

Groundwater Model Status Report

Powertech Dewey-Burdock Uranium In Situ Recovery Project

Fall River and Custer Counties, South Dakota

December 7, 2011

Note: This presentation of the hydrogeological model and preliminary results is a continuation and follow-up of the April 7-8, 2011 public meeting wherein Powertech agreed to develop a model for the proposed Dewey-Burdock Project and present the results to NRC staff. This presentation is preliminary in nature and is not a final product. It is subject to change based upon comments by the NRC staff and finalization of technical details by the consultant. Consequently, this presentation is not intended to be relied upon by the NRC staff nor any of the parties involved in the ongoing litigation regarding the proposed Dewey-Burdock Project and Powertech's application for a uranium recovery license from the NRC as it is not part of the application currently.

Dewey-Burdock Model Objectives (I)

Per Request by NRC

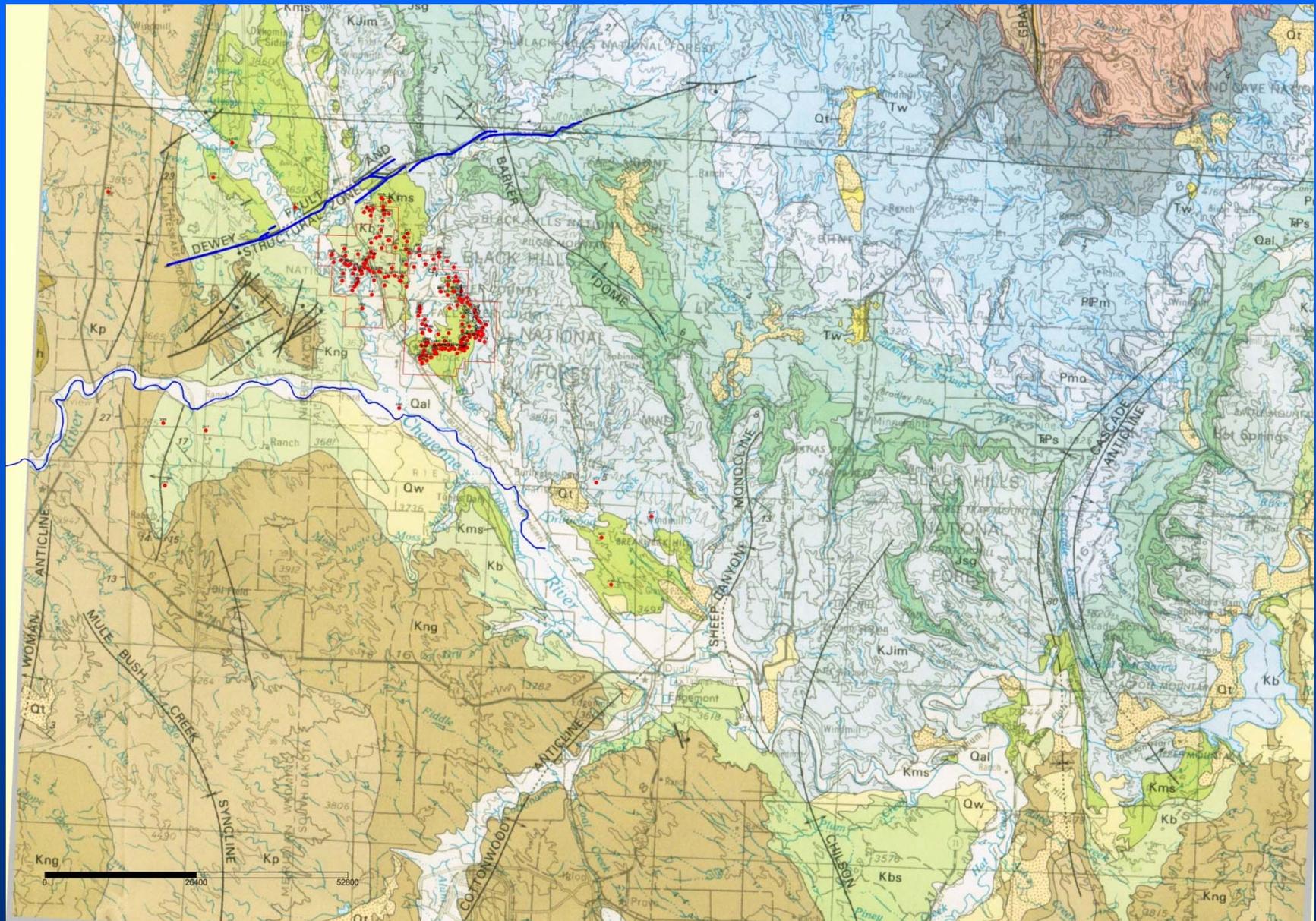
Regional Groundwater Flow Model

- Better Define Recharge/Discharge Boundaries
- Evaluate Regional Flow
- Assess Water Budget
 - available and sustainable resources
 - potential long term impacts to aquifers from ISR operations
- Assess Hypothetical Pathways
 - Breccia Pipes

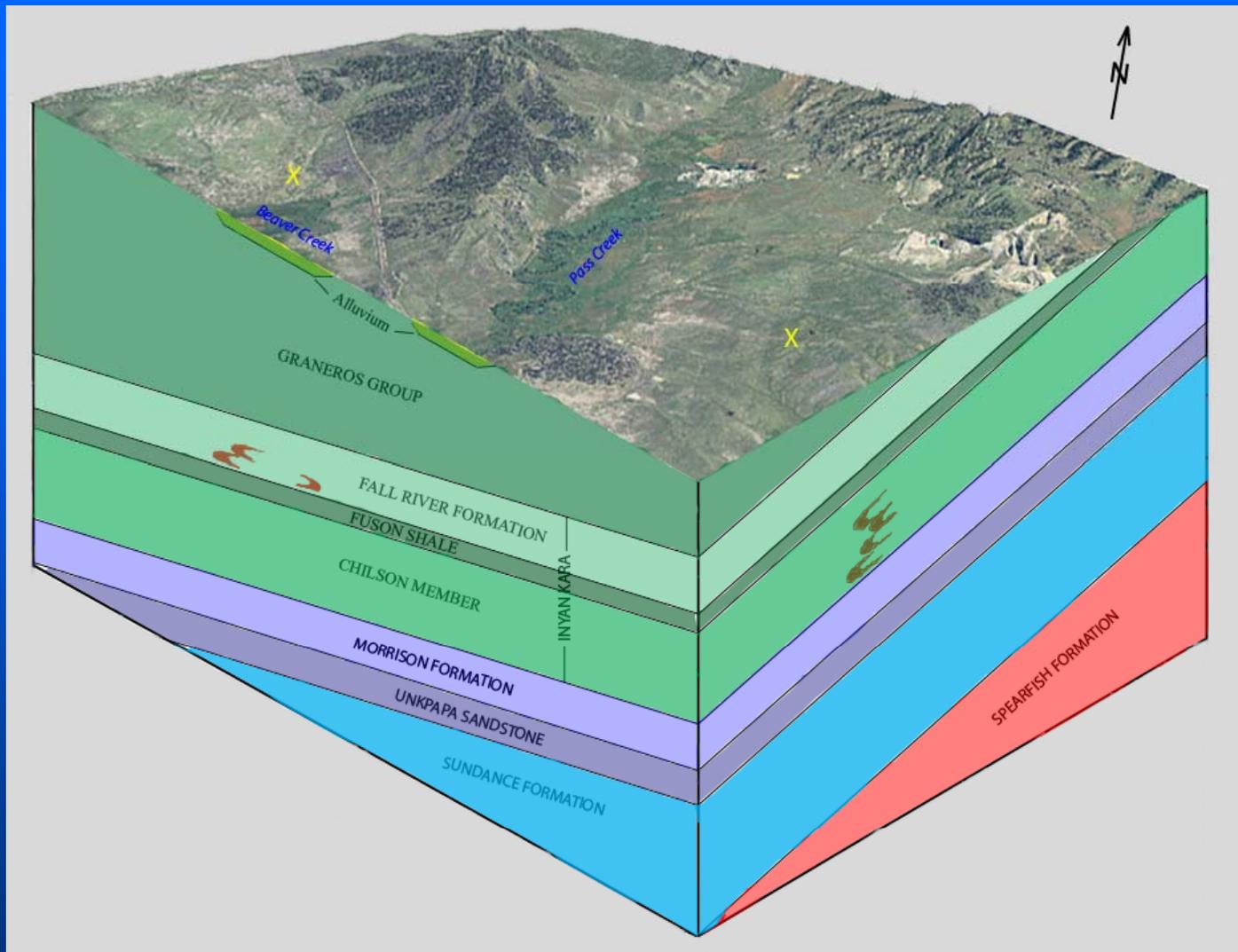
Dewey-Burdock Model Objectives (II)

Wellfield Scale Model

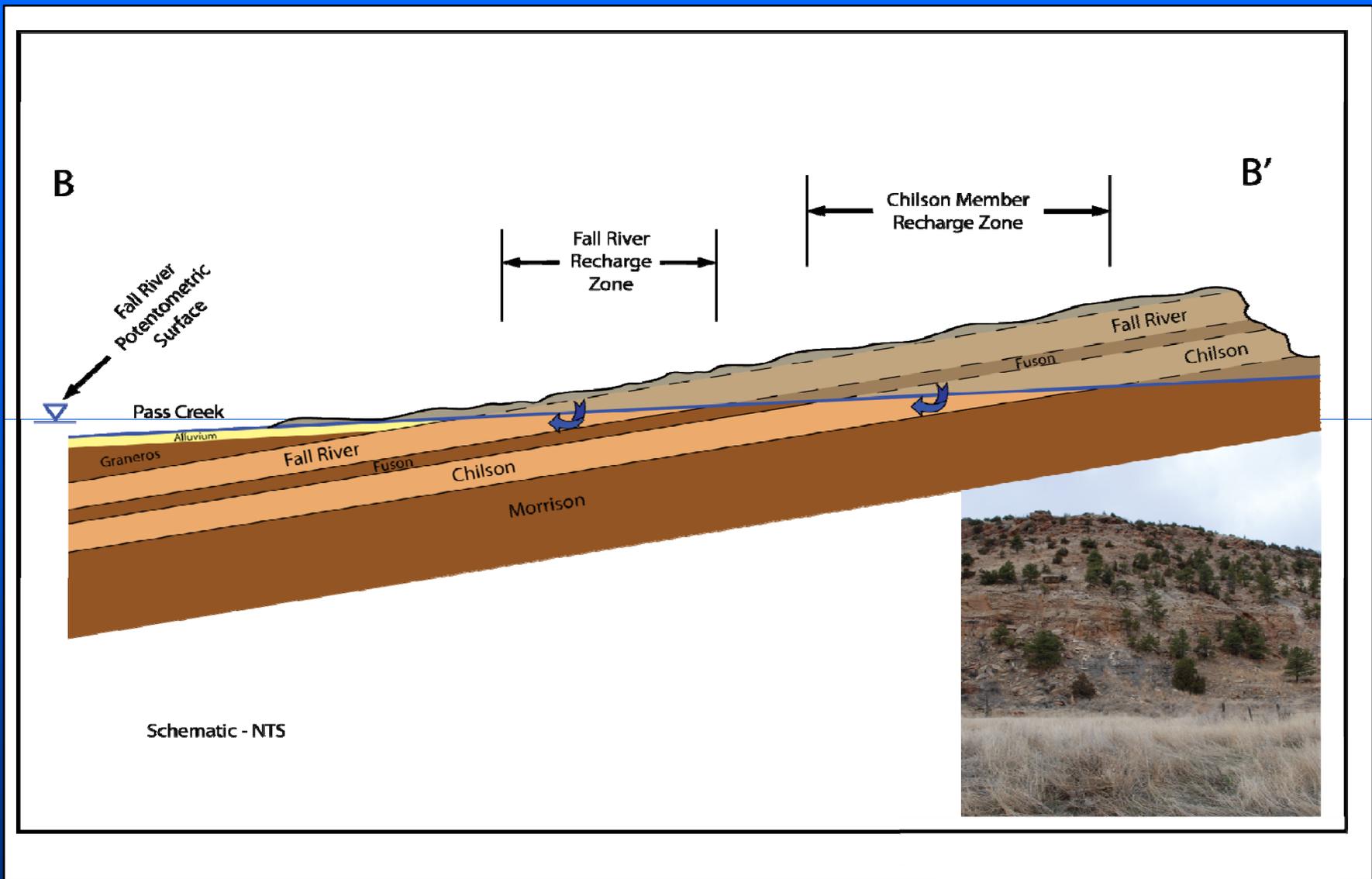
- Hydrologic Test Design
- Monitor Ring Spacing/Excursion Detection
- Wellfield Design/Balance (Wellfield Flare)
- Localized Hydraulic Response to ISR Operations
- Excursion Recovery



