Final

Environmental Impact Statement
Rasmussen Valley Mine
Volume 2

Caribou County, Idaho

Lead Agencies:

U.S. Department of the Interior
Bureau of Land Management
Pocatello Field Office

U.S. Department of Agriculture
Forest Service
Caribou-Targhee National Forest

Cooperating Agencies:

U.S. Army Corps of Engineers

Idaho Department of
Environmental Quality

September 2016

APPENDIX A

DRAFT EIS COMMENTS REPORT

TOPICS, COMMENTS, AND RESPONSES

1.1 PUBLIC COMMENTS

The National Environmental Policy Act (NEPA) regulations at 50 Code of Federal Regulations (CFR) 1503.1 require the lead agencies, in this case the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS), to request public comment on a Draft Environmental Impact Statement (Draft EIS) before preparing a Final EIS. Comments should be obtained from federal, state, and local agencies; Indian tribes; and those persons or organizations who may be interested in or affected by the proposed project. The Notice of Availability (NOA) for the Rasmussen Valley Mine Draft EIS was published in the Federal Register (FR) on September 18, 2015. The 45-day comment period ended on November 2, 2015.

Public meetings were held on October 6 and 7, 2015 at the BLM Pocatello Field Office (PFO) in Pocatello, and at the USFS Soda Springs Ranger District in Soda Springs, Idaho, respectively.

Agencies, organizations, and interested parties provided comments on the Draft EIS via mail, email, and public meetings. Comments also came in the forms of post cards, form letters, and comment forms. A total of 1,010 comment letters were received. In many of the 1,010 comment letters received, there was more than one comment, which represented a total of 1,295 comments on the Draft EIS.

1.2 COMMENT ANALYSIS

All of the Draft EIS comments received by the close of the comment period were compiled and categorized for the full range of public viewpoints and concerns. The process facilitates good decision-making by helping to clarify, adjust, or incorporate information into the preparation of the Final EIS for a project. All comments (letters, emails, and other types of input) are included in this analysis. In the analysis process used for the Rasmussen Valley Mine Project, each comment letter is given a unique identifying number, which allows analysts to link specific comments to original letters. Commenters' names and addresses are then entered into a project-specific database, enabling creation of a complete mailing list of all commenters. The database is also used to track pertinent demographic information such as comments from groups of commenters or federal, state, tribal, county, and local governments. Comments from specific groups are given unique identifying numbers even if they are form letters.

All input is considered and reviewed by two analysts. Each comment letter is first read by one analyst and sorted into comments addressing various concerns and themes. A second analyst reviews the sorted comments to ensure accuracy and consistency of the analysis. Summary statements of each comment or groups of similar comments are entered into the database. Complete copies of each comment letter are also attached to each associated comment statement in the database. In preparing the final summary analysis, public comments are reviewed again. These reports track all coded input and allow analysts to identify a wide range of public comments and analyze the relationships among them. The final product includes a list of issues addressing the Draft EIS and all public comments relating to the issues.

It is important for the public to understand that this process makes no attempt to treat comments as votes. In no way does content analysis attempt to sway decision-makers toward the will of any majority. Content analysis provides the means to ensure that every original comment is considered at some point in the decision process. The content analysis method employs both qualitative and quantitative approaches. It is a systematic process designed to provide specific demographic information, to compile a mailing list of respondents, to identify individual comments by topic in each comment letter, to evaluate similar comments from different responders, and to summarize like comments as specific comment statements. The breadth, depth, and rationale of each comment are especially important. In addition to capturing relevant factual input, analysts try to capture the relative emotion and strength of public sentiment behind particular viewpoints in order to represent the public's values and concerns as fairly as possible. Analysts then organize the concern statements to facilitate systematic review and response by decision-makers.

Each comment statement is an analyst's brief rephrasing of one or more comments expressing similar views of which management action the agency should take. Each comment statement is assigned a unique number. Organized by topic, chapter, or resource, the comment statements and responses appear in Draft EIS Topics, Issues, and Responses section of this Appendix. Under each comment statement, similar comments are paraphrased and a response is given. Letter number and comment number are provided and can be cross-referenced to identify the comment author in **Table A** and **Table B**. **Table A** is a list (alphabetical by author) of all the comment letters that generated original comments captured in the content analysis process. **Table B** is the same list organized numerically by letter number. To help the reader of this Final EIS understand how their comments were considered, they should find their comment letter number from the list in **Table A** and then look for the comment letter numbers in the Draft EIS Topics, Issues, and Responses section of this Appendix, where the specific comments and responses are shown. For readers specifically interested in how all their comments were coded into the database, copies of the comment database are available on CD and can be requested from the BLM EIS Project Manager.

1.2.1 Organizational Affiliation

Responses were received from various organizations and unaffiliated individuals. Respondents include businesses, state and local governments, mining support industries, as well as unaffiliated individuals and others. Organization types were tracked for each post card, form letter, and comment form (**Table C**).

1.2.2 Form Responses

Forms are defined as responses received separately, but containing identical text. There were a total of 20 form letters submitted on the project, accounting for 905 submittals (**Table D**).

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
	Chysler Weeks	Self	171	1
	Danny	Self	286	1
	Jarom	Self	172	1
	Nolan	Self	553	1
Aalbers	Angela	Self	727	1
Abramson	Nick	Self	700	1
Abramson	Taeyler	Self	701	1
Adkins	Lorin T	Self	229	1
Alleman	John	Self	941	1
Alleman	Todd	Self	248	1
Allen	Adele	Self	555	1
Allen	Gerald	Self	381	1
Allen	Scott P.	Self	556	1
Altieri	Patty	Self	536	1
Andersen	Bruce	Self	489	1
Andersen	Bruce	Self	490	1
Andersen	Clint	Self	170	1
Anderson	Brent	Self	391	1
Anderson	Gary N.	Business	625	1
Anderson	Kathy	Self	564	1
Anderson	Linda S.	Self	779	1
Anderson	Linda S.	Self	785	1
Anderson	Spencer	Self	792	1
Anderson	Terry	Self	462	1
Anderson	Wendy	Self	468	1
Anderson	William	Self	867	1
Andreasen	Camille	Self	1000	1
Andreasen	Karsen	Self	994	1
Ansley	Shannon Leigh	Tribal Organization	1015	27
Apel	Darryl	Self	425	1
Armitage	Chris	Self	585	1
Armstrong	Byron	Self	204	1
Armstrong	Clay	Self	472	1
Arnell	Bryan S.	Self	826	1
Arnold	Alton	Self	950	1
Astle	Jamie	Self	584	1
Attebury	Amanda	Self	162	1
Avery	George	Self	361	1
Avila	T. J.	Self	388	1
Azary	Sara	Self	780	1
Bachman	Dean	Self	736	1
Bachman	Debbie	Self	737	1
Bacon	Travis	Self	505	1
Bair	Steve	State Elected Official	379	3
Baker	Michael	Self	6	1
Banks	John	Self	175	1
Bardswich	Joe	Self	794	1
Barfuss	Delene	Self	164	1
Barfuss	Wyatt	Self	372	1
Barger	Charlotte Deanna	Self	845	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Barger	Talon	Self	843	1
Bartschi	Zach	Self	879	1
Bassett	Brad	Self	210	1
Bates	Jared	Self	704	1
Bauer	Christopher	Self	725	1
Baughman	Vanessa	Self	597	1
Beall	James	Self	776	1
Beckstead	Carol	Self	256	1
Beckstead	Darin	Self	93	1
Bell	Jeffery	Self	944	1
Belnap	Doug	Self	151	1
Bendixen	Wayne	Self	851	1
Beres	Michael	Self	880	1
Bergholm	Greg	Self	9	1
Bergholm	Katy	Self	552	1
Betancourt	Terral	Self	275	1
Betancourt	Terral	Self	276	1
Billman	Gary	State Agency	1012	1
Bills	Steve	Self	754	1
Blackadar	Ruth	Self	63	1
Blackadar	Ruth Jean	Self	671	1
Blankenbaker	Chad	Self	799	1
Blomberg	Peter	Self	48	1
Bostick	Jim	Self	403	1
Bostick	Jim	Self	905	1
Bowen	Jake	Self	376	1
Bowen	Jessica	Self	326	1
Bowles	David	Self	641	1
Bowles	Dirk	Local Official	933	1
Bowman	Shari	Self	390	1
Bowmer	Ed	Self	574	1
Bradfield	Jason	Self	328	1
Bradley	Bruce N.	Self	562	1
Bragg	Ashley	Self	896	1
Bragg	Brooklynn	Self	897	1
Bragg	Clint	Self	476	1
Braun	Doug	Self	166	1
Brewer	Brian	Self	377	1
Bridges	Chris	Self	889	1
Bridges	Jason	Self	373	1
Briggs	Cody	Self	232	1
Briggs	Maurie	Self	305	1
Brogan	Gary	Educational Institution	429	1
Brogan	Janniece	Self	58	1
Brooks	Anthony	Self	196	1
Brown	Jonathan	Self	765	1
Brown	Scott	Local Agency	1007	3
Browning	Nathan	Self	860	1
Bruce	Derek Evan	Self	886	1
Bruce	Devin	Self	392	1

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Last Name	First Name	Affiliation	Letter Number	Number of Comments
Bruner	Dan	Self	767	1
Brzygot	Jennifer	Self	119	1
Buchanan	Doug	Self	545	1
Buck	Robert	Self	242	1
Buenemann	Jason	Self	327	1
Bullock		Self	928	1
Bullock	Bill	Self	929	1
Bunderson	Shannon	Self	918	1
Burbank	Jason	Self	823	1
Burbank	Jaydon	Self	991	1
Burbank	Travis Rex	Self	825	1
Burnham	Dick	Self	453	1
Burnham	Judy	Self	323	1
Burnham	Judy	Self	459	1
Burnham	Justin	Self	642	1
Burnham	Melonee	Self	362	1
Burton	Jason L	Self	865	1
Burttram Jr	John G	Self	450	1
Butka	Jay	Self	612	1
Byram	Brock	Self	345	1
Byram	Paige	Self	126	1
Call	Brock	Self	578	1
Call	Kate	Self	910	1
Call	Kate	Self	911	1
Call	Stephen L.	Self	596	1
Callicrate	Thomas	Self	456	1
Camp	Joe	Self	56	1
Campbell	Kirk	Self	592	1
Campbell	Vanesia	Self	521	1
Carlisle	Lanny Colby	Self	378	1
Carlisle	Lanny John	Self	570	1
Carlson	Dennis L	Self	201	1
Carpenter	Bryce	Self	79	1
Carpenter	Caidie	Self	81	1
Carpenter	Cory	Self	82	1
Carpenter	Cory Bryce	Self	80	1
Carr	Mike	Self	678	1
Carroll	Ross	Self	850	1
Carter	John	Organization	626	9
Carter	Rick	Self	583	1
Carter	Travis	Self	416	2
Carver	Skylar	Self	96	1
Cash	Gordon	Self	27	1
Cellan	Sid R.	Organization	956	2
Chambers	David M.	Organization	627	18
Chapin	Kelly	Self	454	1
Chapman	Mark	Self	721	1
Christensen	Brad	Self	158	1
Christensen	Brad	Self	159	1
Christensen	Chad	Self	220	1

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Last Name	First Name	Affiliation	Letter Number	Number of Comments
Christensen	Charlie	Self	835	1
Christensen	George	Self	691	1
Christensen	Jarred	Self	891	1
Christensen	Jeremy	Self	577	1
Christensen	Mark	Self	590	1
Christensen	Rick	Self	203	1
Christiansen	Stephanie	Self	282	1
Christiansen	Stephanie	Self	283	1
Christiansen	Tyson	Self	235	1
Christopherson	Erik	Self	223	1
Cipriano	Joe	Self	535	1
City of Soda Springs	City Council	Local Agency	953	2
Clark	Shane	Self	735	1
Cochran	Eric W	Self	25	1
Cochran	Linda	Self	598	1
Cochran	Paizlee	Self	469	1
Cochran	Tamra	Self	24	1
Cochran	Tilly	Self	466	1
Coffin	Matt	Self	746	1
Coker	Jason	Self	554	1
Cole	Paige	Self	4	1
Cole	Rhonda	Self	565	1
Coleman	Tom	Self	684	1
Collins	Cassie	Self	996	1
Collins	Dennis	Self	995	1
Collins	John	Self	557	1
Collins	Robert	Self	513	1
Colson	Tony	Self	352	1
Colvin	Marissa	Self	712	1
Colvin	Matthew	Self	636	1
Colvin	Rich l.	Self	348	1
Comish	Robert	Self	67	1
Coombs	Ron	Self	784	1
Cooper	Anjanette	Self	640	1
Cooper	Brad	Self	471	1
Cooper	Gordon	Self	927	1
Cooper	Randy	Self	408	1
Corbett	Chad	Self	52	1
Corbett	Craig	Self	426	1
Corder	Randy	Self	939	1
Corkal	Bryan	Self	497	1
Cothran	Troy	Self	143	1
Coughlin	Sean	Self	515	1
Countryman	Steve	Self	42	1
Covert	Matthew T	Self	153	1
Coyne	O Norman	Self	64	1
Crane	Jason	Self	915	1
Crockett	Daniel	Self	548	1
Crockett	Mick	Self	528	1
Crockett	Nicole	Self	529	1

