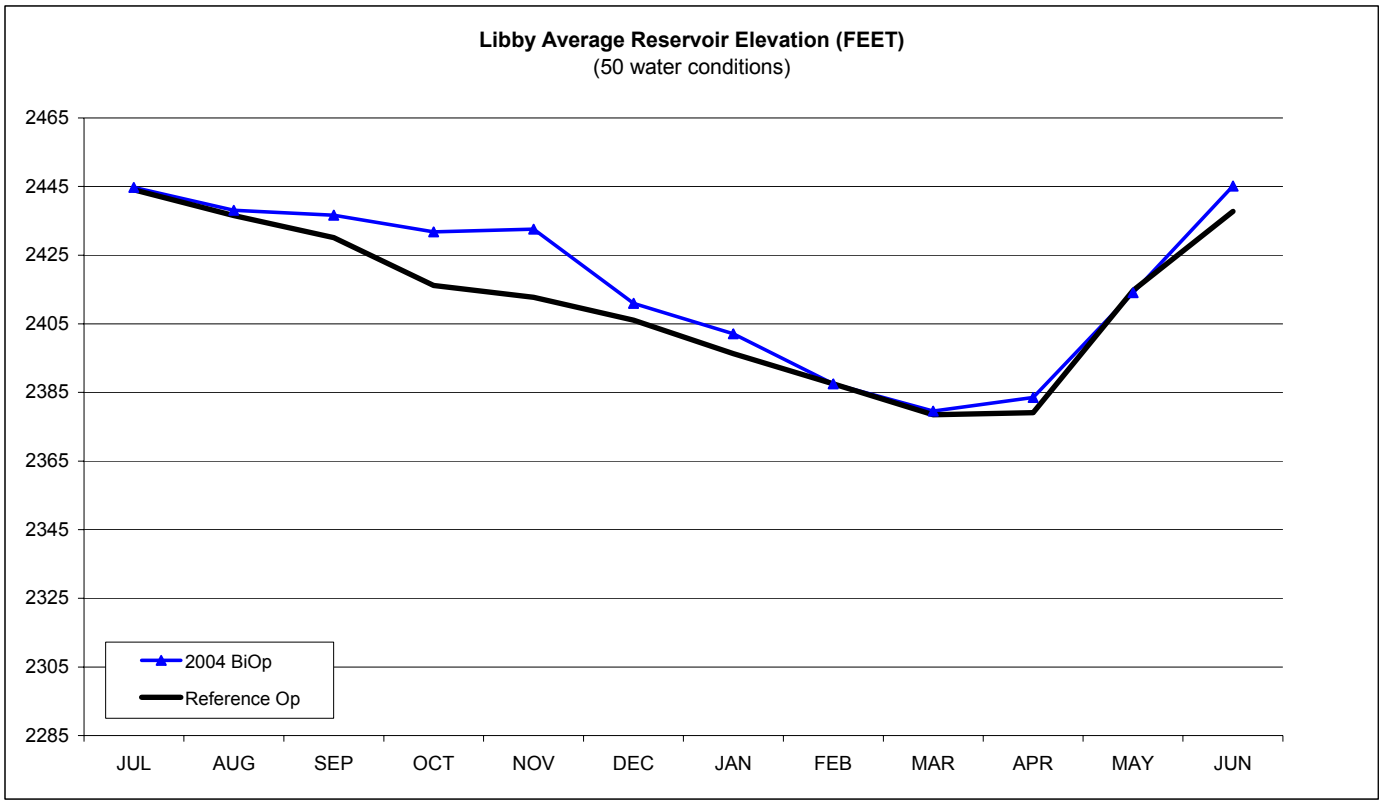



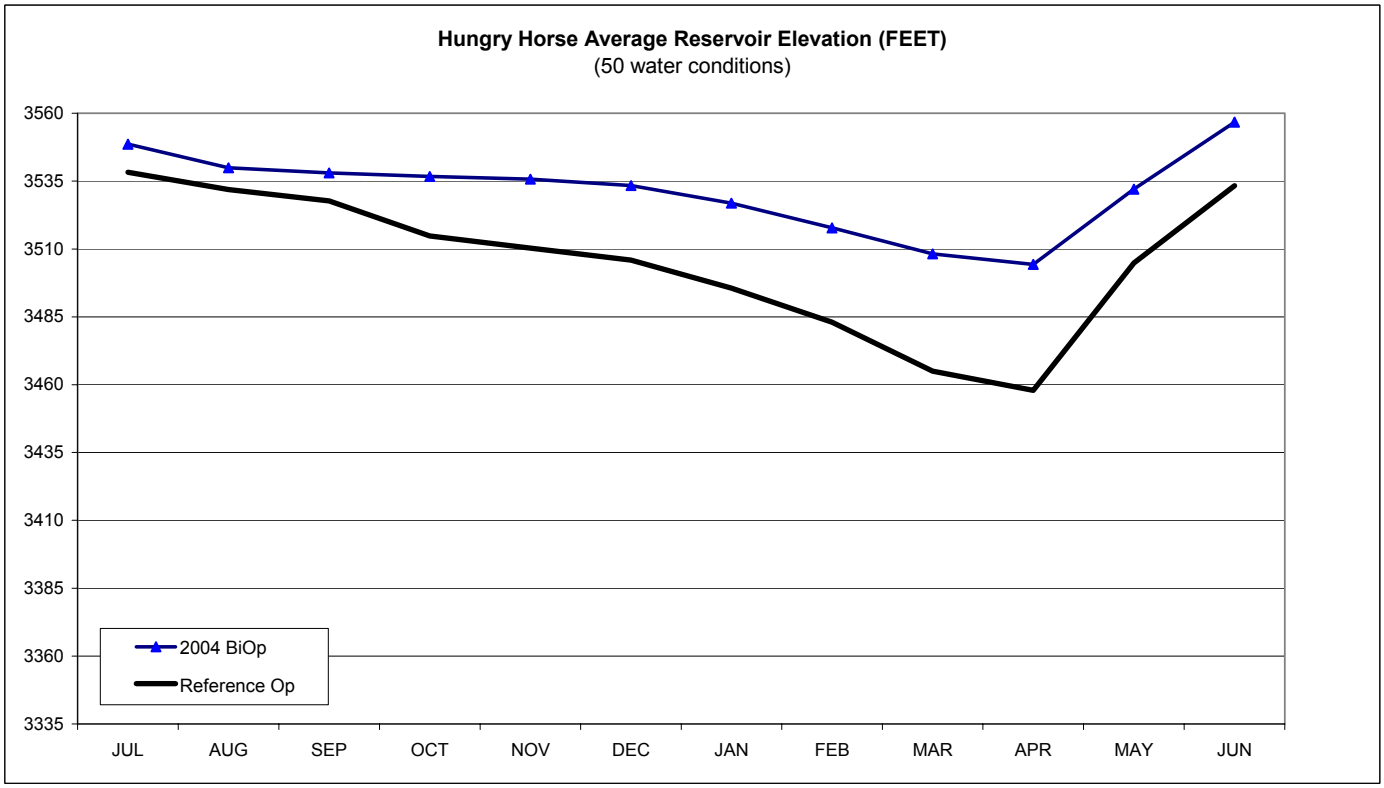
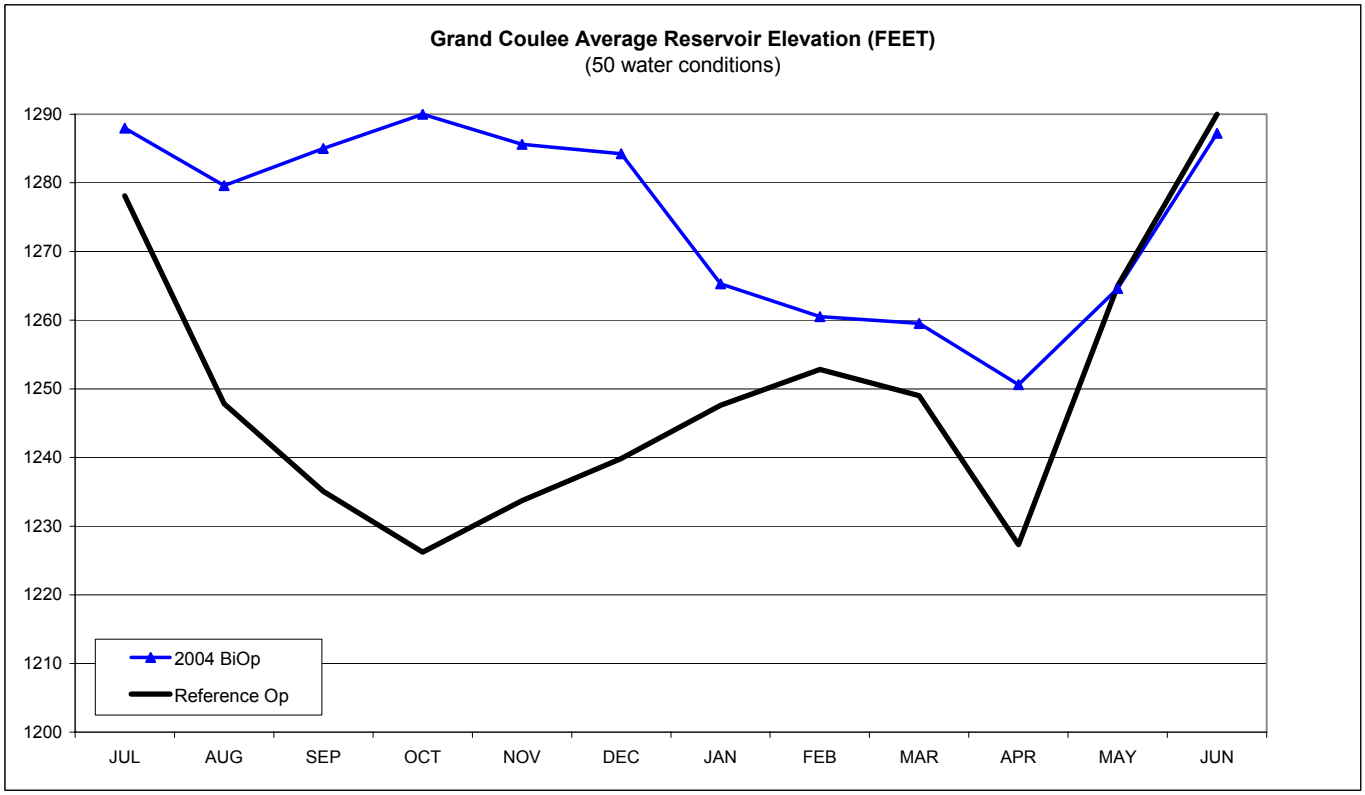
