

Comparison of Coal Bed Natural Gas-Related Disposal to Receiving Drainage Hydrology Following 70% Conveyance Loss

Antelope Creek Near Teckla, Wyoming (Station 06364700)

| Alternative | | | | | | | | | | | | | |
|-------------|-------------------------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|
| Month | Receiving Drainage Streamflow (cfs) | 2003 | | | 2010 | | | 2015 | | | 2020 | | |
| | | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) |
| | | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) |
| Oct | 1.1 | 3.0 | 0.9 | 81.8% | 10.9 | 3.3 | 300.0% | 13.5 | 4.1 | 372.7% | 12.9 | 3.9 | 354.5% |
| Nov | 0.5 | 3.0 | 0.9 | 180.0% | 10.9 | 3.3 | 660.0% | 13.5 | 4.1 | 820.0% | 12.9 | 3.9 | 780.0% |
| Dec | 0.3 | 3.0 | 0.9 | 300.0% | 10.9 | 3.3 | 1100.0% | 13.5 | 4.1 | 1366.7% | 12.9 | 3.9 | 1300.0% |
| Jan | 0.3 | 3.0 | 0.9 | 300.0% | 10.9 | 3.3 | 1100.0% | 13.5 | 4.1 | 1366.7% | 12.9 | 3.9 | 1300.0% |
| Feb | 3.6 | 3.0 | 0.9 | 25.0% | 10.9 | 3.3 | 91.7% | 13.5 | 4.1 | 113.9% | 12.9 | 3.9 | 108.3% |
| Mar | 10.7 | 3.0 | 0.9 | 8.4% | 10.9 | 3.3 | 30.8% | 13.5 | 4.1 | 38.3% | 12.9 | 3.9 | 36.4% |
| Apr | 5.1 | 3.0 | 0.9 | 17.6% | 10.9 | 3.3 | 64.7% | 13.5 | 4.1 | 80.4% | 12.9 | 3.9 | 76.5% |
| May | 8.4 | 3.0 | 0.9 | 10.7% | 10.9 | 3.3 | 39.3% | 13.5 | 4.1 | 48.8% | 12.9 | 3.9 | 46.4% |
| Jun | 8.9 | 3.0 | 0.9 | 10.1% | 10.9 | 3.3 | 37.1% | 13.5 | 4.1 | 46.1% | 12.9 | 3.9 | 43.8% |
| Jul | 4.4 | 3.0 | 0.9 | 20.5% | 10.9 | 3.3 | 75.0% | 13.5 | 4.1 | 93.2% | 12.9 | 3.9 | 88.6% |
| Aug | 2.9 | 3.0 | 0.9 | 31.0% | 10.9 | 3.3 | 113.8% | 13.5 | 4.1 | 141.4% | 12.9 | 3.9 | 134.5% |
| Sep | 1.6 | 3.0 | 0.9 | 56.3% | 10.9 | 3.3 | 206.3% | 13.5 | 4.1 | 256.3% | 12.9 | 3.9 | 243.8% |

(1) Source: ENSR, October 2005

(2) CBNG Flow reduced assuming 70% conveyance loss

(3) Reduced CBNG Flow divided by Receiving Drainage Streamflow

Comparison of Coal Bed Natural Gas-Related Disposal to Receiving Drainage Hydrology Following 70% Conveyance Loss

