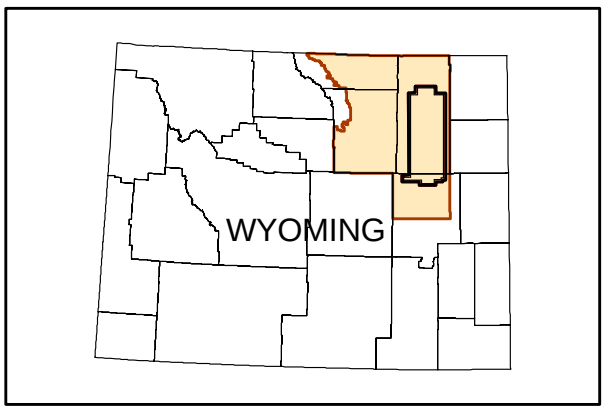
APPENDIX D

MODELED GROUNDWATER LEVELS



Coal Mine Groundwater Model

Legend

- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

Contour Interval = 25 feet

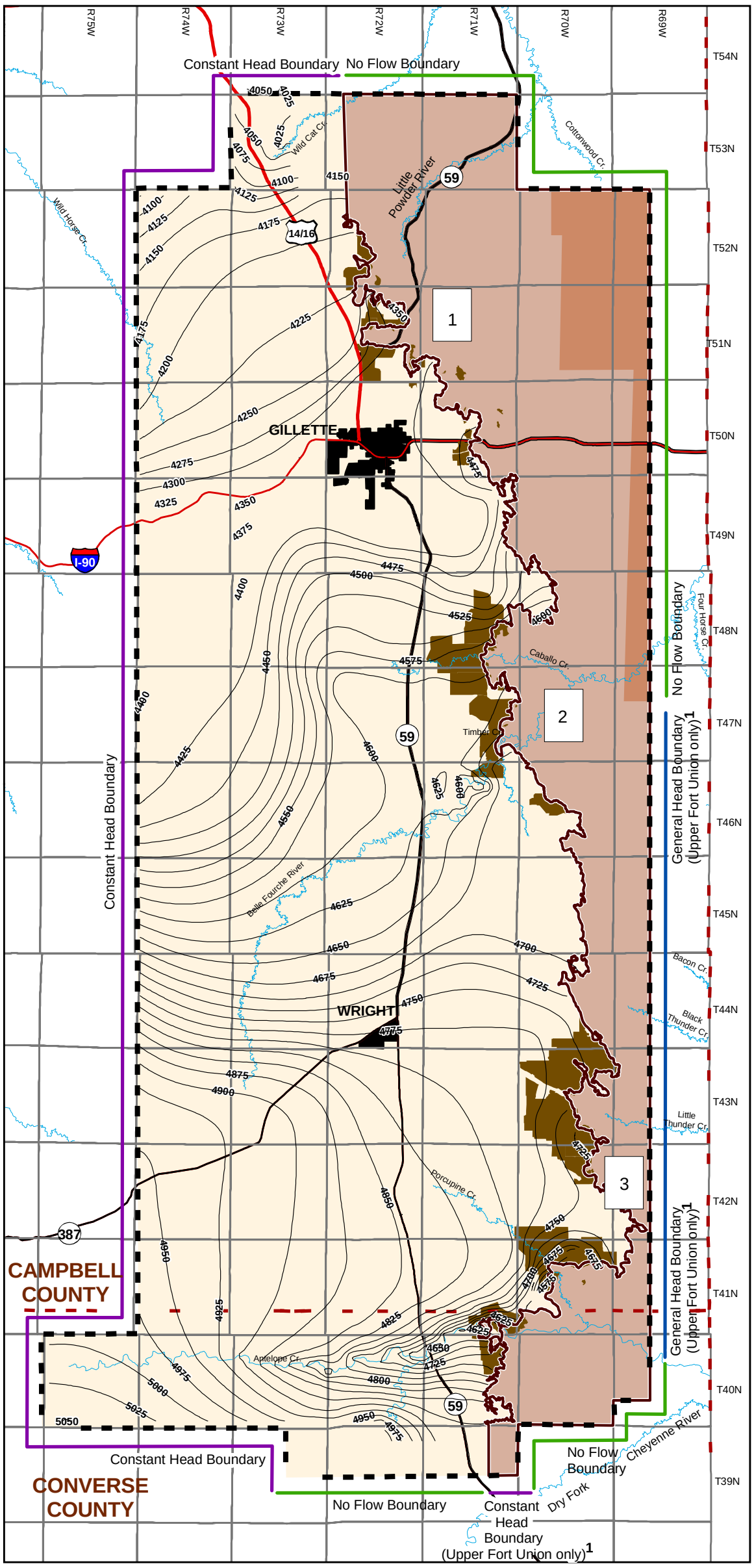
Groundwater level contours (Range = 4025 to 5050 feet)

Coal Mine Subregions

1 Subregion 1 (North Gillette)

2 Subregion 2 (South Gillette)

3 Subregion 3 (Wright)



N
W E
S

0 5 10 Miles

0 5 10 Kilometers

[1]Boundary condition is No Flow Boundary for all other layers.

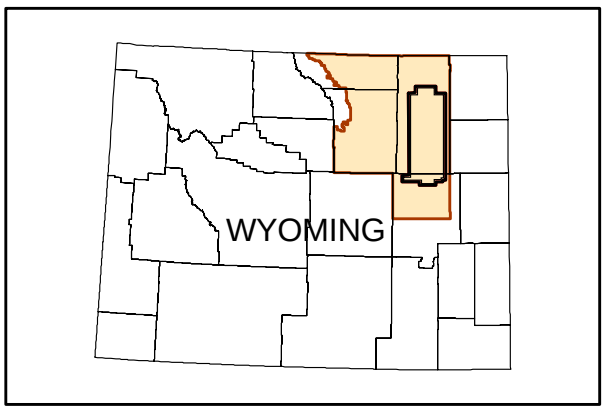
Source: BLM 2009a, b.