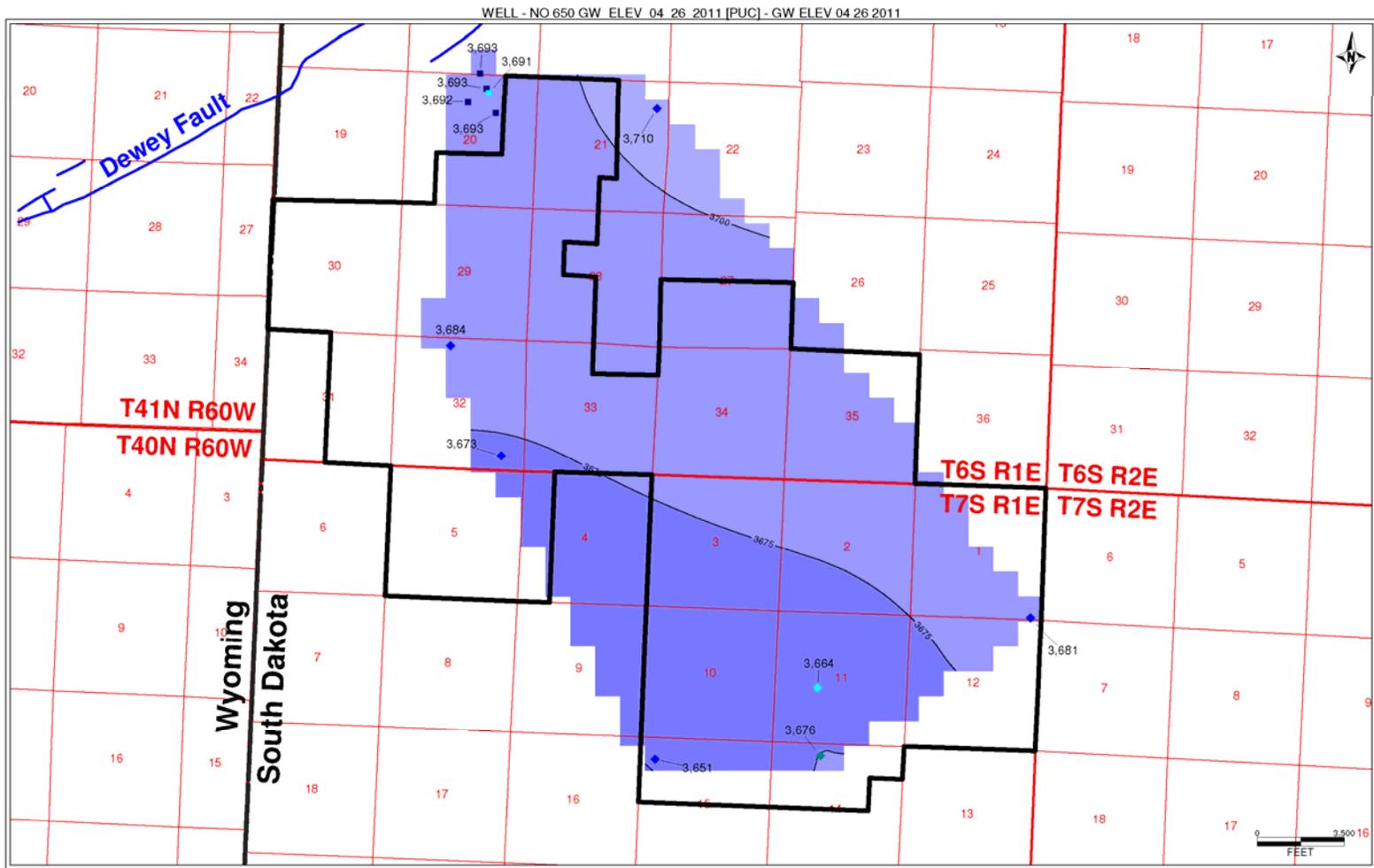
Dewey Burdock Physiographic Setting



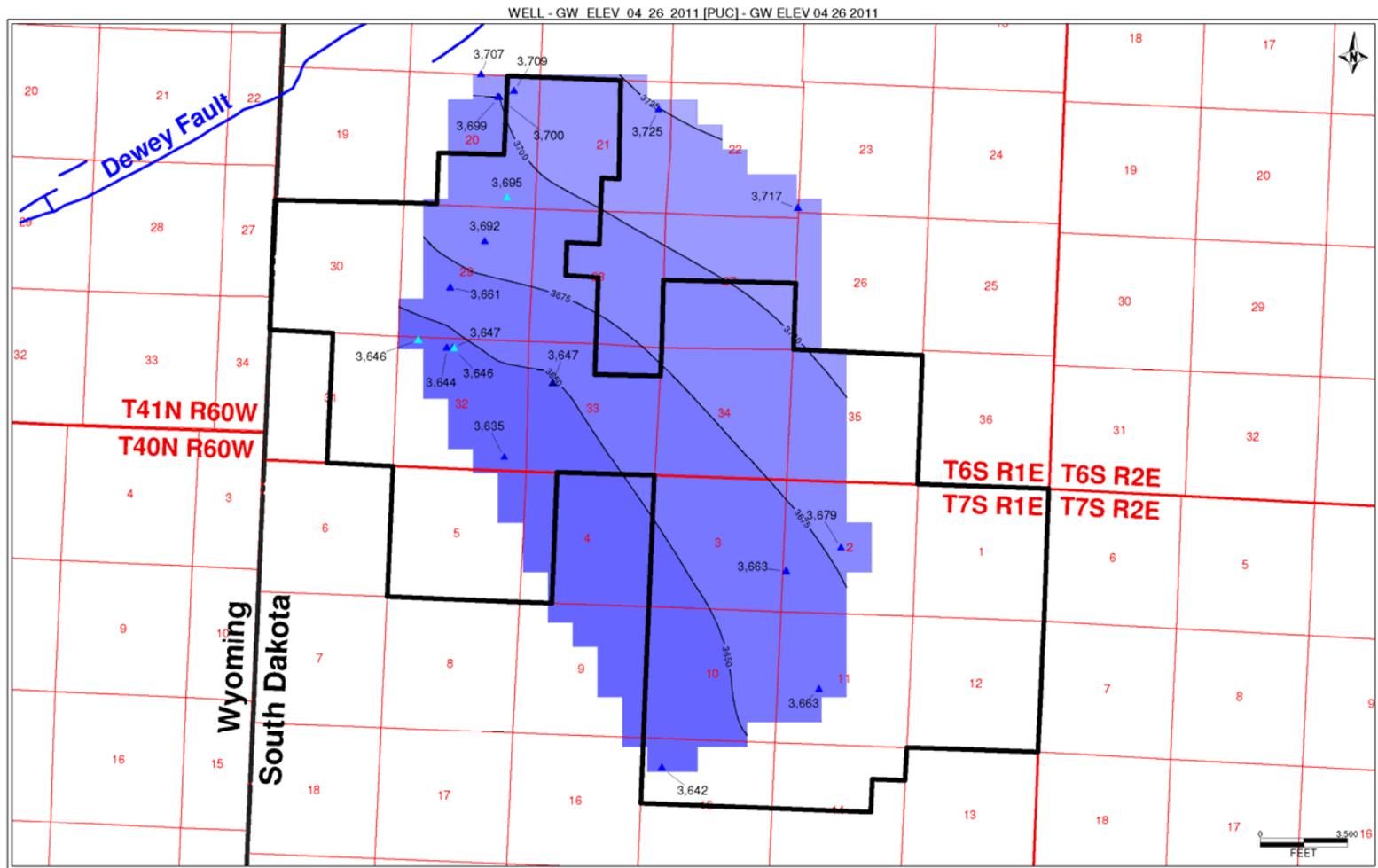
Dewey-Burdock Project Area Geology



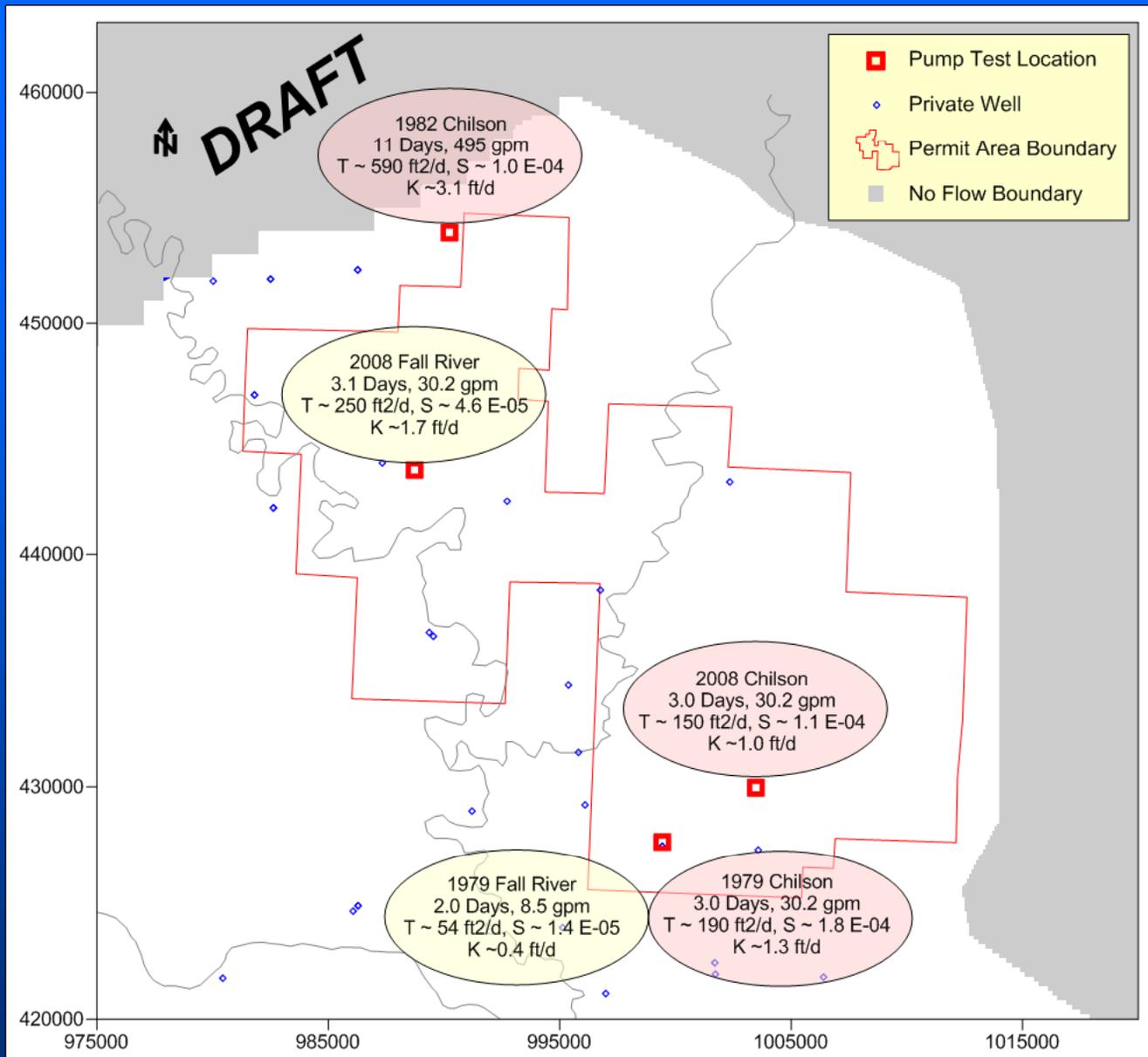
Dewey-Burdock Hydrogeologic Cross Section



Potentiometric Surface-Chilson, April 2011



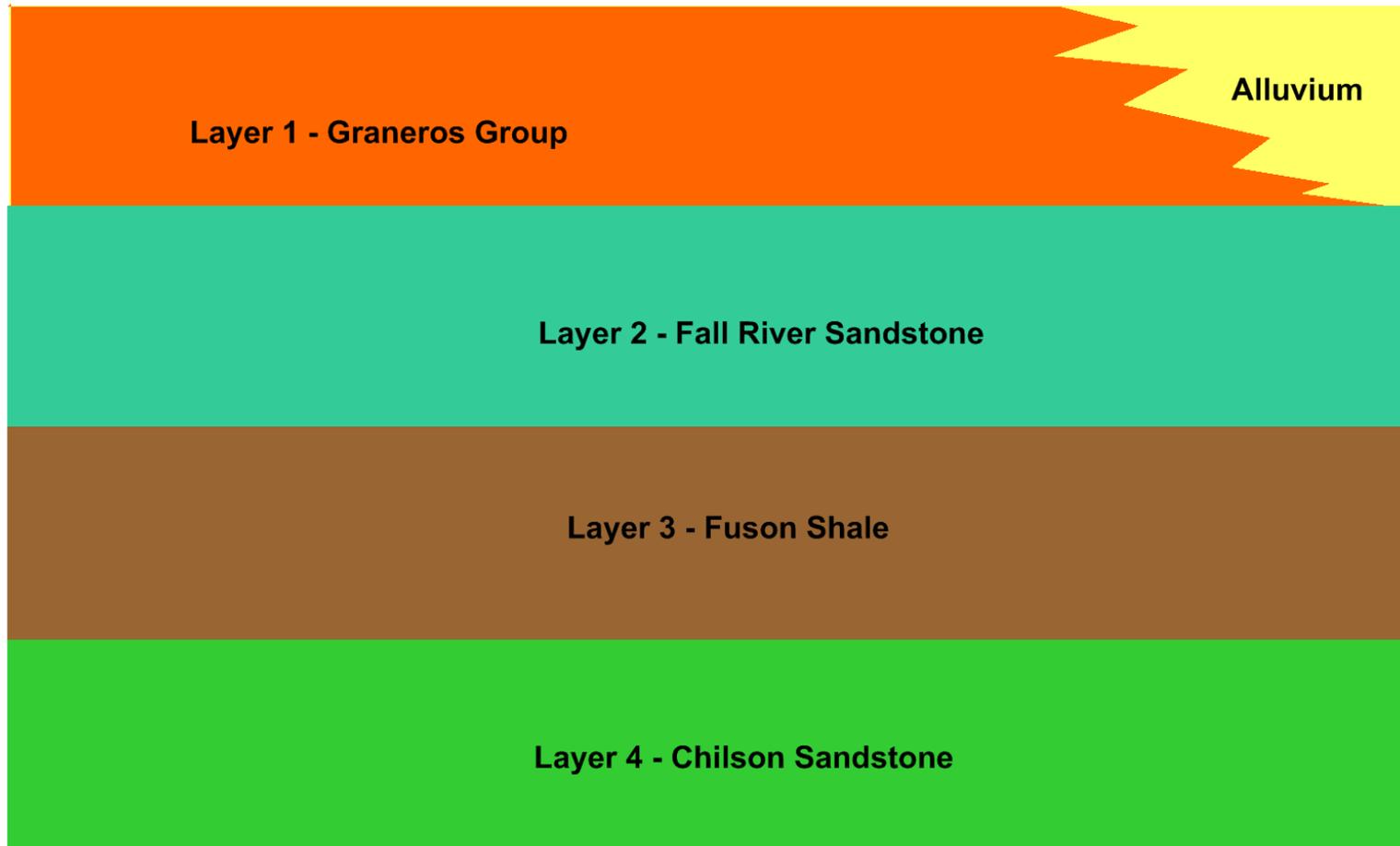
Potentiometric Surface-Fall River, April 2011



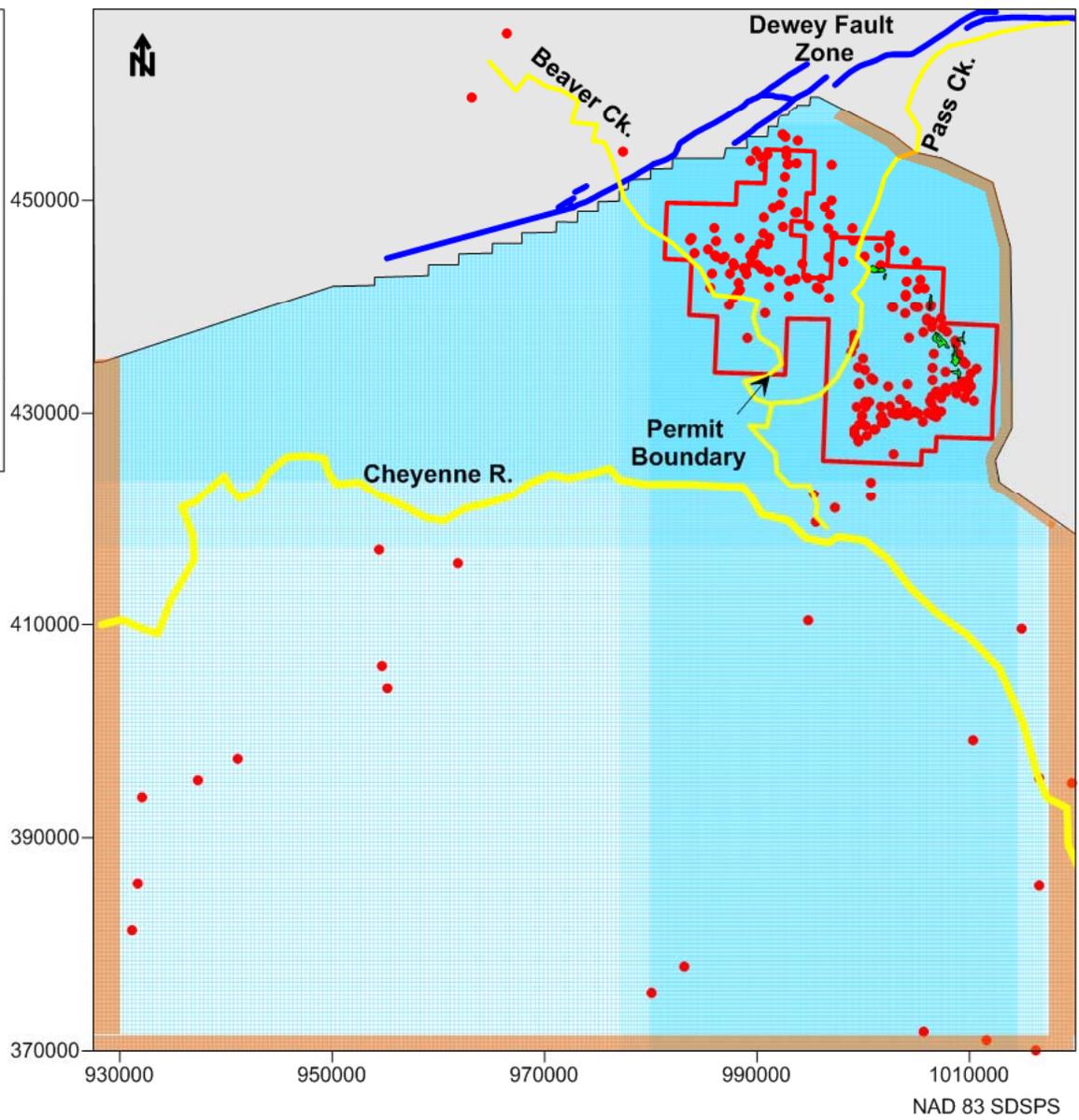
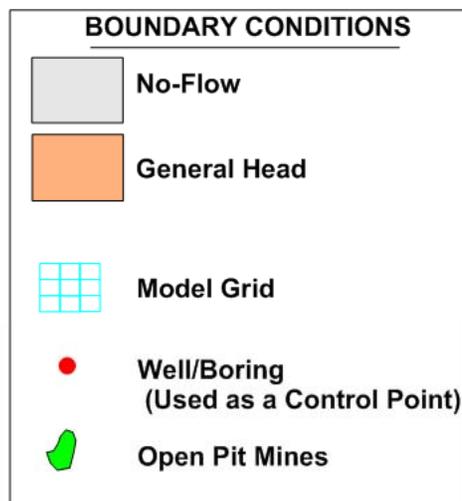
Location of Pump Tests at Dewey Burdock

Model Codes

- **GROUNDWATER FLOW MODELING**
 - MODFLOW2000 (USGS)
 - MODFLOW SURFACT (V 3.0 Hydrogeologic Inc)
- **FLOWPATHS/CAPTURE ZONES**
 - MODPATH (V. 3.0, USGS)
- **PRE-POST PROCESSING**
 - Groundwater Vistas (V. 6, Environmental Simulations)



