Dewey-Burdock Project
Groundwater Discharge Plan
Revision Index

November 21, 2012 Response to August 7, 2012 Technical Comment

Volume	Page, Map or other Permit Entry to be Removed	Page, Map or other Permit Entry to be Added	Description of Change
1	p. 89	p. 89	Updated discussion on alluvial potentiometric contour map.
1	p. 91 (Fig. 3.7-8)	p. 91 (Fig. 3.7-8)	Updated alluvial potentiometric contour map to include November 2012 water level measurements, including those from alluvial compliance wells and additional wells near BC-2.
1	p. 152	p. 152	Corrected reference to Plate 3.6-10; updated minimum observed depth to groundwater in the Burdock land application area from 25 to 13 feet based on the November 2012 static water level measurement from well 715.
1	3.6-A-10 (App. 3.6-A)	3.6-A-10 (App. 3.6-A)	Replaced DB11-3-ALLUV-2 borehole log to remove previous note indicating water measurement was suspected of being made in error.
2	Plate 3.6-10	Plate 3.6-10	Added new Cross Section H-H' and updated Cross Sections F-F' and G-G' to reflect revised potentiometric contours based on November 2012 water level measurements.

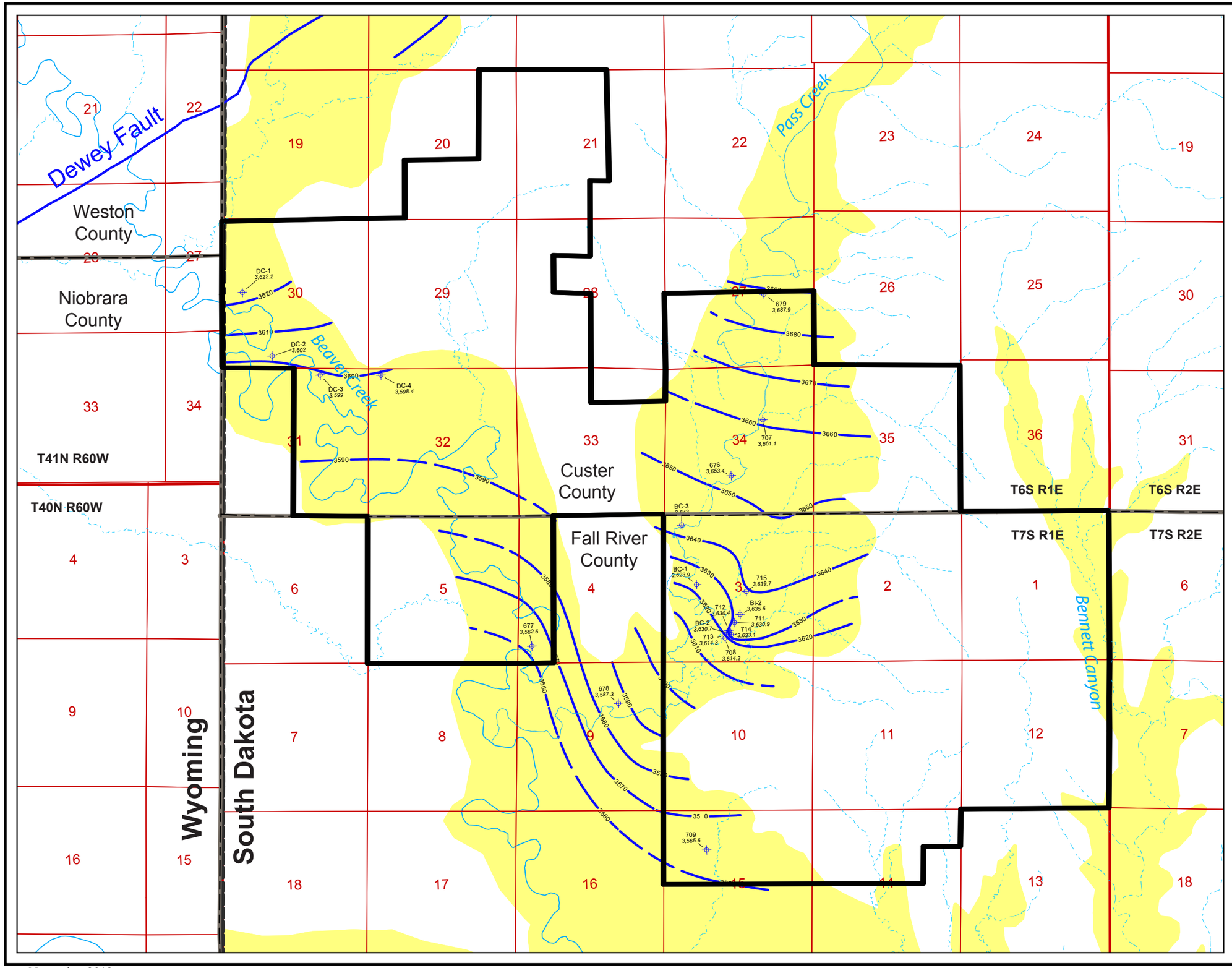
falls on the land surface and by infiltration of surface runoff, primarily in the Pass Creek and Bennett Canyon drainages north and east of the project area, respectively.