Powder River Basin Coal Review

Figure D-1

Wasatch Formation 1990 Water Levels

08/12/09



Coal Mine Groundwater Model

Legend

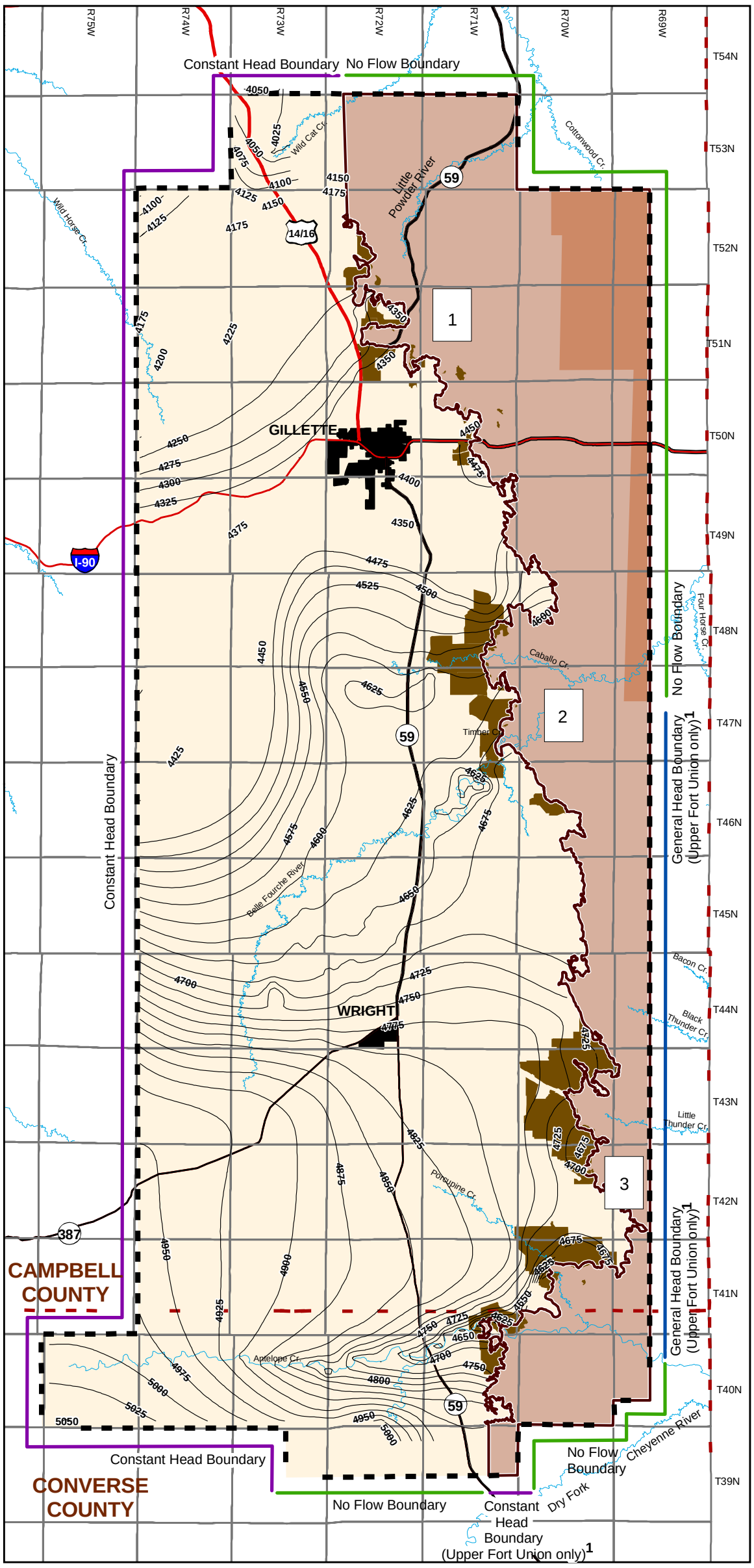
- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

Contour Interval = 25 feet

- Groundwater level contours (Range = 4025 to 5050 feet)

Coal Mine Subregions

- 1 Subregion 1 (North Gillette)
- 2 Subregion 2 (South Gillette)
- 3 Subregion 3 (Wright)



N
W E
S

0 5 10 Miles

0 5 10 Kilometers

[1]Boundary condition is No Flow Boundary for all other layers.

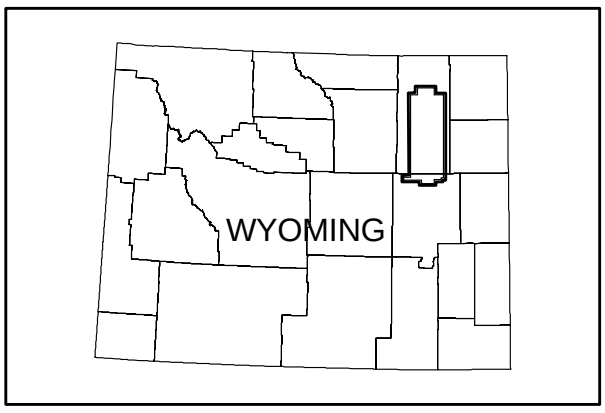
Source: BLM 2009a, b.