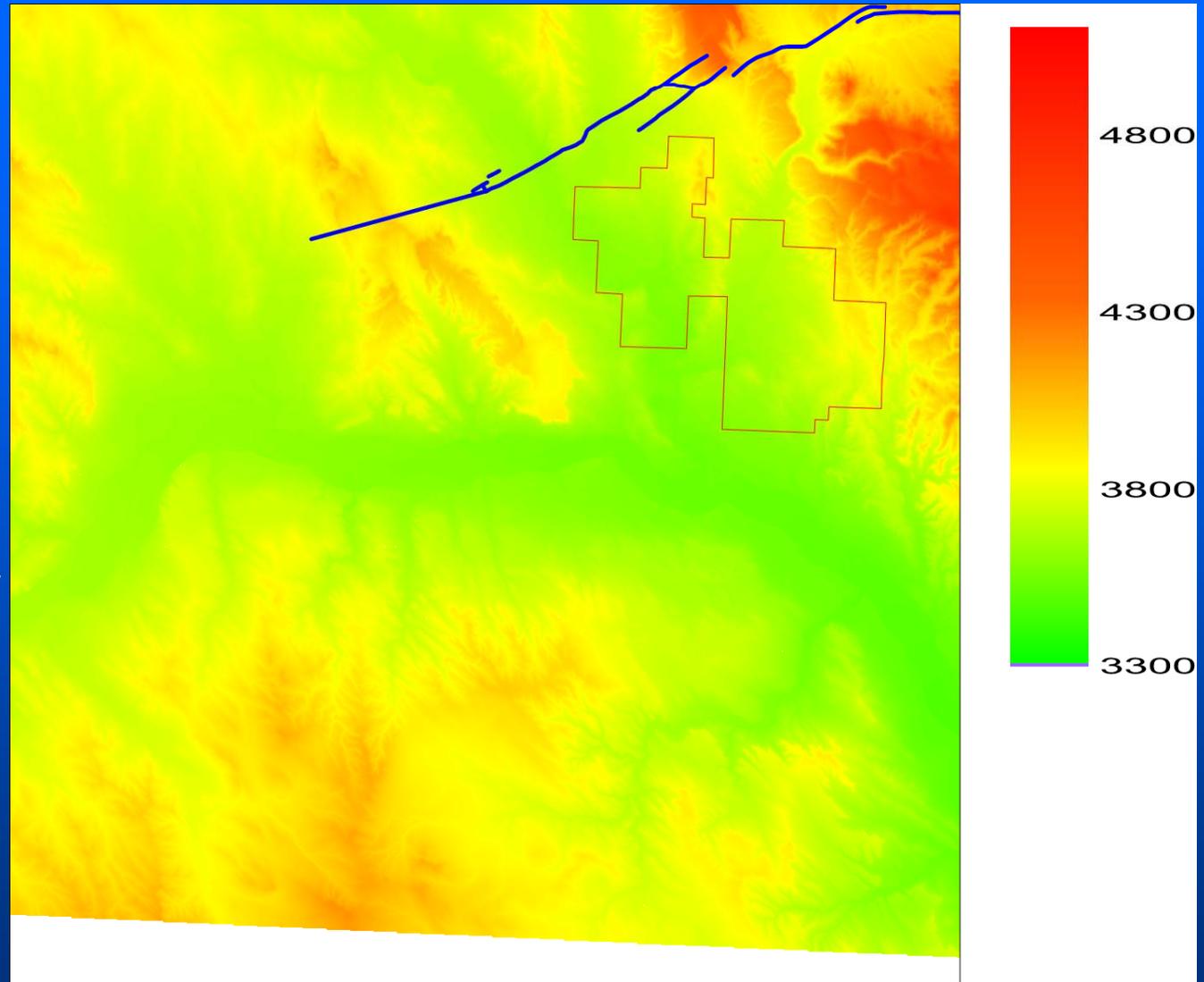
Dewey-Burdock Model Layers

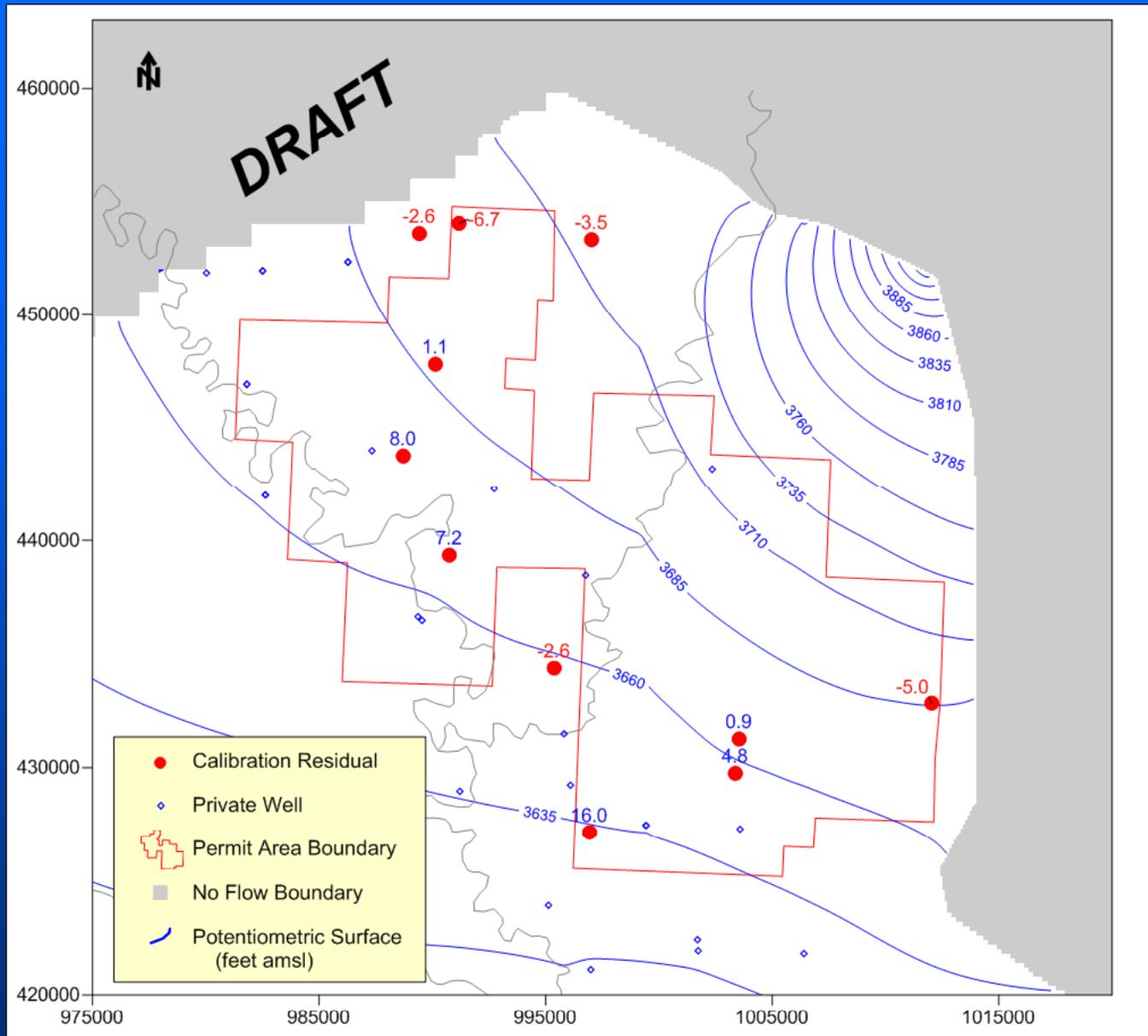


Dewey-Burdock Model Grid and Boundary Conditions

Dewey-Burdock Model

Top Elevation of Upper Layer (Ground Surface)





Calibration Statistics

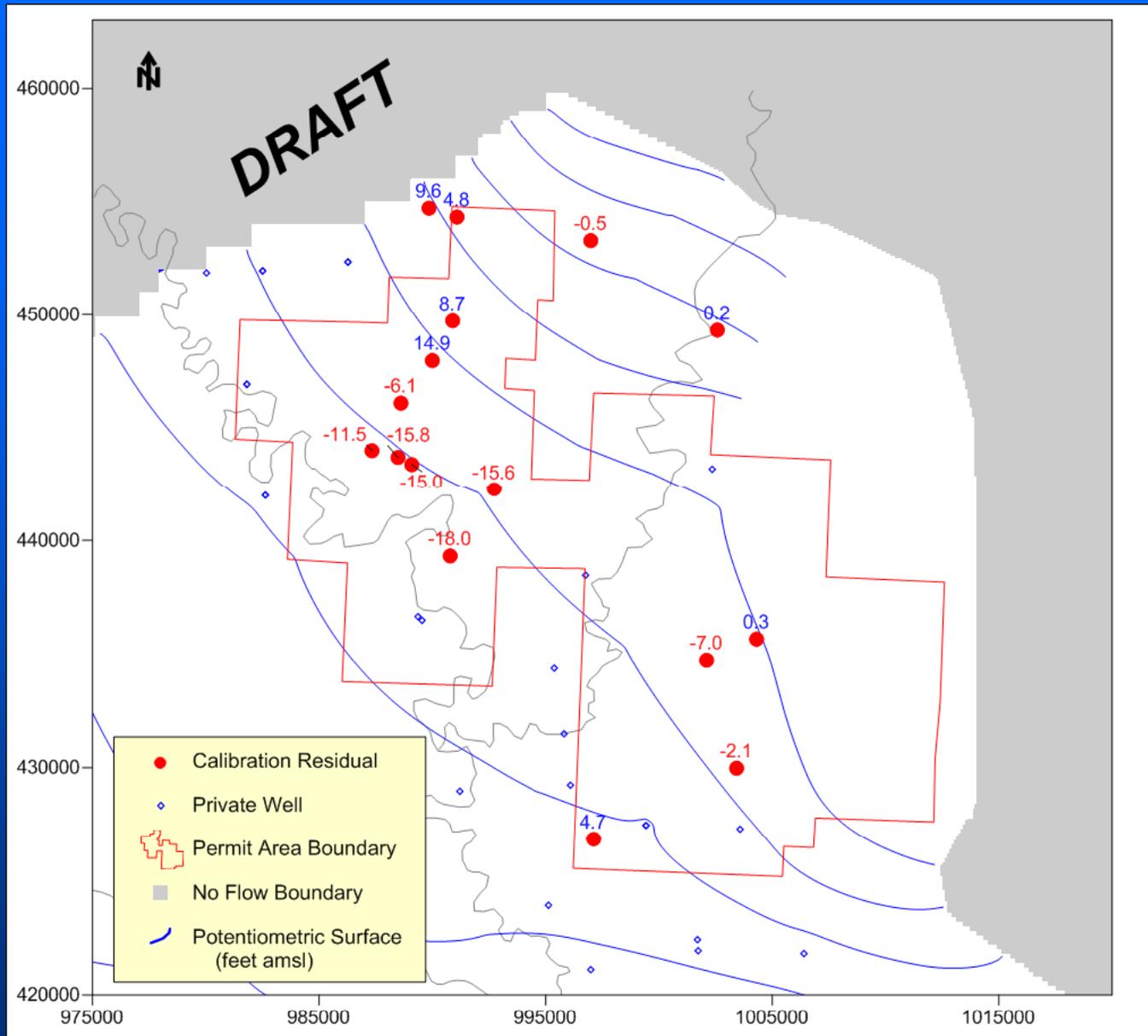
RM 1.16

ARM 5.16

RSS 506

SRSD 0.051

CALIBRATION SIMULATION-LAYER 4 (CHILSON)



Calibration Statistics

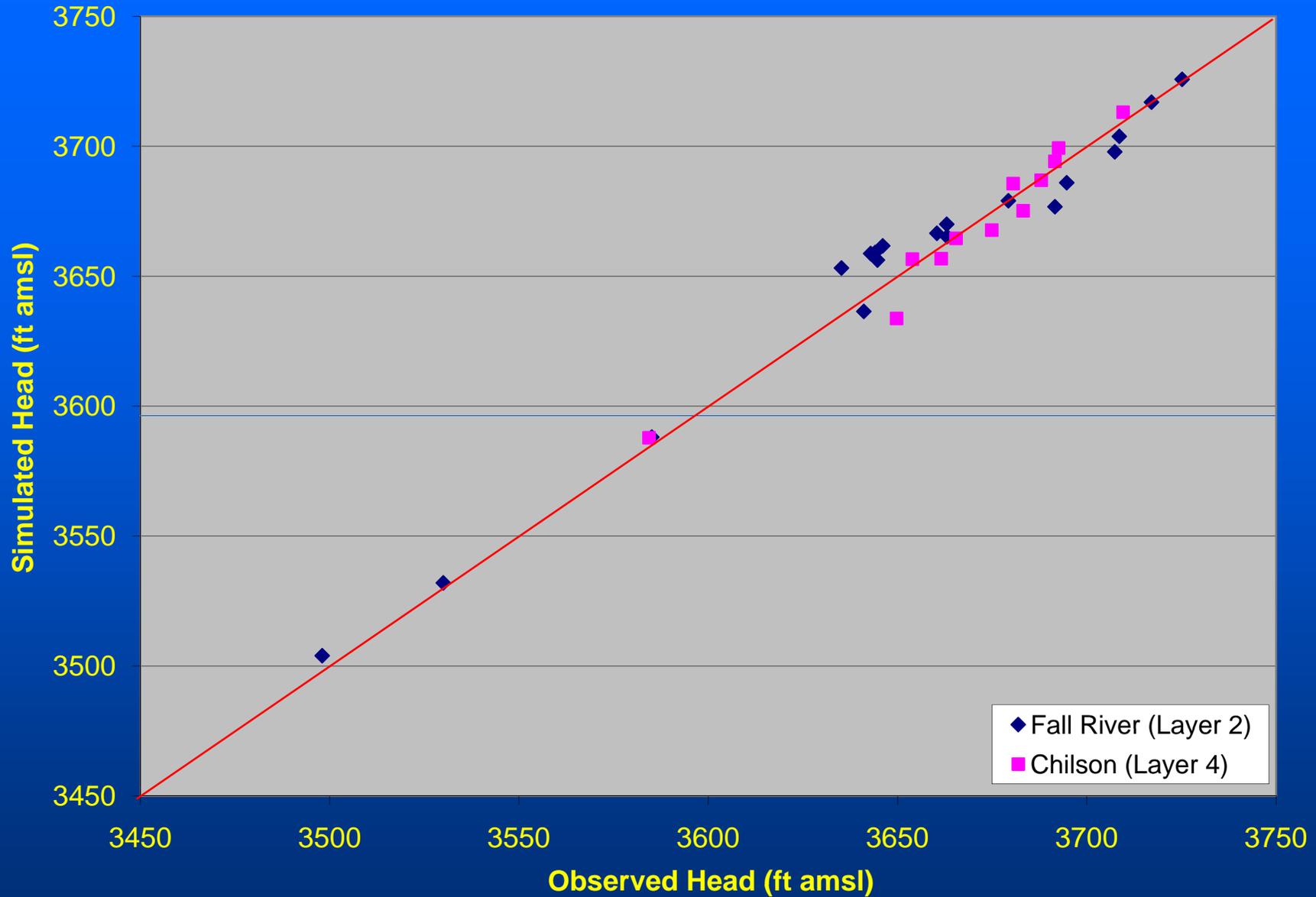
RM -3.14

ARM 7.67

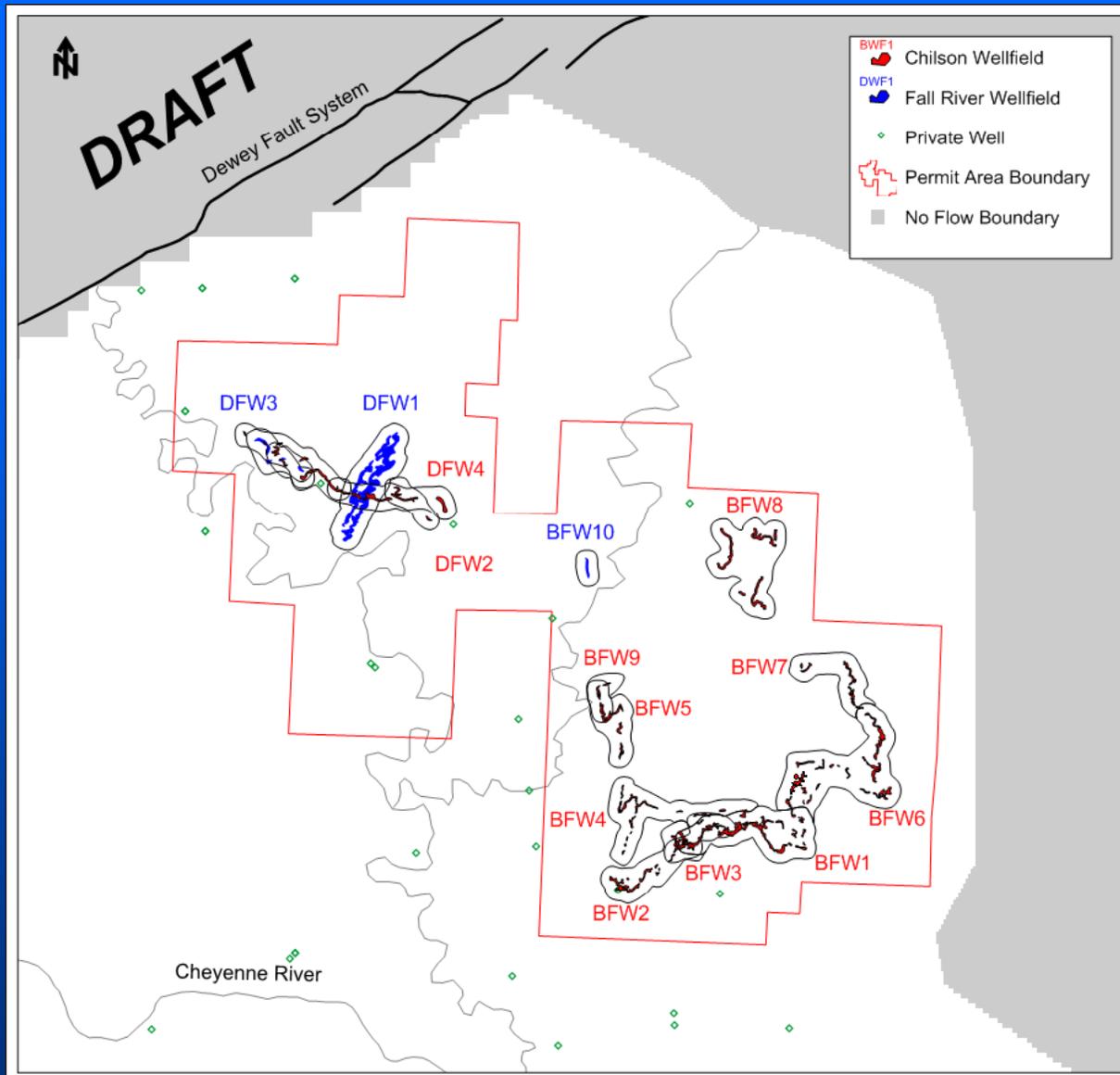
RSS 1750

SRSD 0.04

CALIBRATION SIMULATION-LAYER 2 (FALL RIVER)