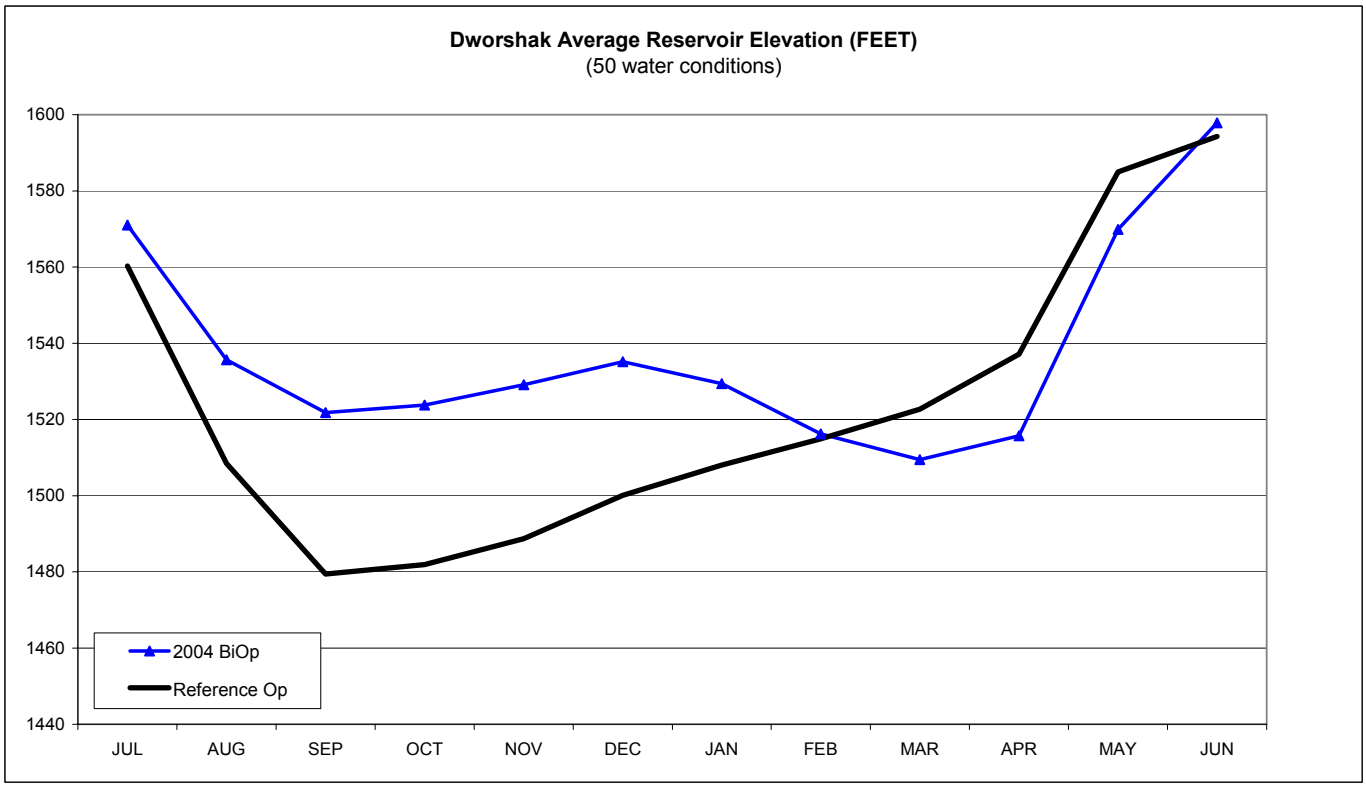
**Background for #2: Success Meeting BiOp Flow Augmentation Targets.**



**Background for #3: Reservoir Elevation Impacts.**






**Background for #3: Reservoir Elevation Impacts.**