Powder River Basin Coal Review

Figure D-2

Wasatch Formation 2002 Water Levels

08/12/09



Coal Mine Groundwater Model

Legend

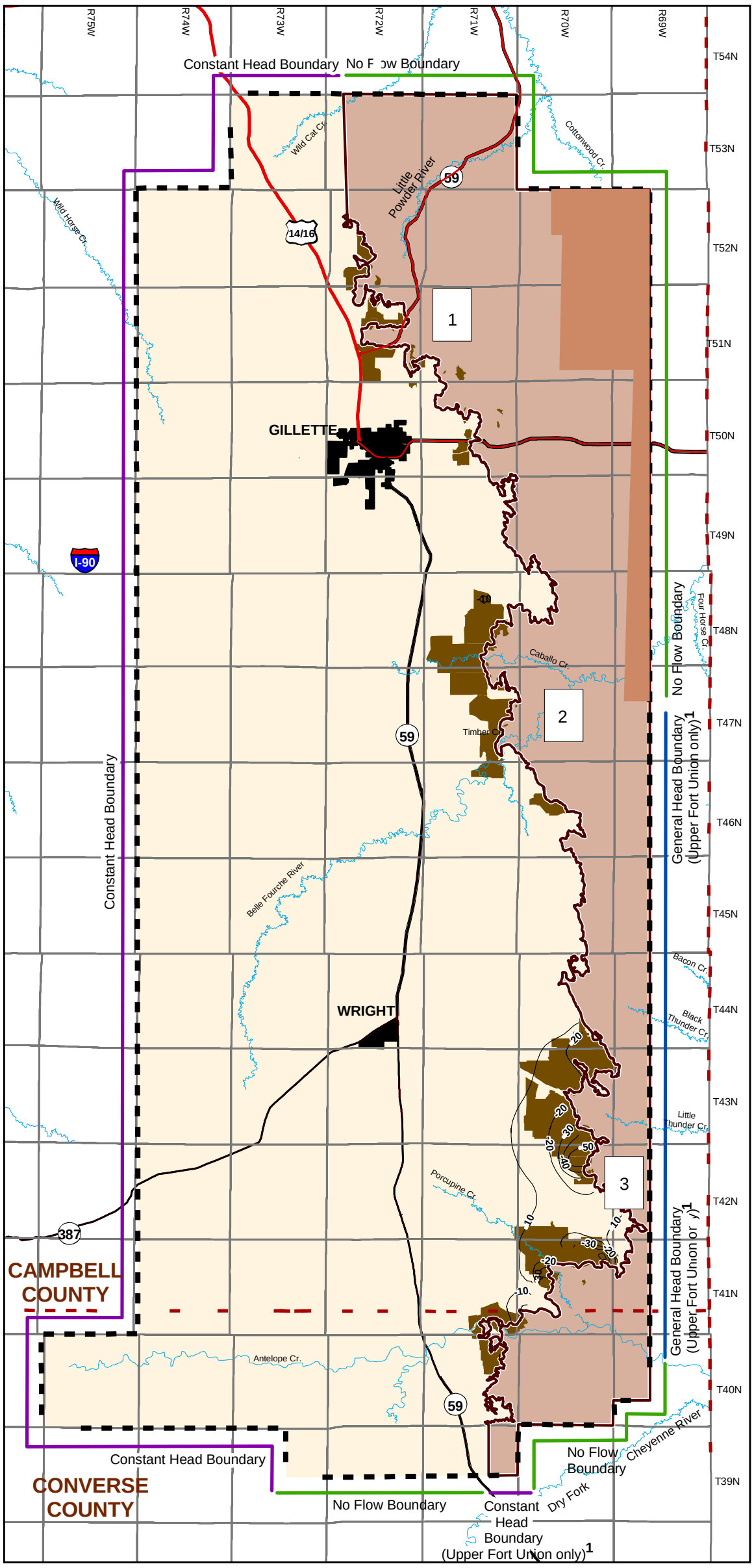
- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

Contour Interval = 10 feet

- Groundwater drawdown level contours

Coal Mine Subregions

- 1 Subregion 1 (North Gillette)
- 2 Subregion 2 (South Gillette)
- 3 Subregion 3 (Wright)



N
W E
S

0 5 10 Miles

0 5 10 Kilometers

[1]Boundary condition is No Flow Boundary for all other layers.

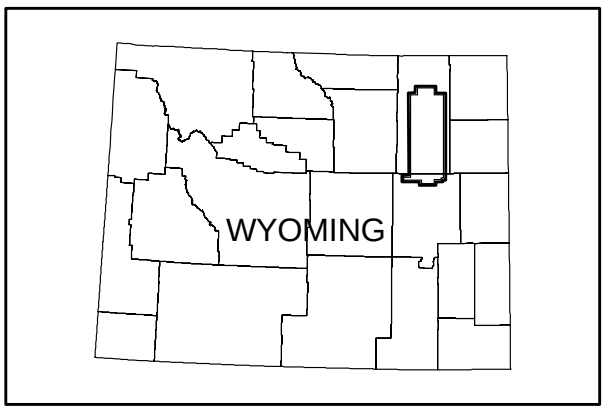
Source: BLM 2009a, b.

Powder River Basin Coal Review

Figure D-3

Wasatch Formation
2002 Coal Mine only Drawdown

11/22/09



Coal Mine Groundwater Model

Legend

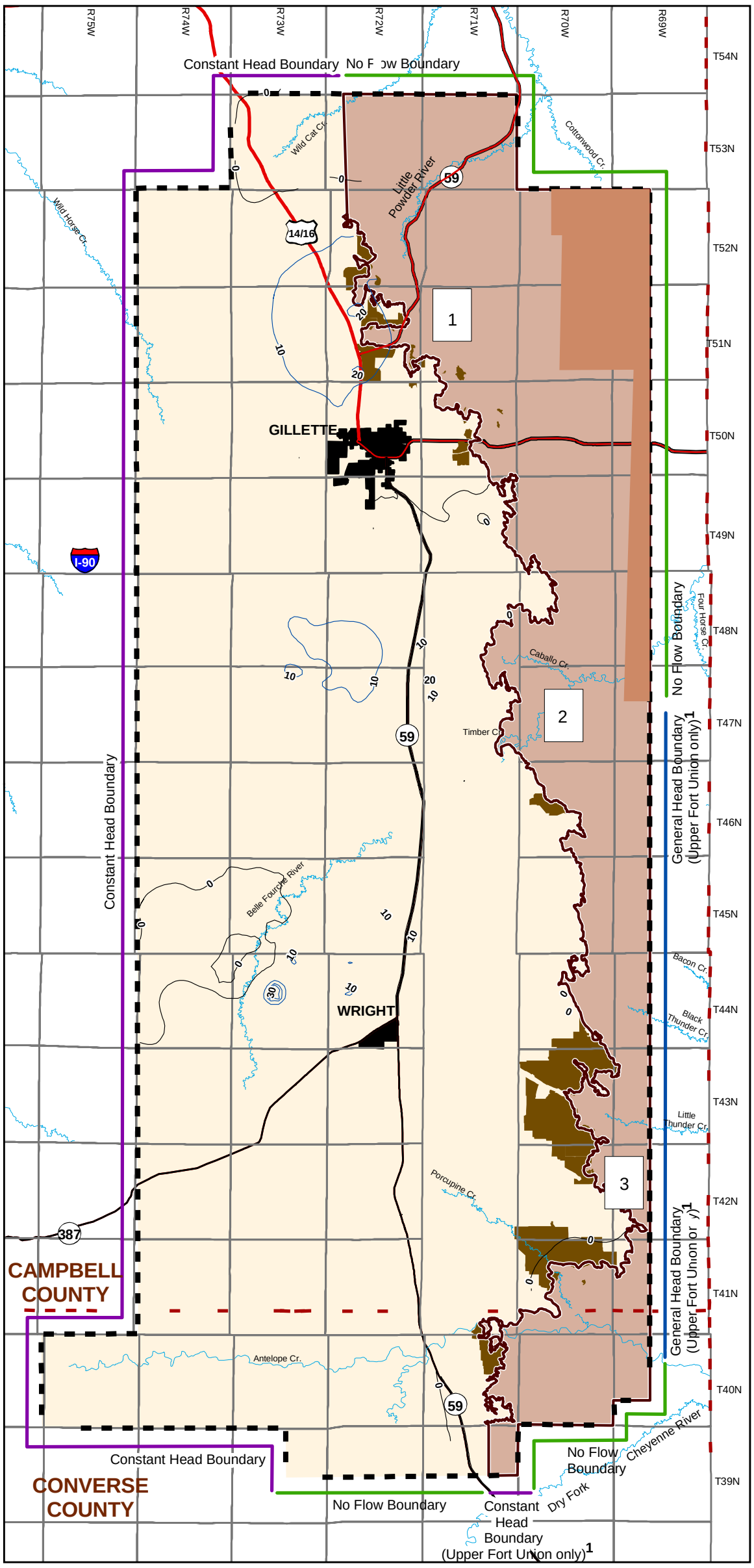
- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

Contour Interval = 10 feet

- Groundwater drawdown level contours
- Groundwater mounding level contours

Coal Mine Subregions

- 1 Subregion 1 (North Gillette)
- 2 Subregion 2 (South Gillette)
- 3 Subregion 3 (Wright)



N
W E
S

0 5 10 Miles

0 5 10 Kilometers

[1]Boundary condition is No Flow Boundary for all other layers.

