

TECHNICAL MEMORANDUM

Date: April 9, 2015
To: Randy C. Budge
From: Michael Klisch, LHG, David Banton, LHG, RG, and Derek Holom
Project No.: 913-1101-004.003.3I
Company: Racine Olsen Nye Budge & Bailey
cc: Jason Maughan – Monsanto
Jim McCulloch – Monsanto
Email: dbanton@golder.com
RE: **EVALUATION OF POTENTIAL IMPACTS TO SURFACE WATER IN SODA CREEK-
MONSANTO WATER RIGHTS TRANSFER**

ATTORNEY-CLIENT WORK PRODUCT

1.0 INTRODUCTION

This technical memorandum summarizes Golder Associates Inc.'s (Golder's) evaluation of the potential depletion to Soda Creek including potential impacts to springs discharging to Soda Creek resulting from the consolidation of existing water rights and the transfer of part of the existing water rights from the current Soda Springs Elemental Phosphorus Plant (Plant) Production Wells (Wells 1, 2, 3, and 4) to new production well(s) located north of the Plant (North Wells) and several wells at the South Plant Fenceline (South Wells).

1.1 Definitions

The following are definitions for terms used in this memorandum.

- **Depletion.** The quantity of water depleted from the water supply of the Bear River Basin resulting from diversion and use of water or that would result from the diversion and use of water under a proposed project, as determined by the Director (from Section 1.1 of the Management Plan for Bear River Ground Water Management Area, IDWR 2003).
- **Injury.** Injury to a senior priority water right occurs when water diverted under a junior priority water right diminishes the amount of water that otherwise would have been physically and legally available for the use authorized under the senior priority water right (from Section 1.1 of the Management Plan for Bear River Ground Water Management Area, IDWR 2003).
- **Incremental Depletion.** Incremental depletion is the difference (increase or decrease) in stream depletion over a specific reach of the stream resulting from the current operation of the existing Plant Wells and the stream depletion resulting from the proposed transfer.
- **Cumulative Depletion.** Cumulative depletion is the sum of the incremental depletion in the reaches of a stream upstream of the point of diversion.



1.2 Background

This evaluation was prepared to evaluate whether the proposed transfer will reduce the quantity of water available to existing surface water rights, as described in a letter from Randy Budge of Racine Olsen Nye Budge & Bailey to David Banton of Golder, dated February 24, 2015. Potential impacts to Soda Creek and to springs feeding Soda Creek upstream of Soda Creek Reservoir in the Fivemile Meadows area were described in our memorandum of August 8, 2014 (Golder 2014a).

Monsanto (P4 Productions) has filed an application (transfer number 79037) with the Idaho Department of Water Resources (IDWR) to transfer their existing water rights, including combining the existing water rights, adding two new points of diversion (North Wells) and one new place of use, and adding an additional purpose of use (industrial) to one of the existing water rights (Table 1). The application also includes adding four additional points of diversion (South Wells) at the South Plant Fenceline area (TW-58, TW-75, TW-80, and TW-83). The North Wells have not been drilled.

Monsanto's application for transfer was objected to by several holders of either surface water rights on Soda Creek, springs that feed Soda Creek, or groundwater rights. Stipulated Settlement Agreements were reached with all Protestants with the exception of Nedra Torgesen and Brian Torgesen (collectively referred to as Torgesen). The Stipulated Settlement Agreement that was reached with all Protestants excluding the Torgesens includes the following stipulations (IDWR 2014):

- Monsanto will develop a mitigation plan that provides mitigation for any reduction in water flows causing material injury to Protestant's senior water rights in Soda Creek, and also to the John Lau wells. The mitigation plan must be approved by IDWR prior to diversion and use of water at the new points of diversion and places of use.
- The rate of diversion at the Quarry Well will be limited to an average annual diversion rate of 2 cubic feet per second (cfs). If Monsanto wishes to increase the rate of diversion, IDWR approval of a mitigation plan is required.
- The diversion conditions described in the Stipulated Settlement Agreement shall not limit or otherwise affect Monsanto's right to the beneficial use of all amounts of water available under the rights which are the subject of the transfer.
- Monsanto shall install and maintain an approved measuring device on the Quarry Well and all new reconstructed wells under the subject water rights.

Monsanto prepared a draft Stipulated Settlement Agreement (Monsanto 2015) for the Torgesens that includes the provisions of the November 24, 2014 Stipulated Settlement Agreement along with additional conditions and stipulations. Torgesens have not signed the Stipulated Settlement Agreement and requested additional technical analysis of potential impacts on their Soda Creek water rights.

This technical memorandum address specific impacts to the Torgesen surface water rights on Soda Creek in the reach from Soda Creek Reservoir to the Torgesen Point of Diversion. This technical memorandum uses the term depletion as defined in Section 1.1. In addition, this technical memorandum

assumes that depletion to surface water resulting from a proposed water rights transfer will not result in injury to senior priority rights if the proposed transfer does not restrict the ability of the senior priority rights to be fully exercised.

2.0 SITE CONDITIONS

2.1 Hydrogeology

The geology and hydrogeology of the area in the vicinity of the Monsanto Plant is described in Golder (1995), Ralston (1988), and Dion (1974). The Blackfoot Lava Field underlies much of the broad valley north of Soda Springs and the Bear River. The Blackfoot Lava Field consists of several Quaternary-age basalt flows that are about 10 to 80 feet thick. The basalt flows are generally dense and unfractured. The basalt flows are separated by permeable interflow zones consisting of sediments, fractured and weathered basalt, and cinders. The interflow zones are about 1 to 23 feet thick and constitute the primary saturated groundwater pathways in the area of the Plant.

The primary hydrostratigraphic zones developed in the Blackfoot Lava Field in the vicinity of Plant include the Upper Basalt Zone (UBZ) and the Lower Basalt Zone (LBZ). The UBZ and LBZ are separated into smaller regions of interest (designated UBZ-1 through UBZ-4 and LBZ-1 through LBZ-4), based on faulting, hydrogeological controls, and groundwater quality. Details pertaining to the breakdown of UBZ and LBZ regions are provided in Golder (1995). Two north-northwest trending regional geological structures occur on the west side of the Plant (Figure 1). These structures were noted by Ralston (1988) and Dion (1974) and are referred to as the Monsanto and Subsidiary Faults in the area of the Monsanto Plant. Maps and regional geological cross sections prepared by Ralston (1988) and Dion (1974) showing the Monsanto and Subsidiary Faults are included in Attachment A. Ralston (1988) observed the regional north-northwest trending geological structures appear to influence groundwater quality, with "sodic" groundwater containing high levels of dissolved carbon dioxide, manganese, and iron occurring on the west, with "fresh" groundwater occurring on the east. The proposed North Wells are located on the east side of the Monsanto and Subsidiary Faults, while Soda Creek is on the west side of the faults.

All of the Monsanto Plant Production Wells are completed in both the UBZ-4 and LBZ-4 on the east side of the Monsanto and Subsidiary Faults, and pump fresh groundwater. Soda Creek is located west of the Plant in UBZ-1. In the central portion of the Plant and south to the South Plant Fenceline, the Monsanto Fault acts as a hydraulic barrier based on groundwater elevations and the lack of groundwater level response in wells west of the fault to pumping of the Plant Wells (Golder 2014c). Similarly, at the South Plant Fenceline where the South Wells are located, the Subsidiary Fault acts as a partial barrier to groundwater flow (Golder 2014c).

2.2 Monsanto Wells Considered in Transfer Application

The existing Plant Production Wells and the proposed North and South Wells are shown on Figure 1. The North Wells are located in T8S/R42E SW ¼ SE ¼ Section 19 and T8S/R42E SE ¼ SE ¼ Section 19. The South Wells are located in T8S/R42E NW ¼ SE ¼ Section 31 (TW-75) and T8S/R42E SW ¼ SE ¼ Section 31 (TW-58, TW-80, and TW-83).

2.2.1 Monsanto Plant Wells

Monsanto Plant Wells PW-01, PW-02, and PW-03 are used to supply non-contact cooling water and process water to the Plant. Most of the water supplied by the Plant Wells is used for non-contact cooling water in the furnace shells, and is not consumptively used. After the water is used for cooling, it is settled in a pond prior to discharge to Soda Creek at Monsanto's Nation Pollution Discharge Elimination System (NPDES) outfall on Soda Creek. Approximately 4 to 5 cfs for water are returned to the creek and this portion of the Plant's water use is non-consumptive; the return of the water to Soda Creek provides a net benefit to the reach of the creek below the outfall.

2.2.2 South Wells

Well TW-58 is an 8-inch diameter test well that has been drilled and tested and is expected to be pumped at a rate up to about 350 gallons per minute (gpm). Wells TW-80 and TW-83 are 8-inch diameter test wells drilled in 2014, but have not yet been tested. It is expected that these wells will produce between 100 gpm (TW-83) and 350 gpm (TW-80).

It is anticipated that TW-58, TW-80, and TW-83 at the South Plant Fenceline will be pumped in the future as part of a planned groundwater remediation project. This analysis assumes each well at the South Plant Fenceline will be pumped at the respective anticipated maximum pumping rate, or a total pumping rate of 800 gpm (1.8 cfs). Water from the wells will be used in the Plant as non-contact cooling water in place of existing groundwater from either wells PW-01, PW-02, or PW-03, or will be treated and discharged under Monsanto's NPDES permit to Soda Creek just upstream of the power/irrigation diversion. As such, a significant portion of this groundwater use will be non-consumptive.

2.2.3 Monitoring Well

Well TW-75 is a 4-inch diameter monitoring well that produces a maximum of 10 to 15 gpm (0.022 to 0.033 cfs) and will be used for water treatment pilot testing. Pumping of TW-75 is expected to have negligible impact on flows in Soda Creek and springs because of the low pumping rate and the distance to the creek of about 4,000 feet.