| Little Powder River above Dry Creek Near Weston, Wyoming (Station 06324970) | | | | | | | | | | | | | |
|---|-------------------------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|
| Month | Receiving Drainage Streamflow (cfs) | Alternative | | | | | | | | | | | |
| | | 2003 | | | 2010 | | | 2015 | | | 2020 | | |
| | | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) |
| | | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) |
| Oct | 4.6 | 5.3 | 1.6 | 34.8% | 7.3 | 2.2 | 47.8% | 7.0 | 2.1 | 45.7% | 6.0 | 1.8 | 39.1% |
| Nov | 2.4 | 5.3 | 1.6 | 66.7% | 7.3 | 2.2 | 91.7% | 7.0 | 2.1 | 87.5% | 6.0 | 1.8 | 75.0% |
| Dec | 1.1 | 5.3 | 1.6 | 145.5% | 7.3 | 2.2 | 200.0% | 7.0 | 2.1 | 190.9% | 6.0 | 1.8 | 163.6% |
| Jan | 6.6 | 5.3 | 1.6 | 24.2% | 7.3 | 2.2 | 33.3% | 7.0 | 2.1 | 31.8% | 6.0 | 1.8 | 27.3% |
| Feb | 20.0 | 5.3 | 1.6 | 8.0% | 7.3 | 2.2 | 11.0% | 7.0 | 2.1 | 10.5% | 6.0 | 1.8 | 9.0% |
| Mar | 25.3 | 5.3 | 1.6 | 6.3% | 7.3 | 2.2 | 8.7% | 7.0 | 2.1 | 8.3% | 6.0 | 1.8 | 7.1% |
| Apr | 18.8 | 5.3 | 1.6 | 8.5% | 7.3 | 2.2 | 11.7% | 7.0 | 2.1 | 11.2% | 6.0 | 1.8 | 9.6% |
| May | 32.0 | 5.3 | 1.6 | 5.0% | 7.3 | 2.2 | 6.9% | 7.0 | 2.1 | 6.6% | 6.0 | 1.8 | 5.6% |
| Jun | 28.3 | 5.3 | 1.6 | 5.7% | 7.3 | 2.2 | 7.8% | 7.0 | 2.1 | 7.4% | 6.0 | 1.8 | 6.4% |
| Jul | 10.2 | 5.3 | 1.6 | 15.7% | 7.3 | 2.2 | 21.6% | 7.0 | 2.1 | 20.6% | 6.0 | 1.8 | 17.6% |
| Aug | 5.0 | 5.3 | 1.6 | 32.0% | 7.3 | 2.2 | 44.0% | 7.0 | 2.1 | 42.0% | 6.0 | 1.8 | 36.0% |
| Sep | 4.1 | 5.3 | 1.6 | 39.0% | 7.3 | 2.2 | 53.7% | 7.0 | 2.1 | 51.2% | 6.0 | 1.8 | 43.9% |

(1) Source: ENSR, October 2005

(2) CBNG Flow reduced assuming 70% conveyance loss

(3) Reduced CBNG Flow divided by Receiving Drainage Streamflow

Comparison of Coal Bed Natural Gas-Related Disposal to Receiving Drainage Hydrology Following 70% Conveyance Loss