Within the project area, the Fall River dips gently to the southwest at 2 to 6 degrees away from its outcrop areas. As a result, groundwater flow generally occurs from the northeast to the southwest toward the Powder River Basin.

A potentiometric contour map for the Fall River Formation is shown on Figure 3.7-7. This map is based on representative water level measurements taken over a 5-day period from April 25 through April 29, 2011. The potentiometric contour map for the Fall River Formation shows a relatively uniform hydraulic gradient across the project area, with the potentiometric levels decreasing to the southwest.

A shallow, perched groundwater system exists within some of the alluvium associated with Beaver Creek, Pass Creek, and Bennett Canyon on the eastern edge of the project area. These alluvial systems are perched above the top of the Graneros Group on the portions of the project area where land application of water is proposed. Groundwater flow within the alluvium is controlled by the configuration of the drainage channel on the top of bedrock and in most situations is generally parallel to surface drainage patterns. In the case of Bennett Canyon, the alluvium directly overlies the Chilson Member of the Lakota Formation. As such, the alluvial groundwater is a potential source of recharge to the underlying Chilson. The closest land application area, Burdock, is over 4,000 feet west of Bennett Canyon and will have no influence on Bennett Canyon alluvium or the Chilson Member.

A potentiometric surface contour map for the Pass Creek and Beaver Creek alluvium is shown on Figure 3.7-8. An isopach map for the alluvium is shown on Plate 3.6-4. The potentiometric surfaces within the alluvium show typical down-valley gradients paralleling the surface topography. The potentiometric surface in Figure 3.7-8 is based on water level measurements taken on November 5, 2012. The significant drop in the static water elevation between alluvial compliance well BC-2 and alluvial wells 708 and 713 is believed to be attributed to significant heterogeneity of the basal alluvial gravel material in this vicinity. This conclusion is supported by significant differences in water quality between wells BC-2 and 708.



Legend

- Alluvial Well
- Ephemeral Streams
- Perennial Streams
- Potentiometric Contour
- Inferred Potentiometric Contour
- Project Boundary
- Alluvium

Note: Potentiometric Contour Elevations in feet above sea level.

Feet
0 2,000 4,000 6,000
0 1,000 2,000
Meters

N

Figure 3.7-8

Potentiometric Contour Map,
Pass Creek and
Beaver Creek Alluvium
Dewey-Burdock Project

DRAWN BY	K. Schlieper
DATE	13-Nov-2012
FILENAME	2012_GDP_Fig_3.7-8.ai

POWERTECH (USA) INC.

8.0 MITIGATION OF POTENTIAL IMPACTS

The following sections describe the mitigation measures that will be used to minimize the potential impacts to groundwater, surface water, soil, vegetation, livestock and wildlife.

8.1 Groundwater

8.1.1 Alluvial Groundwater

Mitigation measures used to protect alluvial groundwater quality are described below and include:

- Siting the land application areas at locations where natural conditions make it highly unlikely that the land application water will reach the alluvium,
- Plugging and abandoning existing wells within the land application areas,
- Design and construct well fields and land application systems to avoid any potential conflicts and minimize potential risks,
- Applying the water at agronomic rates,
- Treating the land application water to remove radionuclides,
- Providing sufficient pond storage capacity to stabilize the water quality over long periods of time,
- Implementing an extensive monitoring program, and
- Implementing a contingency plan to address increasing trends in groundwater quality constituents within the POP zones in order to avoid potential impacts to groundwater outside of the POP zones.

Natural Conditions

Potential impacts to alluvial groundwater will be minimized by natural conditions that make it highly unlikely that the land application water will reach the alluvial groundwater. Plate 3.6-10 depicts shallow geologic cross sections drawn through the Burdock land application area. The figure shows that the depth to the top of the alluvial gravel ranges from about 12 to 33 feet and is typically 15 to 25 feet. The depth to alluvial groundwater, where encountered, is typically 13 to 35 feet. By comparison, the SPAW model simulations predict that the land application water will not percolate deeper than 8 feet.

POWERTECH (USA) INC.

PowerTech (USA) Inc.