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Last Name	First Name	Affiliation	Letter Number	Number of Comments
Crockett	Zach	Self	75	1
Crossley	Kelci	Self	693	1
Crossley	Kelley	Self	98	1
Crossley	Kylee	Self	366	1
Crossley	Terrie	Self	551	1
Crouse	Russell	Self	33	1
Crouse	Russell	Self	34	1
Crouse	Russell	Self	35	1
Crouse	Russell	Self	36	1
Crouse	Russell	Self	37	1
Cullinan	Mary	Self	656	1
Cureton	Nicholas	Self	217	1
Cutler	Mark	Self	394	1
Dail	W.B.	Self	422	1
Dainels	Kenny	Self	316	1
Daniell	Jack	Self	518	1
Daniels	Diane	Self	304	1
Darling	Mary	Self	795	2
Davino	Anne	Self	837	1
Davis	Alisha	Self	188	1
Davis	Cleve	Tribal Organization	1013	7
Davis	Kristopher	Self	311	1
Davis	Shawn	Self	231	1
Davison	Arthur	Self	743	1
Deiter	William	Self	981	1
DeLucia	Elaine	Self	444	1
Deros	Kimberly	Self	676	1
DeWall	JaLyn	Self	967	1
Didden	L. Jan	Self	451	1
Diehl	Robert	Self	292	1
Diehl2	Robert	Self	808	1
Dille	Scott	Self	181	1
Dimond	Harold	Self	1	1
Dmochowski	Casimer Alexander	Self	382	1
Dockstader	Darrin	Self	236	1
Dockstader	Tricia	Self	336	1
Doman	Brad	Self	540	1
Donahoo	Molly	Self	301	1
Donahoo	Scott	Self	480	1
Dorn	Forest Van	Self	559	1
Dorsey	Tom	Self	397	1
Douglass	Jack	Self	653	1
Drake	Pam	Self	183	1
Draney	Terryl Kevin	Self	561	1
Duncan	Eric	Self	875	1
Dunford	Scott	Self	19	1
Dunford	Scott	Self	20	1
Dunham	Shirley	Self	517	1
Duran	Denise	Self	546	1
Duran	Jon	Self	483	1

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Last Name	First Name	Affiliation	Letter Number	Number of Comments
Duran	Jordan	Self	478	1
Duran	Kaitlin	Self	485	1
Duran	Kassy	Self	481	1
Duran	Miranda	Self	484	1
Dursteler	Sonja	Self	284	1
Dutra	Gregory	Self	878	1
Eborn	Chantz	Self	920	1
Eborn	Jessie	Self	916	1
Eborn	Josh	Self	921	1
Eborn	Kandi	Self	566	1
Eborn	Larry	Self	919	1
Eborn	Linda	Self	917	1
Edwards	Denny	Self	846	1
Edwards	Tanya	Self	844	1
Egbert	Chad	Self	587	1
Eisenbarth	Greg	Self	876	1
Eisenbarth	Ora	Self	690	1
Elieson	Robert	Self	21	2
Elkins	Casey	Self	699	1
Erickson	Brenda	Self	969	1
Erickson	Josiah	Self	861	1
Erickson	Wendy	Self	614	1
Espinoza	Ambrocio	Self	135	1
Espinoza	Pedro	Self	136	1
Evans	Kyle	Self	591	1
Evertz	Theodore David	Self	274	1
Farnworth	Brock	Self	730	1
Fay	Vincent	Self	354	1
Feld	Ken	Self	648	1
Feld	Russell	Self	646	1
Feld	Shelby	Self	643	1
Feld	Stephanie	Self	651	1
Fetters	Jeffery	Self	883	1
Fetters	Jeffery	Self	884	1
Finlayson	Matthew	Self	306	1
Fischer	Roland	Self	655	1
Fisher	Larry	Self	123	1
Fisher	Sandi	Federal Agency	542	6
Fitzgerald	James F.	Local Agency	797	1
Fletcher	Joseph J.	Self	925	1
Fletcher	Julia	Self	16	1
Floorsweep	John	Self	729	1
Flores	Lido	Self	724	1
Foss	Mark	Self	502	1
Foster	Collen	Self	810	1
Fowler	Jon	Self	832	1
Fraizer	Riley	Self	686	1
Franklin	Bobby E	Self	120	1
Frankos	Tom	Self	519	1
Friesen	Jared	Self	111	1

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Last Name	First Name	Affiliation	Letter Number	Number of Comments
Friesen	Merle	Self	109	1
Friesen	Pilar	Self	112	1
Fryar	Charles	Self	30	1
Fuentes	John	Self	600	1
Fulks	Kathey	Self	781	1
Fullmer	Mike	Self	660	1
Galarza	Kevin	Self	437	1
Gallegos	Elaine	Self	674	1
Gamangasso	Robin Marc	Self	760	1
Gambles	Cassie	Self	710	1
Gambles	Mary	Self	708	1
Gambles	Sarah	Self	706	1
Gambles	Scott	Self	709	1
Garcia	Dennis O.	Self	436	1
Garcia	Schap	Self	582	1
Garner	Aja	Self	615	1
Gasu	Lee	Self	28	1
Gaudette	James	Self	435	1
Gaughan	Darsen	Self	290	2
Gear	Jay	Self	764	1
Gehring	Dean	Self	682	1
Gentry	Joy	Self	219	1
Gerenza	Patricia	Self	417	1
Gibbons	Nancy	Self	433	2
Gibbs	Marc	Federal Elected Official	428	2
Gibson	Brody	Self	964	1
Gibson	Forrest	Self	125	1
Gibson	Roger	Self	59	1
Gilbertson	Raymond	Self	141	1
Gilmer	Lacey	Self	812	1
Gilmer	Steve	Self	980	1
Gilner	Brad	Self	255	1
Gonzalez	Mitzi	Self	572	1
Goode	Benjamin D.	Self	749	1
Goode	John D	Self	424	2
Goode	Shari	Self	975	1
Goodin	John	Self	72	1
Gorski	Shula	Self	77	1
Gorton	James	Self	331	1
Graham	Duane	Self	121	1
Grammatico	John	Self	440	1
Grant	Kathryn	Self	319	1
Graunke	Doug	Self	414	1
Green	Brandon	Self	118	1
Green	Debora	Self	638	1
Green	Michelle	Self	303	1
Greene	Jason	Self	586	1
Gresko	Allisyn	Self	146	1
Griffiths	Abram	Self	672	1
Griffiths	Dave	Self	470	1

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Last Name	First Name	Affiliation	Letter Number	Number of Comments
Griffiths	Tamara	Self	603	1
Gronning	Mat	Self	445	1
Grundy	Dean	Self	165	1
Guedes	Chris	Self	962	1
Guedes	Tina	Self	963	1
Gummersall	Jake	Self	355	1
Gummersall	Lonnie	Self	992	1
Gummersall	Saesha	Self	367	1
Gunn	Gary M.	Self	770	1
Gunn	Josh	Self	871	1
Guslander	John	Self	805	1
Guthmiller	Demian	Self	997	1
Guthmiller	Gina	Self	314	1
Guthrie	Jim	State Elected Official	1009	2
Haderlie	Andrea	Self	252	1
Hall	Clay	Self	176	1
Hall	Jeffery O	Educational Institution	623	6
Hall	Scott Jason	Self	368	1
Hall	Wes	Self	982	1
Hallinan	Stephanie	Self	777	1
Hamp	Steve	Self	357	1
Hansen	Adam	Self	657	1
Hansen	Barry	Self	167	1
Hansen	Debbie	Self	696	1
Hansen	Gary	Self	234	1
Hansen	Julie	Self	347	1
Hansen	Kirk L.	Self	512	1
Hansen	Sue	Self	525	1
Hanson	Michael	Self	386	1
Harcus	John	Self	685	1
Harmon	Jerry T	Local Agency	225	3
Harper	Clay	Self	31	1
Harris	Jason	Self	23	1
Harris	Mark	State Elected Official	1008	4
Harris	Megan R	Self	65	1
Harris	Tom	Business	88	2
Harris	Whitney	Self	62	1
Harrison	Alex	Self	461	1
Harrison	Laurie	Self	738	1
Hart	Mitchell J.	Local Official	802	3
Hartke	Tony	Self	608	1
Haslam	Alan D.	Business	628	5
Haslam	Leisa	Self	972	1
Hatch	Judy	Self	322	1
Hatch	Royce	Self	438	1
Hayes	Tammy	Self	277	1
Hays	Josh	Self	407	1
Hebert	David	Self	739	1
Hendrickson	F. Lee	State Agency	593	2
Henesh	Joann	Self	961	1

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Last Name	First Name	Affiliation	Letter Number	Number of Comments
Henesh	Leo Tyler	Self	405	2
Henesh	Tamra	Self	278	1
Henesh2	Leo Tyler	Self	985	1
Hennings	Megan	Self	887	1
Henry	Sarah	Self	289	1
Hermes	Richard	Self	543	1
Heyl	Chris	Self	533	1
Higgins	Chris	Self	211	1
Higley	Chad	Self	346	1
Hill	Brent	State Elected Official	340	3
Hill	Courtney	Self	458	1
Hill	Matthew	Self	731	1
Hillman	Kerry	Self	506	1
Hirschi	Marc	Self	177	1
Hirschi	Mathew	Self	544	1
Hobson	Eric	Self	479	1
Hodson	Dereck	Self	909	1
Hoefeldt	Nicholas	Self	244	1
Hoffman	Rick	Self	903	1
Hoggan	Richard	Self	755	1
Holhos-Vaida	Cosmin	Self	679	1
Hollaway	Jeffrey	Self	926	1
Hopkins	Wade	Self	271	1
Horn	Alister	Self	343	1
Horsley	Eli	Self	91	1
Housley	Jonathan	Self	163	1
Hovland	Emily	Self	43	1
Hubbard	Alan	Self	251	1
Hubbard	Diane	Self	218	2
Hubbard	Jarom	Self	226	1
Hueckstaedt	Derrek	Self	296	1
Humble	Mark	Self	532	1
Humble	Shelly	Self	589	1
Humphreys	Clint	Self	191	1
Humphreys	Shelly	Self	287	1
Hunsaker	Dee	Self	888	1
Hunter	Chad	Self	92	1
Hunter	Dustin	Self	778	1
Hunzeker	Todd	Self	29	1
Hymas	Scott	Self	395	1
Hymas	Troy	Self	87	1
Iannelli	Jodi	Self	819	1
Iannelli	John	Self	161	1
Irick	Jacob	Self	863	1
Irick	JB Shane	Self	874	1
Isaak	Adriane	Self	266	1
Jackson	Mark	Self	402	1
Jacobon	Rod	Organization	694	1
Jacobson	Timothy	Self	446	2
Jass	Karen	Self	793	2