2.3 Soda Creek

Soda Creek originates at Fivemile Meadows about three miles northwest of the Plant (Figure 1). There is no current streamflow information for Soda Creek with the exception of annual measurements at several

locations conducted as part of annual water quality sampling at the Monsanto Plant (Golder 2014b). Historical United States Geological Survey (USGS) data collected at a gage located on Soda Creek at Fivemile Meadows over the period 1965 to 1986 indicated average annual streamflow was about 18 cfs, and ranged from about 6 cfs to 35 cfs (Golder 1995).

A schematic of Soda Creek and the power/irrigation diversions, canal, and returns is shown on Figure 2. Soda Creek has been subdivided into the following reaches for this evaluation:

- **Reach A** - This is the reach of Soda Creek between the outlet of Fivemile Meadows and the inlet to the Soda Creek Reservoir. Potential impacts to this reach were evaluated in Golder's August 2014 memorandum (Golder 2014a).
- **Reach B** - This reach extends from the outlet of Soda Creek Reservoir to the first power plant. Below the reservoir, a large portion of the streamflow is diverted at the first diversion into a power canal (first power canal) and returned to Soda Creek at the first power plant, about one mile downstream of the reservoir. There are a number of seeps and springs that discharge to Soda Creek in the reach between the reservoir and second power and irrigation canal (Figures 2 and 3). With the exception of Hooper Spring, which discharges 1 to 2 cfs to Soda Creek about 0.2 miles upstream of the first power plant, the location and discharge rate of the most of the springs is unknown, and there is no stream gaging data in this reach to evaluate the changes in streamflow in the reach of Soda Creek from the reservoir to the second power diversion.
- **Reach C** - This reach extends from the first power plant to the second power and irrigation canal diversion weir (Torgesen Diversion). The second power and irrigation canal diversion weir is located about 0.2 miles downstream of the first power return. Monsanto's non-contact cooling water effluent discharge to Soda Creek is about 50 feet upstream of the second power and irrigation canal diversion weir. Spot streamflow measurements in Soda Creek at the head of the second diversion (below the Monsanto non-contact cooling water discharge) is summarized on Table 2 and ranges from about 42.2 to 70.2 cfs based on measurements made during irrigation season in late spring between 2010 and 2014 (Golder 2014b). The Monsanto non-contact cooling water discharge to Soda Creek is consistently about 4 to 5 cfs, providing a net benefit to the creek downstream of the outfall.
- **Reach D** - Reach D extends from the second power and irrigation canal to the second power plant. There is very little natural flow in Reach D because most of the streamflow in Soda Creek is diverted into the second power and irrigation canal. Streamflow in the natural channel of Soda Creek below the second power and irrigation diversion consists of a small amount of seepage through the diversion flashboards and discharge from springs (Southwest Spring, Mormon A, B, and C Springs, and Homestead Spring) and diffuse groundwater discharge.

Water diverted into the second power and irrigation canal is conveyed to the Farmers Land and Irrigation Company canal diversion located about 0.8 miles downstream from the second power and irrigation diversion weir (Figure 2). At the canal diversion, some of the water is diverted into the Farmers Land and Irrigation Company Ditch during the irrigation season, and the remaining water is routed through the second power plant and returned to Soda Creek. The amount of water diverted to the Farmers Land and Irrigation Company Ditch is not known.

About 0.5 miles downstream of the second power plant, most of the flow in Soda Creek during the irrigation season is diverted into Soda Canal. Water that is not diverted flows into Alexander Reservoir.

3.0 WATER RIGHTS IMPACT EVALUATION APPROACH

3.1 Torgesen Water Rights

The IDWR Online Water Right Database was queried to obtain information on the Torgesen rights (IDWR 2015). Torgesen holds 14 water rights on Soda Creek for irrigation (5.93 cfs) and for a small amount of domestic and stockwater use (0.07 cfs), totaling 6 cfs. Information on the Torgesen water rights based on the information available from IDWR is summarized on Table 3.

All of the Torgesen water rights are senior to nearly all water rights on Soda Creek and all of Monsanto's water rights. The Torgesen water rights have priority dates ranging from February 10, 1881 to June 17, 1889. Monsanto's water rights have priority dates ranging from October 10, 1951 to June 10, 1966 (Table 1). There is no evidence that the current pumping by Monsanto has resulted in injury to the Torgesen rights because streamflow measurements indicate there is sufficient water in Soda Creek to meet the full amount of the Torgesen rights.

The points of diversion (POD) and places of use (POU) for the Torgesen's surface water rights are shown on Figure 1. The Torgesen PODs for the majority of their water rights is on Soda Creek at the second power and irrigation canal diversion weir (located at the south end of Reach C) in the NW ¼ NW ¼ of Section 6, T9S, R42E (Figures 1 and 2). The Torgesen PODs are all downgradient of the proposed Monsanto PODs for the North and South Wells. Under Torgesen's rights, water is diverted and conveyed in the second power and irrigation canal to the Farmers Land and Irrigation Ditch and then applied at the POUs using flood irrigation in areas below the ditch or pumping to areas above the ditch (Figure 1).

The potential cumulative depletion in Soda Creek streamflow in Reaches A, B, and C (upstream of the Torgesen PODs) as a result of the proposed water rights transfer are evaluated in this memorandum. Reach D is downstream of the Torgesen POD and any potential impacts to this reach of Soda Creek resulting from the water right transfer will not impair the ability to divert water under the existing water rights.

3.2 Approach

The incremental and cumulative impacts to surface water flow (stream depletion) were evaluated assuming the following transfer options:

- Option 1 - 9 cfs to the North Wells.
- Option 2 - Transferring 3 cfs to the North Wells and retaining 6 cfs at the Plant Production Wells.

- Option 3 - Transferring 1.2 cfs to the North Wells and 1.8 cfs to the South Wells and retaining 6 cfs at the Plant Production Wells.

The incremental streamflow impact is defined as the difference (increase or decrease) in stream depletion over a specific reach of the stream resulting from the current operation of the existing Plant Wells and the stream depletion resulting from the proposed transfer. The potential impact on springs, including Hooper Spring, is also evaluated.

The incremental impacts to streamflows in specific reaches of Soda Creek were evaluated using analytical methods implemented in spreadsheets (Microsoft Excel).

3.3 Methodology

Pumping can result in a decrease in streamflow (stream depletion) through interception of groundwater that would otherwise discharge to the creek, or inducing leakage from the stream. The amount of stream depletion will be dependent on the distance between the well and stream, the aquifer hydraulic properties between the well and the stream, the hydraulic properties of the stream bed, and the pumping rate and duration.

Potential stream depletion in Soda Creek from pumping by Monsanto was estimated using the Hunt (1999) analytical method implemented in the IGARF (Impact of Groundwater Abstractions on River Flows) version 4 (Environment Agency 2011) software package. The conceptualization of the Hunt (1999) method and the assumptions are shown on Figure 4. The inputs to the Hunt solution used to evaluate depletion in Soda Creek are:

- Aquifer transmissivity – estimated to be 60,000 to 240,000 square feet per day (ft²/d) (Golder Associates Ltd. 1985; Golder 1995).
- Aquifer storativity – estimated to be 4.3×10^{-5} to 4.3×10^{-4} (Golder Associates Ltd. 1985; Golder 1995, dimensionless).
- Aquifer thickness of 100 feet
- Pumping rate – 9 cfs (777,600 cubic feet per day [ft³/d]).
- Stream width and depth - estimated to be 80 feet with and 3.3 feet deep, respectively.
- Thickness of sediment in the stream bottom – estimated to be 1 foot thick.
- Hydraulic conductivity of the sediment in the stream bottom – estimated to be 2.83×10^{-2} feet per day (ft/d) to 2.83 ft/d (10^{-3} to 10^{-5} centimeter per second [cm/s]) based on observations of silt to silty sand materials in the base of Soda Creek and published values for hydraulic conductivity (Freeze and Cherry 1979).

This analysis assumes an infinite aquifer and does not consider the effects of faults that are known to subdivide the basalt aquifer into smaller regions. The Plant Wells (and the South and proposed North Wells) are located to the east of the Monsanto and Subsidiary Faults which are hydraulic barriers in the vicinity of the Plant (Golder 2014c) based on lack of groundwater response in wells west of the fault to

pumping of the Plant Wells. The Plant Wells (and the proposed North and South Wells) are also located east of regional geologic structures identified by Ralston (1988) and Dion (1974) as controls on groundwater quality and groundwater flow (Attachment A). Thus, this analysis likely overpredicts the impacts to Soda Creek because it does not consider the faults act as hydraulic barriers. Because the faults are hydraulic barriers, the effects of pumping and the actual depletion on Soda Creek is anticipated to be less than predicted.

A range of hydraulic properties ("Cases") were used to evaluate the impacts of the three transfer options. The cases evaluated are summarized on Table 4.

The reaches of Soda Creek evaluated for depletion are shown on Figure 5. The change in stream depletion in the reaches of Soda Creek shown on Figure 5 as a result of the proposed water right transfer is described as an incremental change, or change in stream depletion resulting from the transfer compared to the current streamflow impacts from pumping the Plant Wells. The cumulative depletion over all reaches of Soda Creek above the Torgesen diversion (Reaches A, B, and C) are also described.

4.0 RESULTS

4.1 Fivemile Meadows Area (Reach A)

Potential incremental depletion to Soda Creek between the Fivemile Meadows area and Soda Creek Reservoir (Reach A, Figure 2) over a stream reach of 7,500 feet upstream (north) from the inlet of Soda Creek Reservoir was described in our August 2014 memorandum (Golder 2014a). Options 1 and 2 are the same as described in the August 2014 evaluation. Option 3 has been updated to account for increased pumping from the South Wells (1.8 cfs instead of 0.5 cfs evaluated in August 2014) and decreased pumping from the North Wells (1.2 cfs instead of 2.5 cfs evaluated in August 2014) to reflect the anticipated operation of the South Wells.

Reach A is upgradient of the existing Plant Wells and the South Wells, and the North Wells are in the middle of the reach. The estimated incremental depletion to Soda Creek was greatest for pumping 9 cfs from the proposed North Wells, and least for a combination of pumping from the existing Plant Wells, the proposed North Wells, and the proposed South Wells. Depletion resulting from pumping the South Wells at 0.5 cfs was evaluated in our August 2014 memorandum (Golder 2014a). We have updated our analysis to reflect the anticipated pumping of the South Wells at a higher rate based on the anticipated maximum pumping rate (1.8 cfs) with a corresponding reduction in pumping from the North Wells to 1.2 cfs.