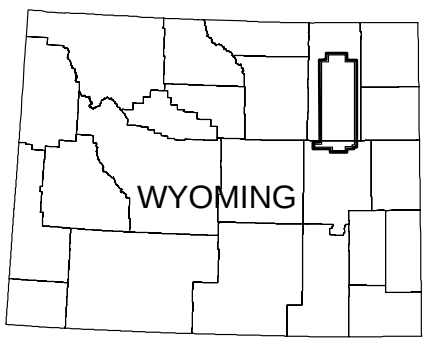
Source: BLM 2009a, b.

Powder River Basin Coal Review

Figure D-4

Wasatch Formation
2002 CBNG only Drawdown

11/22/09



Coal Mine Groundwater Model

Legend

- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

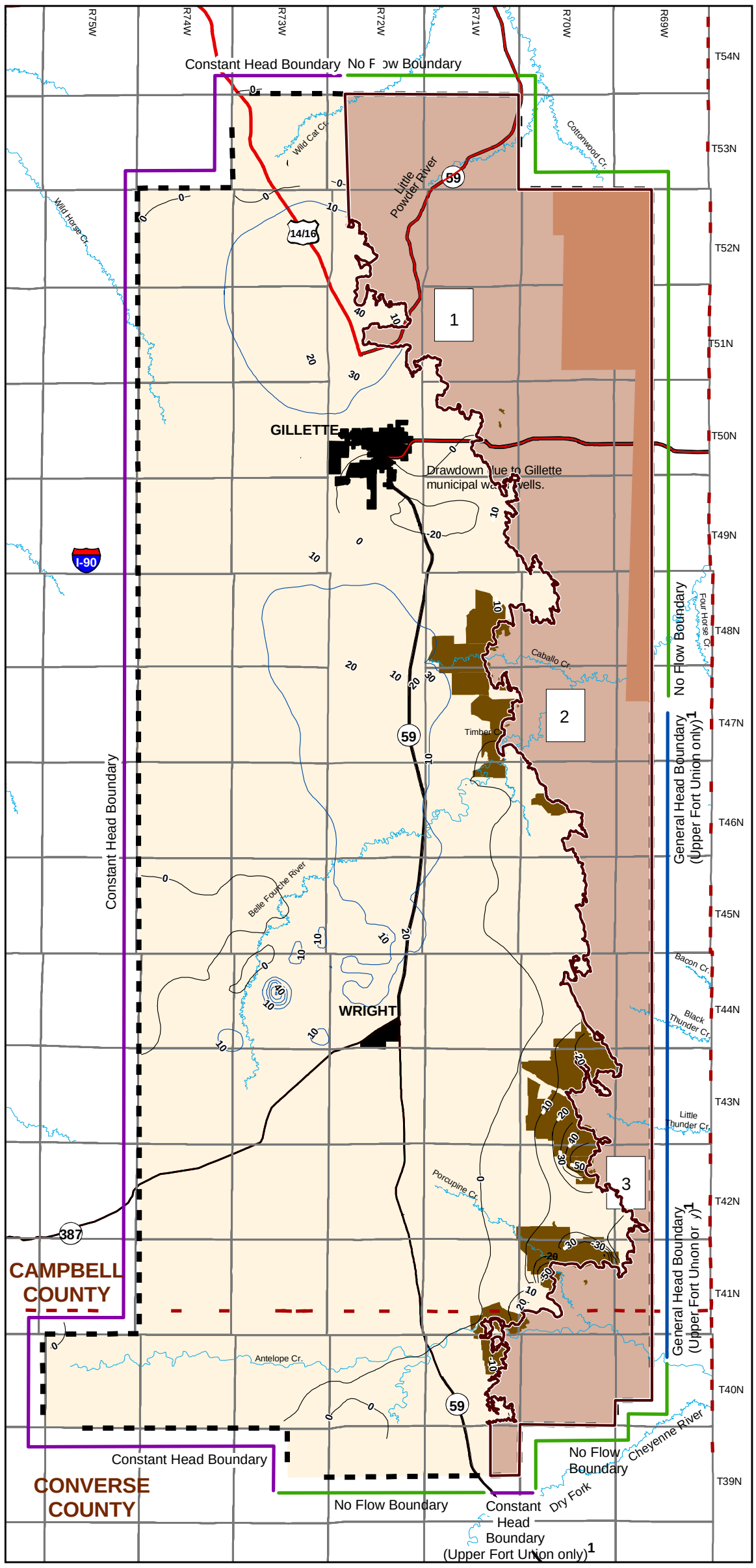
Contour Interval = 10 feet

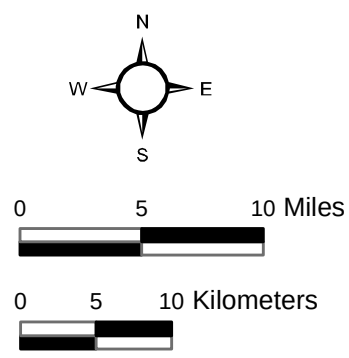
- Groundwater drawdown level contours
- Groundwater mounding level contours

Coal Mine Subregions

- 1 Subregion 1 (North Gillette)
- 2 Subregion 2 (South Gillette)
- 3 Subregion 3 (Wright)

Notes: Includes effects of coal mine and CBNG groundwater pumping and CBNG water discharge.





[1]Boundary condition is No Flow Boundary for all other layers.