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Last Name	First Name	Affiliation	Letter Number	Number of Comments
Jeffiers	Jim	Self	86	1
Jensen	Jenn	Self	595	1
Jensen	Tad	Self	370	1
Johnson	Casey	Self	650	1
Johnson	Douglas	Self	604	1
Johnson	Jori	Self	669	1
Johnson	Randy	Self	658	1
Johnson	Sally D	Self	474	1
Johnson	Timothy Curti	Self	937	1
Johnson Jr.	Howard	Self	757	1
Johnston	Deborah	Self	752	1
Jones	Hannah	Self	839	1
Jones	Karl	Self	862	1
Jones	Melanie	Self	644	1
Jones	Walter	Self	531	1
Jorgensen	Dora Deen	Self	110	1
Jupka	Dan	Self	116	1
Jupka	Jim	Self	496	2
Jurgens	Stan	Self	673	1
Kaikuulamai	Kimber	Self	702	1
Kaikuulamai	Kimber	Self	707	1
Kalb	Kenneth G.	Self	498	1
Kane	Jade	Self	130	1
Keetch	Tyler	Self	834	1
Keetch	William J.	Self	979	1
Kelly	Sean	Self	769	1
Kelly	Tony	Self	493	1
Kelly	Tony	Self	494	1
Kenley	Marc	Self	907	1
Kenley	Marc	Self	908	1
Kenley	Paige	Self	573	1
Kenley	Paige	Self	906	1
Kent	Blake	Self	645	1
Kenyon	Craig	Self	227	1
Kiehn	Kacey	Self	804	1
Kirby	Amity	Self	631	1
Kirby	Mark P.	Self	807	1
Kneebone	Travis	Self	824	1
Kovacich	Kevin	Self	740	1
Kowallis	Paul	Self	787	1
Kramer	Brian	Self	605	1
Kraupie	Juliene K.	Self	412	1
Kraupie	Marshall W.	Self	411	1
Kristo	Peter	Self	14	1
Kuhn	Don	Self	104	1
Kula	Norbertj	Self	460	1
Kunz	Corey	Self	611	1
Kunz	Lee	Self	178	1
LaBeau	Alex	Organization	954	2
Lacefield	Jamie	Self	960	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Lacey	Roy	State Elected Official	932	2
Lake	Jerod	Self	423	1
Lamonte	Mark	Self	207	1
Lamonte	Sue	Self	279	1
Lancaster	Mandy	Self	182	1
Lapthorne	Brandy	Self	599	1
Larsen	Bryan	Self	748	1
Larsen	Todd	Self	895	1
Latham	Laura	Self	680	1
Lau	Caribou Jacks	Self	338	2
Lau	Robert	Self	131	1
Lau	Stephanie	Self	986	1
Law	Stephen	Self	358	2
Leal	Jesus	Self	138	1
Leaming	John	Self	602	1
Learning	Donna	Self	526	1
Leathan	Garth	Self	40	1
Lecce	Mary Anne	Self	652	1
Lee	Robbin	Self	189	1
Leipheimer	Annie	Self	374	1
Leissring	Jay	Self	630	1
Leissring	Jay	Self	632	1
Leissring	Jeff	Self	618	1
Leissring2	Jeff	Self	619	1
Lemming	Thomas	Self	133	1
Lewis	Bill	Self	822	1
Lewis	Phil	Self	541	1
Liebetrau	James	Self	661	1
Liebtrau	James	Self	662	1
Liechty	Alysia	Self	90	1
Liechty	Tim	Self	859	1
Liggett	Chase	Self	774	1
Lindstrom	Jason	Self	537	1
Lish	Kim	Self	617	1
Little	Brad	State Elected Official	383	2
Littleton	Christine B.	Federal Agency	579	46
Llewellyn	Ashley	Self	705	1
Llewellyn	Todd	Self	703	1
Lloyd	Chad	Self	384	1
Lloyd	Leslie	Self	307	1
Loertscher	Ross	Self	775	1
Lombardo	Michael J	Self	447	1
Lott	Aaron	Self	714	1
Lott	Dawna	Self	717	1
Lott	Debbie	Self	718	1
Lott	Jay	Self	715	1
Lott	Jenny	Self	716	1
Lott	Randy	Self	713	1
Low	John	Self	222	1
Lutz	Tania	Self	817	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Lyon	Vicky	Organization	1011	2
MacAulay	James	Self	530	1
MacCheyne	Cayla	Self	501	1
MacKenzie	W.S.	Self	337	2
Maduck	Crystal	Self	360	1
Magee	Randy	Self	294	1
Maggiore	John G.	Self	828	1
Magnum	Shane	Self	51	1
Mai	Theron	Self	473	1
Malek	Luke	State Agency	432	2
Mangum	Kevin	Self	885	1
Mansfield	Coral	Self	241	1
Mansfield	Dustin	Self	719	1
Marler	Camille	Self	899	1
Marquis	Joanne	Self	441	1
Martin	Marvin	Self	332	2
Martin	Sandy	Self	335	2
Marx	Jonathan W.	Self	324	1
Mascarenas	Sal	Self	128	1
Mason	Dale	Self	267	1
Massaro	Diana	Self	147	1
Mathews	Kevin	Self	410	1
Matthews	Sonia	Self	511	1
Matyus	David	Self	455	1
Maxie	JWayne	Self	3	1
Maxwell	Ned	Self	209	1
Mayne	Judy	Self	321	1
Mazza	Douglas James	Self	221	2
McAlister	Leslie	State Agency	945	1
McCaig	Kris	Self	667	1
McClernan	John	Self	741	1
McCullough	Patrick M.	Self	914	1
McCune	Birtha	Self	958	1
McCune	Thomas	Self	396	1
McCurdy	Troy Don	Self	633	1
McEntire	Bryan	Self	639	1
McKinley	Forrest	Self	246	1
Mclain	Shaunna	Self	509	1
Mcmurray	Warren Roy	Self	115	1
McNabb	Michael Lee	Self	993	1
McNee	LeAnne	Self	575	1
Mecham	Kylie	Self	973	1
Mecham	Trevor	Self	852	1
Medina	Juan	Self	499	1
Meixner	Jonathan	Self	89	1
Meixner	Jonathan	Self	250	1
Mellor	Dustin	Self	571	1
Menousek	Danny	Self	550	1
Mentzer	Jana	Self	637	1
Metzger	Anthony	Self	134	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Metzger	Dwain	Self	197	1
Meyers	Hayley	Self	22	1
Mickelson	Rachelle	Self	758	1
Mickelson	Vaughn	Self	762	1
Miller	Alisa	Self	260	1
Miller	Carlyle	Self	240	1
Miller	Kim	Self	186	1
Miller	Nick	Self	742	1
Miller	Tom	Self	687	2
Millett	Noah	Self	401	1
Mishriky	Nabil	Self	520	1
Moore	Jason	Self	156	1
Moore	Jerry	Self	249	1
Moore	Steve	Self	245	1
Moore	Virgil	State Agency	620	5
Moyer	Dan	Self	873	1
Muir	Adelee	Self	160	1
Muir	Cody	Self	233	1
Muir	Will	Self	185	1
Mullen	Ray	Self	900	1
Mumford	Angie	Self	263	1
Mumford	Neil	Self	300	1
Mumme	Kristynn	Self	816	1
Munsee	Kurt Lee	Self	73	1
Murray	Clinton	Self	786	1
Mussler	John	Self	624	2
Myers	Jesse Luke	Self	238	1
Myers	Lorraine	Self	791	1
Myers	Tom	Local Agency	1014	60
Naef	Jordyn	Self	942	1
Naef	Sheraun	Self	976	1
Naef	Travis L	Self	224	1
Nally	Michael	Self	173	1
Natoli	Jay	Self	44	1
Natoli	Jay	Self	45	1
Natoli	Jay	Self	46	1
Natoli	Jay	Self	61	1
Neal	David	Self	508	1
Neiber	Jacob	Self	695	1
Nelson	Timothy S	Self	818	1
Neuman	Anndee	Self	951	1
Neuman	Dan	Self	350	1
Neuman	Maddisen	Self	977	1
Neuman	Tom	Self	904	1
Newman	Brandon Lee	Self	400	1
Newman	Jack	Self	677	1
Newton	David	Self	539	1
Nichols	Dennis	Self	820	1
Nichols	Jerry	Self	821	1
Nield	Abby	Self	688	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Nield	Beau	Self	523	1
Nielsen	Andrew	Self	790	1
Noureldin	Tawfik	Self	563	1
Nuttall	Andrew Mark	Self	654	1
Nye	Mark	State Elected Official	931	2
Ochsenbein	Robert	Self	230	1
O'Donnell	Christopher	Self	380	1
Offret	Brandon	Self	901	1
Oliver	Sam	Self	806	2
Olivia	Avel	Self	580	1
Olsen	Stetson	Self	882	1
Olson	Art	Self	761	1
Ongaro	Frank	Self	766	1
Orchard	Jesse	Self	387	1
Orr	Robert	Self	516	1
Ostler	Blake	Self	491	1
Ostvig	Grant	Self	801	1
Otazua	John A.	Self	815	1
Otey	Wendy	Self	421	1
Otter	C.L. Butch	Local Official	1006	3
Ozburn	Dean	Self	452	1
Pace	Dustin	Self	364	1
Packer	Kelley	State Agency	339	2
Packham	Gary	Self	753	1
Paredes	David	Self	773	1
Park	John	Self	184	1
Park	Tim	Self	984	1
Parker	AJ	Self	856	1
Parker	Blake	Self	195	1
Parker	Holly	Self	330	2
Parker	Jeff	Self	113	1
Parker	M. Kay	Self	534	1
Parker	Mark Smith	Self	488	1
Parker	Niki	Self	299	1
Parker	Ron	Self	974	1
Partey	Frederick	Self	500	1
Partridge	Mike	Self	66	1
Passey	Kindra Rae	Self	842	1
Passey	Shane T	Self	78	1
Passey	Tamra	Self	838	1
Passey	Todd	Self	107	1
Passey	Tyler L.	State Agency	827	1
Patel	Pintu	Self	41	1
Patterson	David P	Self	71	1
Payne	Robin	Self	813	1
Peoples	Dave	Self	293	1
Perez	J. Rosario Rodriguez	Self	495	1
Perron	Mitch	Self	990	1
Petersen	Rodnie	Self	174	1
Peterson	Austin	Self	68	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Peterson	Jessica	Self	720	1
Peterson	Randy	Self	247	1
Peterson	Ryan	Self	152	1
Peterson	Shawn	Self	149	1
Peterson	Shawn	Self	150	1
Petterborg	Katie	Self	772	1
Petterborg	Russell J	Self	127	1
Pettibone	Don	Self	60	1
Phelan	Matthew	Self	978	1
Pipkin	Forrest	Self	193	1
Poplawski	Joseph	Self	349	1
Prahl	Diane	Self	902	1
Prenn	Neil	Self	759	1
Prescott	Wyatt	Organization	1005	3
Preuss	Nicole	Self	681	1
Prevatte	Alex	Self	342	1
Price	Chris	Self	190	1
Price	Jeffery	Self	872	1
Price	Jesse	Self	809	1
Price	Kendi	Self	318	1
Price	Tony	Self	192	1
Price	Vicki	Self	848	1
Prickett	Molly	Self	952	4
Priestly	Frank	Organization	430	3
Pugmire	Charles	Self	448	1
Pugmire	Charles	Self	449	1
Pumbaleh	Lauren	Self	308	1
Quisel	Larry	Self	2	1
Randall	Jacob	Self	439	1
Ransom	Bailey	Self	560	1
Ransom	Richard Keith	Self	634	1
Rasmussen	Blair	Self	344	1
Rasmussen	Hans	Self	747	1
Rasmussen	Vaughn	Self	745	1
Rasmussen2	Vaughn	Local Official	957	2
Rauh	Fred L	Self	351	1
Raybould	Dell	Federal Elected Official	930	1
Redthunder	Andrew	Self	569	1
Regan	Josh	Self	38	1
Regan	Josh	Self	39	1
Reynolds	David	Organization	420	1
Rice	West A	Self	877	1
Richards	L. Shalin	Self	841	1
Ricks	Tiffini	Self	538	1
Ricks	Will	Organization	409	2
Rider	Sheri	Self	285	1
Ridley	David L.	Self	399	1
Rigby	Keith	Self	588	1
Rigby	Scott	Self	947	1
Riley	Brian	Self	264	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Ritter	Ross	Self	722	1
Robbins	Kurt D	Self	728	1
Roberts	Rick Rill	Self	389	1
Roberts	Rosalie	Self	291	1
Roberts	Traci	Self	213	1
Roberts2	Traci	Self	811	1
Robinson	Brad	Self	881	1
Robison	John	Organization	621	36
Robison	John	Organization	622	3
Rodman	Dale	Self	76	1
Rodriguez	Valerie	Self	649	1
Roeber	Anthony	Self	935	1
Rowe	Winthrop A.	Self	771	1
Rowland	Brian	Self	418	1
Russell	Scott	Self	50	1
Rust	Grant	Self	800	1
Rust	Samuel	Self	726	1
Ruud	Koriann	Self	803	1
Sam	Charlie	Self	212	1
Sant	Braiden	Self	208	1
Sant	Sadie	Self	214	1
Satre	Michael	Self	744	1
Saxton	Trevor	Self	369	1
Schenker	Rod	Self	510	1
Schrader	Shawn	Self	629	1
Schulz	Dan	Self	549	1
Scruggs	James	Self	137	1
Scruggs	Rick	Self	144	1
Searle	Kenneth	Self	359	1
Seelos	Ken	Self	670	1
Setser	Austin W	Self	95	1
Setser	Tiffany L	Self	94	1
Shaffer	Bradley D	Self	228	1
Shaffer	Brandon	Self	179	1
Sharp	Jared	Local Official	1001	3
Shaw	Stacy	Self	487	1
Shelton	Stephanie	Self	281	1
Shepherd	Chris	Self	814	1
Shepherd	Kirby	Self	938	1
Shepherd	Marty	Self	940	1
Shipley	Bert	Self	697	1
Shirley	Mike	Self	302	1
Shively	John	Self	581	1
Shreve	Carolyn	Self	607	1
Shubbard	Shane	Self	547	1
Siemon	Marrisa	Self	936	1
Sievers	Andrew	Self	57	1
Silva	David	Self	689	1
Simmons	Russell	Self	853	1
Simons	Brady	Self	457	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Sippola	Susan	Self	833	1
Sirbono	Greg	Self	959	1
Skaer	Laura	Organization	1004	2
Skinner	Brad	Self	363	1
Skinner	Justin	Self	601	1
Skinner	Kent	Self	313	1
Skinner	Kent	Self	315	1
Skinner	Kristen	Self	692	1
Skinner	L Michelle Loya	Self	84	1
Skinner	Michael Don	Self	83	1
Skinner	Michael Don	Self	85	1
Skinner	R. Scott	Self	898	1
Sleight	Jeff	Self	894	1
Smith	Amanda	Self	54	1
Smith	Andy L.	Self	829	1
Smith	Cody	Self	970	1
Smith	David	Self	943	1
Smith	Deloris	Self	132	1
Smith	DeVaughn	Self	298	1
Smith	Donald	Self	206	1
Smith	Helen K	Self	756	1
Smith	Holly	Self	966	1
Smith	Ivan	Self	527	1
Smith	James	Local Agency	955	2
Smith	Jamie	Self	329	1
Smith	Jeremy	Self	870	1
Smith	Jon	Self	202	1
Smith	Jon	Local Official	934	2
Smith	Lisa	Self	999	1
Smith	Mandy	Self	53	1
Smith	Matthew	Self	987	1
Smith	Monica	Self	864	1
Smith	Pete	Self	334	1
Smith	Quade	Self	215	1
Smith	Toy	Organization	406	2
Smith	Tyson	Self	273	1
Smith	Wendell	Self	270	1
Smith	Wesley	Self	892	1
Smith	Zach	Self	857	1
Smith2	Jon	Organization	1010	2
Snow	Jeff	Self	205	1
Solum	Becky	Self	155	1
Solum	Dawson Zakary	Self	154	1
Solum	Robert	Self	666	1
Solum	Robert	Self	668	1
Somsen	Earl	Local Official	431	2
Sorensen	Jill Ann	Self	398	1
Sorensen	Logan	Self	783	1
Spackman	Adam	Self	341	1
Spahr	Travis	Self	983	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Spencer	Lance	Self	732	1
Spendlove	Joey	Self	47	1
Spor	Shane	Self	763	1
Stalcup	Stephen	Self	280	1
Standley	J. Casey	Self	923	1
Steadman	Derek	Self	798	2
Steele	Nathan	Self	393	1
Steele	Paul R	Self	198	1
Stein	Molly, Dr.	Educational Institution	1003	1
Stein	Ron	Self	32	1
Steiner	Branson	Self	11	1
Steiner	Denise	Self	12	1
Steiner	Karl	Self	17	1
Steiner	Karson	Self	10	1
Steiner	Nick	Self	239	1
Steiner	Val	Self	13	1
Steiner	Val	Self	122	1
Stephens	Codi	Self	262	1
Stephens	Randy	Self	988	1
Stephens	Tyler	Self	568	1
Stills	Tony Jess	Self	108	1
Stites	John	Self	522	1
Stoker	Dana	Self	269	1
Stoket	Bob	Self	257	1
Stone	Shirley	Self	15	1
Stoor	Bruce	Self	74	1
Stoor	Hailey	Self	317	1
Stoor	Wendy	Self	268	1
Stopka	RJ	Self	855	1
Stringham	Brian	Self	258	1
Stucki	Dirk	Self	97	1
Sturges	Chad	Self	869	1
Sturm	Brock	Self	613	1
Sturm	Krista M	Self	768	1
Suckow	Albert	Self	187	1
Surrell	Arreana Rene	Self	253	1
Swain	Carter	Self	663	1
Sweers	John	Self	868	1
Sweet	Adecca	Self	254	1
Taggart	Jeff	Self	711	1
Talbot	Chad	Self	261	1
Talbot	Chanda	Self	265	1
Talbot	Todd	Self	858	1
Tarbet	Aaron	Self	609	1
Tarbet	Tamara	Self	610	1
Taylor	Robby	Self	890	1
Thielman	Brandi	Self	965	1
Thielman	Joannie	Self	989	1
Thielman	John	Self	971	1
Thomas	Brent F.	Self	922	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Thomas	Cameron A	Self	106	1
Thomas	Jed	Self	124	1
Thomas	Joy N	Self	404	1
Thomas	Marty	Self	99	1
Thomaz	Lacie	Self	103	1
Thompson	Bryce	Self	101	1
Thompson	Chris	Self	194	1
Thompson	Heidi J	Self	320	1
Thompson	Jamie	Self	100	1
Thompson	Jerod	Self	866	1
Thompson	Quinn M.	Self	635	1
Thorne	Sara	Self	751	1
Thornock	Brian	Self	893	1
Thornock	Don	Self	375	1
Tillotson	Jacob	Self	840	1
Tillotson	Kit	Organization	415	2
Tomer	Thomas	Self	443	1
Torgesen	Bradley	Self	665	1
Torgesen	Greg	Self	463	1
Torgesen	Shannon	Self	683	1
Tucker	Omer	Self	142	1
Turner	Chad	Self	7	1
Turner	Chris	Self	606	1
Turner	David	Self	524	1
Umanzor	Juan	Self	140	1
Vaichus	Tom	Self	434	1
Valenta	John J.	Self	419	1
Van Leuven	Eric Shawn	Self	312	1
Vaughan	Jacquelyn	Self	69	1
Vedder	David	Self	504	1
Vedder	Kate	Self	507	1
Vedder	Kristen	Self	647	1
Vedder	Matt	Self	734	1
Vedder	Thomas	Self	464	1
Vedder II	Timothy A	Self	467	1
Vedder III	Timothy A	Self	129	1
Viehweg	Allen	Self	948	1
Viehweg	Pat	Self	216	1
Viehweg	Pat	Self	297	1
Vincent	Heidi	Self	836	1
Violette	Michelle	Self	492	1
Vitacolonna	Daniel	Self	482	1
Vitacolonna	Kelsey	Self	486	1
Volpi	Lynne	Self	750	1
Vorwaller	Todd	Self	385	1
Vranes	Randy	Business	1002	2
Wakem	Devin	Self	26	1
Walker	Cathy	Self	157	1
Walker	Cathy	Self	259	1
Walker	Diane	Self	139	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Walker	Sheldon	Self	288	1
Walter	Heinz K	Self	325	2
Ward	Karl	Self	55	1
Warren	Gary	Self	830	1
Warren	Marilyn	Self	831	1
Watkins	Brad	Self	998	1
Weaver	Darrin	Self	514	1
Weaver	Larry	Self	310	1
Webley	Jared	Self	576	1
Weed	David	Self	295	1
Weick	Eric	Self	924	1
Weinheimer	Kurt J	Self	117	1
Welch	Donna Cote	Self	788	1
Wells	Jeremy	Self	356	1
Wells-Grube	Adam	Self	913	1
Wells-Grube	Krista	Self	912	1
West	Clark	Self	789	1
Westbrook	Jeannette	Self	413	1
Wetherington III	James Neal	Self	782	1
Wheeler	Kellie	Self	675	1
Whitaker	Diane Marie	Self	148	1
Whitaker	Kayla	Self	145	1
White	Brennan	Self	199	1
White	Cade	Self	105	1
White	Charles	Self	168	1
White	Dan	Self	503	1
White	Eraleigh	Self	49	1
White	Patrick	Self	353	1
Wilde	Jason	Self	70	1
Wilde	Lisa L.	Self	18	1
Wilking	Bart	Self	849	1
Williams	Eric	Self	968	2
Williams	James	Self	946	1
Willie	Michael	Self	169	1
Wilson	Galen	Self	698	1
Wilson	Joy	Self	427	1
Wilson	Kris	Self	465	1
Winmill	Jonathan	Self	180	1
Wistisen	Bruce	Self	558	1
Withrow	Justin	Self	371	1
Wolfley	Kirk	Self	854	1
Wolters	Anne	Self	442	1
Wood	Brian	Self	733	1
Woods	Joseph	Self	365	1
Woolstenhulme	Travis	Self	477	1
Wright	Darrell	Self	102	1
Wright	Eugene	Self	723	1
Wuthrich	Jamie	Self	475	1
Wyler	Brenda	Self	616	1
Yamauchi	Hailey	Self	659	1