Table 5 presents the estimated incremental depletion in Reach A for all the cases presented in Table 4. The estimated incremental depletion in Reach A for Case 3c (the highest estimated incremental

drawdown) is shown on Figure 6. In summary, all cases are predicted to result in an increase in depletion in Reach A relative to the current pumping of the Plant Wells:

- Option 1 is predicted to have the greatest incremental stream depletion, ranging from 0.05 to 1.28 cfs, depending on stream and aquifer properties.
- Option 2 is predicted to have a lower incremental stream depletion compared to Option 1, ranging from 0.02 to 0.43 cfs.
- Option 3 is predicted to have least incremental stream depletion, ranging from 0.004 to 0.11 cfs.

4.2 Soda Creek Reservoir to Second Diversion (Reaches B and C)

The reaches of Soda Creek between Soda Creek Reservoir and the second power/irrigation diversion (Reaches B and C, Figure 2) are downgradient of the North Wells. The Plant Wells and the South Wells are east of Reaches B and C. Potential incremental stream depletions to Reaches B and C are summarized in Table 6.

Table 6 shows the estimated incremental stream depletion in Reaches B and C decreases (i.e. streamflow increases) relative to the stream depletion estimated for the current pumping of 9 cfs at the Plant Wells. The estimated incremental depletion in Reaches B and C for Case 3c (the highest estimated incremental depletion) is shown on Figure 6. Assuming 9 cfs is transferred to the North Wells under Option 1, the estimated incremental stream depletion decreases by 0.05 to 1.13 cfs (i.e. stream flow in Reaches B and C increases by 0.05 to 1.13 cfs); this is because the point of diversion under the transfer is located farther from Soda Creek than the existing points of diversion. The estimated incremental decrease in stream depletion for Option 2 ranges from 0.02 to 0.38 cfs. The estimated incremental decrease in stream depletion for Option 3 ranges from 0.004 to 0.09 cfs. In summary, all cases are predicted to result in a decrease in depletion in Reaches B and C relative to the current pumping of the Plant Wells.

Transferring Monsanto's water rights from the Plant Wells to the North Wells (Option 1) will result in less depletion to Soda Creek between Soda Creek Reservoir and the second diversion (Reaches B and C; the location of the Torgesen PODs) because the North Wells are located farther from Soda Creek Reaches B and C and the Torgesen PODs than the existing Plant Wells. Assuming the water rights are transferred between a combination of the Plant Wells, the proposed North Wells, and the South Wells (Option 3), the predicted incremental depletion to Reaches B and C is similar to or slightly less than the current operation of the Plant Wells, but greater than predicted for transfer of 9 cfs to the North Wells; this is because there is a reduction of pumping at the Plant Wells, and transfer of some pumping to the North Wells which are farther from Soda Creek Reaches B and C.

4.3 Fivemile Meadows to Torgesen Diversion (Reaches A, B, and C)

Table 7 shows the total estimated cumulative stream depletion in Reaches A, B, and C (upstream of the Torgesen diversion) of Soda Creek relative to the cumulative depletion estimated for the current pumping of 9 cfs at the Plant Wells. The cumulative depletion over Reaches A, B, and C for Case 3c (the greatest depletion) is shown on Figure 7. This figure also shows the maximum and minimum streamflow measured in Soda Creek based on spot measurements in late spring between 2010 and 2014 (Table 2) at the head of the second irrigation and power diversion. The flow measurement location is below the Monsanto non-contact cooling water discharge; therefore, the measured flows include Soda Creek and the non-contact cooling water.

Assuming 9 cfs is transferred to the North Wells (Option 1), there would be an estimated decrease in streamflow over Reaches A, B, and C of between 0.01 and 0.19 cfs. Assuming the transfer of 3 cfs to the North Wells while retaining 6 cfs at the Plant Wells (Option 2) would result in an estimated decrease in streamflow of between 0.003 to 0.064 cfs. Assuming 1.8 cfs is transferred to the South Wells and 1.2 cfs transferred to the North Wells, with 6 cfs remaining at the Plant Wells (Option 3), there would either be a slight increase or decrease in streamflow.

The greatest potential impact to Soda Creek is for the transfer of 9 cfs to the North Wells (Option 1), while the smallest is for transfer of 1.2 cfs to the North Wells, 1.8 cfs to the South Wells, and retaining 6 cfs at the Plant Wells (Option 3). This is because there is a reduction of pumping at the Plant Wells, transfer of some pumping to the North Wells which are farther from Soda Creek Reaches B and C, and transfer of some pumping to the South Wells which are farther from Reach A.

Overall, the proposed transfer will not result in injury to the Torgesen water rights because the streamflow in Soda Creek, after accounting for the minor depletion from the proposed transfer, is many times greater than the Torgesen water rights.

4.4 Uncertainty

The estimated streamflow depletions presented in this technical memorandum are subject to some uncertainty because of uncertainties in the hydrogeological characteristics of the subsurface, and particular the hydraulic behavior of the faults. A worst-case scenario is that pumping from the South Wells has a direct influence on Soda Creek in Reaches B and C whereas pumping from the Plant Wells does not impact Soda Creek because the Monsanto Fault behaves as a flow barrier. Under these conditions, the impact on Soda Creek Reach B and C would be greater than presented in Table 5 and Figure 6.

The estimated depletion under this worst-case scenario resulting from pumping of the South Wells is summarized on Table 8. The estimated depletion under this condition ranges from about 0.050 to

0.566 cfs depending on the hydraulic properties. The maximum estimated depletion of 0.57 cfs (Case 3c), represents about 0.8 to 1.4% of the streamflow measured just above the second power and irrigation diversion (Table 2). Therefore, even under this worst-case scenario, the streamflows at the Torgesen POD will be more than sufficient to meet the needs of the water right and there will be no injury to the ability to exercise their senior water rights.

5.0 POTENTIAL IMPACTS TO SPRINGS

Soda Creek is fed by numerous springs that discharge in the Fivemile Meadows area and downstream of Fivemile Meadows (Figure 3). Water discharged at the springs includes "fresh" groundwater and "sodic" groundwater. Fresh groundwater occurs in the shallow groundwater system in the Blackfoot Lava Field. The shallow groundwater system (fresh groundwater) is recharged by seepage from Blackfoot Reservoir and infiltration of precipitation. Fresh groundwater springs that discharge to Soda Creek upstream of the second diversion include the springs in the Fivemile Meadows area and other small, unnamed springs downstream of Fivemile Meadows. Sodic groundwater occurs in deeper groundwater systems and discharges by upwelling along faults, and is characterized by dissolved carbon dioxide and elevated iron and manganese concentrations. Sodic groundwater generally occurs to the west the Subsidiary Fault. Ralston (1988) also noted the occurrence of sodic water west of north to northwest trending structures later interpreted to be the Monsanto and Subsidiary Faults). Sodic springs discharging to Soda Creek upstream of the diversion include Hooper Spring, Kackley Spring (Figure 3), and several smaller, unnamed springs (Dion 1974, Golder 1995, Ralston 1988).

The estimates of stream depletion include the interception of groundwater that would otherwise discharge to Soda Creek from springs. The portion of the estimated incremental depletion resulting from a decrease in spring flow cannot be estimated. The following sections present a narrative of the potential qualitative impacts to both sodic and fresh springs.

5.1 Sodic Groundwater Springs

The proposed North and South Wells are anticipated to have negligible impacts on Hooper and Kackley Springs (Reaches B and C), and to smaller unnamed sodic springs, because:

- The overall estimated incremental streamflow depletion in Reaches B and C is low (Tables 4 and 5) and much less than the measured flow of Hooper Spring. The flow in Kackley Spring has not been measured.
- The proposed North and South Wells are located east of the Monsanto and Subsidiary Faults, identified by Dion (1974), Ralston (1988), and Golder (1995) as a control on the occurrence of sodic water, which occurs west of the fault.
- The South Wells pump fresh groundwater and the proposed North Wells are anticipated to pump fresh groundwater, which is recharged from seepage from the Blackfoot Reservoir and precipitation, similar to the existing Plant Wells, rather than the sodic

groundwater which upwells along faults to reach the surface at Hooper and Kackley Springs.

There are reportedly a number of small springs discharging to Soda Creek below the first diversion at the reservoir (Reach B, Figure 2). The location, discharge rates, and groundwater type (sodic or fresh) of the springs is not known. The reach of Soda Creek below the first diversion to the first power return (Reaches B and C) is flow impaired because most of the water is diverted to the power canal. There is no information on streamflow in Reach B of Soda Creek.

5.2 Fresh Groundwater Springs

Pumping of the proposed North and South Wells on fresh water springs in the reach of Soda Creek below the reservoir and first diversion to the second power and irrigation diversion (Reaches B and C) is expected to have less impact on spring flow than pumping of the existing Plant Wells because:

- The existing Plant Wells are located about 5,100 feet from this reach of Soda Creek. The proposed North Wells are over 10,000 feet from this reach of Soda Creek.
- The proposed South Wells, although located closer to this reach of Soda Creek (about 2,300 feet away), will be pumped at a significantly lower rate (about 1.8 cfs) than the existing Plant Wells.
- The proposed South Wells are located to the east of the Subsidiary Fault which acts as a partial hydraulic barrier at the South Plant Fenceline. Therefore, the predicted depletion, which is based on the conservative assumption of an infinite aquifer, overestimates the actual impact.