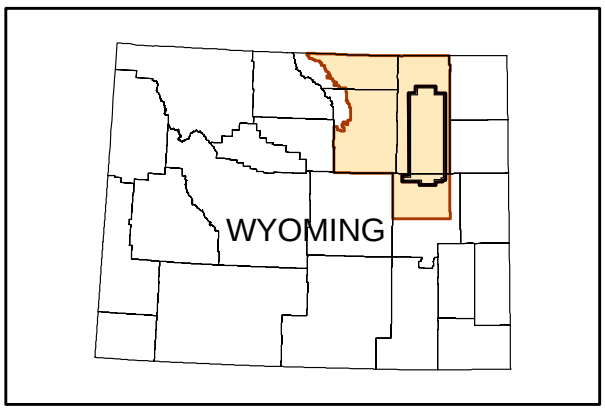
Source: BLM 2009a, b.

Powder River Basin Coal Review

Figure D-5

Wasatch Formation 1990-2002 Groundwater Level Changes

11/22/09



Coal Mine Groundwater Model

Legend

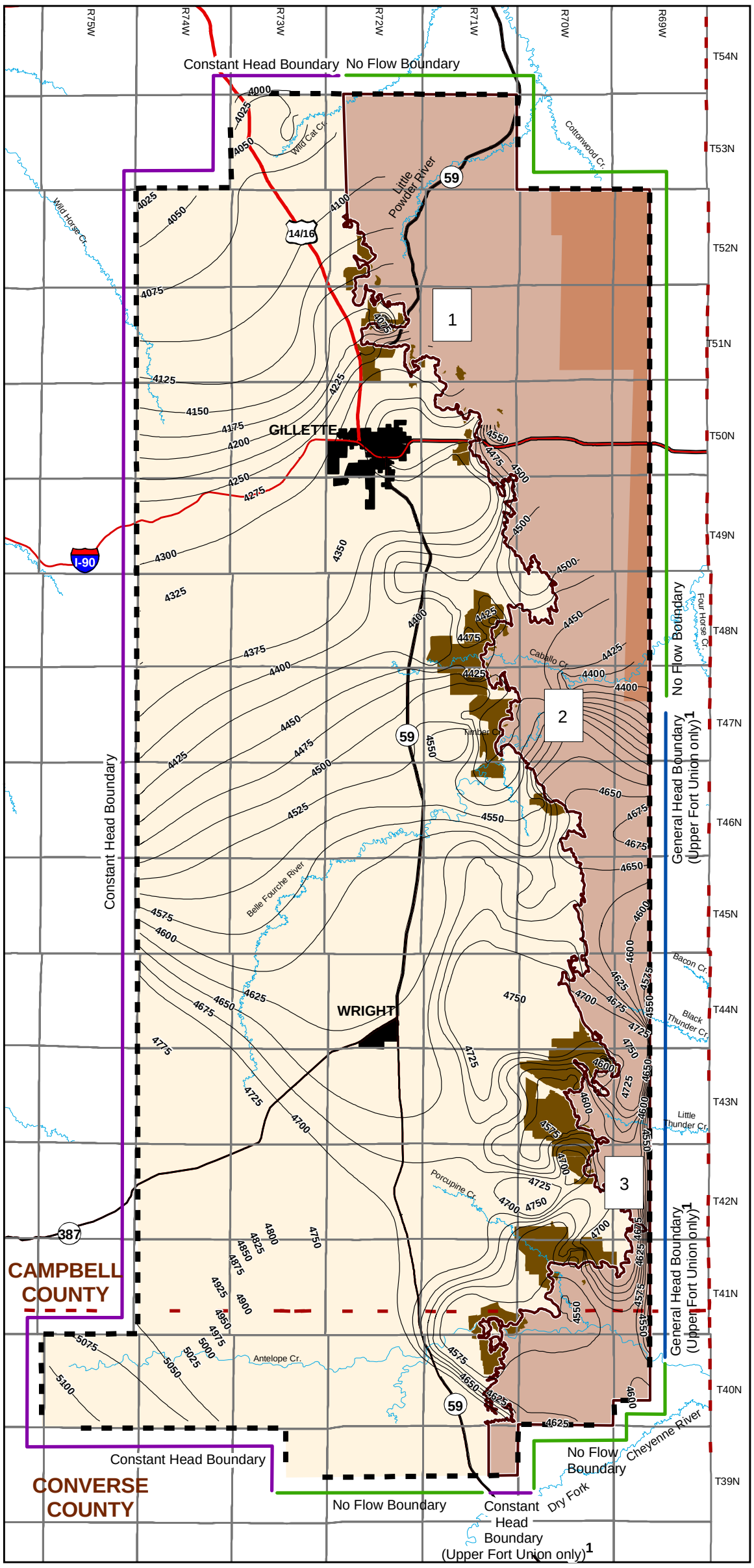
- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

Contour Interval = 25 feet

- Groundwater level contours (Range = 4000 to 5100 feet)

Coal Mine Subregions

- 1 Subregion 1 (North Gillette)
- 2 Subregion 2 (South Gillette)
- 3 Subregion 3 (Wright)



N
W E
S

0 5 10 Miles

0 5 10 Kilometers

[1]Boundary condition is No Flow Boundary for all other layers.

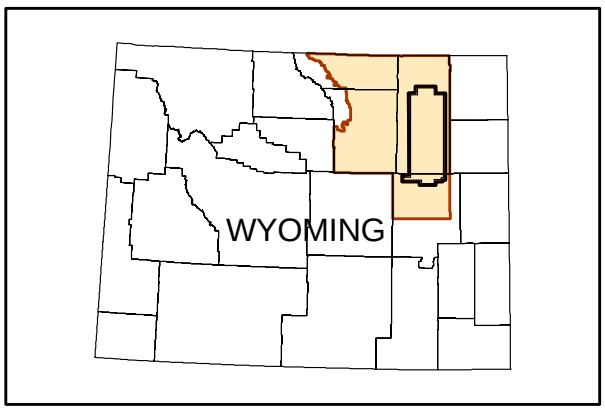
Source: BLM 2009a, b.