| (Upper) Belle Fourche River Below Moorcroft, Wyoming (Station 06426500) | | | | | | | | | | | | | |
|---|-------------------------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|
| Month | Receiving Drainage Streamflow (cfs) | Alternative | | | | | | | | | | | |
| | | 2003 | | | 2010 | | | 2015 | | | 2020 | | |
| | | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) |
| | | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) |
| Oct | 13.8 | 14.4 | 4.3 | 31.2% | 13.1 | 3.9 | 28.3% | 9.9 | 3.0 | 21.7% | 7.3 | 2.2 | 15.9% |
| Nov | 4.6 | 14.4 | 4.3 | 93.5% | 13.1 | 3.9 | 84.8% | 9.9 | 3.0 | 65.2% | 7.3 | 2.2 | 47.8% |
| Dec | 3.3 | 14.4 | 4.3 | 130.3% | 13.1 | 3.9 | 118.2% | 9.9 | 3.0 | 90.9% | 7.3 | 2.2 | 66.7% |
| Jan | 8.0 | 14.4 | 4.3 | 53.8% | 13.1 | 3.9 | 48.8% | 9.9 | 3.0 | 37.5% | 7.3 | 2.2 | 27.5% |
| Feb | 27.2 | 14.4 | 4.3 | 15.8% | 13.1 | 3.9 | 14.3% | 9.9 | 3.0 | 11.0% | 7.3 | 2.2 | 8.1% |
| Mar | 55.4 | 14.4 | 4.3 | 7.8% | 13.1 | 3.9 | 7.0% | 9.9 | 3.0 | 5.4% | 7.3 | 2.2 | 4.0% |
| Apr | 35.8 | 14.4 | 4.3 | 12.0% | 13.1 | 3.9 | 10.9% | 9.9 | 3.0 | 8.4% | 7.3 | 2.2 | 6.1% |
| May | 39.4 | 14.4 | 4.3 | 10.9% | 13.1 | 3.9 | 9.9% | 9.9 | 3.0 | 7.6% | 7.3 | 2.2 | 5.6% |
| Jun | 28.1 | 14.4 | 4.3 | 15.3% | 13.1 | 3.9 | 13.9% | 9.9 | 3.0 | 10.7% | 7.3 | 2.2 | 7.8% |
| Jul | 13.1 | 14.4 | 4.3 | 32.8% | 13.1 | 3.9 | 29.8% | 9.9 | 3.0 | 22.9% | 7.3 | 2.2 | 16.8% |
| Aug | 6.8 | 14.4 | 4.3 | 63.2% | 13.1 | 3.9 | 57.4% | 9.9 | 3.0 | 44.1% | 7.3 | 2.2 | 32.4% |
| Sep | 6.3 | 14.4 | 4.3 | 68.3% | 13.1 | 3.9 | 61.9% | 9.9 | 3.0 | 47.6% | 7.3 | 2.2 | 34.9% |

(1) Source: ENSR, October 2005

(2) CBNG Flow reduced assuming 70% conveyance loss

(3) Reduced CBNG Flow divided by Receiving Drainage Streamflow

Comparison of Coal Bed Natural Gas-Related Disposal to Receiving Drainage Hydrology Following 70% Conveyance Loss

| (Upper) Cheyenne River Near Spencer, Wyoming (Station 06395000) | | | | | | | | | | | | | |
|---|-------------------------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|
| Month | Receiving Drainage Streamflow (cfs) | Alternative | | | | | | | | | | | |
| | | 2003 | | | 2010 | | | 2015 | | | 2020 | | |
| | | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) |
| | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | |
| Oct | 3.0 | 2.5 | 0.8 | 26.7% | 2.8 | 0.8 | 26.7% | 2.4 | 0.7 | 23.3% | 1.9 | 0.6 | 20.0% |
| Nov | 2.7 | 2.5 | 0.8 | 29.6% | 2.8 | 0.8 | 29.6% | 2.4 | 0.7 | 25.9% | 1.9 | 0.6 | 22.2% |
| Dec | 0.8 | 2.5 | 0.8 | 100.0% | 2.8 | 0.8 | 100.0% | 2.4 | 0.7 | 87.5% | 1.9 | 0.6 | 75.0% |
| Jan | 11.3 | 2.5 | 0.8 | 7.1% | 2.8 | 0.8 | 7.1% | 2.4 | 0.7 | 6.2% | 1.9 | 0.6 | 5.3% |
| Feb | 21.5 | 2.5 | 0.8 | 3.7% | 2.8 | 0.8 | 3.7% | 2.4 | 0.7 | 3.3% | 1.9 | 0.6 | 2.8% |
| Mar | 12.2 | 2.5 | 0.8 | 6.6% | 2.8 | 0.8 | 6.6% | 2.4 | 0.7 | 5.7% | 1.9 | 0.6 | 4.9% |
| Apr | 25.8 | 2.5 | 0.8 | 3.1% | 2.8 | 0.8 | 3.1% | 2.4 | 0.7 | 2.7% | 1.9 | 0.6 | 2.3% |
| May | 240.6 | 2.5 | 0.8 | 0.3% | 2.8 | 0.8 | 0.3% | 2.4 | 0.7 | 0.3% | 1.9 | 0.6 | 0.2% |
| Jun | 115.8 | 2.5 | 0.8 | 0.7% | 2.8 | 0.8 | 0.7% | 2.4 | 0.7 | 0.6% | 1.9 | 0.6 | 0.5% |
| Jul | 31.5 | 2.5 | 0.8 | 2.5% | 2.8 | 0.8 | 2.5% | 2.4 | 0.7 | 2.2% | 1.9 | 0.6 | 1.9% |
| Aug | 8.3 | 2.5 | 0.8 | 9.6% | 2.8 | 0.8 | 9.6% | 2.4 | 0.7 | 8.4% | 1.9 | 0.6 | 7.2% |
| Sep | 55.9 | 2.5 | 0.8 | 1.4% | 2.8 | 0.8 | 1.4% | 2.4 | 0.7 | 1.3% | 1.9 | 0.6 | 1.1% |