CALIBRATION TARGETS – OBSERVED VS SIMULATED



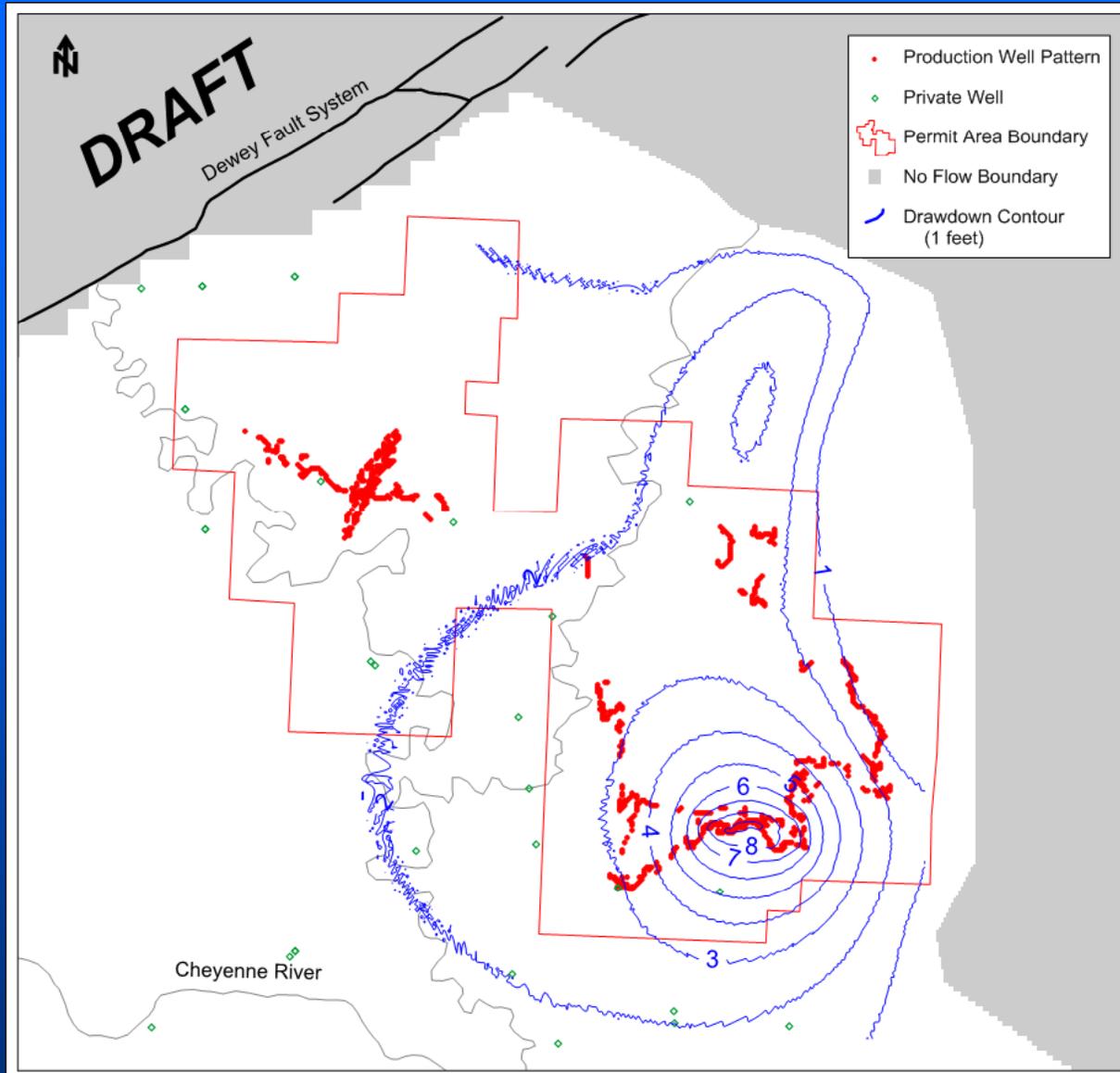
10 Burdock Wellfields
9 Chilson
1 Fall River
4 Dewey Wellfields
2 Chilson
2 Fall River

12 Stress Periods
Cover Production and
Restoration of all
Wellfields over 8 1/4 years

LIFE OF MINE PRODUCTION/RESTORATION SIMULATIONS

Wellfield	No of Well Patterns	STRESS PERIOD											
		SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9	SP10	SP11	SP12
		No. of Days in Stress Period											
		720	183	183	91	275	183	458	183	183	183	183	183
BURDOCK MINE													
BWF1	120	P	R										
BWF2	60		P	P	R								
BWF3	20				P	P	R						
BWF4	60				P	P	R						
BWF5	40				P	P	R						
BWF6	120						P	P	R				
BWF7	52							P	P	R			
BWF8	68							P	P	R			
BWF9	11									P	P	R	
BWF10	9									P	P	R	
DEWEY MINE													
DWF1	160	P	P	P	P	P	P	P	R				
DWF2	80							P	P	R			
DWF3	15									P	P	R	
DWF4	25									P	P	R	

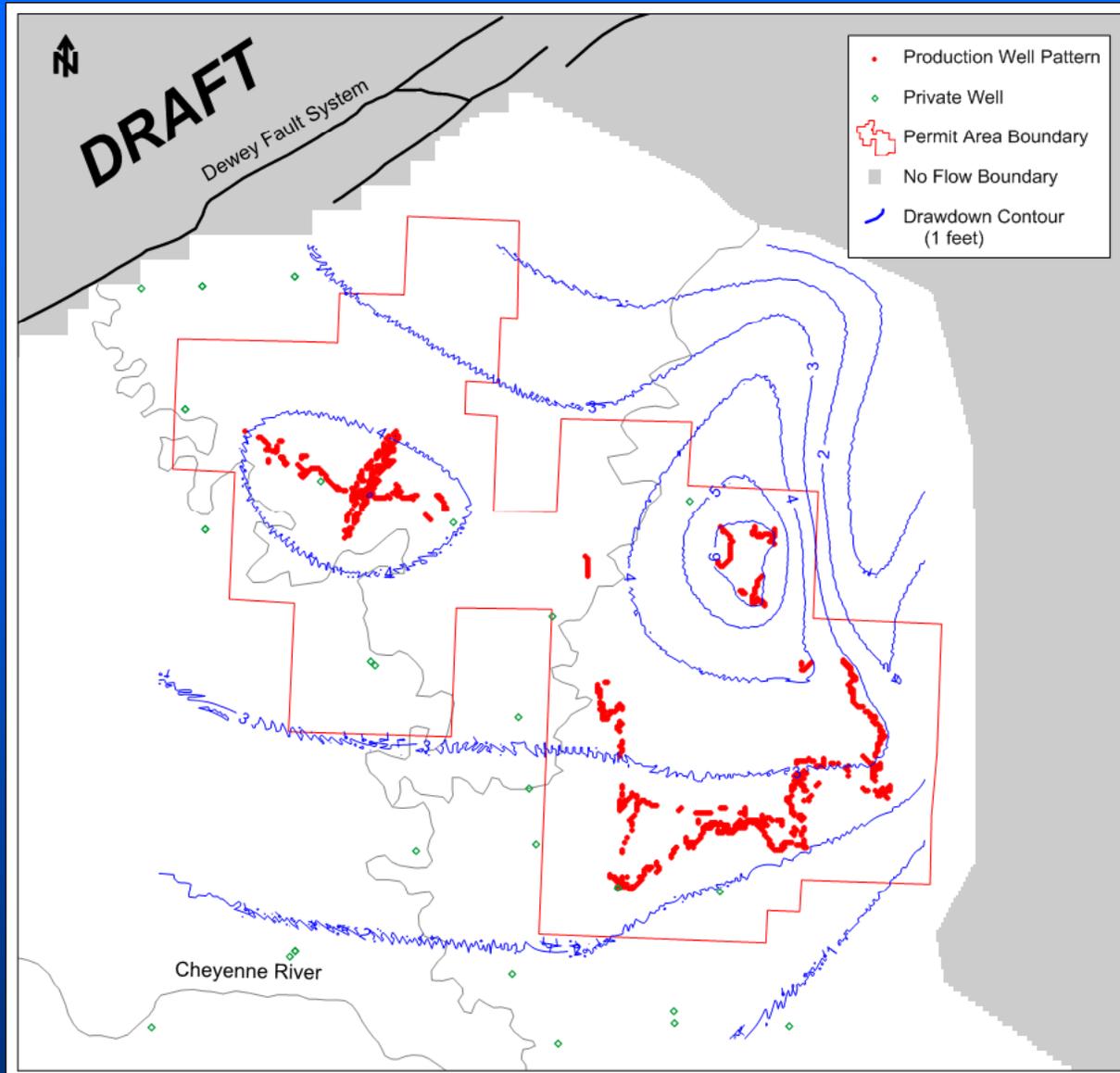
DEWEY BURDOCK LIFE-OF-MINE SIMULATIONS PRODUCTION/RESTORATION SCHEDULE



**Drawdown after 730 Days
Production at Wellfield
BWF1**

(End of Stress Period 1)

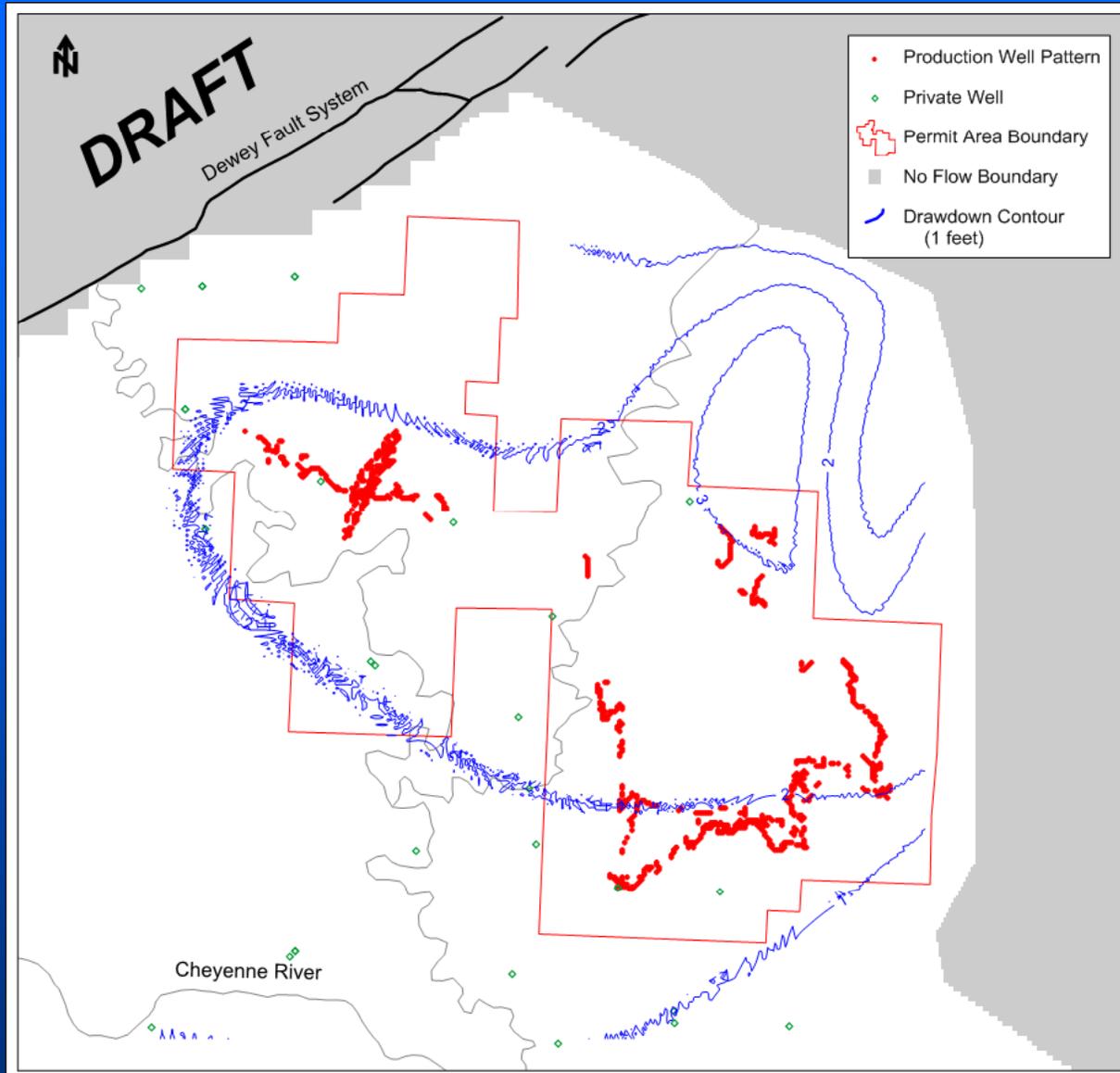
Chilson Drawdown -Simulation of 4000 gpm and 0.875% Bleed



**Drawdown after 366 Days
Production at BWF7,
BWF8 and DWF2**

(End of Stress Period 9)

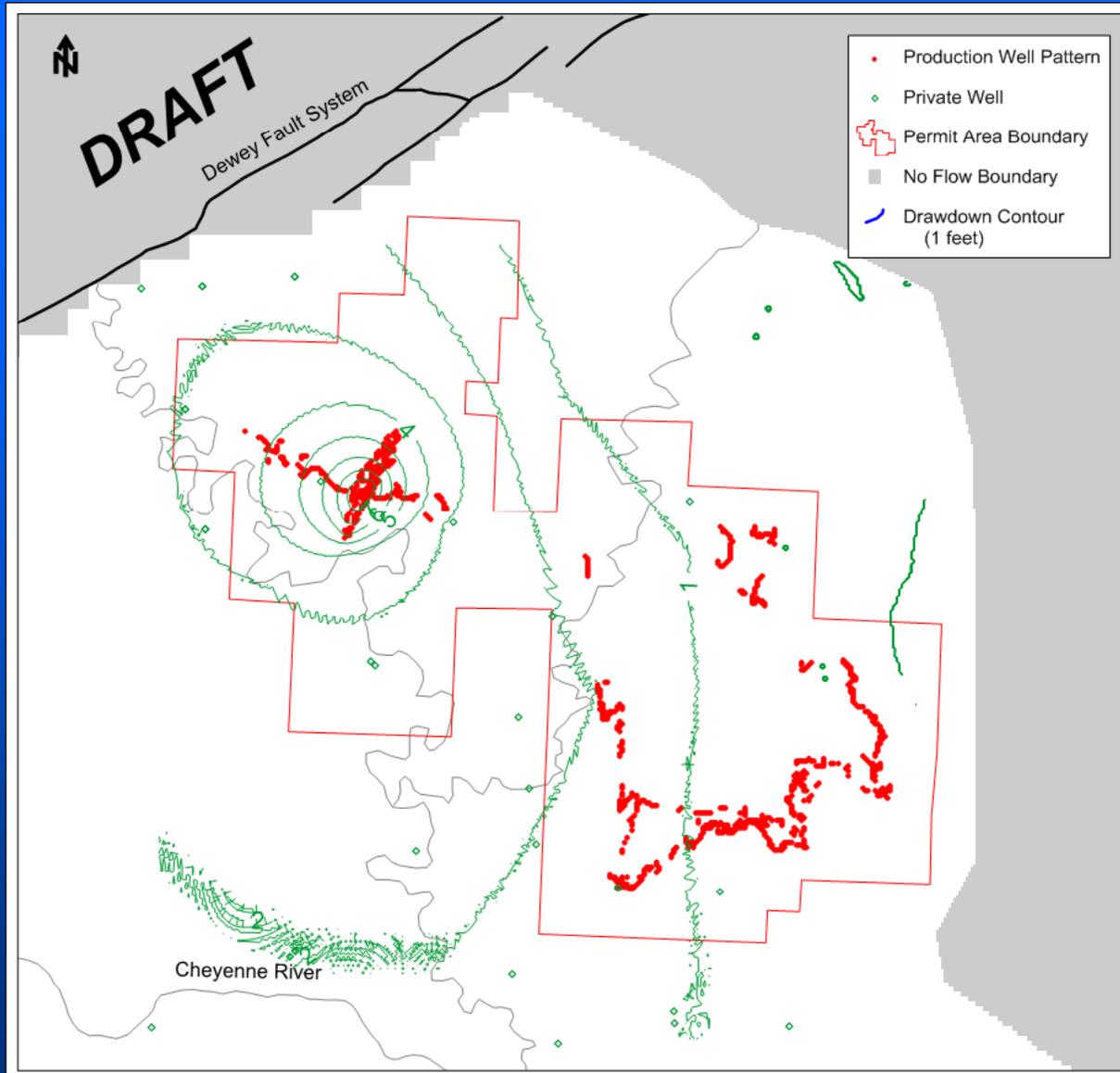
Chilson Drawdown -Simulation of 4000 gpm and 0.875% Bleed