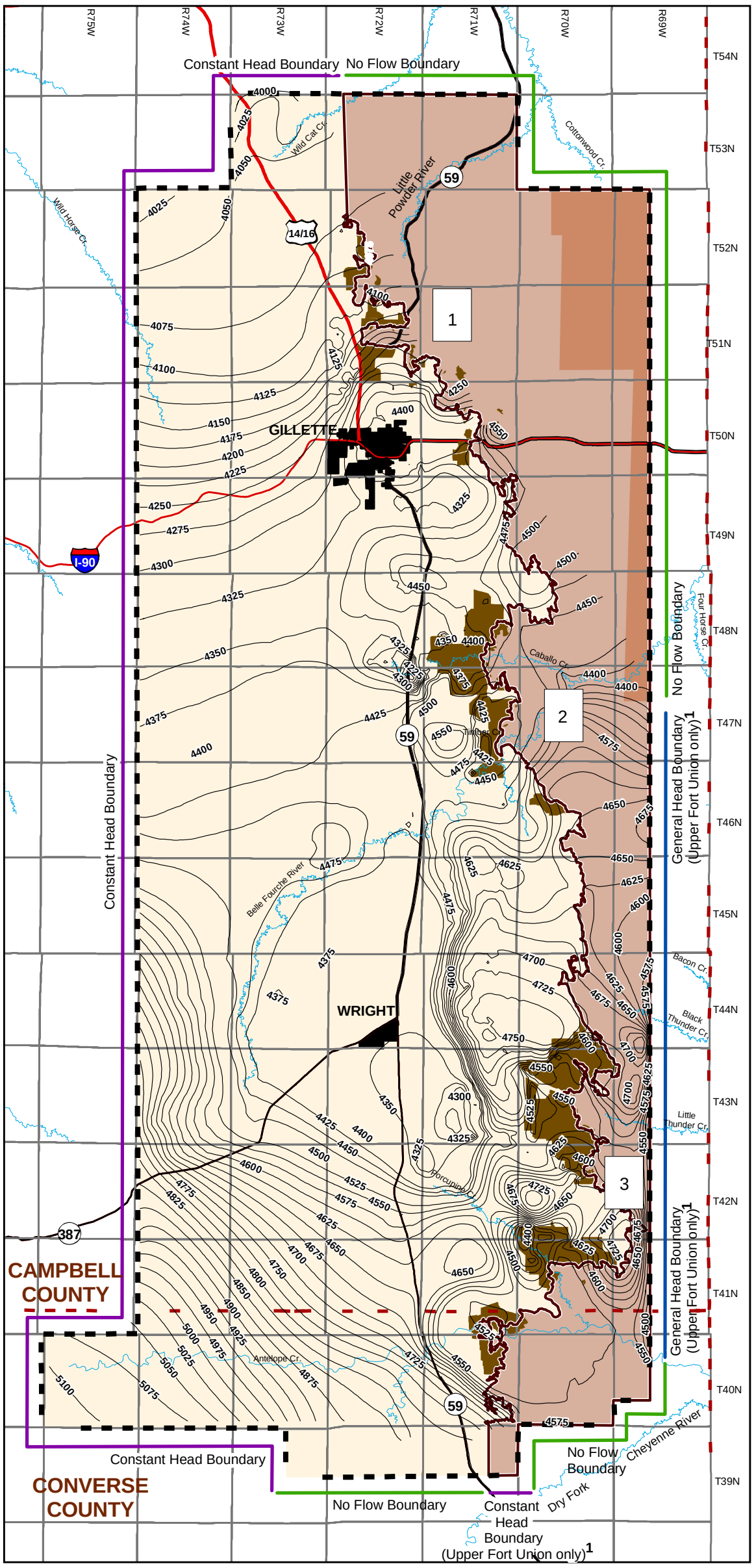
Powder River Basin Coal Review

Figure D-6

Upper Fort Union Formation
1990 Water Levels

08/12/09





Coal Mine Groundwater Model

Legend

- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

Contour Interval = 25 feet

- Groundwater level contours (Range = 4000 to 5100 feet)

Coal Mine Subregions

- 1 Subregion 1 (North Gillette)
- 2 Subregion 2 (South Gillette)
- 3 Subregion 3 (Wright)

N
W E
S

0 5 10 Miles

0 5 10 Kilometers

[1]Boundary condition is No Flow Boundary for all other layers.

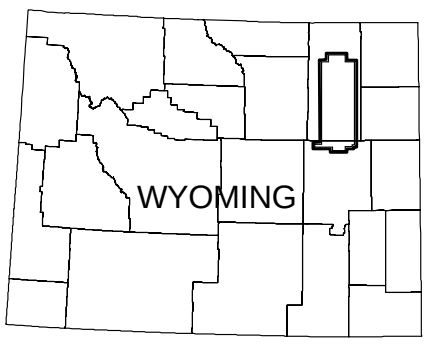
Source: BLM 2009a, b.

Powder River Basin Coal Review

Figure D-7

Upper Fort Union Formation
2002 Water Levels

08/10/09



Coal Mine Groundwater Model

Legend

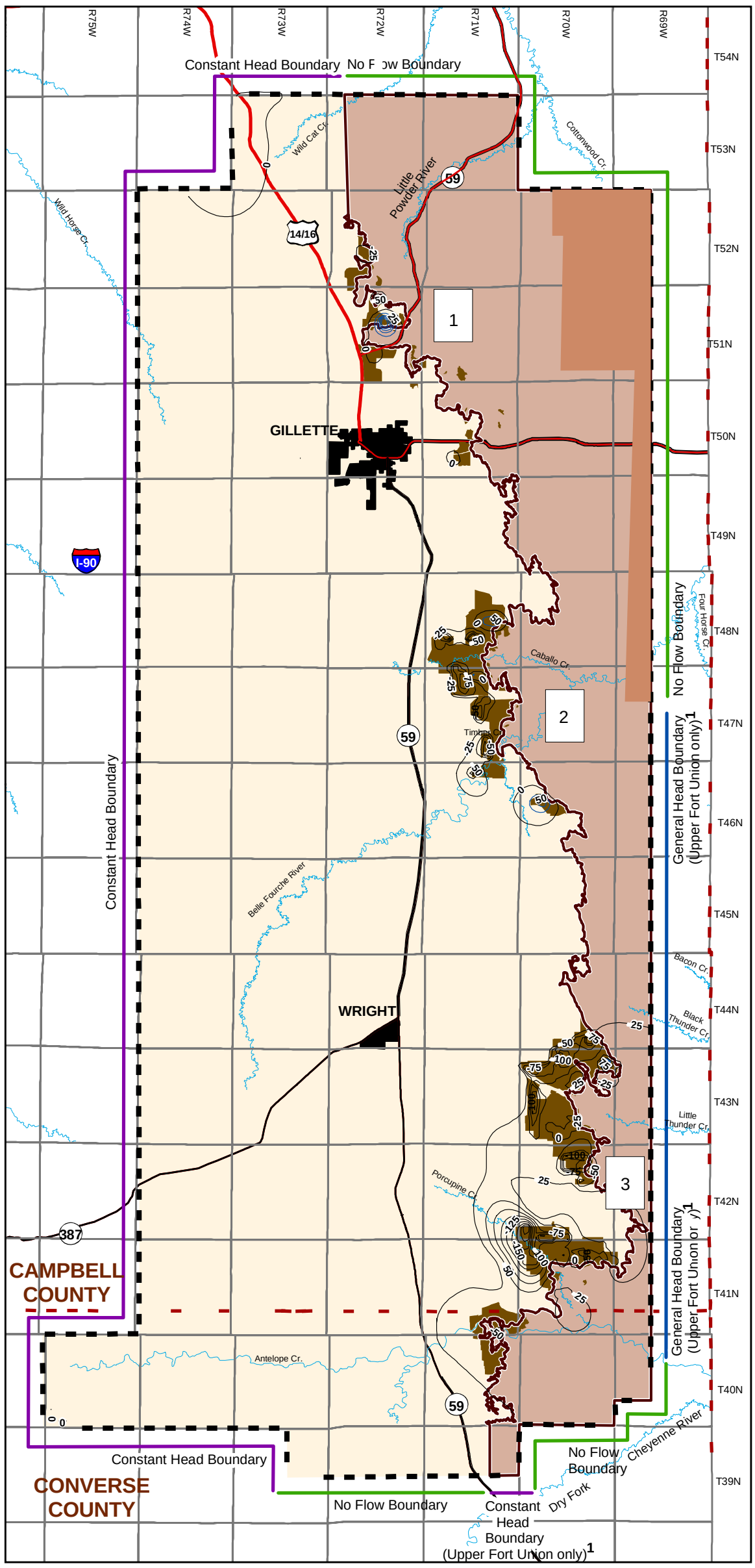
- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