6.0 CONCLUSIONS

Monsanto is proposing to transfer water rights from the Plant Production Wells to new wells located north of the Plant, or a combination of the Plant Wells, the North Wells, and wells along the South Plant Fenceline. Three transfer options are evaluated in this memorandum:

- Option 1 - Transfer 9 cfs to the North Wells with no pumping from the Plant Wells.
- Option 2 - Transfer 3 cfs to the North Wells and retain 6 cfs pumping from the Plant Wells.
- Option 3 - Transfer 1.2 cfs to the North Wells and 1.8 cfs to the South Wells, and retain 6 cfs pumping from the Plant Wells

Monsanto's transfer was protested by Nedra Torgesen and Brian Torgesen. This evaluation addressed specific impacts (incremental and cumulative stream depletion) to the Torgesen surface water rights on Soda Creek in the reach from Soda Creek Reservoir to the Torgesen POD (Reaches B and C) and updated our previous evaluation of impacts to Soda Creek upstream of Soda Creek reservoir (Reach A).

- **Reach A** – The estimated incremental depletion in Reach A resulting from the transfer of water rights to the North Wells was estimated to be about 0.05 to 1.28 cfs if the full 9 cfs is transferred to the North Wells. The estimated incremental depletion is about 0.004 to

0.11 cfs for the transfer of 1.2 cfs to the North Wells and 1.8 cfs to the South Wells, retaining 6 cfs at the Plant Wells.

- **Reaches B and C** – The incremental depletion in Reaches B and C decreases by about 0.05 to 1.13 cfs (i.e., streamflow increases) assuming the full 9 cfs is transferred to the North Wells. The estimated incremental depletion was estimated to decrease by about 0.004 to 0.09 cfs for the transfer of 1.2 cfs to the North Wells and 1.8 cfs to the South Wells, retaining 6 cfs at the Plant Wells. The estimated incremental stream depletion decreases because the North Wells are located farther from Reaches B and C than the Plant Wells and there is a reduction in pumping of the Plant Wells.
- **Reaches A, B, and C** – The streamflow in Reaches A, B, and C is estimated to decrease by a cumulative 0.01 to 0.19 cfs assuming the transfer of 9 cfs to the North Wells. Assuming the transfer of 1.2 cfs to the North Wells and 1.8 cfs to the South Wells (with 6 cfs at the Plant Wells), the streamflow in Reaches A, B and C would either decrease or increase by a small amount (less than 0.023 cfs).
- **Reaches B and C – Impacts from South Wells Only with No Fault Boundary** -The estimated worst-case depletion on Soda Creek attributable to pumping of the South Wells is between about 0.050 cfs to 0.566 cfs, assuming the South Wells are in continuity with Soda Creek. Measured irrigation season flows in Soda Creek at the second power and irrigation diversion have ranged from 42.2 to 70.2 cfs (Table 2). Therefore, the estimated maximum depletion is less than 1.5% of the lowest streamflow measured at the second power and irrigation diversion and Torgesen would be able to fully exercise their rights.

Pumping of the proposed North and South Wells is anticipated to cause negligible impacts to streamflow in Soda Creek and no injury to Torgesen's ability to utilize their water rights because:

- The Torgesen water rights are for a total of 6 cfs. Streamflow in Soda Creek at the second diversion (Torgesen POD) is measured in the spring in the range of 42.2 to 70.2 cfs. This includes about 4 to 5 cfs of non-contact cooling water that is continuously discharged to the creek by Monsanto upstream of the diversion that provides a net benefit to the creek below the outfall.
- Most of the water pumped from the North and South Wells under the proposed transfer will continue to be used for non-consumptive non-contact cooling water and will therefore continue to be discharged to Soda Creek, providing a net benefit to the creek below the outfall. Similar to current practice, some of the water will be consumptively used as part of the Plant process and through evaporation.
- Potential impacts to the reach of Soda Creek above the Torgesen PODs and below Soda Creek Reservoir (Reaches B and C) are anticipated to be less than any impacts from pumping of the existing Plant Wells because of the transfer of some or all of the pumping to the North Wells which are located further from Reaches B and C. Over the reach of Soda Creek from Fivemile Meadows to the Torgesen PODs (Reaches A, B, and C), the potential impacts from the transfer are less than 0.2 cfs. This is less than 0.5% of the lowest measured flow of 42.2 cfs at the second irrigation and power diversion. The results of the analysis indicate the proposed transfer will not cause injury to the Torgesen's ability to exercise their senior water rights.
- The analysis of stream depletion is considered conservative because it assumes an infinite aquifer. The UBZ and LBZ aquifers in the Plant area are subdivided into zones because of the effects of faulting on groundwater flow. The Monsanto Fault and Subsidiary Fault are present between Soda Creek and the Plant Wells, North Wells, and South Wells and act as hydraulic barriers which reduce the predicted incremental stream depletion.

GOLDER ASSOCIATES INC.


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Attachment A Geological Maps and Sections from Ralston (1988) and Dion (1974)

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TABLES

Table 1: Monsanto Soda Springs Plant Water Rights

Water Right Number	Amount (cfs/AF)	Purpose of Use	Priority Date	Note
11-2102	2.22	Industrial	10/5/1951	
11-2107A	1.0	Industrial	10/6/1952	
11-2107B	1.6	Industrial	11/18/1952	
11-2141	4.35/5,000	Industrial	9/27/1965	
11-2144	3.68/1,778	Mining	6/10/1966	Add Industrial to purpose of use as part of transfer

Notes:

cfs cubic feet per second
AF Acre-Feet

Table 2: Measured Streamflow at Head of Second Power and Irrigation Diversion (Torgesen Diversion)

Date Measured	Streamflow (cfs)
5/25/2010	42.2
5/24/2011	56.6
7/16/2011	57.4
6/13/2012	70.2
6/7/2013	51.0
6/13/2014	58.8

Notes:

cfs cubic feet per second

Streamflow measured at head of second power and irrigation diversion (Torgesen Diversion) and downstream of Monsanto Non-Contact Cooling Water Discharge.

Streamflow measurements are spot measurements.

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Table 3: Torgesen Water Right Information

Water Right Number	Basis	Priority Date	Diversion Rate (cfs)	Purpose of Use	Point of Diversion	Period of Use	Place of Use	Total Acres
11-451	Decreed	2/10/1881	0.02	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30	T9S/R41E-1 SENW, NESW, NWSE, SWSE, SESE	117.4
11-453	Decreed	2/10/1881	0.01	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30		117.4
11-459	Decreed	2/10/1881	0.01	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30		117.4
11-467	Decreed	2/10/1881	0.5	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30		117.4
11-468	Decreed	2/10/1881	0.01	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30	T9S/R41E-12 NENE, NWNW	117.4
11-475	Decreed	2/10/1881	1.03	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30		117.4
11-481	Decreed	2/10/1881	0.01	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30		117.4
11-484	Decreed	2/10/1881	0.14	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30		117.4
11-485	Decreed	2/10/1881	0.2	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30	T9S/R41E-1 SESW, SWSE, SESE	117.4
11-489	Decreed	2/10/1881	0.4	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30		117.4
11-490	Decreed	2/10/1881	0.2	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30		117.4
11-492	Decreed	6/17/1889	0.5	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30		20
11-528	Decreed	10/13/1883	2.9	IRRIGATION	T9S/R42E-6 NWNW	4/20 to 9/30	T9S/R41E-12 NENE, NENW, NWNW	145
Total Irrigation Water Rights								
11-4289	Statutory Claim	10/13/1883	0.07	DOMESTIC, STOCK WATER	T9S/R42E-6 NWNW T9S/R42E-6 NESW T9S/R42E-6 NWSW	1/01 to 12/31	T9S/R41E-12 NENE	na
Total Torgesen Water Rights			6.0 cfs					

Notes:

Compiled using information on file with Idaho Department of Water Resource and access via online water rights database at <http://www.idwr.idaho.gov/apps/ExtSearch/WRAJSearch/WRADJSearch.aspx> on March 4, 2015.

All rights in name of Nedra Torgesen

cfs cubic feet per second

na: not applicable

No annual quantity or duty information specified.

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Table 4: Summary of Stream Depletion Cases Evaluated

Case	Aquifer Transmissivity (ft ² /d)	Aquifer Storativity (-)	Aquifer Thickness (feet)	Width Soda Creek (feet)	Soda Creek Depth (feet)	Soda Creek Hydraulic Conductivity (ft/d)	Soda Creek Sediment Thickness (feet)	Well Radius (feet)
1a	240,000	4.30E-04	100	80	3.3	2.83	1	0.82
1b	120,000	4.30E-04	100	80	3.3	2.83	1	0.82
1c	60,000	4.30E-04	100	80	3.3	2.83	1	0.82
2a	240,000	4.30E-04	100	80	3.3	2.83 x10 ⁻²	1	0.82
2b	120,000	4.30E-04	100	80	3.3	2.83 x10 ⁻²	1	0.82
2c	60,000	4.30E-04	100	80	3.3	2.83 x10 ⁻²	1	0.82
3a	240,000	4.30E-05	100	80	3.3	2.83	1	0.82
3b	120,000	4.30E-05	100	80	3.3	2.83	1	0.82
3c	60,000	4.30E-05	100	80	3.3	2.83	1	0.82
4a	240,000	4.30E-05	100	80	3.3	2.83 x10 ⁻²	1	0.82
4b	120,000	4.30E-05	100	80	3.3	2.83 x10 ⁻²	1	0.82
4c	60,000	4.30E-05	100	80	3.3	2.83 x10 ⁻²	1	0.82

Notes:

ft²/d square feet per day

ft/d feet per day

Table 5: Summary of Estimated Incremental Stream Depletion in Soda Creek after One Year of Pumping (Reach A - Fivemile Meadows to Soda Creek Reservoir)

Case	Option 1 Incremental Change in Stream Depletion 9 cfs Transferred to North Wells (cfs)	Option 2 Incremental Change in Stream Depletion 3 cfs Transferred to North Wells (cfs)	Option 3 Incremental Change in Stream Depletion 1.2 cfs Transferred to North Wells and 1.8 cfs to South Wells (cfs)
1a	1.026	0.34	0.08
1b	1.17	0.39	0.10
1c	1.28	0.43	0.11
2a	0.05	0.02	0.00
2b	0.10	0.03	0.01
2c	0.18	0.06	0.01
3a	1.02	0.34	0.08
3b	1.07	0.39	0.10
3c	1.28	0.43	0.11
4a	0.05	0.02	0.00
4b	0.10	0.03	0.01
4c	0.18	0.06	0.01

Note:

cfs cubic feet per second

A negative incremental depletion is an increase in streamflow.