Table A: Comment Letters Alphabetically by Author

Last Name	First Name	Affiliation	Letter Number	Number of Comments
Yeo	Scott	Self	664	1
Young	Joseph A	Self	114	1
Zaharias	Robert	Self	847	1
Zander	Danielle	Self	272	1
Zander	Michael	Self	333	2
Zander	Ryan	Self	567	1
Zander	Zack	Self	200	1
		Total Number of Comments		**1,268**

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
1	Dimond	Harold	Self	1
2	Quisel	Larry	Self	1
3	Maxie	JWayne	Self	1
4	Cole	Paige	Self	1
6	Baker	Michael	Self	1
7	Turner	Chad	Self	1
9	Bergholm	Greg	Self	1
10	Steiner	Karson	Self	1
11	Steiner	Branson	Self	1
12	Steiner	Denise	Self	1
13	Steiner	Val	Self	1
14	Kristo	Peter	Self	1
15	Stone	Shirley	Self	1
16	Fletcher	Julia	Self	1
17	Steiner	Karl	Self	1
18	Wilde	Lisa L.	Self	1
19	Dunford	Scott	Self	1
20	Dunford	Scott	Self	1
21	Elieson	Robert	Self	2
22	Meyers	Hayley	Self	1
23	Harris	Jason	Self	1
24	Cochran	Tamra	Self	1
25	Cochran	Eric W	Self	1
26	Wakem	Devin	Self	1
27	Cash	Gordon	Self	1
28	Gasu	Lee	Self	1
29	Hunzeker	Todd	Self	1
30	Fryar	Charles	Self	1
31	Harper	Clay	Self	1
32	Stein	Ron	Self	1
33	Crouse	Russell	Self	1
34	Crouse	Russell	Self	1
35	Crouse	Russell	Self	1
36	Crouse	Russell	Self	1
37	Crouse	Russell	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
38	Regan	Josh	Self	1
39	Regan	Josh	Self	1
40	Leathan	Garth	Self	1
41	Patel	Pintu	Self	1
42	Countryman	Steve	Self	1
43	Hovland	Emily	Self	1
44	Natoli	Jay	Self	1
45	Natoli	Jay	Self	1
46	Natoli	Jay	Self	1
47	Spendlove	Joey	Self	1
48	Blomberg	Peter	Self	1
49	White	Eraleigh	Self	1
50	Russell	Scott	Self	1
51	Magnum	Shane	Self	1
52	Corbett	Chad	Self	1
53	Smith	Mandy	Self	1
54	Smith	Amanda	Self	1
55	Ward	Karl	Self	1
56	Camp	Joe	Self	1
57	Sievers	Andrew	Self	1
58	Brogan	Janniece	Self	1
59	Gibson	Roger	Self	1
60	Pettibone	Don	Self	1
61	Natoli	Jay	Self	1
62	Harris	Whitney	Self	1
63	Blackadar	Ruth	Self	1
64	Coyne	O Norman	Self	1
65	Harris	Megan R	Self	1
66	Partridge	Mike	Self	1
67	Comish	Robert	Self	1
68	Peterson	Austin	Self	1
69	Vaughan	Jacquelyn	Self	1
70	Wilde	Jason	Self	1
71	Patterson	David P	Self	1
72	Goodin	John	Self	1
73	Munsee	Kurt Lee	Self	1
74	Stoor	Bruce	Self	1
75	Crockett	Zach	Self	1
76	Rodman	Dale	Self	1
77	Gorski	Shula	Self	1
78	Passey	Shane T	Self	1
79	Carpenter	Bryce	Self	1
80	Carpenter	Cory Bryce	Self	1
81	Carpenter	Caidie	Self	1
82	Carpenter	Cory	Self	1
83	Skinner	Michael Don	Self	1
84	Skinner	L Michelle Loya	Self	1
85	Skinner	Michael Don	Self	1
86	Jeffiers	Jim	Self	1
87	Hymas	Troy	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
88	Harris	Tom	Business	2
89	Meixner	Jonathan	Self	1
90	Liechty	Alysia	Self	1
91	Horsley	Eli	Self	1
92	Hunter	Chad	Self	1
93	Beckstead	Darin	Self	1
94	Setser	Tiffany L	Self	1
95	Setser	Austin W	Self	1
96	Carver	Skylar	Self	1
97	Stucki	Dirk	Self	1
98	Crossley	Kelley	Self	1
99	Thomas	Marty	Self	1
100	Thompson	Jamie	Self	1
101	Thompson	Bryce	Self	1
102	Wright	Darrell	Self	1
103	Thomaz	Lacie	Self	1
104	Kuhn	Don	Self	1
105	White	Cade	Self	1
106	Thomas	Cameron A	Self	1
107	Passey	Todd	Self	1
108	Stills	Tony Jess	Self	1
109	Friesen	Merle	Self	1
110	Jorgensen	Dora Deen	Self	1
111	Friesen	Jared	Self	1
112	Friesen	Pilar	Self	1
113	Parker	Jeff	Self	1
114	Young	Joseph A	Self	1
115	Mcmurray	Warren Roy	Self	1
116	Jupka	Dan	Self	1
117	Weinheimer	Kurt J	Self	1
118	Green	Brandon	Self	1
119	Brzygot	Jennifer	Self	1
120	Franklin	Bobby E	Self	1
121	Graham	Duane	Self	1
122	Steiner	Val	Self	1
123	Fisher	Larry	Self	1
124	Thomas	Jed	Self	1
125	Gibson	Forrest	Self	1
126	Byram	Paige	Self	1
127	Petterborg	Russell J	Self	1
128	Mascarenas	Sal	Self	1
129	Vedder III	Timothy A	Self	1
130	Kane	Jade	Self	1
131	Lau	Robert	Self	1
132	Smith	Deloris	Self	1
133	Lemming	Thomas	Self	1
134	Metzger	Anthony	Self	1
135	Espinoza	Ambrocio	Self	1
136	Espinoza	Pedro	Self	1
137	Scruggs	James	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
138	Leal	Jesus	Self	1
139	Walker	Diane	Self	1
140	Umanzor	Juan	Self	1
141	Gilbertson	Raymond	Self	1
142	Tucker	Omer	Self	1
143	Cothran	Troy	Self	1
144	Scruggs	Rick	Self	1
145	Whitaker	Kayla	Self	1
146	Gresko	Allisyn	Self	1
147	Massaro	Diana	Self	1
148	Whitaker	Diane Marie	Self	1
149	Peterson	Shawn	Self	1
150	Peterson	Shawn	Self	1
151	Belnap	Doug	Self	1
152	Peterson	Ryan	Self	1
153	Covert	Matthew T	Self	1
154	Solum	Dawson Zakary	Self	1
155	Solum	Becky	Self	1
156	Moore	Jason	Self	1
157	Walker	Cathy	Self	1
158	Christensen	Brad	Self	1
159	Christensen	Brad	Self	1
160	Muir	Adelee	Self	1
161	Iannelli	John	Self	1
162	Attebury	Amanda	Self	1
163	Housley	Jonathan	Self	1
164	Barfuss	Delene	Self	1
165	Grundy	Dean	Self	1
166	Braun	Doug	Self	1
167	Hansen	Barry	Self	1
168	White	Charles	Self	1
169	Willie	Michael	Self	1
170	Andersen	Clint	Self	1
171		Chysler Weeks	Self	1
172		Jarom	Self	1
173	Nally	Michael	Self	1
174	Petersen	Rodnie	Self	1
175	Banks	John	Self	1
176	Hall	Clay	Self	1
177	Hirschi	Marc	Self	1
178	Kunz	Lee	Self	1
179	Shaffer	Brandon	Self	1
180	Winmill	Jonathan	Self	1
181	Dille	Scott	Self	1
182	Lancaster	Mandy	Self	1
183	Drake	Pam	Self	1
184	Park	John	Self	1
185	Muir	Will	Self	1
186	Miller	Kim	Self	1
187	Suckow	Albert	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
188	Davis	Alisha	Self	1
189	Lee	Robbin	Self	1
190	Price	Chris	Self	1
191	Humphreys	Clint	Self	1
192	Price	Tony	Self	1
193	Pipkin	Forrest	Self	1
194	Thompson	Chris	Self	1
195	Parker	Blake	Self	1
196	Brooks	Anthony	Self	1
197	Metzger	Dwain	Self	1
198	Steele	Paul R	Self	1
199	White	Brennan	Self	1
200	Zander	Zack	Self	1
201	Carlson	Dennis L	Self	1
202	Smith	Jon	Self	1
203	Christensen	Rick	Self	1
204	Armstrong	Byron	Self	1
205	Snow	Jeff	Self	1
206	Smith	Donald	Self	1
207	Lamonte	Mark	Self	1
208	Sant	Braiden	Self	1
209	Maxwell	Ned	Self	1
210	Bassett	Brad	Self	1
211	Higgins	Chris	Self	1
212	Sam	Charlie	Self	1
213	Roberts	Traci	Self	1
214	Sant	Sadie	Self	1
215	Smith	Quade	Self	1
216	Viehweg	Pat	Self	1
217	Cureton	Nicholas	Self	1
218	Hubbard	Diane	Self	2
219	Gentry	Joy	Self	1
220	Christensen	Chad	Self	1
221	Mazza	Douglas James	Self	2
222	Low	John	Self	1
223	Christopherson	Erik	Self	1
224	Naef	Travis L	Self	1
225	Harmon	Jerry T	Local Agency	3
226	Hubbard	Jarom	Self	1
227	Kenyon	Craig	Self	1
228	Shaffer	Bradley D	Self	1
229	Adkins	Lorin T	Self	1
230	Ochsenbein	Robert	Self	1
231	Davis	Shawn	Self	1
232	Briggs	Cody	Self	1
233	Muir	Cody	Self	1
234	Hansen	Gary	Self	1
235	Christiansen	Tyson	Self	1
236	Dockstader	Darrin	Self	1
238	Myers	Jesse Luke	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
239	Steiner	Nick	Self	1
240	Miller	Carlyle	Self	1
241	Mansfield	Coral	Self	1
242	Buck	Robert	Self	1
244	Hoefeldt	Nicholas	Self	1
245	Moore	Steve	Self	1
246	McKinley	Forrest	Self	1
247	Peterson	Randy	Self	1
248	Alleman	Todd	Self	1
249	Moore	Jerry	Self	1
250	Meixner	Jonathan	Self	1
251	Hubbard	Alan	Self	1
252	Haderlie	Andrea	Self	1
253	Surrell	Arreana Rene	Self	1
254	Sweet	Adecca	Self	1
255	Gilner	Brad	Self	1
256	Beckstead	Carol	Self	1
257	Stoket	Bob	Self	1
258	Stringham	Brian	Self	1
259	Walker	Cathy	Self	1
260	Miller	Alisa	Self	1
261	Talbot	Chad	Self	1
262	Stephens	Codi	Self	1
263	Mumford	Angie	Self	1
264	Riley	Brian	Self	1
265	Talbot	Chanda	Self	1
266	Isaak	Adriane	Self	1
267	Mason	Dale	Self	1
268	Stoor	Wendy	Self	1
269	Stoker	Dana	Self	1
270	Smith	Wendell	Self	1
271	Hopkins	Wade	Self	1
272	Zander	Danielle	Self	1
273	Smith	Tyson	Self	1
274	Evertz	Theodore David	Self	1
275	Betancourt	Terral	Self	1
276	Betancourt	Terral	Self	1
277	Hayes	Tammy	Self	1
278	Henesh	Tamra	Self	1
279	Lamonte	Sue	Self	1
280	Stalcup	Stephen	Self	1
281	Shelton	Stephanie	Self	1
282	Christiansen	Stephanie	Self	1
283	Christiansen	Stephanie	Self	1
284	Dursteler	Sonja	Self	1
285	Rider	Sheri	Self	1
286		Danny	Self	1
287	Humphreys	Shelly	Self	1
288	Walker	Sheldon	Self	1
289	Henry	Sarah	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
290	Gaughan	Darsen	Self	2
291	Roberts	Rosalie	Self	1
292	Diehl	Robert	Self	1
293	Peoples	Dave	Self	1
294	Magee	Randy	Self	1
295	Weed	David	Self	1
296	Hueckstaedt	Derrek	Self	1
297	Viehweg	Pat	Self	1
298	Smith	DeVaughn	Self	1
299	Parker	Niki	Self	1
300	Mumford	Neil	Self	1
301	Donahoo	Molly	Self	1
302	Shirley	Mike	Self	1
303	Green	Michelle	Self	1
304	Daniels	Diane	Self	1
305	Briggs	Maurie	Self	1
306	Finlayson	Matthew	Self	1
307	Lloyd	Leslie	Self	1
308	Pumbaleh	Lauren	Self	1
310	Weaver	Larry	Self	1
311	Davis	Kristopher	Self	1
312	Van Leuven	Eric Shawn	Self	1
313	Skinner	Kent	Self	1
314	Guthmiller	Gina	Self	1
315	Skinner	Kent	Self	1
316	Dainels	Kenny	Self	1
317	Stoor	Hailey	Self	1
318	Price	Kendi	Self	1
319	Grant	Kathryn	Self	1
320	Thompson	Heidi J	Self	1
321	Mayne	Judy	Self	1
322	Hatch	Judy	Self	1
323	Burnham	Judy	Self	1
324	Marx	Jonathan W.	Self	1
325	Walter	Heinz K	Self	2
326	Bowen	Jessica	Self	1
327	Buenemann	Jason	Self	1
328	Bradfield	Jason	Self	1
329	Smith	Jamie	Self	1
330	Parker	Holly	Self	2
331	Gorton	James	Self	1
332	Martin	Marvin	Self	2
333	Zander	Michael	Self	2
334	Smith	Pete	Self	1
335	Martin	Sandy	Self	2
336	Dockstader	Tricia	Self	1
337	MacKenzie	W.S.	Self	2
338	Lau	Caribou Jacks	Self	2
339	Packer	Kelley	State Agency	2
340	Hill	Brent	State Elected Official	3