(1) Source: ENSR, October 2005

(2) CBNG Flow reduced assuming 70% conveyance loss

(3) Reduced CBNG Flow divided by Receiving Drainage Streamflow

Comparison of Coal Bed Natural Gas-Related Disposal to Receiving Drainage Hydrology Following 70% Conveyance Loss

| (Upper) Powder River at Arvada, Wyoming (Station 06317000) | | | | | | | | | | | | | |
|--|-------------------------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|
| Month | Receiving Drainage Streamflow (cfs) | Alternative | | | | | | | | | | | |
| | | 2003 | | | 2010 | | | 2015 | | | 2020 | | |
| | | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) |
| | | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) |
| Oct | 160.6 | 7.8 | 2.3 | 1.4% | 26.6 | 8.0 | 5.0% | 31.9 | 9.6 | 6.0% | 30.0 | 9.0 | 5.6% |
| Nov | 157.0 | 7.8 | 2.3 | 1.5% | 26.6 | 8.0 | 5.1% | 31.9 | 9.6 | 6.1% | 30.0 | 9.0 | 5.7% |
| Dec | 112.6 | 7.8 | 2.3 | 2.0% | 26.6 | 8.0 | 7.1% | 31.9 | 9.6 | 8.5% | 30.0 | 9.0 | 8.0% |
| Jan | 104.5 | 7.8 | 2.3 | 2.2% | 26.6 | 8.0 | 7.7% | 31.9 | 9.6 | 9.2% | 30.0 | 9.0 | 8.6% |
| Feb | 218.6 | 7.8 | 2.3 | 1.1% | 26.6 | 8.0 | 3.7% | 31.9 | 9.6 | 4.4% | 30.0 | 9.0 | 4.1% |
| Mar | 391.3 | 7.8 | 2.3 | 0.6% | 26.6 | 8.0 | 2.0% | 31.9 | 9.6 | 2.5% | 30.0 | 9.0 | 2.3% |
| Apr | 391.7 | 7.8 | 2.3 | 0.6% | 26.6 | 8.0 | 2.0% | 31.9 | 9.6 | 2.5% | 30.0 | 9.0 | 2.3% |
| May | 724.8 | 7.8 | 2.3 | 0.3% | 26.6 | 8.0 | 1.1% | 31.9 | 9.6 | 1.3% | 30.0 | 9.0 | 1.2% |
| Jun | 638.8 | 7.8 | 2.3 | 0.4% | 26.6 | 8.0 | 1.3% | 31.9 | 9.6 | 1.5% | 30.0 | 9.0 | 1.4% |
| Jul | 216.8 | 7.8 | 2.3 | 1.1% | 26.6 | 8.0 | 3.7% | 31.9 | 9.6 | 4.4% | 30.0 | 9.0 | 4.2% |
| Aug | 107.5 | 7.8 | 2.3 | 2.1% | 26.6 | 8.0 | 7.4% | 31.9 | 9.6 | 8.9% | 30.0 | 9.0 | 8.4% |
| Sep | 110.0 | 7.8 | 2.3 | 2.1% | 26.6 | 8.0 | 7.3% | 31.9 | 9.6 | 8.7% | 30.0 | 9.0 | 8.2% |