A positive incremental depletion is a decrease in streamflow.

Table 6: Summary of Estimated Incremental Stream Depletion in Soda Creek after One Year of Pumping (Reaches B and C - Soda Creek Reservoir to Second Diversion)

Case	Option 1 Incremental Change in Stream Depletion 9 cfs Transferred to North Wells (cfs)	Option 2 Incremental Change in Stream Depletion 3 cfs Transferred to North Wells (cfs)	Option 3 Incremental Change in Stream Depletion 1.2 cfs Transferred to North Wells and 1.8 cfs to South Wells (cfs)
1a	-0.85	-0.28	-0.07
1b	-1.03	-0.34	-0.08
1c	-1.09	-0.36	-0.09
2a	-0.05	-0.02	-0.00-
2b	-0.08	-0.03	-0.01
2c	-0.15	-0.00	-0.01
3a	-0.89	-0.30	-0.07
3b	-1.03	-0.34	-0.08
3c	-1.13	-0.38	-0.09
4a	-0.05	-0.02	-0.00
4b	-0.08	-0.03	-0.01
4c	-0.15	-0.05	-0.01

Notes:

cfs cubic feet per second

A negative incremental depletion is an increase in streamflow.

A positive incremental depletion is a decrease in streamflow.

Table 7: Summary of Estimated Cumulative Stream Depletion in Soda Creek after One Year of Pumping (All Reaches)

Case	Option 1 Incremental Change in Stream Depletion 9 cfs Transferred to North Wells (cfs)	Option 2 Incremental Change in Stream Depletion 3 cfs Transferred to North Wells (cfs)	Option 3 Incremental Change in Stream Depletion 1.2 cfs Transferred to North Wells and 1.8 cfs to South Wells (cfs)
1a	0.17	0.06	0.01
1b	0.14	0.05	0.02
1c	0.19	0.06	0.02
2a	0.01	0.00	0.00
2b	0.02	0.01	0.00
2c	0.03	0.01	0.00
3a	0.13	0.04	0.01
3b	0.04	0.05	0.02
3c	0.15	0.05	0.02
4a	0.01	0.00	0.00
4b	0.02	0.01	-0.01
4c	0.03	0.01	-0.00

Notes:

cfs cubic feet per second

A negative cumulative depletion is an increase in streamflow.

A positive cumulative depletion is a decrease in streamflow.

Table 8: Summary of Estimated Stream Depletion in Soda Creek after One Year of Pumping South Wells Only (Reaches B and C)

Case	Estimated Stream Depletion – South Wells Only (cfs)
1a	0.45
1b	0.53
1c	0.54
2a	0.05
2b	0.08
2c	0.13
3a	0.47
3b	0.53
3c	0.57
4a	0.05
4b	0.08
4c	0.13

Notes:

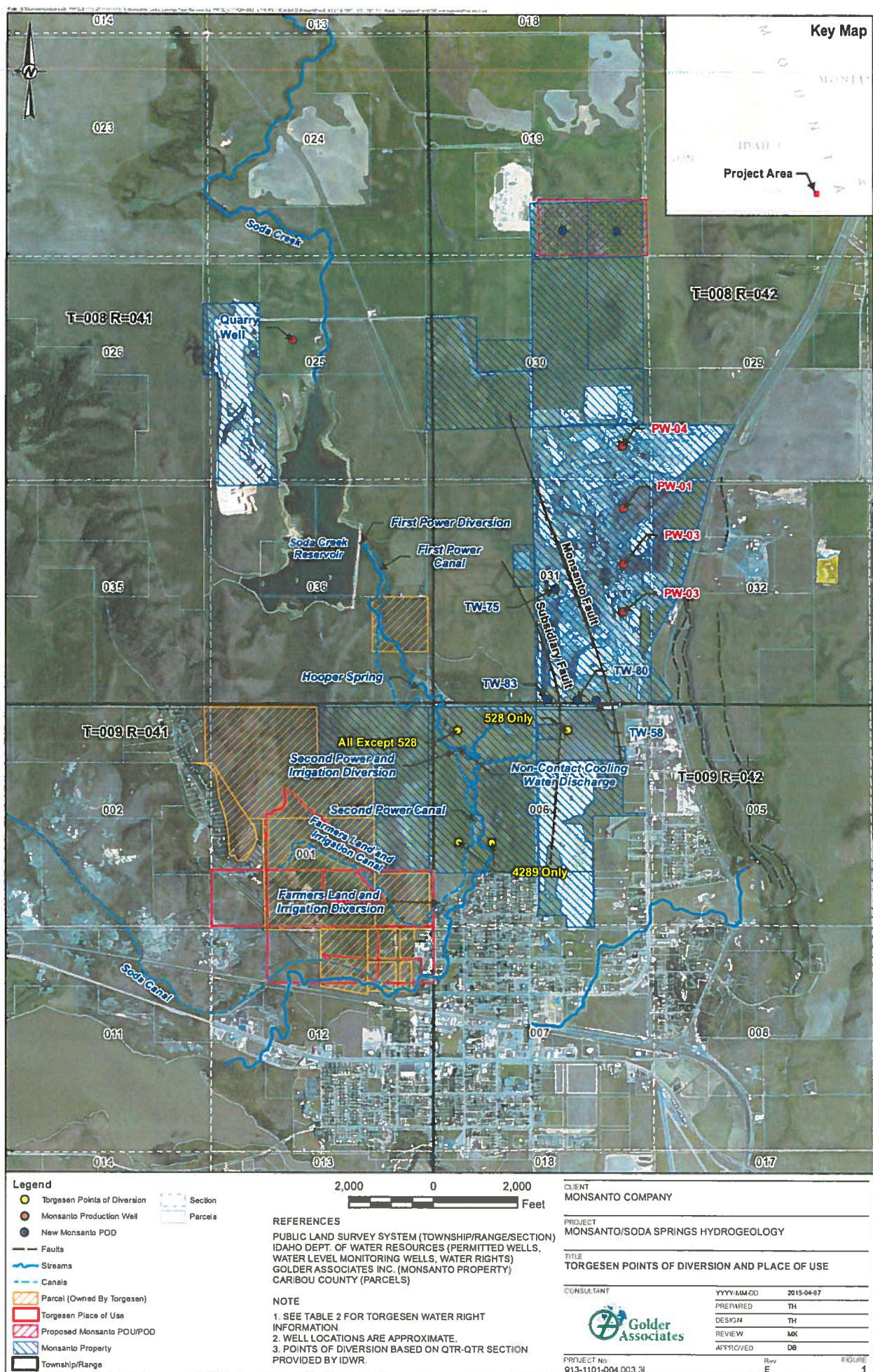
No pumping from North Wells

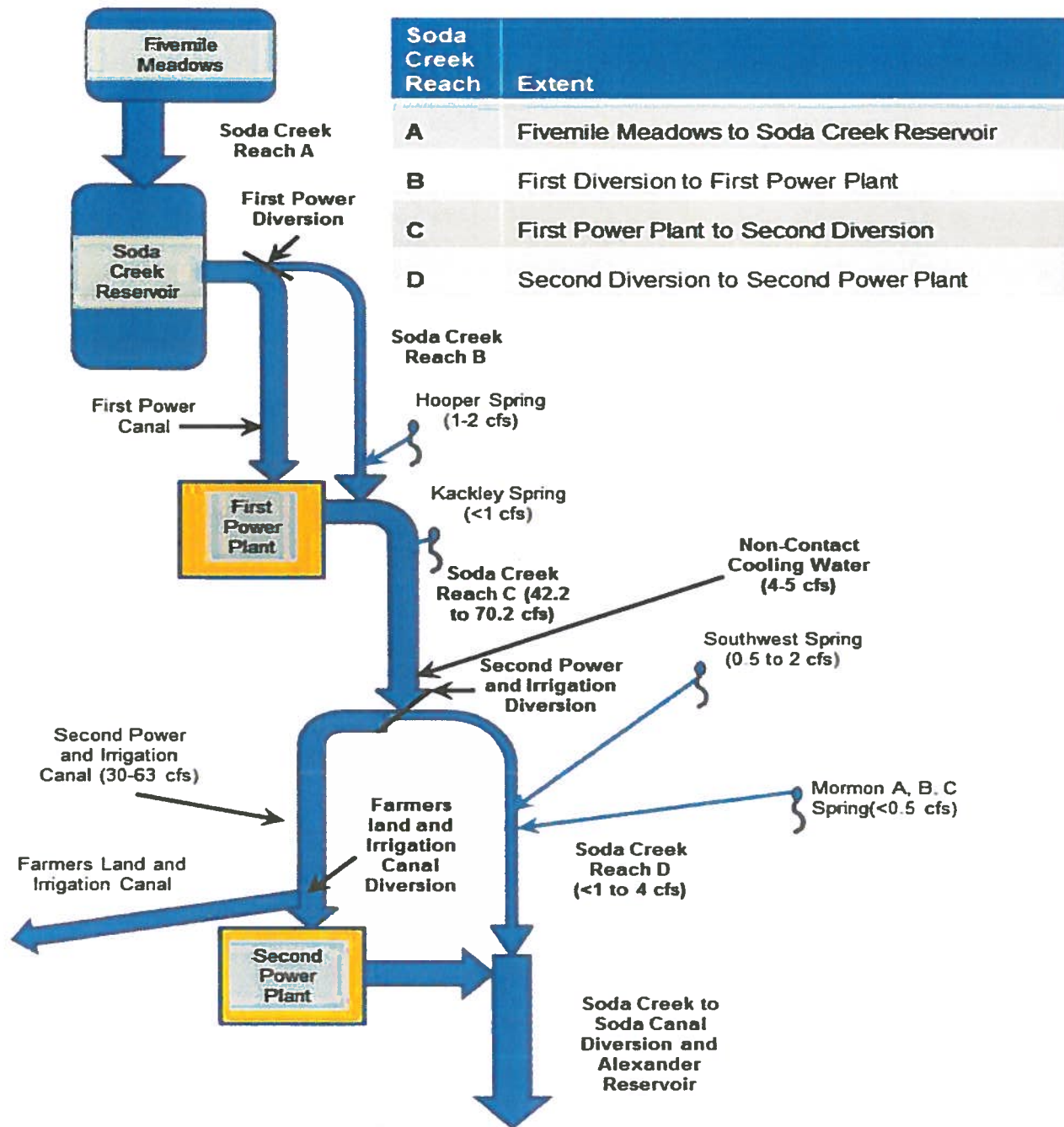
cfs cubic feet per second

A negative depletion is an increase in streamflow.