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. DBH-3-ALLUV-2

T.D. 33' LOCATION: 433708.09N 1031228.36E State Plane, NAD27

BIT SIZE 4" FA

SAMPLE LOG BY LE LEASE: (PROJECT) Dewey Burdock

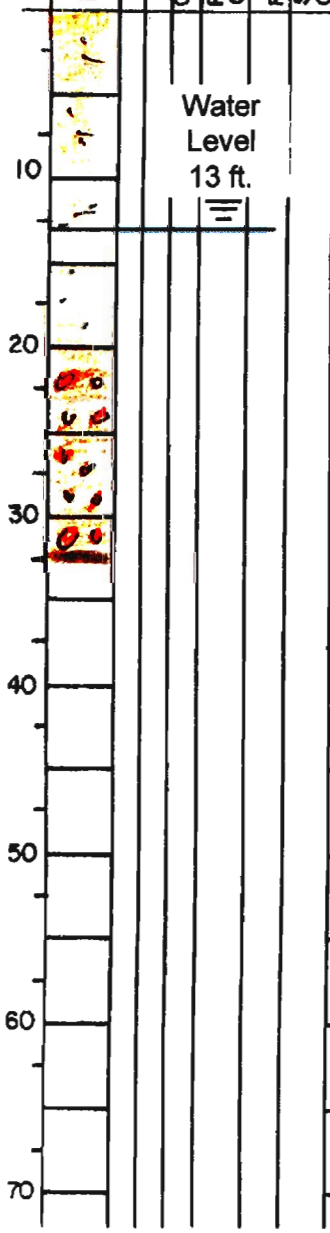
DATE 5/4/11 COUNTY Fall River STATE SD

DEPTH | LITHOLOGY | CARBON | PYRITE | OTHER Alteration | Alteration % Primary Oxidation | Reduction | Secondary Oxidation

L = Limonite (Lmn)
SOX Surf. Oxidation
Rd. Reduced
Rdt. Reduction
P = Pyrite (Pyr)
P_T = Pyrite Tarnish
POX = Primary Oxid.
BSOX = Base of Surf. Oxid.
SOX = Secondary Oxid.
Tn = Transition Zone
fld = Feldspar

SAMPLE DESCRIPTION
(Amounts in Percent, %)

T = Trace
1 = Minor
2 = Moderate
3 = Abundant
C = Carbon
K = Kaolin
B = Bleached
Cht = Chert