(1) Source: ENSR, October 2005

(2) CBNG Flow reduced assuming 70% conveyance loss

(3) Reduced CBNG Flow divided by Receiving Drainage Streamflow

Comparison of Coal Bed Natural Gas-Related Disposal to Receiving Drainage Hydrology Following 70% Conveyance Loss

| Dry Fork Cheyenne River Near Bill, Wyoming (Station 0634700) | | | | | | | | | | | | | |
|--|-------------------------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|--------------------------|------------------------|----------------------|
| Month | Receiving Drainage Streamflow (cfs) | Alternative | | | | | | | | | | | |
| | | 2003 | | | 2010 | | | 2015 | | | 2020 | | |
| | | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) | Annual CBNG Disposal (1) | Ultimate CBNG Flow (2) | Percent Increase (3) |
| | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | (cfs) | (cfs) | (%) | |
| Oct | 0.03 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 100.0% | 0.15 | 0.04 | 133.3% | 0.15 | 0.04 | 133.3% |
| Nov | 0.08 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 37.5% | 0.15 | 0.04 | 50.0% | 0.15 | 0.04 | 50.0% |
| Dec | 0.08 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 37.5% | 0.15 | 0.04 | 50.0% | 0.15 | 0.04 | 50.0% |
| Jan | 0.03 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 100.0% | 0.15 | 0.04 | 133.3% | 0.15 | 0.04 | 133.3% |
| Feb | 0.25 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 12.0% | 0.15 | 0.04 | 16.0% | 0.15 | 0.04 | 16.0% |
| Mar | 0.49 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 6.1% | 0.15 | 0.04 | 8.2% | 0.15 | 0.04 | 8.2% |
| Apr | 0.27 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 11.1% | 0.15 | 0.04 | 14.8% | 0.15 | 0.04 | 14.8% |
| May | 1.51 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 2.0% | 0.15 | 0.04 | 2.6% | 0.15 | 0.04 | 2.6% |
| Jun | 0.34 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 8.8% | 0.15 | 0.04 | 11.8% | 0.15 | 0.04 | 11.8% |
| Jul | 0.23 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 13.0% | 0.15 | 0.04 | 17.4% | 0.15 | 0.04 | 17.4% |
| Aug | 0.13 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 23.1% | 0.15 | 0.04 | 30.8% | 0.15 | 0.04 | 30.8% |
| Sep | 0.00 | 0.00 | 0.00 | #DIV/0! | 0.09 | 0.03 | #DIV/0! | 0.15 | 0.04 | #DIV/0! | 0.15 | 0.04 | #DIV/0! |

(1) Source: ENSR, October 2005

(2) CBNG Flow reduced assuming 70% conveyance loss

(3) Reduced CBNG Flow divided by Receiving Drainage Streamflow

Normal Year Conditions

| | Antelope Creek Near Teckla, Wyoming (1) | Little Powder River above Dry Creek Near Weston, Wyoming (2) | Belle Fourche River Below Moorcroft, Wyoming (1) | Cheyenne River Near Spencer, Wyoming (1) | Powder River at Arvada, Wyoming (2) | Dry Fork Cheyenne River Near Bill, Wyoming (1) |
|-----------------|---|--|--|--|-------------------------------------|--|
| Station Number: | 06364700 | 06324970 | 06426500 | 06386500 | 06317000 | 06365300 |
| Month | Streamflow (3) | Streamflow (3) | Streamflow (3) | Streamflow (3) | Streamflow (3) | Streamflow (3) |
| | (ac-ft) | (ac-ft) | (ac-ft) | (ac-ft) | (ac-ft) | (ac-ft) |
| Oct | 69 | 283 | 846 | 186 | 9,874 | 2 |
| Nov | 27 | 144 | 276 | 159 | 9,343 | 5 |
| Dec | 19 | 65 | 205 | 48 | 6,922 | 5 |
| Jan | 21 | 405 | 494 | 695 | 6,424 | 2 |
| Feb | 199 | 1,109 | 1,513 | 1,196 | 12,141 | 14 |
| Mar | 658 | 1,553 | 3,406 | 748 | 24,059 | 30 |
| Apr | 302 | 1,119 | 2,128 | 1,534 | 23,309 | 16 |
| May | 519 | 1,970 | 2,420 | 14,793 | 44,564 | 93 |
| Jun | 531 | 1,683 | 1,675 | 6,889 | 38,014 | 20 |
| Jul | 268 | 625 | 804 | 1,938 | 13,330 | 14 |
| Aug | 179 | 309 | 418 | 511 | 6,608 | 8 |
| Sep | 94 | 246 | 376 | 3,325 | 6,543 | 0 |
| Total | 2,882 | 9,511 | 15,059 | 32,023 | 201,124 | 209 |