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
341	Spackman	Adam	Self	1
342	Prevatte	Alex	Self	1
343	Horn	Alister	Self	1
344	Rasmussen	Blair	Self	1
345	Byram	Brock	Self	1
346	Higley	Chad	Self	1
347	Hansen	Julie	Self	1
348	Colvin	Rich l.	Self	1
349	Poplawski	Joseph	Self	1
350	Neuman	Dan	Self	1
351	Rauh	Fred L	Self	1
352	Colson	Tony	Self	1
353	White	Patrick	Self	1
354	Fay	Vincent	Self	1
355	Gummersall	Jake	Self	1
356	Wells	Jeremy	Self	1
357	Hamp	Steve	Self	1
358	Law	Stephen	Self	2
359	Searle	Kenneth	Self	1
360	Maduck	Crystal	Self	1
361	Avery	George	Self	1
362	Burnham	Melonee	Self	1
363	Skinner	Brad	Self	1
364	Pace	Dustin	Self	1
365	Woods	Joseph	Self	1
366	Crossley	Kylee	Self	1
367	Gummersall	Saesha	Self	1
368	Hall	Scott Jason	Self	1
369	Saxton	Trevor	Self	1
370	Jensen	Tad	Self	1
371	Withrow	Justin	Self	1
372	Barfuss	Wyatt	Self	1
373	Bridges	Jason	Self	1
374	Leipheimer	Annie	Self	1
375	Thornock	Don	Self	1
376	Bowen	Jake	Self	1
377	Brewer	Brian	Self	1
378	Carlisle	Lanny Colby	Self	1
379	Bair	Steve	State Elected Official	3
380	O'Donnell	Christopher	Self	1
381	Allen	Gerald	Self	1
382	Dmochowski	Casimer Alexander	Self	1
383	Little	Brad	State Elected Official	2
384	Lloyd	Chad	Self	1
385	Vorwaller	Todd	Self	1
386	Hanson	Michael	Self	1
387	Orchard	Jesse	Self	1
388	Avila	T. J.	Self	1
389	Roberts	Rick Rill	Self	1
390	Bowman	Shari	Self	1

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Letter Number	Last Name	First Name	Affiliation	Number of Comments
391	Anderson	Brent	Self	1
392	Bruce	Devin	Self	1
393	Steele	Nathan	Self	1
394	Cutler	Mark	Self	1
395	Hymas	Scott	Self	1
396	McCune	Thomas	Self	1
397	Dorsey	Tom	Self	1
398	Sorensen	Jill Ann	Self	1
399	Ridley	David L.	Self	1
400	Newman	Brandon Lee	Self	1
401	Millett	Noah	Self	1
402	Jackson	Mark	Self	1
403	Bostick	Jim	Self	1
404	Thomas	Joy N	Self	1
405	Henesh	Leo Tyler	Self	2
406	Smith	Toy	Organization	2
407	Hays	Josh	Self	1
408	Cooper	Randy	Self	1
409	Ricks	Will	Organization	2
410	Mathews	Kevin	Self	1
411	Kraupie	Marshall W.	Self	1
412	Kraupie	Juliene K.	Self	1
413	Westbrook	Jeannette	Self	1
414	Graunke	Doug	Self	1
415	Tillotson	Kit	Organization	2
416	Carter	Travis	Self	2
417	Gerenza	Patricia	Self	1
418	Rowland	Brian	Self	1
419	Valenta	John J.	Self	1
420	Reynolds	David	Organization	1
421	Otey	Wendy	Self	1
422	Dail	W.B.	Self	1
423	Lake	Jerod	Self	1
424	Goode	John D	Self	2
425	Apel	Darryl	Self	1
426	Corbett	Craig	Self	1
427	Wilson	Joy	Self	1
428	Gibbs	Marc	Federal Elected Official	2
429	Brogan	Gary	Educational Institution	1
430	Priestly	Frank	Organization	3
431	Somsen	Earl	Local Official	2
432	Malek	Luke	State Agency	2
433	Gibbons	Nancy	Self	2
434	Vaichus	Tom	Self	1
435	Gaudette	James	Self	1
436	Garcia	Dennis O.	Self	1
437	Galarza	Kevin	Self	1
438	Hatch	Royce	Self	1
439	Randall	Jacob	Self	1
440	Grammatico	John	Self	1

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Letter Number	Last Name	First Name	Affiliation	Number of Comments
441	Marquis	Joanne	Self	1
442	Wolters	Anne	Self	1
443	Tomer	Thomas	Self	1
444	DeLucia	Elaine	Self	1
445	Gronning	Mat	Self	1
446	Jacobson	Timothy	Self	2
447	Lombardo	Michael J	Self	1
448	Pugmire	Charles	Self	1
449	Pugmire	Charles	Self	1
450	Burttram Jr	John G	Self	1
451	Didden	L. Jan	Self	1
452	Ozburn	Dean	Self	1
453	Burnham	Dick	Self	1
454	Chapin	Kelly	Self	1
455	Matyus	David	Self	1
456	Callicrate	Thomas	Self	1
457	Simons	Brady	Self	1
458	Hill	Courtney	Self	1
459	Burnham	Judy	Self	1
460	Kula	Norbertj	Self	1
461	Harrison	Alex	Self	1
462	Anderson	Terry	Self	1
463	Torgesen	Greg	Self	1
464	Vedder	Thomas	Self	1
465	Wilson	Kris	Self	1
466	Cochran	Tilly	Self	1
467	Vedder II	Timothy A	Self	1
468	Anderson	Wendy	Self	1
469	Cochran	Paizlee	Self	1
470	Griffiths	Dave	Self	1
471	Cooper	Brad	Self	1
472	Armstrong	Clay	Self	1
473	Mai	Theron	Self	1
474	Johnson	Sally D	Self	1
475	Wuthrich	Jamie	Self	1
476	Bragg	Clint	Self	1
477	Woolstenhulme	Travis	Self	1
478	Duran	Jordan	Self	1
479	Hobson	Eric	Self	1
480	Donahoo	Scott	Self	1
481	Duran	Kassy	Self	1
482	Vitacolonna	Daniel	Self	1
483	Duran	Jon	Self	1
484	Duran	Miranda	Self	1
485	Duran	Kaitlin	Self	1
486	Vitacolonna	Kelsey	Self	1
487	Shaw	Stacy	Self	1
488	Parker	Mark Smith	Self	1
489	Andersen	Bruce	Self	1
490	Andersen	Bruce	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
491	Ostler	Blake	Self	1
492	Violette	Michelle	Self	1
493	Kelly	Tony	Self	1
494	Kelly	Tony	Self	1
495	Perez	J. Rosario Rodriguez	Self	1
496	Jupka	Jim	Self	2
497	Corkal	Bryan	Self	1
498	Kalb	Kenneth G.	Self	1
499	Medina	Juan	Self	1
500	Partey	Frederick	Self	1
501	MacCheyne	Cayla	Self	1
502	Foss	Mark	Self	1
503	White	Dan	Self	1
504	Vedder	David	Self	1
505	Bacon	Travis	Self	1
506	Hillman	Kerry	Self	1
507	Vedder	Kate	Self	1
508	Neal	David	Self	1
509	Mclain	Shaunna	Self	1
510	Schenker	Rod	Self	1
511	Matthews	Sonia	Self	1
512	Hansen	Kirk L.	Self	1
513	Collins	Robert	Self	1
514	Weaver	Darrin	Self	1
515	Coughlin	Sean	Self	1
516	Orr	Robert	Self	1
517	Dunham	Shirley	Self	1
518	Daniell	Jack	Self	1
519	Frankos	Tom	Self	1
520	Mishriky	Nabil	Self	1
521	Campbell	Vanesia	Self	1
522	Stites	John	Self	1
523	Nield	Beau	Self	1
524	Turner	David	Self	1
525	Hansen	Sue	Self	1
526	Learning	Donna	Self	1
527	Smith	Ivan	Self	1
528	Crockett	Mick	Self	1
529	Crockett	Nicole	Self	1
530	MacAulay	James	Self	1
531	Jones	Walter	Self	1
532	Humble	Mark	Self	1
533	Heyl	Chris	Self	1
534	Parker	M. Kay	Self	1
535	Cipriano	Joe	Self	1
536	Altieri	Patty	Self	1
537	Lindstrom	Jason	Self	1
538	Ricks	Tiffini	Self	1
539	Newton	David	Self	1
540	Doman	Brad	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
541	Lewis	Phil	Self	1
542	Fisher	Sandi	Federal Agency	6
543	Hermes	Richard	Self	1
544	Hirschi	Mathew	Self	1
545	Buchanan	Doug	Self	1
546	Duran	Denise	Self	1
547	Shubbard	Shane	Self	1
548	Crockett	Daniel	Self	1
549	Schulz	Dan	Self	1
550	Menousek	Danny	Self	1
551	Crossley	Terrie	Self	1
552	Bergholm	Katy	Self	1
553		Nolan	Self	1
554	Coker	Jason	Self	1
555	Allen	Adele	Self	1
556	Allen	Scott P.	Self	1
557	Collins	John	Self	1
558	Wistisen	Bruce	Self	1
559	Dorn	Forest Van	Self	1
560	Ransom	Bailey	Self	1
561	Draney	Terryl Kevin	Self	1
562	Bradley	Bruce N.	Self	1
563	Noureldin	Tawfik	Self	1
564	Anderson	Kathy	Self	1
565	Cole	Rhonda	Self	1
566	Eborn	Kandi	Self	1
567	Zander	Ryan	Self	1
568	Stephens	Tyler	Self	1
569	Redthunder	Andrew	Self	1
570	Carlisle	Lanny John	Self	1
571	Mellor	Dustin	Self	1
572	Gonzalez	Mitzi	Self	1
573	Kenley	Paige	Self	1
574	Bowmer	Ed	Self	1
575	McNee	LeAnne	Self	1
576	Webley	Jared	Self	1
577	Christensen	Jeremy	Self	1
578	Call	Brock	Self	1
579	Littleton	Christine B.	Federal Agency	46
580	Olivia	Avel	Self	1
581	Shively	John	Self	1
582	Garcia	Schap	Self	1
583	Carter	Rick	Self	1
584	Astle	Jamie	Self	1
585	Armitage	Chris	Self	1
586	Greene	Jason	Self	1
587	Egbert	Chad	Self	1
588	Rigby	Keith	Self	1
589	Humble	Shelly	Self	1
590	Christensen	Mark	Self	1