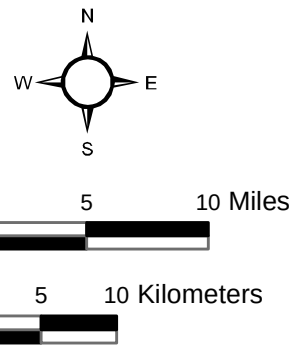
Contour Interval = 25 feet

- Groundwater drawdown level contours
- Groundwater mounding level contours

Coal Mine Subregions

- 1 Subregion 1 (North Gillette)
- 2 Subregion 2 (South Gillette)
- 3 Subregion 3 (Wright)





[1]Boundary condition is No Flow Boundary for all other layers.

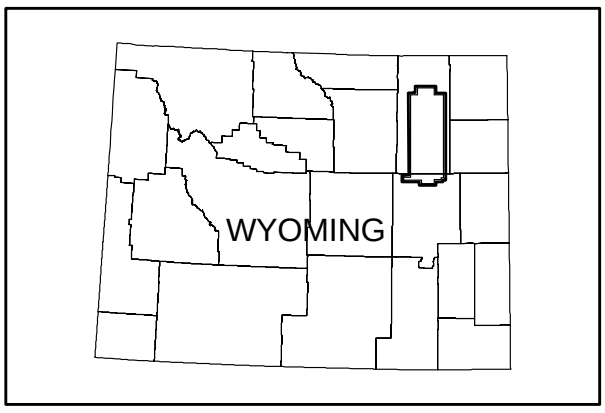
Source: BLM 2009a, b.

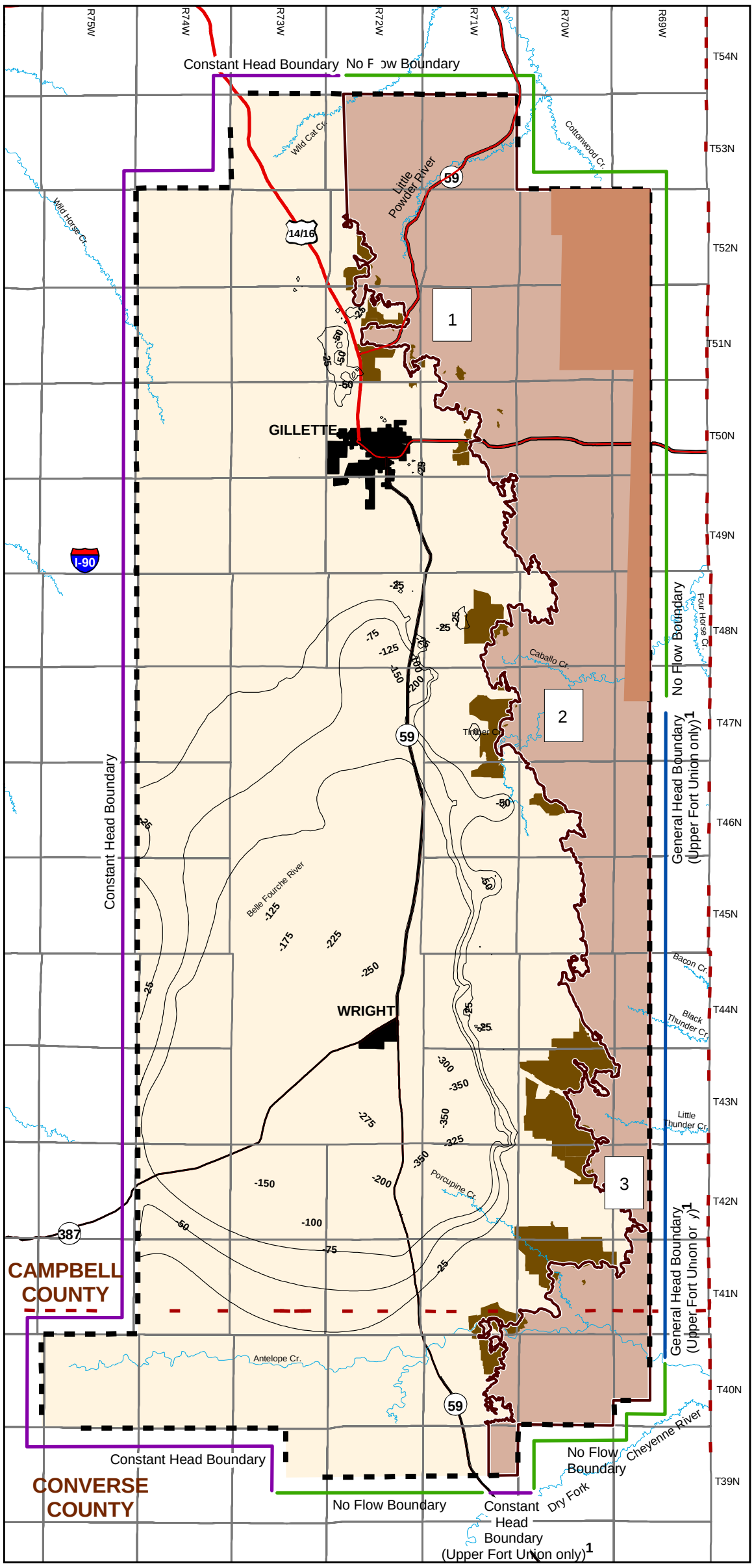
Powder River Basin Coal Review

Figure D-8

Upper Fort Union Formation
2002 Coal mine only Drawdown

08/12/09





Coal Mine Groundwater Model

Legend

- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

Contour Interval = 25 feet

- Groundwater drawdown level contours

Coal Mine Subregions

1 Subregion 1 (North Gillette)

2 Subregion 2 (South Gillette)

3 Subregion 3 (Wright)

N
W E
S

0 5 10 Miles

0 5 10 Kilometers

[1]Boundary condition is No Flow Boundary for all other layers.