Note:

- (1) HKM Engineering, Inc. 2002a. Northeast Wyoming River Basins Plan, Surface Water Hydrology, Tasks 3A and 3B Memorandum
- (2) HKM Engineering, Inc. 2002b. Powder/Tongue River Basins Plan, Surface Water Hydrology, Tasks 3A and 3B Memorandum
- (3) Average Streamflow for 1970-1999 in Acre-Feet

Spreadsheet Model Input Parameters- Normal Year Conditions

Summary of Annual Coal Bed Natural Gas-Related Disposal to Receiving Drainages

| Sub-Basin | Annual CBNG-Related Disposal (mmgpy) ⁽¹⁾ | | | | Annual CBNG-Related Disposal (cfs) | | | |
|---------------------------|---|--------------|--------------|--------------|------------------------------------|-------------|-------------|-------------|
| | 2003 | 2010 | 2015 | 2020 | 2003 | 2010 | 2015 | 2020 |
| Antelope Creek | 710 | 2575 | 3185 | 3038 | 3.0 | 10.9 | 13.5 | 12.9 |
| Dry Fork Cheryenne River | 0 | 22 | 35 | 35 | 0.0 | 0.1 | 0.1 | 0.1 |
| Little Powder River | 1239 | 1716 | 1659 | 1421 | 5.3 | 7.3 | 7.0 | 6.0 |
| Upper Belle Fourche River | 3405 | 3085 | 2332 | 1713 | 14.4 | 13.1 | 9.9 | 7.3 |
| Upper Cheyenne River | 593 | 650 | 560 | 447 | 2.5 | 2.8 | 2.4 | 1.9 |
| Upper Powder River | 1833 | 6273 | 7532 | 7066 | 7.8 | 26.6 | 31.9 | 30.0 |
| Total | 7780 | 14321 | 15303 | 13720 | 33.0 | 60.7 | 64.9 | 58.2 |

Summary of Coal Bed Natural Gas-Related Discharge Water Quality (Source: WDEQ / WQD)

| Sub-Basin | EC | | | SAR | | |
|---------------------------|----------|----------|----------|-----------|----------|----------|
| | 95%lower | mean | 95%upper | 95%lower | mean | 95%upper |
| Antelope Creek | 908.5711 | 929.4581 | 950.3451 | 6.8012275 | 7.615577 | 8.429927 |
| Dry Fork Cheryenne River | 908.5711 | 929.4581 | 950.3451 | 6.8012275 | 7.615577 | 8.429927 |
| Little Powder River | 1493.365 | 1508.912 | 1524.46 | 9.9514769 | 10.49116 | 11.03085 |
| Upper Belle Fourche River | 1102.166 | 1109.774 | 1117.382 | 8.4426895 | 8.834127 | 9.225564 |
| Upper Cheyenne River | 908.5711 | 929.4581 | 950.3451 | 6.8012275 | 7.615577 | 8.429927 |
| Upper Powder River | 2160.573 | 2180.179 | 2199.786 | 21.615331 | 22.57612 | 23.53691 |