Drawdown At End of ISR Operations

(End of Stress Period 12)

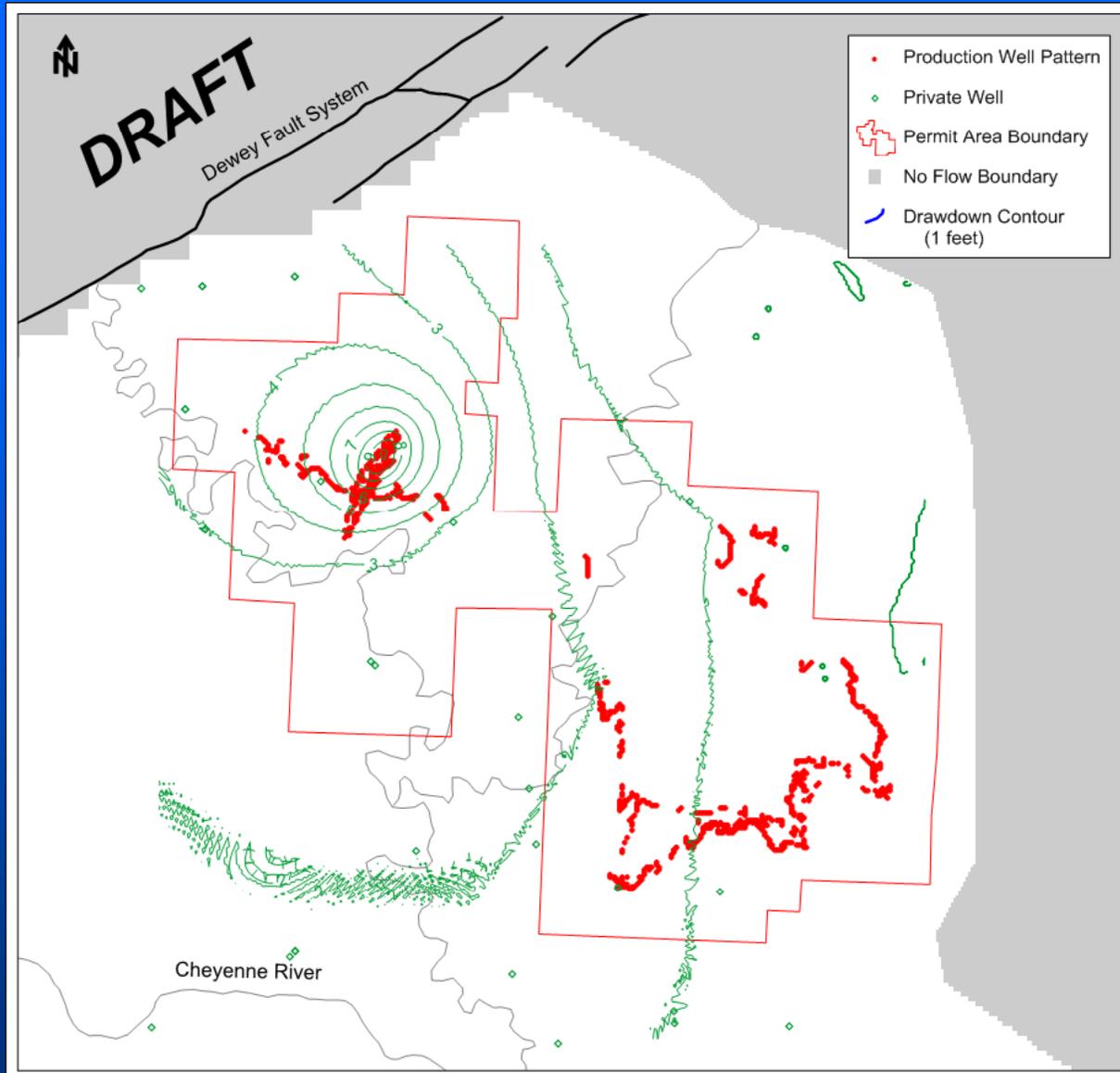
Chilson Drawdown -Simulation of 4000 gpm and 0.875% Bleed



**Drawdown after 730 Days
Production at Wellfield
DWF1**

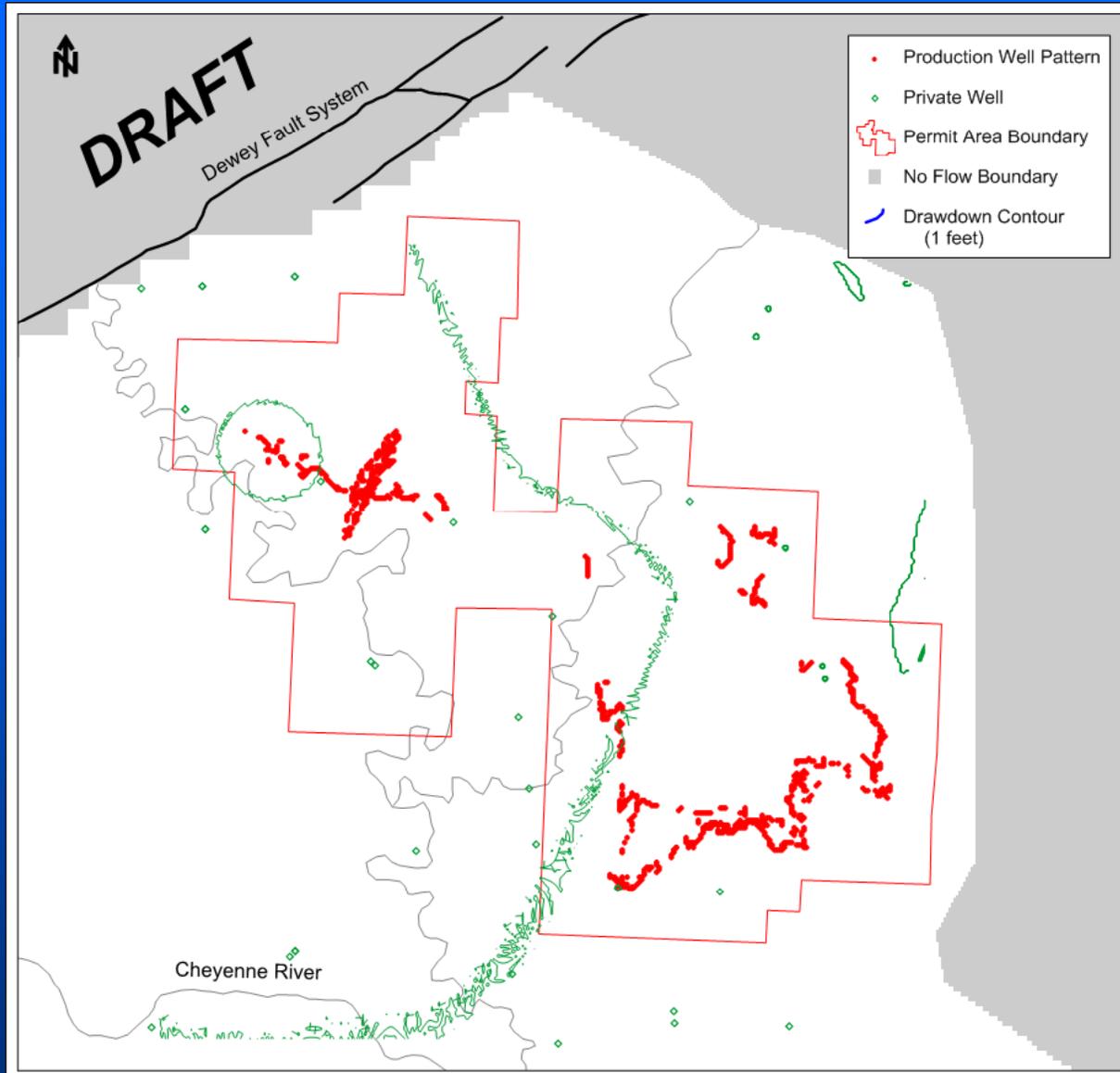
(End of Stress Period 1)

Fall River Drawdown -Simulation of 4000 gpm and 0.875% Bleed



**Drawdown after 2093
Days Production at DWF1
(End of Stress Period 7)**

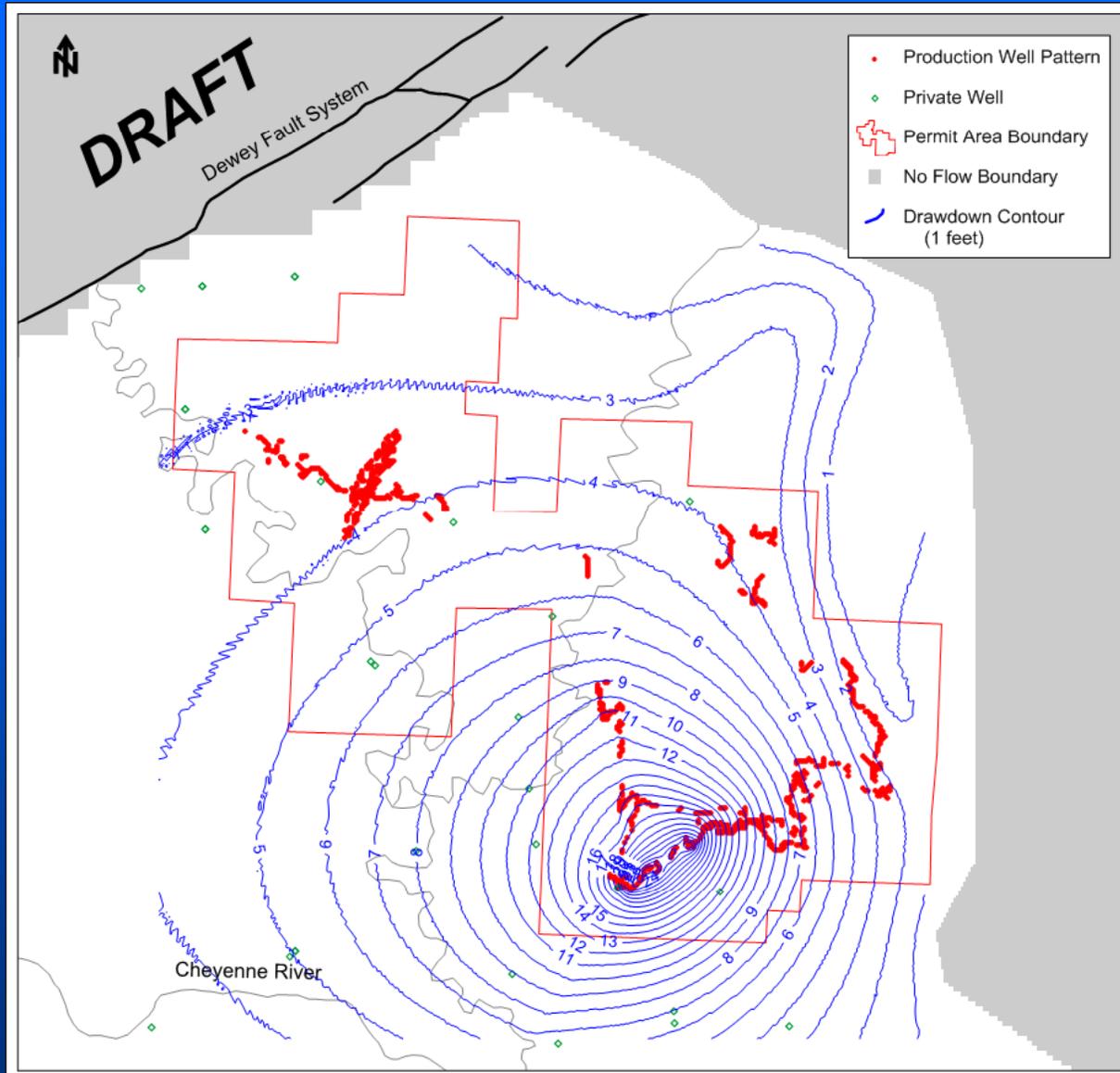
Fall River Drawdown -Simulation of 4000 gpm and 0.875% Bleed



Drawdown At End of ISR Operations

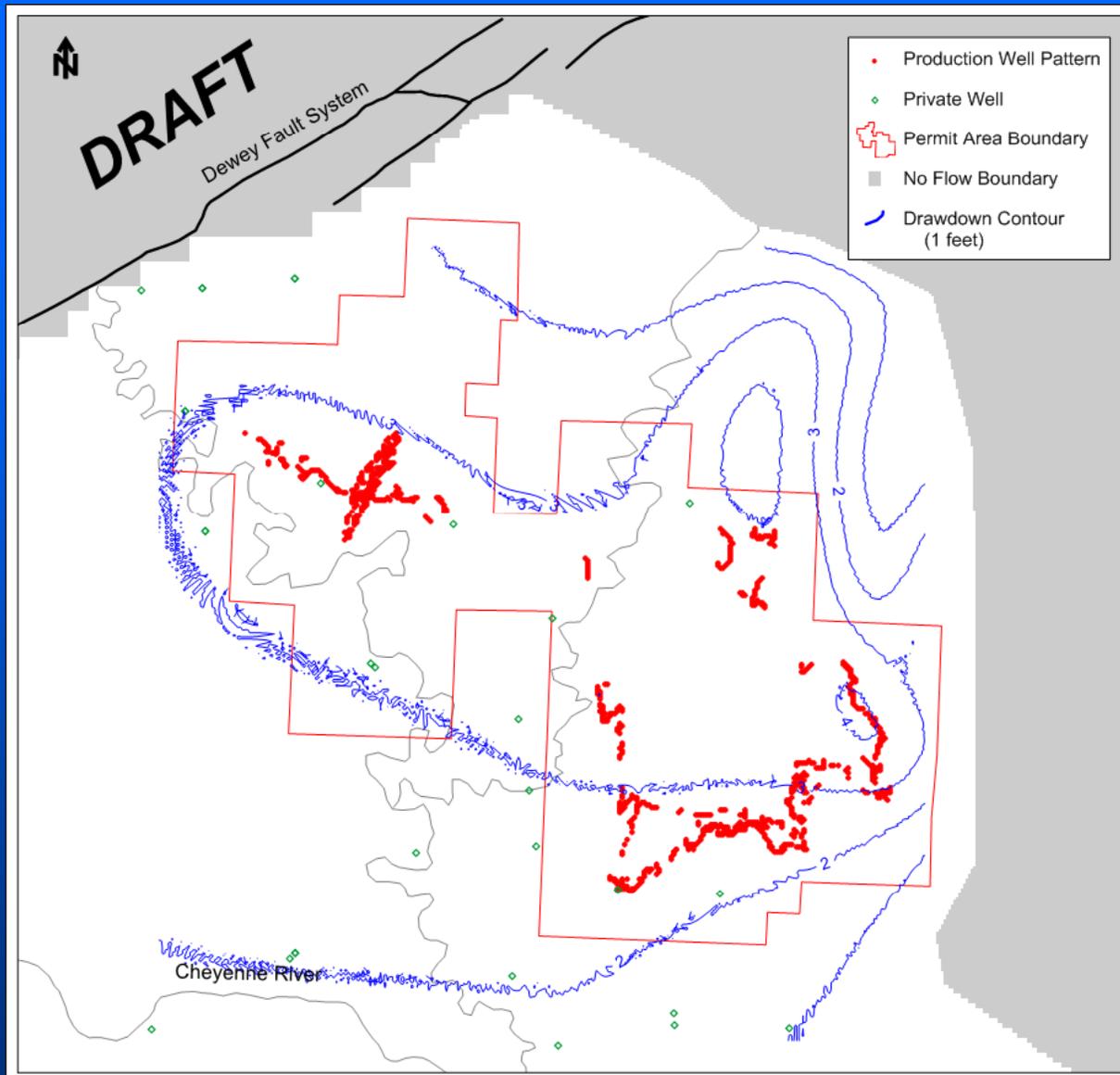
(End of Stress Period 12)