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Letter Number	Last Name	First Name	Affiliation	Number of Comments
591	Evans	Kyle	Self	1
592	Campbell	Kirk	Self	1
593	Hendrickson	F. Lee	State Agency	2
595	Jensen	Jenn	Self	1
596	Call	Stephen L.	Self	1
597	Baughman	Vanessa	Self	1
598	Cochran	Linda	Self	1
599	Lapthorne	Brandy	Self	1
600	Fuentes	John	Self	1
601	Skinner	Justin	Self	1
602	Leaming	John	Self	1
603	Griffiths	Tamara	Self	1
604	Johnson	Douglas	Self	1
605	Kramer	Brian	Self	1
606	Turner	Chris	Self	1
607	Shreve	Carolyn	Self	1
608	Hartke	Tony	Self	1
609	Tarbet	Aaron	Self	1
610	Tarbet	Tamara	Self	1
611	Kunz	Corey	Self	1
612	Butka	Jay	Self	1
613	Sturm	Brock	Self	1
614	Erickson	Wendy	Self	1
615	Garner	Aja	Self	1
616	Wyler	Brenda	Self	1
617	Lish	Kim	Self	1
618	Leissring	Jeff	Self	1
619	Leissring2	Jeff	Self	1
620	Moore	Virgil	State Agency	5
621	Robison	John	Organization	36
622	Robison	John	Organization	3
623	Hall	Jeffery O	Educational Institution	6
624	Mussler	John	Self	2
625	Anderson	Gary N.	Business	1
626	Carter	John	Organization	9
627	Chambers	David M.	Organization	18
628	Haslam	Alan D.	Business	5
629	Schrader	Shawn	Self	1
630	Leissring	Jay	Self	1
631	Kirby	Amity	Self	1
632	Leissring	Jay	Self	1
633	McCurdy	Troy Don	Self	1
634	Ransom	Richard Keith	Self	1
635	Thompson	Quinn M.	Self	1
636	Colvin	Matthew	Self	1
637	Mentzer	Jana	Self	1
638	Green	Debora	Self	1
639	McEntire	Bryan	Self	1
640	Cooper	Anjanette	Self	1
641	Bowles	David	Self	1

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Letter Number	Last Name	First Name	Affiliation	Number of Comments
642	Burnham	Justin	Self	1
643	Feld	Shelby	Self	1
644	Jones	Melanie	Self	1
645	Kent	Blake	Self	1
646	Feld	Russell	Self	1
647	Vedder	Kristen	Self	1
648	Feld	Ken	Self	1
649	Rodriguez	Valerie	Self	1
650	Johnson	Casey	Self	1
651	Feld	Stephanie	Self	1
652	Lecce	Mary Anne	Self	1
653	Douglass	Jack	Self	1
654	Nuttall	Andrew Mark	Self	1
655	Fischer	Roland	Self	1
656	Cullinan	Mary	Self	1
657	Hansen	Adam	Self	1
658	Johnson	Randy	Self	1
659	Yamauchi	Hailey	Self	1
660	Fullmer	Mike	Self	1
661	Liebetrau	James	Self	1
662	Liebtrau	James	Self	1
663	Swain	Carter	Self	1
664	Yeo	Scott	Self	1
665	Torgesen	Bradley	Self	1
666	Solum	Robert	Self	1
667	McCaig	Kris	Self	1
668	Solum	Robert	Self	1
669	Johnson	Jori	Self	1
670	Seelos	Ken	Self	1
671	Blackadar	Ruth Jean	Self	1
672	Griffiths	Abram	Self	1
673	Jurgens	Stan	Self	1
674	Gallegos	Elaine	Self	1
675	Wheeler	Kellie	Self	1
676	Deros	Kimberly	Self	1
677	Newman	Jack	Self	1
678	Carr	Mike	Self	1
679	Holhos-Vaida	Cosmin	Self	1
680	Latham	Laura	Self	1
681	Preuss	Nicole	Self	1
682	Gehring	Dean	Self	1
683	Torgesen	Shannon	Self	1
684	Coleman	Tom	Self	1
685	Harcus	John	Self	1
686	Fraizer	Riley	Self	1
687	Miller	Tom	Self	2
688	Nield	Abby	Self	1
689	Silva	David	Self	1
690	Eisenbarth	Ora	Self	1
691	Christensen	George	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
692	Skinner	Kristen	Self	1
693	Crossley	Kelci	Self	1
694	Jacobon	Rod	Organization	1
695	Neiber	Jacob	Self	1
696	Hansen	Debbie	Self	1
697	Shipley	Bert	Self	1
698	Wilson	Galen	Self	1
699	Elkins	Casey	Self	1
700	Abramson	Nick	Self	1
701	Abramson	Taeyler	Self	1
702	Kaikuulamai	Kimber	Self	1
703	Llewellyn	Todd	Self	1
704	Bates	Jared	Self	1
705	Llewellyn	Ashley	Self	1
706	Gambles	Sarah	Self	1
707	Kaikuulamai	Kimber	Self	1
708	Gambles	Mary	Self	1
709	Gambles	Scott	Self	1
710	Gambles	Cassie	Self	1
711	Taggart	Jeff	Self	1
712	Colvin	Marissa	Self	1
713	Lott	Randy	Self	1
714	Lott	Aaron	Self	1
715	Lott	Jay	Self	1
716	Lott	Jenny	Self	1
717	Lott	Dawna	Self	1
718	Lott	Debbie	Self	1
719	Mansfield	Dustin	Self	1
720	Peterson	Jessica	Self	1
721	Chapman	Mark	Self	1
722	Ritter	Ross	Self	1
723	Wright	Eugene	Self	1
724	Flores	Lido	Self	1
725	Bauer	Christopher	Self	1
726	Rust	Samuel	Self	1
727	Aalbers	Angela	Self	1
728	Robbins	Kurt D	Self	1
729	Floorsweep	John	Self	1
730	Farnworth	Brock	Self	1
731	Hill	Matthew	Self	1
732	Spencer	Lance	Self	1
733	Wood	Brian	Self	1
734	Vedder	Matt	Self	1
735	Clark	Shane	Self	1
736	Bachman	Dean	Self	1
737	Bachman	Debbie	Self	1
738	Harrison	Laurie	Self	1
739	Hebert	David	Self	1
740	Kovacich	Kevin	Self	1
741	McClernan	John	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
742	Miller	Nick	Self	1
743	Davison	Arthur	Self	1
744	Satre	Michael	Self	1
745	Rasmussen	Vaughn	Self	1
746	Coffin	Matt	Self	1
747	Rasmussen	Hans	Self	1
748	Larsen	Bryan	Self	1
749	Goode	Benjamin D.	Self	1
750	Volpi	Lynne	Self	1
751	Thorne	Sara	Self	1
752	Johnston	Deborah	Self	1
753	Packham	Gary	Self	1
754	Bills	Steve	Self	1
755	Hoggan	Richard	Self	1
756	Smith	Helen K	Self	1
757	Johnson Jr.	Howard	Self	1
758	Mickelson	Rachelle	Self	1
759	Prenn	Neil	Self	1
760	Gamangasso	Robin Marc	Self	1
761	Olson	Art	Self	1
762	Mickelson	Vaughn	Self	1
763	Spor	Shane	Self	1
764	Gear	Jay	Self	1
765	Brown	Jonathan	Self	1
766	Ongaro	Frank	Self	1
767	Bruner	Dan	Self	1
768	Sturm	Krista M	Self	1
769	Kelly	Sean	Self	1
770	Gunn	Gary M.	Self	1
771	Rowe	Winthrop A.	Self	1
772	Petterborg	Katie	Self	1
773	Paredes	David	Self	1
774	Liggett	Chase	Self	1
775	Loertscher	Ross	Self	1
776	Beall	James	Self	1
777	Hallinan	Stephanie	Self	1
778	Hunter	Dustin	Self	1
779	Anderson	Linda S.	Self	1
780	Azary	Sara	Self	1
781	Fulks	Kathey	Self	1
782	Wetherington III	James Neal	Self	1
783	Sorensen	Logan	Self	1
784	Coombs	Ron	Self	1
785	Anderson	Linda S.	Self	1
786	Murray	Clinton	Self	1
787	Kowallis	Paul	Self	1
788	Welch	Donna Cote	Self	1
789	West	Clark	Self	1
790	Nielsen	Andrew	Self	1
791	Myers	Lorraine	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
792	Anderson	Spencer	Self	1
793	Jass	Karen	Self	2
794	Bardswich	Joe	Self	1
795	Darling	Mary	Self	2
797	Fitzgerald	James F.	Local Agency	1
798	Steadman	Derek	Self	2
799	Blankenbaker	Chad	Self	1
800	Rust	Grant	Self	1
801	Ostvig	Grant	Self	1
802	Hart	Mitchell J.	Local Official	3
803	Ruud	Koriann	Self	1
804	Kiehn	Kacey	Self	1
805	Guslander	John	Self	1
806	Oliver	Sam	Self	2
807	Kirby	Mark P.	Self	1
808	Diehl2	Robert	Self	1
809	Price	Jesse	Self	1
810	Foster	Collen	Self	1
811	Roberts2	Traci	Self	1
812	Gilmer	Lacey	Self	1
813	Payne	Robin	Self	1
814	Shepherd	Chris	Self	1
815	Otazua	John A.	Self	1
816	Mumme	Kristynn	Self	1
817	Lutz	Tania	Self	1
818	Nelson	Timothy S	Self	1
819	Iannelli	Jodi	Self	1
820	Nichols	Dennis	Self	1
821	Nichols	Jerry	Self	1
822	Lewis	Bill	Self	1
823	Burbank	Jason	Self	1
824	Kneebone	Travis	Self	1
825	Burbank	Travis Rex	Self	1
826	Arnell	Bryan S.	Self	1
827	Passey	Tyler L.	State Agency	1
828	Maggiore	John G.	Self	1
829	Smith	Andy L.	Self	1
830	Warren	Gary	Self	1
831	Warren	Marilyn	Self	1
832	Fowler	Jon	Self	1
833	Sippola	Susan	Self	1
834	Keetch	Tyler	Self	1
835	Christensen	Charlie	Self	1
836	Vincent	Heidi	Self	1
837	Davino	Anne	Self	1
838	Passey	Tamra	Self	1
839	Jones	Hannah	Self	1
840	Tillotson	Jacob	Self	1
841	Richards	L. Shalin	Self	1
842	Passey	Kindra Rae	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
843	Barger	Talon	Self	1
844	Edwards	Tanya	Self	1
845	Barger	Charlotte Deanna	Self	1
846	Edwards	Denny	Self	1
847	Zaharias	Robert	Self	1
848	Price	Vicki	Self	1
849	Wilking	Bart	Self	1
850	Carroll	Ross	Self	1
851	Bendixen	Wayne	Self	1
852	Mecham	Trevor	Self	1
853	Simmons	Russell	Self	1
854	Wolfley	Kirk	Self	1
855	Stopka	RJ	Self	1
856	Parker	AJ	Self	1
857	Smith	Zach	Self	1
858	Talbot	Todd	Self	1
859	Liechty	Tim	Self	1
860	Browning	Nathan	Self	1
861	Erickson	Josiah	Self	1
862	Jones	Karl	Self	1
863	Irick	Jacob	Self	1
864	Smith	Monica	Self	1
865	Burton	Jason L	Self	1
866	Thompson	Jerod	Self	1
867	Anderson	William	Self	1
868	Sweers	John	Self	1
869	Sturges	Chad	Self	1
870	Smith	Jeremy	Self	1
871	Gunn	Josh	Self	1
872	Price	Jeffery	Self	1
873	Moyer	Dan	Self	1
874	Irick	JB Shane	Self	1
875	Duncan	Eric	Self	1
876	Eisenbarth	Greg	Self	1
877	Rice	West A	Self	1
878	Dutra	Gregory	Self	1
879	Bartschi	Zach	Self	1
880	Beres	Michael	Self	1
881	Robinson	Brad	Self	1
882	Olsen	Stetson	Self	1
883	Fetters	Jeffery	Self	1
884	Fetters	Jeffery	Self	1
885	Mangum	Kevin	Self	1
886	Bruce	Derek Evan	Self	1
887	Hennings	Megan	Self	1
888	Hunsaker	Dee	Self	1
889	Bridges	Chris	Self	1
890	Taylor	Robby	Self	1
891	Christensen	Jarred	Self	1
892	Smith	Wesley	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
893	Thornock	Brian	Self	1
894	Sleight	Jeff	Self	1
895	Larsen	Todd	Self	1
896	Bragg	Ashley	Self	1
897	Bragg	Brooklynn	Self	1
898	Skinner	R. Scott	Self	1
899	Marler	Camille	Self	1
900	Mullen	Ray	Self	1
901	Offret	Brandon	Self	1
902	Prahl	Diane	Self	1
903	Hoffman	Rick	Self	1
904	Neuman	Tom	Self	1
905	Bostick	Jim	Self	1
906	Kenley	Paige	Self	1
907	Kenley	Marc	Self	1
908	Kenley	Marc	Self	1
909	Hodson	Dereck	Self	1
910	Call	Kate	Self	1
911	Call	Kate	Self	1
912	Wells-Grube	Krista	Self	1
913	Wells-Grube	Adam	Self	1
914	McCullough	Patrick M.	Self	1
915	Crane	Jason	Self	1
916	Eborn	Jessie	Self	1
917	Eborn	Linda	Self	1
918	Bunderson	Shannon	Self	1
919	Eborn	Larry	Self	1
920	Eborn	Chantz	Self	1
921	Eborn	Josh	Self	1
922	Thomas	Brent F.	Self	1
923	Standley	J. Casey	Self	1
924	Weick	Eric	Self	1
925	Fletcher	Joseph J.	Self	1
926	Hollaway	Jeffrey	Self	1
927	Cooper	Gordon	Self	1
928	Bullock		Self	1
929	Bullock	Bill	Self	1
930	Raybould	Dell	Federal Elected Official	1
931	Nye	Mark	Federal Elected Official	2
932	Lacey	Roy	State Elected Official	2
933	Bowles	Dirk	Local Official	1
934	Smith	Jon	Local Official	2
935	Roeber	Anthony	Self	1
936	Siemon	Marrisa	Self	1
937	Johnson	Timothy Curti	Self	1
938	Shepherd	Kirby	Self	1
939	Corder	Randy	Self	1
940	Shepherd	Marty	Self	1
941	Alleman	John	Self	1
942	Naef	Jordyn	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
943	Smith	David	Self	1
944	Bell	Jeffery	Self	1
945	McAlister	Leslie	State Agency	1
946	Williams	James	Self	1
947	Rigby	Scott	Self	1
948	Viehweg	Allen	Self	1
950	Arnold	Alton	Self	1
951	Neuman	Anndee	Self	1
952	Prickett	Molly	Self	4
953	City of Soda Springs	City Council	Local Agency	2
954	LaBeau	Alex	Organization	2
955	Smith	James	Local Agency	2
956	Cellan	Sid R.	Organization	2
957	Rasmussen2	Vaughn	Local Official	2
958	McCune	Birtha	Self	1
959	Sirbono	Greg	Self	1
960	Lacefield	Jamie	Self	1
961	Henesh	Joann	Self	1
962	Guedes	Chris	Self	1
963	Guedes	Tina	Self	1
964	Gibson	Brody	Self	1
965	Thielman	Brandi	Self	1
966	Smith	Holly	Self	1
967	DeWall	JaLyn	Self	1
968	Williams	Eric	Self	2
969	Erickson	Brenda	Self	1
970	Smith	Cody	Self	1
971	Thielman	John	Self	1
972	Haslam	Leisa	Self	1
973	Mecham	Kylie	Self	1
974	Parker	Ron	Self	1
975	Goode	Shari	Self	1
976	Naef	Sheraun	Self	1
977	Neuman	Maddisen	Self	1
978	Phelan	Matthew	Self	1
979	Keetch	William J.	Self	1
980	Gilmer	Steve	Self	1
981	Deiter	William	Self	1
982	Hall	Wes	Self	1
983	Spahr	Travis	Self	1
984	Park	Tim	Self	1
985	Henesh2	Leo Tyler	Self	1
986	Lau	Stephanie	Self	1
987	Smith	Matthew	Self	1
988	Stephens	Randy	Self	1
989	Thielman	Joannie	Self	1
990	Perron	Mitch	Self	1
991	Burbank	Jaydon	Self	1
992	Gummersall	Lonnie	Self	1
993	McNabb	Michael Lee	Self	1