Data used in Draft Report (12/2005)

| EC | SAR |
|------|------|
| 905 | 7.1 |
| 905 | 7.1 |
| 1271 | 11.1 |
| 970 | 8.2 |
| 599 | 6.4 |
| 2163 | 19.5 |

See note
See note

note: no data were obtained specific to these sub-basins(antelope creek and dry fork cheyenne river)

Summary of Conveyance Losses

| Sub-Basin | EC |
|---------------------------|-----|
| Antelope Creek | 0.7 |
| Dry Fork Cheryenne River | 0.7 |
| Little Powder River | 0.7 |
| Upper Belle Fourche River | 0.7 |
| Upper Cheyenne River | 0.7 |
| Upper Powder River | 0.7 |

Water Quality Standards

| | Most Restrictive | | Least Restrictive | | |
|---------------------------|------------------|-----|-------------------|-------|------------------------------------|
| | EC | SAR | EC | SAR | |
| Antelope Creek | 2,000 | | 10 | 2,500 | 10 wdeq |
| Dry Fork Cheryenne River | 2,000 | | 10 | 2,500 | 10 wdeq |
| Little Powder River | 2,000 | | 5 | 2,500 | 9.75 montana deq standards |
| Upper Belle Fourche River | 2,000 | | 6 | 2,500 | 10 sar (6) from south dakota reg's |
| Upper Cheyenne River | 2,000 | | 10 | 2,500 | 10 wdeq |
| Upper Powder River | 2,000 | | 5 | 2,500 | 9.75 montana deq standards |

Background Water Quality Data (Greystone, 2003)

| | Antelope Creek | | Upper Belle Fourche | | Upper Cheyenne | | Upper Powder | | Little Powder | | Dry Fork Cheryenne | |
|-----|----------------|------|---------------------|------|----------------|------|--------------|------|---------------|------|--------------------|------|
| | EC | SAR | EC | SAR | EC | SAR | EC | SAR | EC | SAR | EC | SAR |
| Jan | 2335 | 2.74 | 2887 | 6.29 | 4229 | 8.58 | 2482 | 6.4 | 2953 | 6.33 | 2335 | 2.74 |
| Feb | 2251 | 2.71 | 1907 | 4.08 | 3911 | 8.01 | 2366 | 6.12 | 2477 | 5.57 | 2251 | 2.71 |
| Mar | 1782 | 2.52 | 1564 | 3.64 | 4127 | 8.66 | 2051 | 5.28 | 1785 | 4.44 | 1782 | 2.52 |
| Apr | 1949 | 2.77 | 1722 | 4.34 | 3630 | 7.87 | 2213 | 5.84 | 2457 | 5.55 | 1949 | 2.77 |
| May | 1800 | 2.82 | 1532 | 3.81 | 3155 | 6.88 | 1803 | 4.92 | 2013 | 4.81 | 1800 | 2.82 |
| Jun | 2005 | 2.8 | 1821 | 3.98 | 2895 | 5.93 | 1797 | 4.76 | 2333 | 5.29 | 2005 | 2.8 |
| Jul | 1661 | 2.48 | 1182 | 3.1 | 2250 | 5.69 | 2716 | 6.79 | 2174 | 5.29 | 1661 | 2.48 |
| Aug | 1684 | 2.47 | 1955 | 5.06 | 1972 | 4.82 | 2992 | 6.97 | 2860 | 6.57 | 1684 | 2.47 |
| Sep | 2214 | 2.52 | 2231 | 5.76 | 2271 | 5.63 | 3400 | 7.83 | 2810 | 6.44 | 2214 | 2.52 |
| Oct | 2354 | 2.6 | 2346 | 5.75 | 2916 | 6.46 | 2537 | 6.71 | 2289 | 5.73 | 2354 | 2.6 |
| Nov | 2460 | 2.74 | 2877 | 7.02 | 3565 | 7.22 | 2650 | 6.42 | 3044 | 6.7 | 2460 | 2.74 |
| Dec | 2372 | 2.79 | 2755 | 6.77 | 3405 | 7.39 | 2906 | 6.61 | 3300 | 6.94 | 2372 | 2.79 |