Fall River Drawdown-Simulation of 4000 gpm and 0.875% Bleed



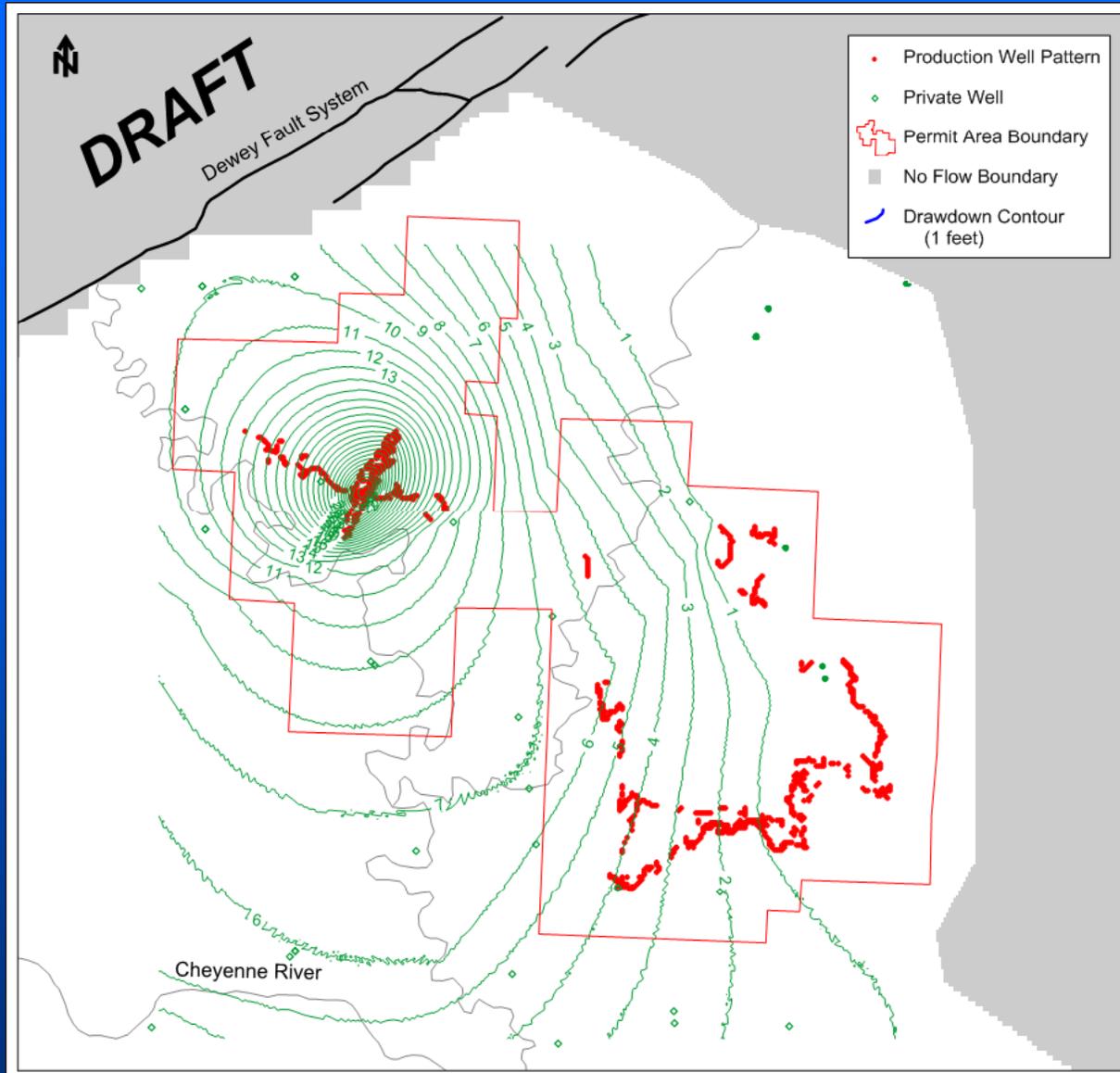
**Drawdown after 183 Days
Production at BWF3,
BWF4 and BWF5 and
Restoration at BWF2
(End of Stress Period 4)**

**Chilson Drawdown-Simulation of 4000 gpm
and 0.875% Bleed with GWS**



**Drawdown At End of
ISR Operations
(End of Stress Period 12)**

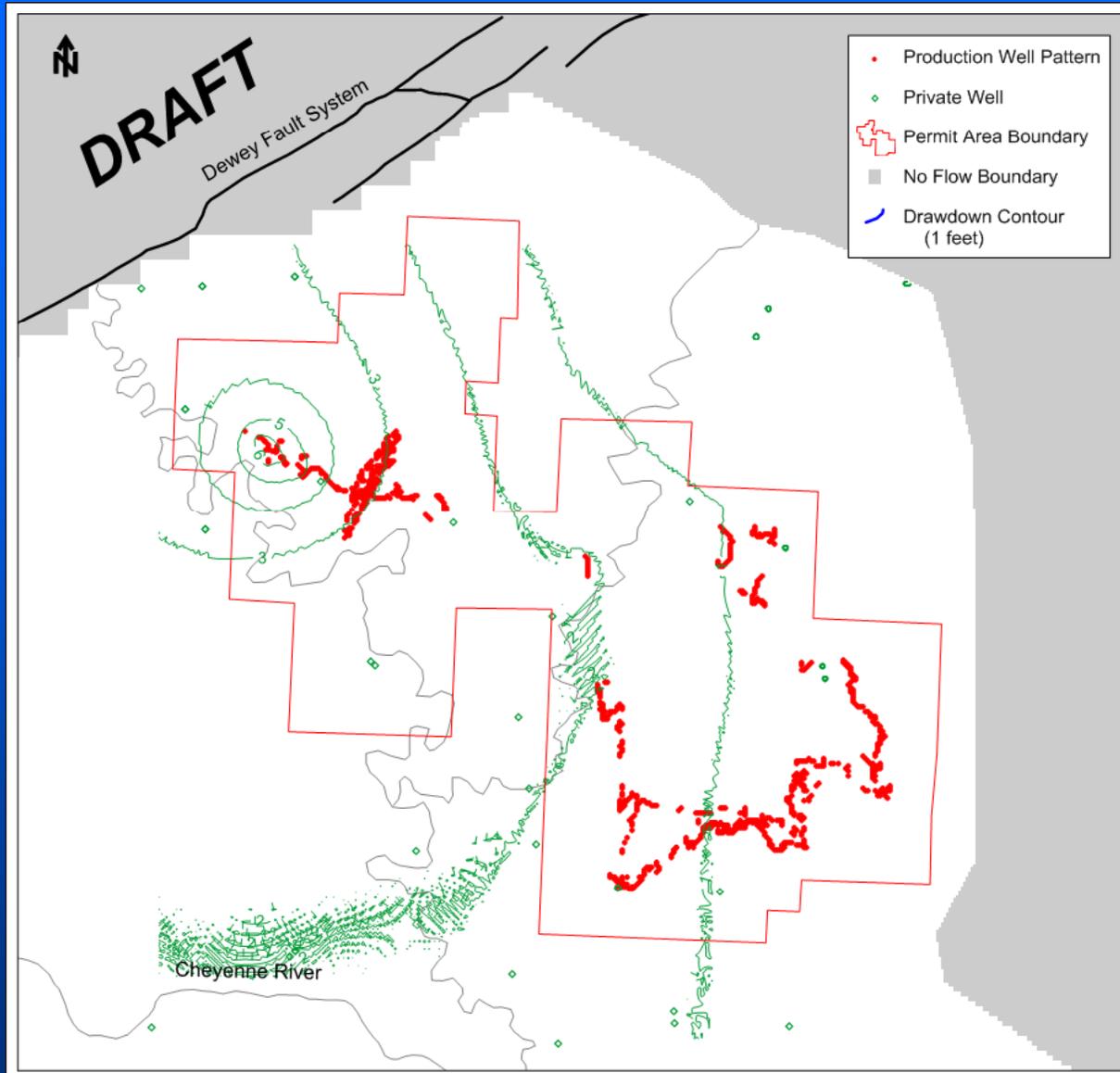
**Chilson Drawdown-Simulation of 4000 gpm
and 0.875% Bleed with GWS**



**Drawdown After
1177 Days of Production
at DWF1 and 91 Days
of Restoration at DWF1**

(End of Stress Period 4)

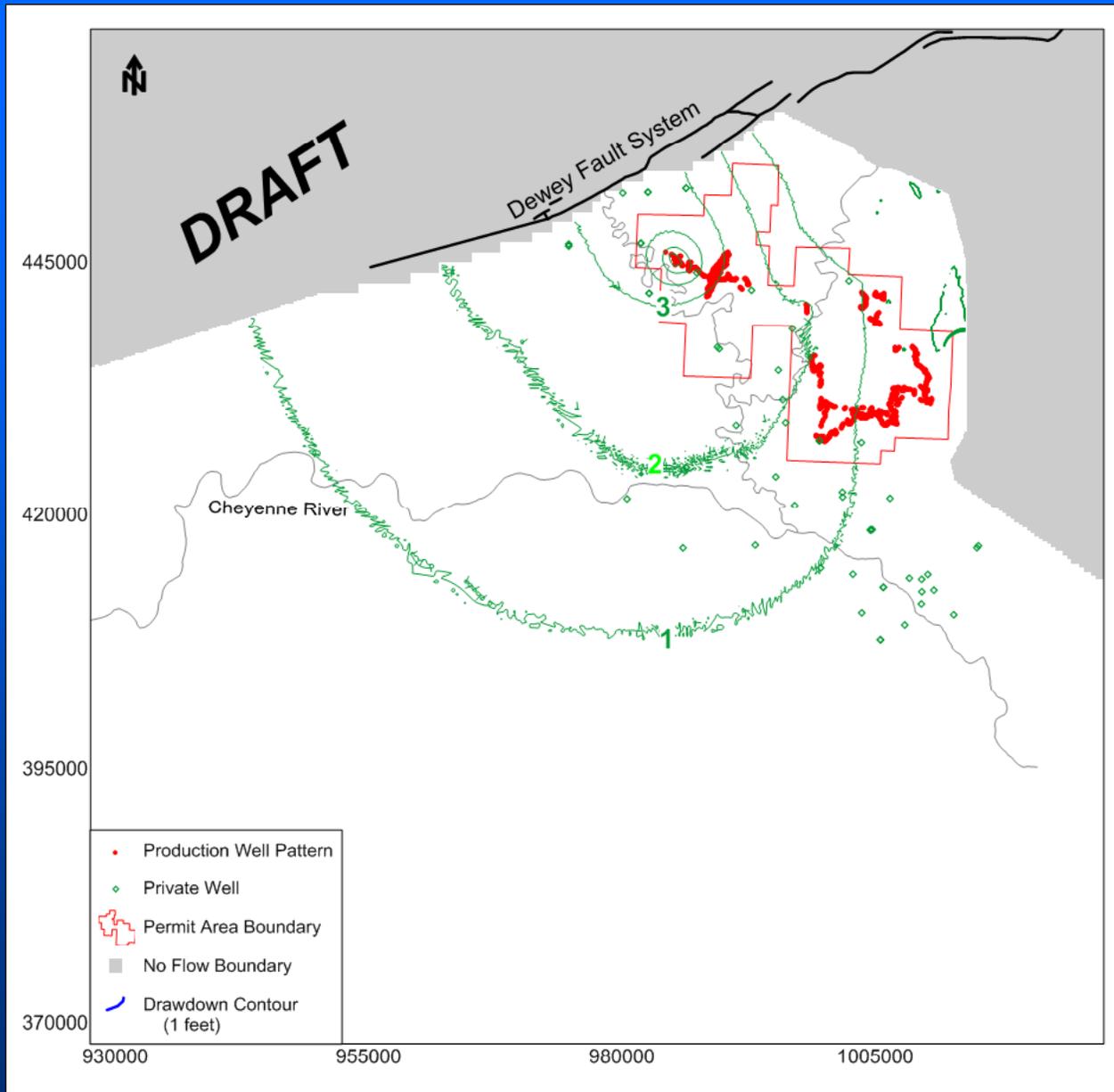
**Fall River Drawdown-Simulation of 4000 gpm
and 0.875% Bleed with GWS**



**Drawdown At End of
ISR Operations**

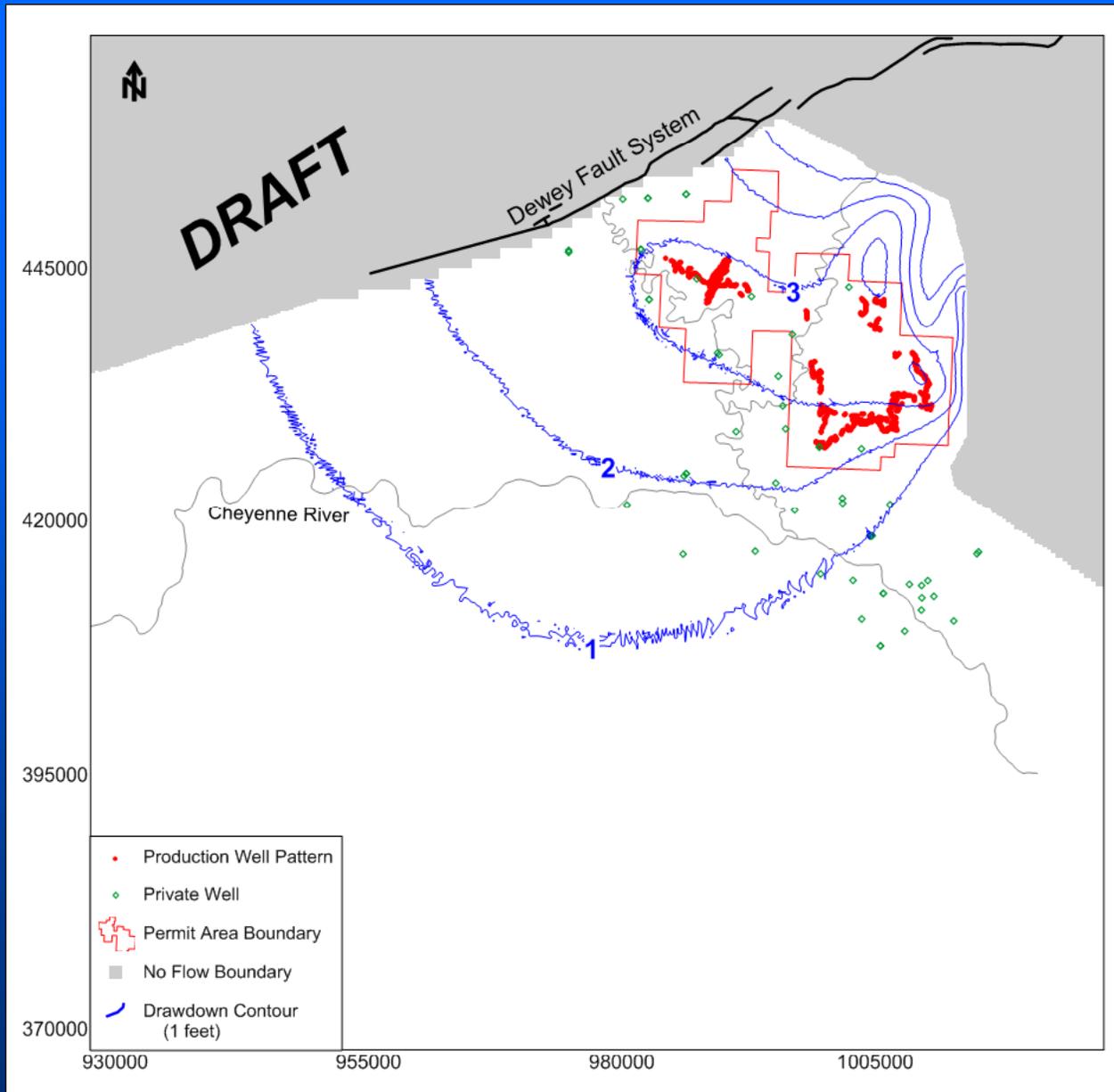
(End of Stress Period 12)