A positive depletion is a decrease in streamflow.

FIGURES





Notes

Flow measurements based on Golder Associates Inc. annual measurements (i.e. Golder 2014b)
No flow measurements for Reaches A and B

FIGURE 2

SODA CREEK SCHEMATIC

Monsanto/Soda Springs Hydrogeology/ID



LEGEND

— ? — $\frac{u}{D}$? — FAULT

-)-)-)-)-)-)-)-)-)-)-)-)-)-)- FISSURE

CREEK

POWER C

POWER OFF

POWER ON

FAN STOP

FAN ON

SPRING

POWER P

◆

NOTES

1. NAD83 IDAHO STATE PLANES, EAST ZONE, US FOOT
2. AERIAL PHOTO FROM GOOGLE EARTH (8/2/2013)

CLIENT
MONSANTO

CONSULTANT

2



Y00Y-AM-00 2015-04-07

PREPARED REDMOND

DESIGN MK

REVIEW	MM
APPROVED	DR

PROJECT
MONSANTO
2014 HYDROGEOLOGICAL
IDAHO

TITLE
SPRING LOCATIONS

PROJECT No.
913-1101-004

CONTROL
003.31

A horizontal scale bar with alternating black and white segments. It is marked with '0' at the left end, '500' in the middle, and '1000' at the right end. Below the bar, the word 'FEET' is written in all caps.

2000

FIGURE 3

Clicking on the 'Go to Data Sheet' button will update the 'Data Sheet' with this data. If you return to this sheet it will be updated with any changes you have made on the 'Data Sheet.'

Select Length Dimensions Metres

Select Time Dimensions Days

Summary of Model Selected

You have selected a single river system using a Hunt solution for the River Big Creek.

Description of Property Selected

Perpendicular distance of well to the assumed straight line of the river course. Refer to User Manual for further guidance.

Go to Data Sheet:

ENVIRONMENT AGENCY

Duration of Pumping: 365.00

Well Abstraction Rate (Q): 21983

River Sediment Hydraulic Conductivity (K): 0.864

River Sediment Thickness: 0.3

Transmissivity (T): 2230.8

Effective Saturated Aquifer Thickness: 30

Storage Coefficient (S): 0.00043

Well Radius: 0.25

Perpendicular Distance of River from Well (a): 1677

Well: Well

River: River (Hunt)

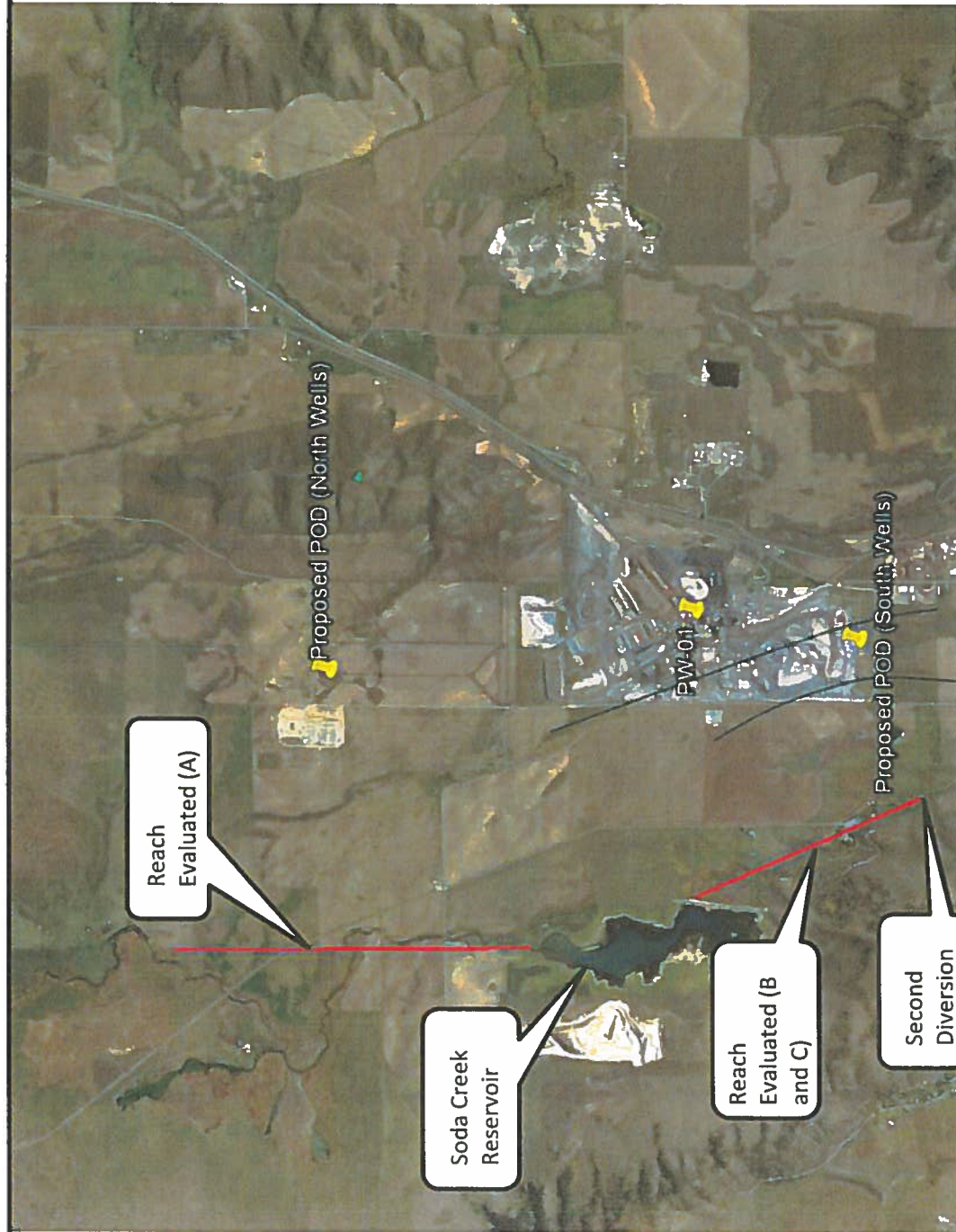
River: Soda Creek

- The aquifer is infinite in a real extent, or semi-infinite and bounded by a no flow boundary parallel to the river for the single river model.
- The aquifer has a homogeneous isotropic transmissivity which does not depend on head. This is strictly true only for confined or leaky confined conditions but may be a reasonable approximation for deep unconfined aquifers.
- Flow is horizontal and vertical gradients are neglected (Dupuit-Forchheimer approximation for an unconfined aquifer).
- The aquifer has a homogeneous isotropic confined storage coefficient (or specific yield if the tool is being used to approximate a deep unconfined aquifer).
- Either confined or unconfined conditions apply over the whole of the aquifer (not a mixture of both).
- The head tends to a fixed value at large distances from the well and this value is equal to the river stage, and that the impact of recharge or differences in river stage and regional groundwater gradients can be addressed separately by the principle of superposition. This condition can be satisfied if the results are interpreted as drawdowns and river flow depletion, in which case the head distribution only needs to be consistent with the equations being linear (transmissivity and storage coefficient constant in space and time).
- The river is described by an infinite straight line with a constant water level that is unaffected by discharge to the aquifer. Again, this condition can be satisfied if the results are interpreted as drawdowns and river flow depletion, in which case the head distribution only needs to be consistent with the equations being linear (transmissivity and storage coefficient constant in space and time).
- There is no storage in the river bed or bank sediments.
- The river is in hydraulic continuity with the groundwater.
- The only significant recharge to the aquifer is derived from the river and there is no significant recharge from surface percolation to the water table. Again, this condition can be satisfied if the results are interpreted as drawdowns and river flow depletion, in which case the head distribution only needs to be consistent with the equations being linear (transmissivity and storage coefficient constant in space and time).
- Water is released instantaneously from storage in the aquifer.
- The borehole is screened over the full depth of the aquifer.