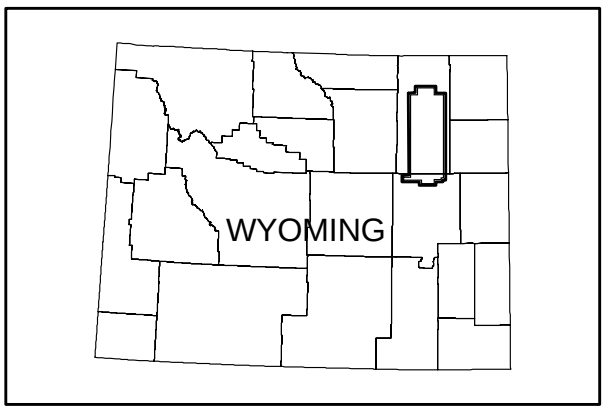
Source: BLM 2009a, b.

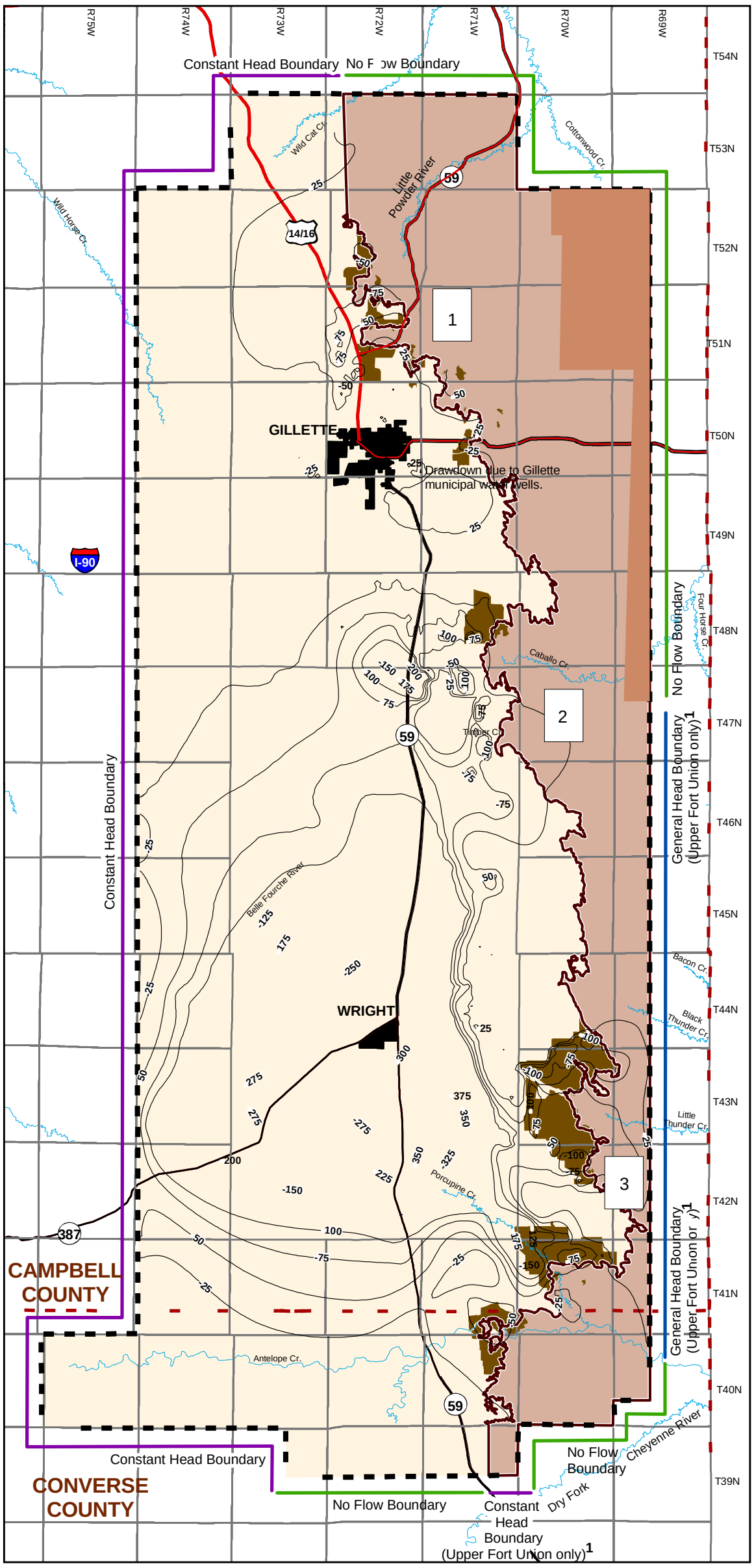
Powder River Basin Coal Review

Figure D-9

Upper Fort Union Formation
2002 CBNG only Drawdown

08/12/09





Coal Mine Groundwater Model

Legend

- Approximate Coal Mined-out Area through 2006
- Groundwater Model Domain
- Wasatch Outcrop Area
- Upper Fort Union Outcrop Area
- Lower Fort Union Outcrop Area
- BLM Coal Outcrop Line
- Constant Head Boundary
- General Head Boundary
- No Flow Boundary
- County Line

Contour Interval = 25 feet

- Groundwater drawdown level contours

Coal Mine Subregions

1 Subregion 1 (North Gillette)

2 Subregion 2 (South Gillette)

3 Subregion 3 (Wright)

Notes: Includes effects of coal mine and CBNG groundwater pumping and CBNG water discharge.

N W E S

0 5 10 Miles

0 5 10 Kilometers

[1]Boundary condition is No Flow Boundary for all other layers.

Source: BLM 2009a, b.

Powder River Basin Coal Review

Figure D-10

Upper Fort Union Formation 1990-2002 Groundwater Level Changes

08/12/09