**Fall River Drawdown-Simulation of 4000 gpm
and 0.875% Bleed with GWS**



**Drawdown At End of
ISR Operations
(End of Stress Period 12)**

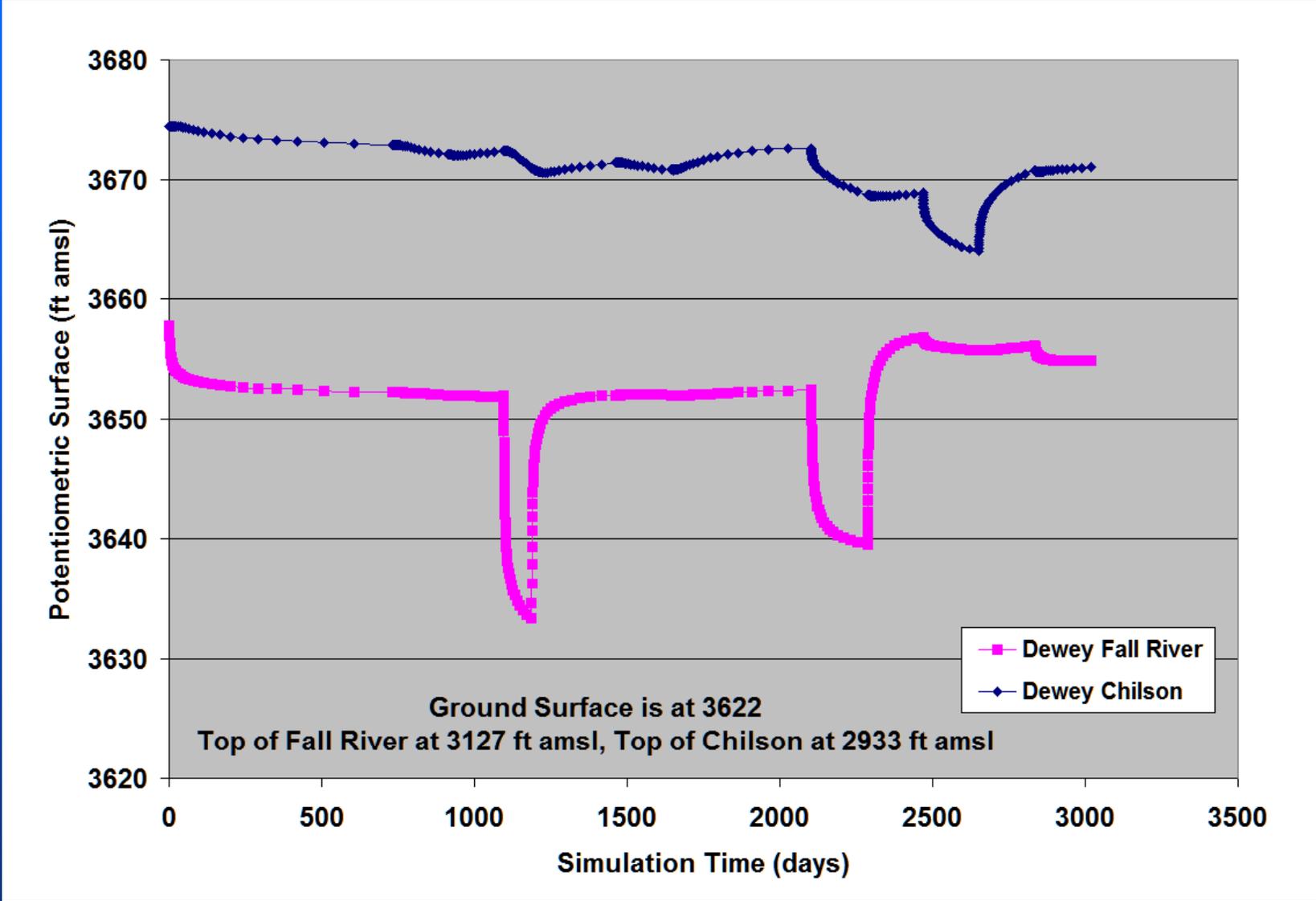
**Fall River Drawdown-Simulation -4000 gpm
and 0.875% Bleed with GWS (Full Model Domain)**



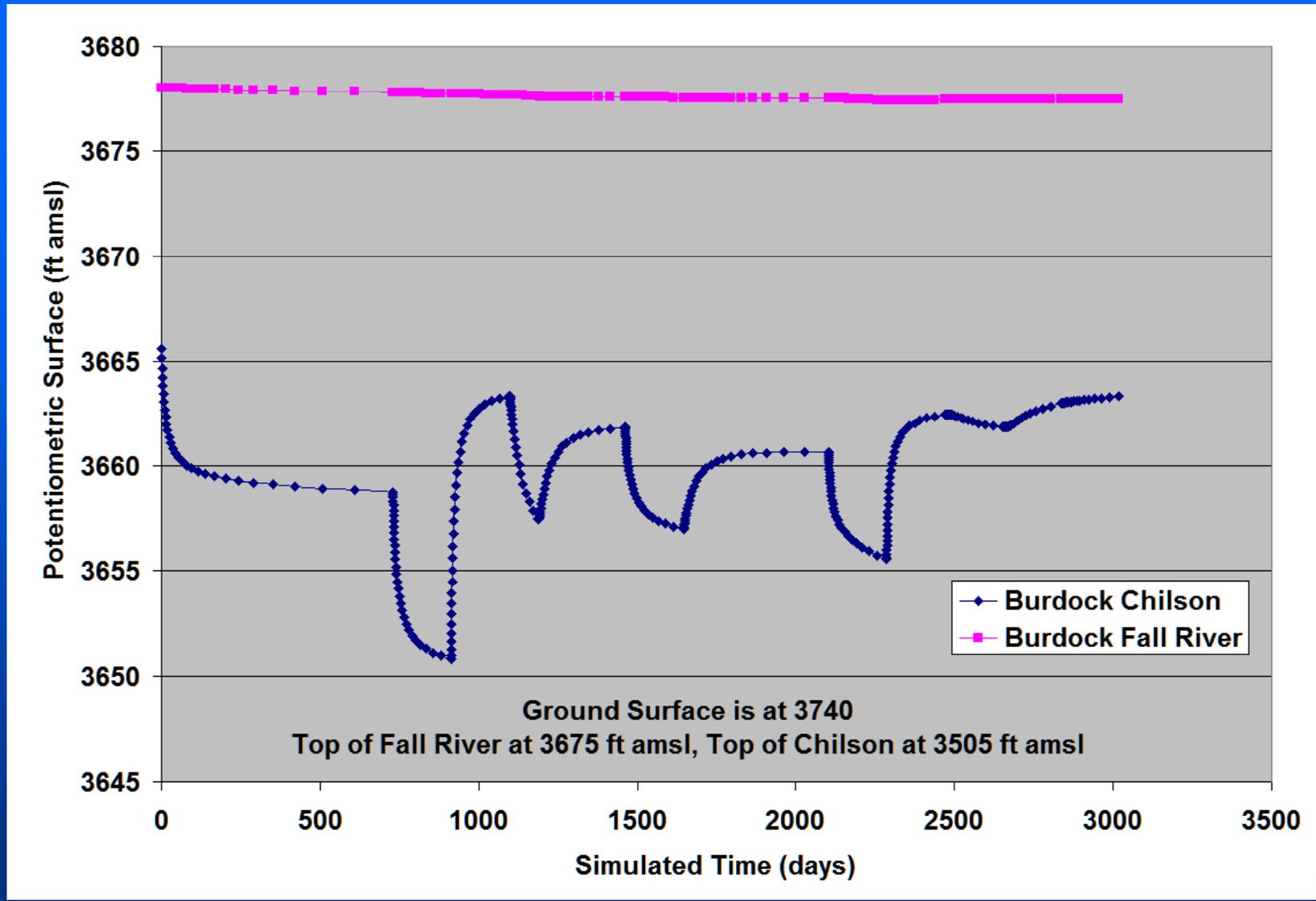
**Drawdown At End of
ISR Operations**

(End of Stress Period 12)

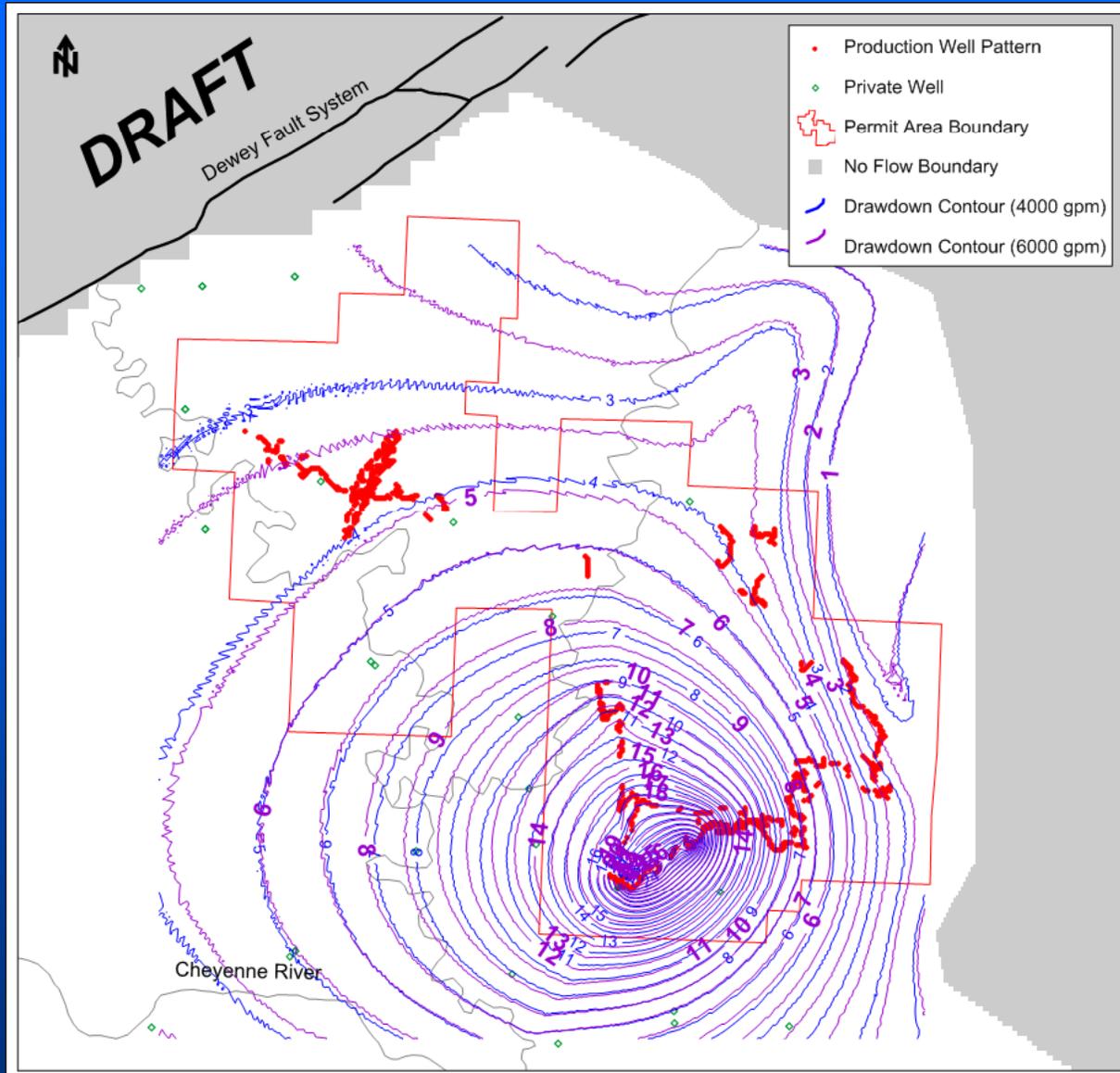
**Chilson Drawdown-Simulation -4000 gpm
and 0.875% Bleed with GWS (Full Model Domain)**



Simulated Potentiometric Surface-Life of Mine Dewey Wellfield Area

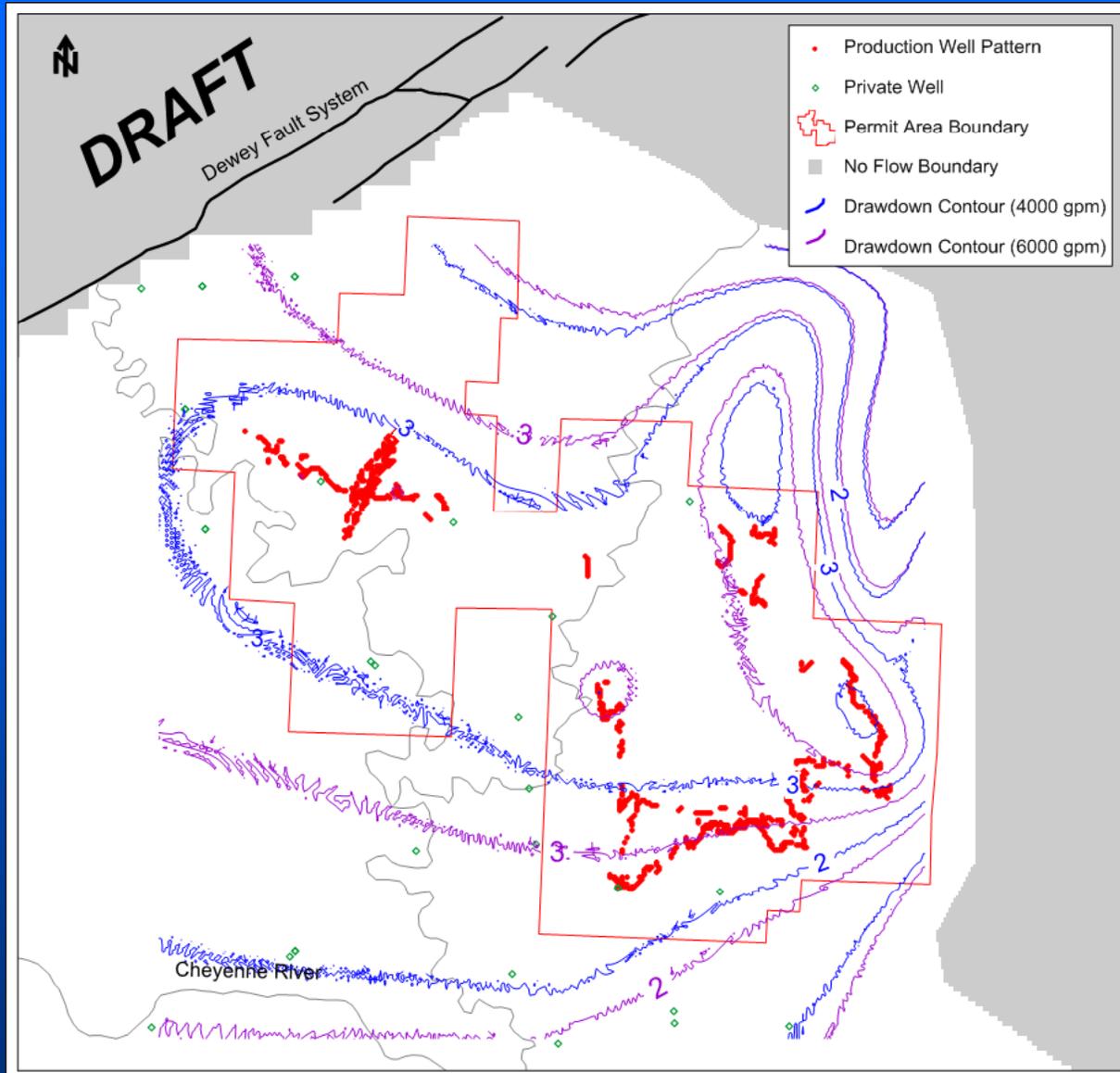


Simulated Potentiometric Surface-Life of Mine, Burdock Wellfield Area



**Drawdown after 183 Days
Production at BWF3,
BWF4 and BWF5 and
Restoration at BWF
(End of Stress Period 4)**

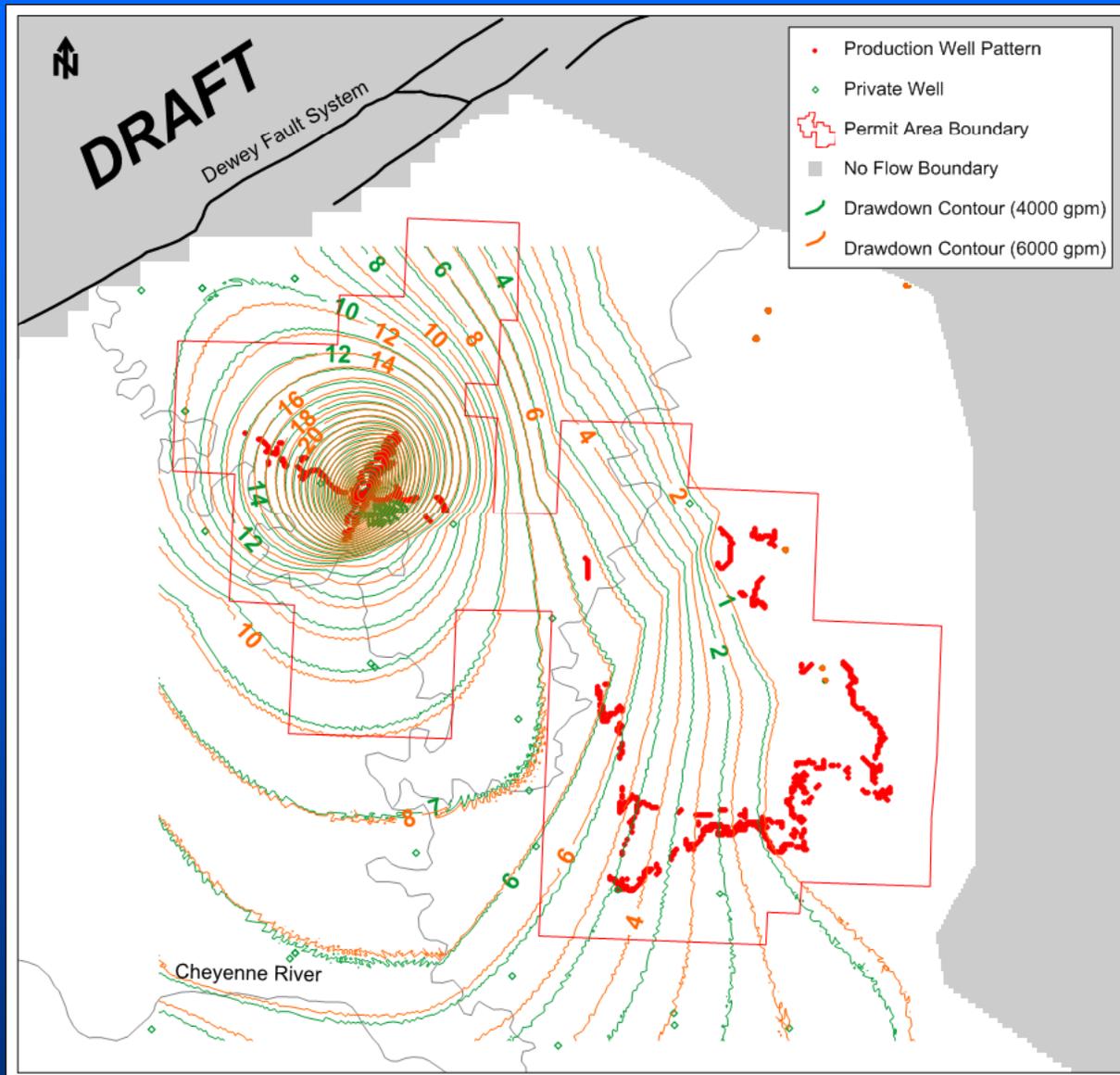
**Comparison of Chilson Drawdown- For 4000 and 6000 gpm
Simulations with and 0.875% Bleed and GWS**