Table B: Comment Letters Numerically

Letter Number	Last Name	First Name	Affiliation	Number of Comments
994	Andreasen	Karsen	Self	1
995	Collins	Dennis	Self	1
996	Collins	Cassie	Self	1
997	Guthmiller	Demian	Self	1
998	Watkins	Brad	Self	1
999	Smith	Lisa	Self	1
1000	Andreasen	Camille	Self	1
1001	Sharp	Jared	Local Official	3
1002	Vranes	Randy	Business	2
1003	Stein	Molly, Dr.	Educational Institution	1
1004	Skaer	Laura	Organization	2
1005	Prescott	Wyatt	Organization	3
1006	Otter	C.L. Butch	Local Official	3
1007	Brown	Scott	Local Agency	3
1008	Harris	Mark	State Elected Official	4
1009	Guthrie	Jim	State Elected Official	2
1010	Smith2	Jon	Organization	2
1011	Lyon	Vicky	Organization	2
1012	Billman	Gary	State Agency	1
1013	Davis	Cleve	Tribal Organization	7
1014	Myers	Tom	Local Agency	60
1015	Ansley	Shannon Leigh	Tribal Organization	27
			Total Number of Comments	**1,295**

Table C: Number of Comments by Organization Affiliation

Organization Type/Affiliation	Number of Comments
Business	10
Educational Institution	8
Federal Agency	52
Federal Elected Official	5
Local Agency	71
Local Official	16
Organization	90
Self	979
State Agency	14
State Elected Official	16
Tribal Organization	34
Total Number of Comments	**1,295**

Table D: Form Letters

Form Number	Comment Number	Number of Comments	Description of Form
1	20a	51	The Bureau of Land Management (BLM) has taken Agrium's solid Proposed Action and improved on it. The Rasmussen Collaborative Alternative (RCA) allows for the production of needed fertilizer while at the same time protecting Idaho's environment. Importantly, as the Draft EIS notes, "There would be no cumulative effects to shallow-and intermediate-scale aquifers in the CEAs (Cumulative Effects Areas) due to the elimination of external stockpiles under the RCA (Rasmussen Collaborative Alternative)." These conclusions are important and demonstrate water quality will be protected.
2	1d	42	In today's climate where environmental and production issues seem to be polarized, it's encouraging to see a company like Agrium working with the BLM to develop a plan like the Rasmussen Collaborative Alternative (RCA). That proposal takes important steps to protect the environment, including removing the need for new fuel tanks and the need for an additional power line to the staging area. These are just two examples of the many environmental safeguards in the RCA.
3	6a	48	Based on suggestions to the BLM, the mine proposal has been modified, even further reducing the modest environmental impacts. This resulted in the Rasmussen Collaborative Alternative which includes improvements like not having to mine below the water table and the elimination of eight stream crossings.
4	21a	47	One important change that Agrium and the BLM have made is to put overburden from the early phases of Rasmussen Valley into P4's partially backfilled and reclaimed South Rasmussen Mine pit, which sits nearby. This will increase the reclaimed area at the South Rasmussen Mine pit. This is a strong example of the agency working with not only Agrium, but all the producers in the phosphate patch.
5	1d	48	There is a consistent theme demonstrated in the Draft Environmental Impact Statement. For example, it says "These potential cumulative impacts to groundwater quantity in the CEA are expected to be long-term and negligible." It later states that "cumulative increases in sediment loads within the CEA are expected to be minor, local and short-term." Similar statements throughout show that everything has been done to minimize the environmental impacts of the project.
6	1d	51	The realignment of the Blackfoot River, Diamond Creek, and Lanes Creek county roads makes sense, as does removing from the plan the need for the haul road across the floor of Rasmussen Valley and the crossings at Rasmussen Valley Road and Angus Creek. These and other adjustments exhibit the extensive thought and a level of detail Agrium and the Agencies have gone to in order to accommodate as many of the needs and interests of the public as possible, while at the same time allowing fertilizer to be produced and water quality to be protected.
7	8a	31	The draft pays particular attention to wetlands protection. The comparison of the Alternatives says "The Proposed Action would remove 20.5 acres of wetlands and non-wetland WOUS.

Table D: Form Letters

Form Number	Comment Number	Number of Comments	Description of Form
			Most wetland impacts (17.5 acres) would occur in Category III wetlands.” However, it adds that the preferred alternative, the Rasmussen Collaborative Alternative “(RCA) would only impact 0.3 acre of wetlands. As in the Proposed Action, most wetland impacts would be to Category III wetlands. Under the RCA, there would be no measureable loading of selenium or other COPCs (contaminants [sic - constituents] of potential concern) to wetlands and riparian areas. Wetlands impacts would be local, long-term and minor.” Given this I feel that our area’s wetlands are well-protected.
8	3a	46	It is encouraging to see that the BLM considered having Agrium use geosynthetic clay laminated liner, sometimes referred to as a GCLL, to reduce water percolation through the backfilled pit. It is also encouraging to see that the agency didn’t immediately default to using the GCLL, as some people and organizations may suggest. As the Draft EIS points out, while the GCLL “would have the lowest net percolation, it would have a very low efficacy-to-cost ratio and would be the most technically challenging to construct. This cover would have substantially more complex construction associated with the haulage and compaction of external borrow material for the bedding layer, installation of the GCLL on steep slopes, crushing and screening of certain local material to be used for a drain layer, as well as using that liner for much of the concurrent reclamation.” With this in mind, I agree that a GCLL is not the right approach for the Rasmussen Valley Mine.
9	22a	47	One factor that becomes apparent when reading the Draft EIS and comparing the original plan with the Preferred Alternative is that Agrium is willing to absorb additional costs in order to have an improved final plan. Changing mine plans to reduce the amount of shrub land and forested habitat impacted costs money, as does fully backfilling pits, and using generators rather than installing power lines.
10	16a	41	In today’s growing world, the demand for phosphorous continues to expand and is predicted to see an increase by 14 percent through 2017. The proposed mine would contribute to prolonged local economic benefit. At the same time, continued mining would not cause a population increase in nearby counties and overly tax available services or infrastructure. The mine’s impact to both economic and social conditions would be substantial and is identified in the Draft EIS as an exceptional benefit.
11	5a	53	Impacts on air resources – such as noise, climate, and air quality – are often discussed in mining projects. The Draft EIS specifically looks at very similar existing mine operations in the area and determines that foreseeable air quality impacts in the proposed project would be very similar to existing projects such as the Rasmussen Ridge Mines. The Rasmussen Ridge Mines are expected to conclude operations in 2017, and only at that time would the proposed plan take place, causing very minimal change to current impacts. In addition, air quality impacts from this project would not pose any additional threat to nearby

Table D: Form Letters

Form Number	Comment Number	Number of Comments	Description of Form
			protected areas.
12	5a	45	Based on the EIS, a close look at predicted greenhouse gas emissions shows no increase in contribution by the proposed activities. In addition, as operations get under way, the Draft EIS indicates that better technology, improved equipment, and lower greenhouse gas emitting engines for vehicles will be considered to enhance greenhouse gas reduction. Though mining does contribute to greenhouse gas emissions in Idaho, the Draft EIS demonstrates no increased contribution in the area due to this project.
13	8a	57	Wetlands are often discussed as highly sensitive habitat. The Draft EIS has taken a close look at impacts on wetlands and other sensitive riparian environments. The Draft EIS identifies considerable efforts to avoid impacts to these resources and outlines mitigation of any lost functions or value from wetlands allowing for a cumulative impact that is negligible. In addition, the Rasmussen Collaborative Alternative takes great measures to eliminate the potential for release of contaminants into surface waters, wetlands, and riparian areas.
14	8a	36	Certainly any project carries with it the possibility of environmental impacts. However, the proposed project clearly has identified those potential impacts and, where necessary, is proposing steps to mitigate them. The Draft EIS states the proposed project would impact 20.5 acres of wetland and riparian habitat. However mitigation measures in the Rasmussen Collaborative Alternative (RCA) are planned to reduce that area considerably and works to eliminate the potential impacts from 20.5 acres to 0.3 acres, a 99 percent reduction! Such a dramatic reduction in potential for release of contaminants into surface waters, wetlands impacts, the RCA clearly fulfills the Clean Water Act primary directive of first and foremost avoiding wetland impacts and riparian areas.
15	18a	39	Mining activity has the potential to generate waste. However, thanks to improved mining technology and practices, that waste is better controlled as well as disposed of. The Rasmussen Collaboration Alternative, using the framework of regulations for transporters and disposal, has minimal effects on hazardous materials and waste generation. In addition, the storage capacity is available and identified.
16	21a	36	The Draft EIS clearly shows a focus on reclamation. In fact, of the total disturbance for the project, 96 percent would be reclaimed - with no open pit left at the end of mining - something we saw in the past. In addition, impacts occurring throughout the project are addressed with plans for mitigation to reduce impact.
17	20a	47	The Draft EIS explores the cumulative effects of the proposed mine and the Rasmussen Collaborative Alternative (RCA). From air quality to water, wetlands to cultural resources, the Draft EIS lays out the RCA as consistently addressing impacts with an emphasis on mitigation throughout. Under the RCA 96 percent of impacted land will be reclaimed. Across the board, in each identified category, the impacts have been extensively examined and for the most part found to be minor to negligible.

Table D: Form Letters

Form Number	Comment Number	Number of Comments	Description of Form
18	1d	42	Agrium is attentive to the environment in which they are operating. By using the best technologies and concurrent reclamation this project represents advancement in the mining industry as we know it.
19	5a	52	Climate change issues are at the top of my environmental priority list. Phosphate mining contributes, as many industries do, to greenhouse gas emissions. Currently the Rasmussen Ridge Mine is a source of greenhouse gas emissions. The activities involved in the Rasmussen Valley Mine are similar to those of the Rasmussen Ridge Mine however they would not begin until after closure of the Rasmussen Ridge Mine. This allows any contributions to remain minimal and not exceed current greenhouse gas emissions.
20	1b	46	Agrium clearly values wildlife protection. They demonstrate their commitment to protecting wildlife by ensuring that almost all of impacted land is properly reclaimed and in condition to be used by wildlife. Their Dry Valley Mine project demonstrated to me their focus on the natural environment and commitment to reclamation. Additionally, they have taken the issue of selenium seriously. Agrium has developed a seed mix and backfill cover combination that will be protective against selenium accumulation in the plants and subsequently the animals that eat those plants.

1.3 ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used frequently in the responses to comments provided in this document. Other abbreviations and acronyms used less frequently are defined at first use within the responses themselves.

BLM	U.S. Bureau of Land Management
BMP	best management practice
CEA	Cumulative Effects Area
COPC	constituent of potential concern
EIS	Environmental Impact Statement
GM	growth medium
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
POC	Point of Compliance
RCA	Rasmussen Collaborative Alternative
ROD	Record of Decision
USFS	U.S. Forest Service

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1.4 RASMUSSEN VALLEY MINE DRAFT EIS TOPICS, ISSUES, AND RESPONSES

TOPIC: 1. GENERAL COMMENTS

Issue: **1a. Commenters expressed support for the project and commented on its importance to the community and the creation of jobs in Idaho.**

Response: The importance of ore from the project to support the continued operation of the Agrium Conda Phosphate Operations fertilizer plant is mentioned in **Section 1.3 Purpose and Need**. The general issue of Agrium as a positive element of the community and contribution to the job force is discussed in **Sections 4.13** and **5.13**. **Sections 4.13.1.1** and **4.13.1.2** discuss how the project would contribute to the maintenance of current levels of employment, levels of personal income in the area and statewide, payments to supporting businesses, community services, and public finance under the Proposed Action or the Rasmussen Collaborative Alternative (RCA), respectively**. Section 5.13.6** places this benefit within a long-term (cumulative) perspective.