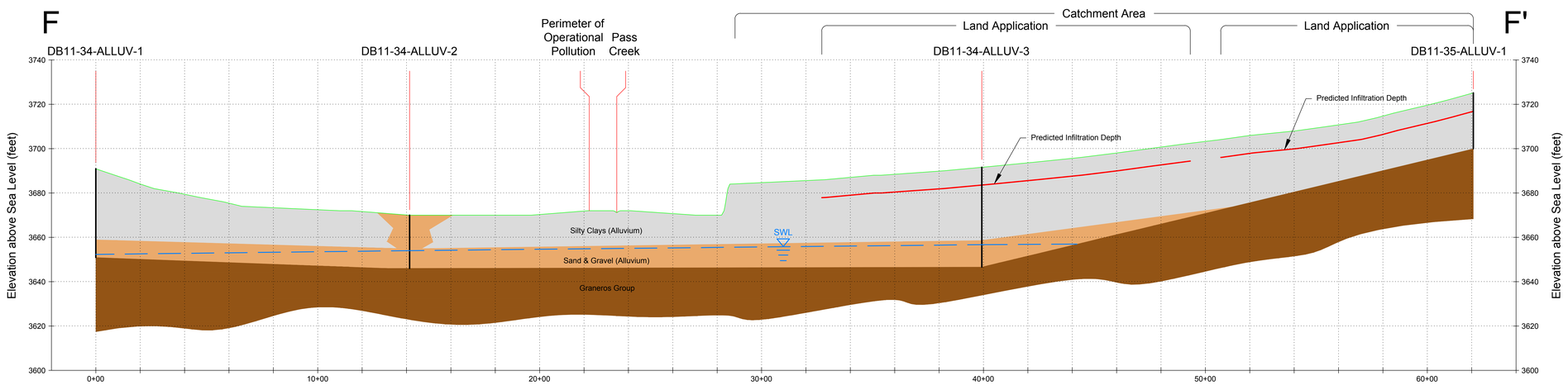


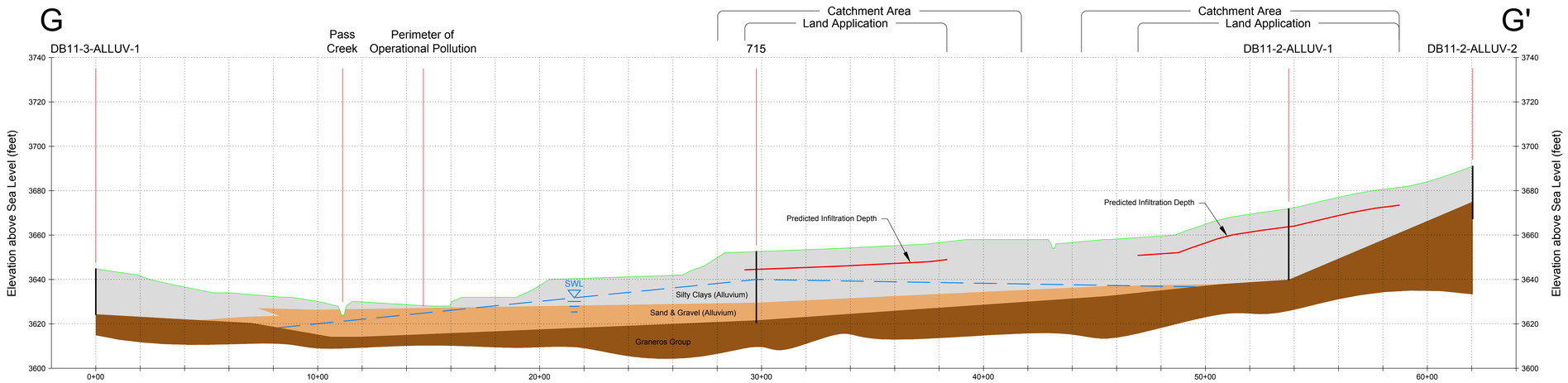
0-22.5'
silty, sandy CLAY, orangish brown, damp, sm! roots

22.5-33'
silty GRAVELS, white/gray/pinks, wet, angular glastes & chorts

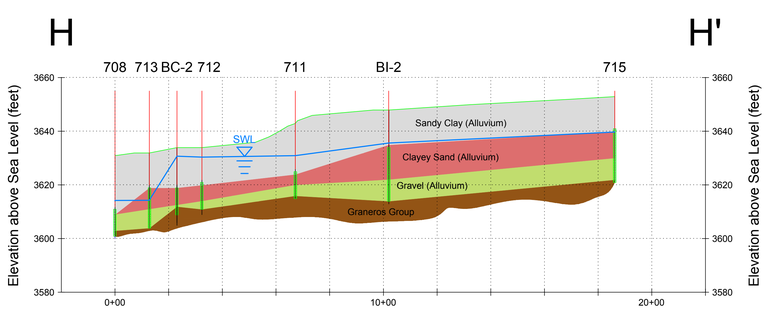
TD @ 33' impeter! GRAVELS - sharp contact.

* hole plugged w/ bentonite chips

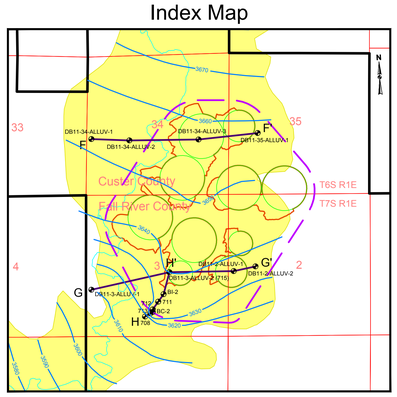




NOTE: The static water level surface depicted on the cross sections and the potentiometric contours depicted on the index map are based on Figure 3.7-8, which was prepared using November 2012 water level measurements. Potentiometric contour elevations are in feet above sea level.



Index Map



Cross Section Legend

- Silty Clays and Sandy Clays (Alluvium)
- Gravel (Alluvium)
- Clayey Sand (Alluvium)
- Sand & Gravel (Alluvium)
- Graneros Group
- SWL — Static Water Level Elevation from Potentiometric Contour Map (see note)
- Well Screen

Index Map Legend

- Project Boundary
- Land Application
- Alluvium
- Pass Creek
- 3625 — Potentiometric Contour (see note)
- Burdock POP Zone
- Catchment Areas

Horizontal Scale

Feet: 0 100 200 400 600 800

Meters: 0 50 100 200

Vertical Scale

Feet: 0 10 20 40 60 80

Meters: 0 5 10 20

CONSULTANT

REVISIONS

#	DRAWN	CHECKED	APPROVED	DATE

REF 948

CHECK SCALES

If this bar does not measure 1 inch this map is not at its original scale.

ANSI B 30" x 42"

POWERTECH (USA) INC.

Plate 3.6-10

Pass Creek Alluvium Cross Sections

Dewey-Burdock Project

PLOT DATE	21-Nov-2012	DATE	21-Nov-2012
DRAWN	Hetrick, Lichnovsky	DGF FILE	Plate 3.6-10_SectionF-F.pdf
CHECKED	J. Bonner, J. Mays	CAD FILE	p:\dewey-burdock\submittals\groundwater discharge permit\finals\plates\sectionf-f.dwg
COORDS	NAD 27, South Dakota State Plane South (feet)		