Drawdown At End of ISR Operations

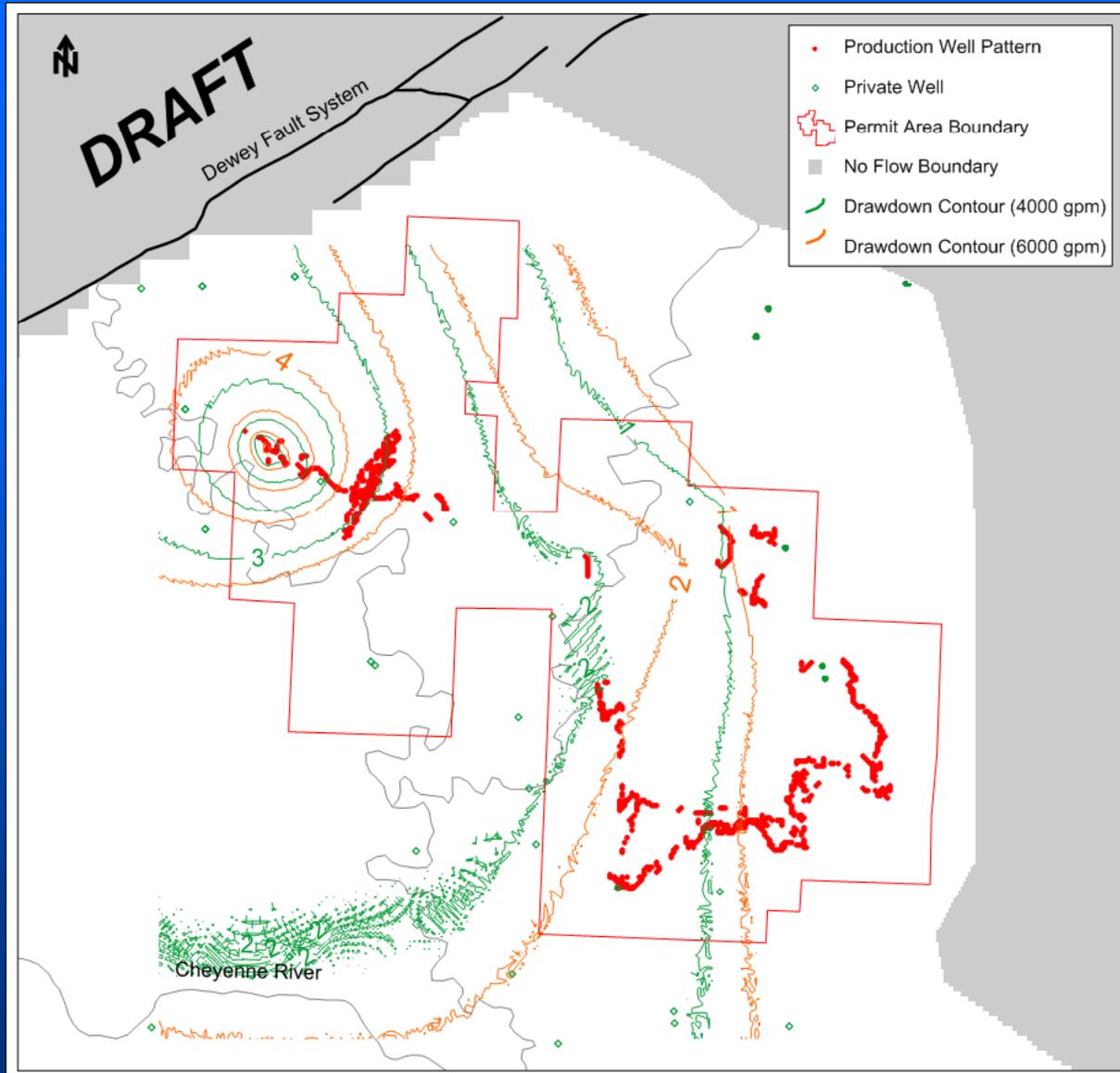
(End of Stress Period 12)

**Comparison of Chilson Drawdown- For 4000 and 6000 gpm
Simulations with 0.875% Bleed and GWS**



**Drawdown After
1177 Days of Production
at DWF1 and 91 Days
of Restoration at DWF1
(End of Stress Period 4)**

**Comparison of Fall River Drawdown- For 4000 and 6000 gpm
Simulations with and 0.875% Bleed and GWS**



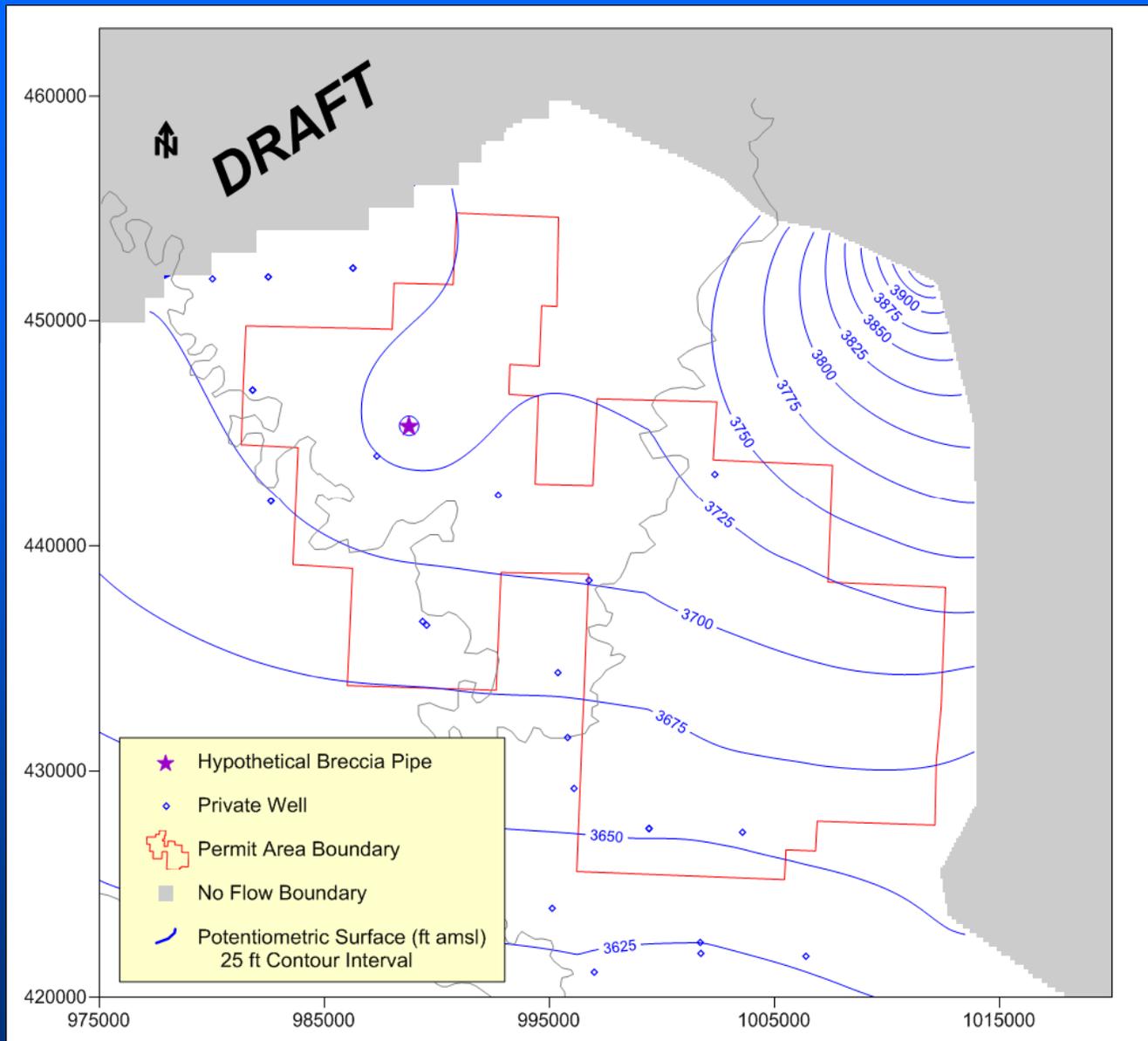
**Drawdown At 12 End of
ISR Operations**

(End of Stress Period 12)

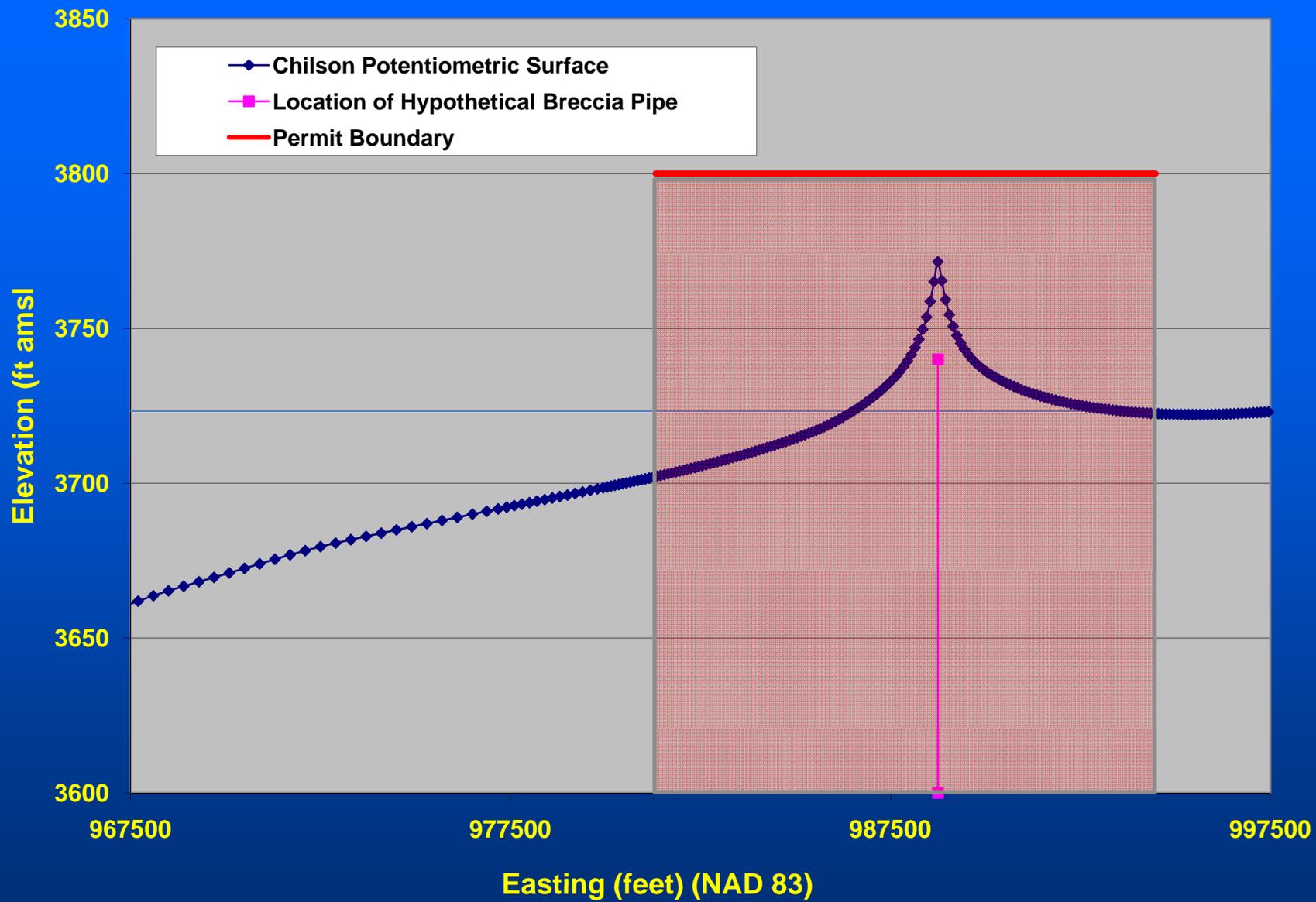
**Comparison of Fall River Drawdown- For 4000 and 6000 gpm
Simulations with and 0.875% Bleed and GWS**

Summary of Life of Mine Simulations

- Simulated Production at 4000 and 6000 gpm with 0.875 % Net Bleed both with and without Groundwater Sweep
- Simulated Drawdown Outside of Permit Area is Generally < 10 feet During All Phases of Production and Restoration
- Modeling Supports Viability of ISR Mining for Uranium in the Fall River and Chilson Aquifers



**Simulation of Hypothetical Breccia Pipe Release in the Chilson
Within the Permit Area at 200 gpm**



Hydraulic Profile (East-West) Through Hypothetical Breccia Pipe

WELLFIELD SIMULATIONS

- Wellfield Flare
- Monitor Ring Spacing/Excursion Detection
- Excursion Recovery
- Wellfield Balance

Simulation of Wellfield Balancing and Wellfield Flare Calculation

(Previously Submitted to NRC)

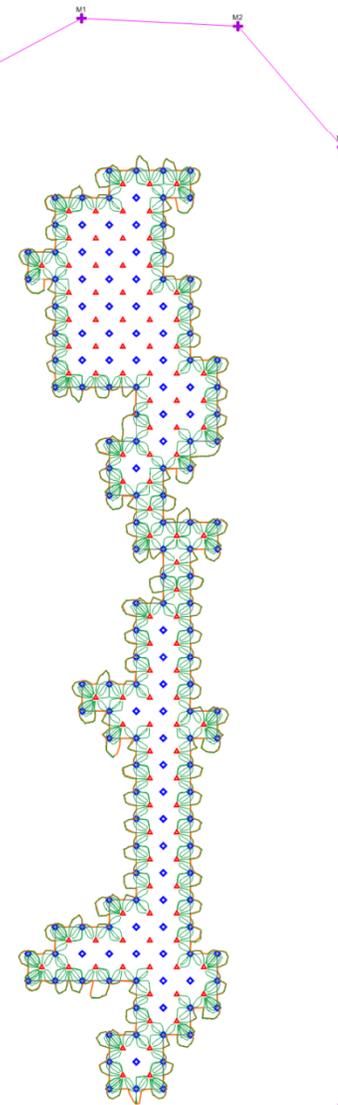
(Dewey Fall River Wellfield)

Horizontal Wellfield
Flare Calculation:
Injection Well Boundary, Area = 509,593 sq. feet
Particle Trace Boundary, Area = 607,185 sq. feet
Horizontal Well Flare = $607,185 / 509,593 = 1.19$

Note:
Dewey F-13 Wellfield balanced and simulated
for a period of 2 years. Groundwater flow
particles were tracked along injection well
boundary over simulated interval.

- ▲ Extraction Well
- ◆ Injection Well
- ✚ Monitor Well
- Monitor Well Ring
- Particle Flow Path
- Horizontal Flare Boundary

0 ft 400 ft 800 ft



SUMMARY

- *Groundwater Model Developed and Calibrated using Site-Specific Geologic and Hydrologic Data*
- *Model Simulations Support Aquifer Sustainability at Projected Production Rates for Life of Mine Operations*
- *Modeling Supports Viability of ISR Mining for Uranium in the Fall River and Chilson Aquifers*

QUESTIONS?

COMMENTS?