LEGEND

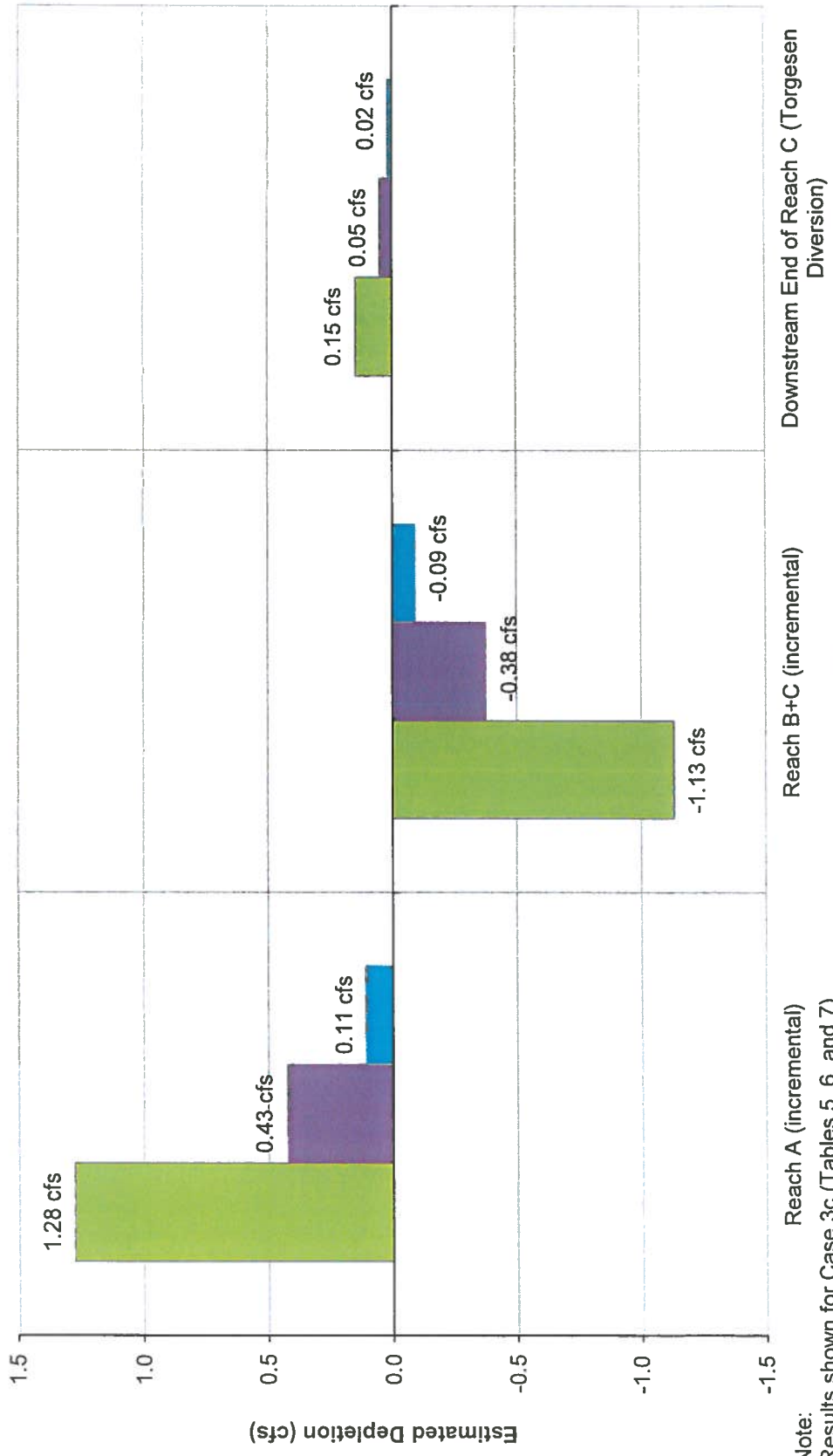
FIGURE 4
CONCEPTUALIZATION AND ASSUMPTIONS OF HUNT (1999) SOLUTION

Monsanto/Soda Springs Hydrogeology/ID



LEGEND

FIGURE 5
REACHES OF SODA CREEK EVALUATED FOR DEPLETION

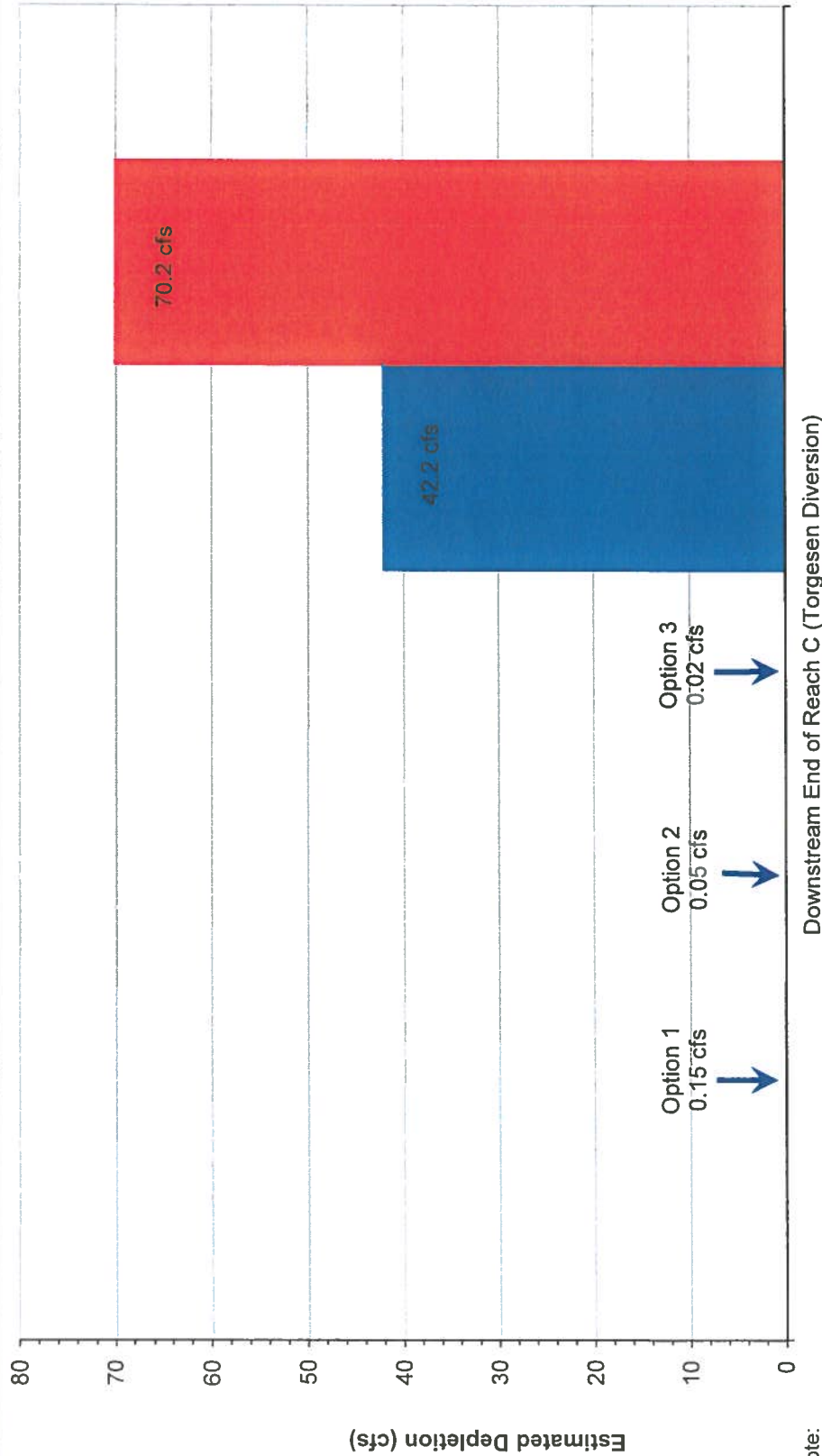


Note:
Results shown for Case 3c (Tables 5, 6, and 7)
Stream depletion is not injury to senior water rights
Negative depletion represents an increase in streamflow

LEGEND

- Streamflow Depletion - Option 1 - 9 cfs Transferred to North Wells
- Streamflow Depletion - Option 2 - 3 cfs Transferred to North Wells
- Streamflow Depletion - Option 3 - 1.2 cfs Transferred to North Wells and 1.8 cfs to South Wells

FIGURE 6
SUMMARY OF ESTIMATED INCREMENTAL AND CUMULATIVE STREAMFLOW DEPLETION



Downstream End of Reach C (Torgesen Diversion)

Note:
Results shown for Case 3c (Table 7)
Stream depletion is not injury to senior water rights
Soda Creek streamflows are spot measurements made in the spring at the head of the Second Power and Irrigation Diversion (downstream of the outfall) between 2010 and 2014
Soda Creek streamflow measurements and measurement dates summarized in Table 2.

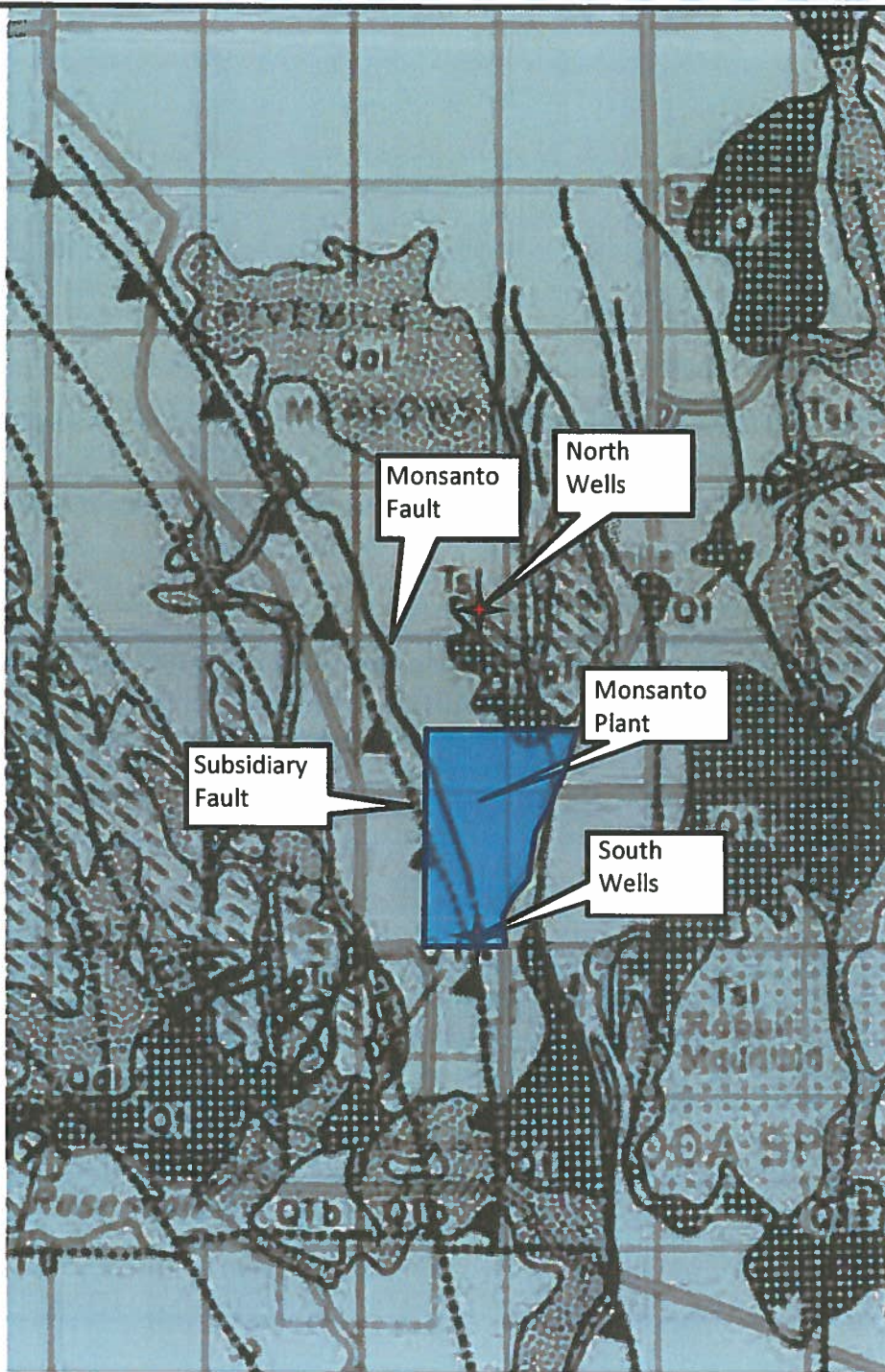
LEGEND

- Streamflow Depletion - Option 1 - 9 cfs Transferred to North Wells
- Streamflow Depletion - Option 2 - 3 cfs Transferred to North Wells
- Streamflow Depletion - Option 3 - 1.2 cfs Transferred to North Wells and 1.8 cfs to South Wells
- Soda Creek Streamflow

FIGURE 7

ESTIMATED CUMULATIVE STREAMFLOW DEPLETION AND STREAMFLOW - ALL REACHES

ATTACHMENT A
GEOLOGICAL MAPS AND SECTIONS FROM RALSTON (1988) AND DION (1974)



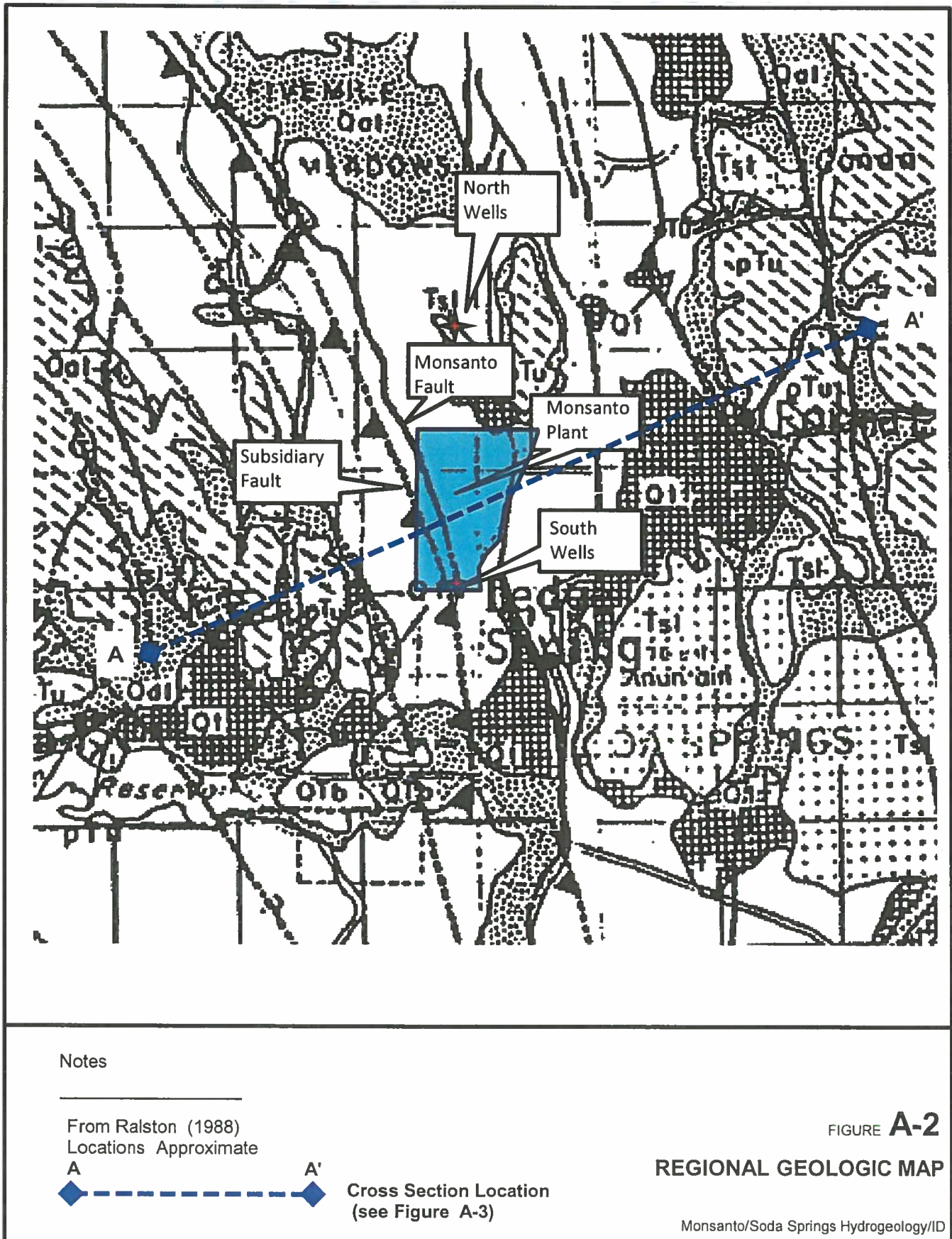
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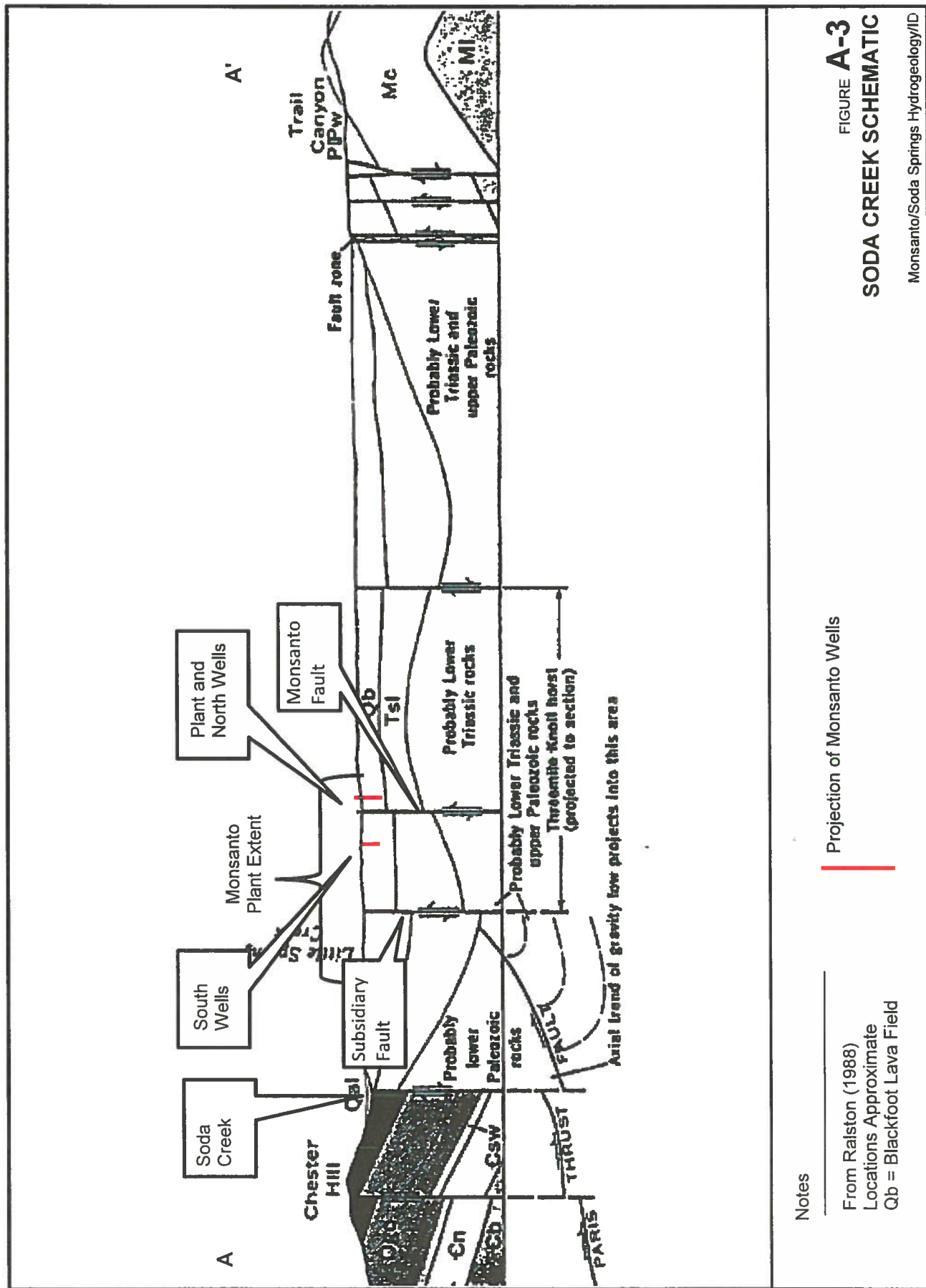
From Dion (1974)
Locations Approximate

FIGURE **A-1**

REGIONAL GEOLOGIC MAP

Monsanto/Soda Springs Hydrogeology/ID





Notes

From Ralston (1988)
Locations Approximate
Qb = Blackfoot Lava Field

Projection of Monsanto Wells

FIGURE A-3
SODA CREEK SCHEMATIC

Monsanto/Soda Springs Hydrogeology/ID