Letter/Comment: 88/A, 290/A, 330/B, 332/B, 336/A, 337/A, 338/A, 339/A, 340/B, 349/A, 379/C, 406/B, 409/B, 415/A, 424/B, 429/A, 430/B, 431/A, 432/B, 446/B, 452/A, 593/A, 628/A, 694/A, 791/A, 795/A, 799/A, 802/C, 806/A, 807/A, 930/A, 931/B, 933/A, 934/A, 952/C, 953/A, 954/B, 955/A, 957/A, 968/A, 975/A, 1001/A, 1002/A, 1003/A, 1005/C, 1006/A, 1006/C, 1007/B, 1008/B, 1008/C, 1009/A, 1010/A, 1011/A

Issue: **1b. Commenters noted Agrium's dedication to employee safety and the environment and their willingness to protect and improve the environment while providing an important resource, as evidenced in past projects and reclamation. Agrium has worked cooperatively with other producers, such as Monsanto, and with all regulatory agencies. Agrium follows regulatory requirements and employs progressive and environmentally responsible technologies and best management practices in their operations.**

Response: Comment noted.

Letter/Comment: 10/A, 11/A, 118/A, 139/A, 163/A, 171/A, 173/A, 184/A, 221/B, 225/C, 229/A, 261/A, 291/A, 302/A, 310/A, 333/B, 335/B, 338/B, 339/B, 340/C, 341/A, 362/A, 372/A, 379/A, 383/B, 391/A, 403/A, 428/B, 431/B, 432/A, 440/A, 479/A, 482/A, 501/A, 528/A, 583/A, 589/A, 597/A, 603/A, 606/A, 619/A, 634/A, 646/A, 654/A, 680/A, 687/B, 696/A, 707/A, 715/A, 739/A, 760/A, 767/A, 808/A, 812/A, 818/A, 824/A, 827/A, 896/A, 921/A, 925/A, 931/A, 932/B, 953/B, 955/B, 956/B, 961/A, 979/A, 1001/C, 1004/B, 1007/A

***Issue*:** **1c. Commenters expressed support of the mine because phosphate is an important element for the production of fertilizers used in local and national agricultural operations.**

***Response*:** As with Issue 1a, these comments relate to **Sections 4.13** and **5.13**, which address Agrium as a positive social and economic element of the community and the region. An issue of wider importance is the production of fertilizers from phosphate. However, the national or worldwide importance of fertilizers is outside the scope of this impact assessment.

Letter/Comment: 218/B, 221/A, 225/A, 325/B, 337/B, 358/B, 379/B, 405/B, 406/A, 409/A, 415/B, 416/B, 420/A, 428/A, 430/A, 433/B, 449/A, 496/A, 793/B, 797/A, 798/B, 839/A, 904/A, 932/A, 954/A, 956/A, 968/B, 1001/B, 1005/A, 1005/B, 1006/B, 1007/C, 1008/A, 1008/D, 1009/B, 1011/B

Issue: **1d. Commenters noted that analysis and consideration of environment are well done in the Draft EIS. The RCA alternative does a good job of addressing potential effects, particularly in regards to wetlands. Under the RCA, there is no increase in air emissions, including potential climate change effects, there is no**

need for a new fuel storage area or overhead power line, and there are thorough measures for the protection of surface water and groundwater quality. The alternative ore haul road that does not cross the floor of Rasmussen Valley also contributes to the protection of the environment.

Response: The analyses of existing conditions and potential effects that are being praised are documented in **Chapters 3 and 4** of the Draft Environmental Impact Statement (Draft EIS). Based on public input, these analyses are refined in the Final Environmental Impact Statement (Final EIS).

Letter/Comment: 13/A, 17/A, 26/A, 28/A, 33/A, 46/A, 48/A, 49/A, 52/A, 58/A, 61/A, 64/A, 66/A, 67/A, 70/A, 78/A, 80/A, 81/A, 83/A, 85/A, 97/A, 100/A, 108/A, 109/A, 111/A, 112/A, 113/A, 114/A, 132/A, 134/A, 136/A, 138/A, 140/A, 143/A, 153/A, 158/A, 159/A, 166/A, 169/A, 175/A, 188/A, 193/A, 227/A, 230/A, 234/A, 236/A, 240/A, 241/A, 254/A, 255/A, 262/A, 270/A, 279/A, 280/A, 281/A, 292/A, 295/A, 297/A, 299/A, 301/A, 304/A, 327/A, 342/A, 344/A, 350/A, 358/A, 359/A, 360/A, 366/A, 373/A, 387/A, 398/A, 401/A, 404/A, 408/A, 410/A, 419/A, 422/A, 424/A, 427/A, 433/A, 435/A, 436/A, 442/A, 445/A, 446/A, 448/A, 457/A, 461/A, 462/A, 470/A, 476/A, 478/A, 481/A, 494/A, 495/A, 496/B, 505/A, 506/A, 517/A, 518/A, 521/A, 530/A, 531/A, 536/A, 538/A, 539/A, 580/A, 582/A, 590/A, 593/B, 598/A, 609/A, 614/A, 618/A, 620/A, 629/A, 631/A, 632/A, 633/A, 642/A, 647/A, 656/A, 661/A, 666/A, 667/A, 668/A, 687/A, 688/A, 712/A, 716/A, 717/A, 720/A, 722/A, 723/A, 726/A, 729/A, 733/A, 734/A, 746/A, 747/A, 750/A, 755/A, 761/A, 764/A, 765/A, 766/A, 770/A, 772/A, 776/A, 777/A, 781/A, 782/A, 789/A, 793/A, 794/A, 795/B, 798/A, 801/A, 810/A, 821/A, 828/A, 840/A, 845/A, 847/A, 854/A, 856/A, 858/A, 864/A, 866/A, 867/A, 868/A, 869/A, 870/A, 872/A, 881/A, 882/A, 883/A, 892/A, 902/A, 906/A, 908/A, 910/A, 917/A, 923/A, 927/A, 928/A, 937/A, 938/A, 942/A, 952/D, 957/B, 958/A, 959/A, 962/A, 965/A, 980/A, 987/A, 991/A, 994/A, 1002/B, 1004/A, 1010/B

Issue: **1e. Commenters noted that the NEPA process from public scoping to Record of Decision is expected to take 7 years. They urged that the process be completed as quickly as possible.**

Response: The process has been expedited to the extent feasible without overlooking any important issue and allowing for adequate public input.

Letter/Comment: 290/B

Issue: **1f. Commenters expressed opposition to the project citing existing selenium contamination and other damage to the environment. Commenters urged that existing problems be cleaned up before mining continues and that future mining avoid new problems.**

Response: The EIS discusses the fact that several federal and state agencies and the mine operators have considered the potential impacts of the mine, including those from selenium contamination, in their analysis of the alternatives and believe that adequate mitigation measures for those impacts have been identified in the Agency Preferred Alternative (the RCA). The water resources section of cumulative effects (**Section 5.3.3**), as well as other resource sections, briefly discuss past contamination, improvements in measures for containing contamination, and remedial investigations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) that are currently underway at many of the historical mines in the area. The Rasmussen Valley Mine would make negligible and manageable contributions to the environmental impacts while progress is being made on remediating existing problems.

Letter/Comment: 286/A, 626/C, 626/I, 804/A, 988/A

Issue: **1g. Commenters observe that, in the Executive Summary and early in the document, the overburden pile locations are described as "downslope" and "upslope" of the pit, but the significance of these differing locations is not immediately apparent. The vulnerability of these locations in relation to groundwater, surface water, and geotechnical stability should be explained early in the document. It is noted that there is an explanation of the significance of the**

terms on page 2-39 that could be presented in the Executive Summary and earlier in Chapter 2.

Response: A brief discussion of the potential issues posed by the external overburden piles has been added to the Executive Summary and to the introduction to the Proposed Action in **Section 2.3.3**. **Section 2.3.3** now includes the following statement:

"Initial stages of mine development include salvaging topsoil and other suitable surface material to be used as reclamation growth medium (GM) and then removing overburden to reach the ore. Overburden is non-economic geologic materials that must be removed or segregated from the ore to obtain an adequate ore grade and quality for processing at Agrium's Conda fertilizer plant. The overburden that has been removed can be backfilled to a previously mined area or stored temporarily or permanently outside the mine pit.

Several identifiable geologic layers or strata comprise the overburden that would be excavated from the mine pits. At various phosphate mines in Southeast Idaho, some of these strata express a potential for releasing higher concentrations of selenium and other COPCs. The selenium and other COPCs released from overburden need to limited to a level that will prevent contamination of surface water, groundwater at concentrations above regulatory standards, and soils to the extent that vegetation is maintained below action levels. Historically, in the Southeast Idaho Phosphate District, strata within the Meade Peak Member, and certain strata within the Rex Chert Member geological formations have contained higher levels of selenium. Conversely, other strata express a lower potential for releasing selenium and other COPCs. Each mine also has its own unique profile of how much selenium and other COPCs are released based on the presence and ratios of the various strata. Consequently, the overburden material for each mine proposal must be evaluated independently.

Agrium's 2011 Mine and Reclamation Plan (Agrium 2011) uses the terms "seleniferous" material and "non-seleniferous" material to describe how Agrium proposes to segregate overburden for different disposal locations to lessen the potential for exceeding water quality standards and vegetation standards for COPCs. In subsequent documents, Agrium replaced the term "non-seleniferous" with "low-seleniferous" to be more accurate because some of the materials slated to be placed in "non-seleniferous" overburden piles may contain some selenium or other COPCs that could be released.

During their review, the Agencies (BLM, USFS, and Idaho Department of Environmental Quality [IDEQ]) determined that the terms "seleniferous" and "low-seleniferous" do not provide enough information to prepare an appropriately informative affects analysis and disclosure. In addition, the site-specific samples Agrium provided for each of the strata cannot be differentiated in accordance with this terminology, thus requiring the site-specific leachability tests performed for this impacts analysis. Consequently, the Agencies have taken a more descriptive approach to defining the overburden materials that would be segregated and placed in the different overburden piles and backfill. Overburden that does not include Meade Peak strata or specific Rex Chert strata is referred to by Agrium as "low-seleniferous." In the EIS, these materials are referred to more descriptively as "non-Meade Peak-containing material" or "non-Meade Peak overburden". Overburden that may contain Meade Peak or specific Rex Chert material, which is referred to by Agrium as "seleniferous" or "SeW," is designated in this EIS as "Meade Peak-containing material" or "Meade Peak overburden."

Agrium proposed to avoid placing Meade Peak overburden in certain permanent external overburden piles. This would reduce, but not eliminate, the potential risk of selenium and other COPCs being released from these locations and exceeding surface water and groundwater quality standards. Again, the impacts were analyzed by performing material-specific leach tests to determine the expected release of COPC's from this material.

The proposed mine pit would be on the southwest slope of Rasmussen Ridge. Available areas for overburden storage near the pit are upslope around the crest of Rasmussen Ridge, or downslope on the steep slopes below the mine pit. Runoff from overburden piles upslope of the mine pit would drain into the mine pit or would be diverted to water management features such as sediment basins. Runoff from overburden piles downslope of the mine pit would be managed by collection ditches and sediment basins, but would still have the potential to drain to nearby surface water (such as Angus Creek) or reach groundwater. In addition, portions of the steep slopes downslope of the mine pit are potentially unstable, and storage of overburden on these slopes could result in slope failure."

Letter/Comment: 579/R

Issue: **1h. Commenters observe that there is a specific statement on page 12 of the Executive Summary of the degree of hydrological disturbance from the Proposed Action, but no explanation of the nature of that impact. Commenters recommend a description and definition of hydrological disturbance.**

Response: The following text has been added to **Section ES.4.3** of the Executive Summary of the Final EIS to introduce and define the concept of hydrologic disturbance:

"Hydrologic disturbance is defined as changes in natural canopy cover (vegetation removal) or a change in surface soil characteristics (such as compaction) that may alter natural streamflow quantities and character. There would be no hydrologic disturbance on USFS lands in the Lower Lanes Creek or Diamond Creek sub-watersheds."

Letter/Comment: 579/S

Issue: **1i. Commenters observe that the Draft EIS does not fully examine the potential effects of either the Proposed Action or the RCA.**

Response: The commenters did not provide examples of analyses that were inadequate or potential effects that were not considered. The preparers feel that the potential effects were adequately examined. There were some locations in the Draft EIS where the comparison of effects between the alternatives was not clearly described. These have been revised in locations where they were recognized. Other commenters noted that some of the alternative elements that were ultimately included in the RCA were "discarded" at initial public scoping. That is, they were presented as possibly being problematic or ineffective. No alternative elements were discarded by the Agencies at the public scoping. The alternatives in question were those that Agrium had considered and not chosen. This is a misunderstanding of the scoping process. Public scoping is implemented to identify issues that are important to the public and to obtain suggestions on how these issues can be dealt with. The Proposed Action is the Mine Plan that is submitted by the proponent before scoping and analysis. Analysis of the existing conditions, issues, and potential effects would often lead to alternatives that are more protective of the environment than the Proposed Action, and can be alternatives that the proponent would not have chosen.

Letter/Comment: 621/A

Issue: **1j. Commenters request that in the Dear Reader Letter and throughout the document (do word search): The "Shoshone-Bannock Tribes" be named because they are the only Tribe with a Reservation located within this BLM Region.**

Response: This "BLM region" includes the Northwestern Band of Shoshoni in northern Utah and the Eastern Shoshone of the Wind River Reservation. It would also be reasonable to consider the Skull Valley Gosiute Reservation and the Uintah and Ouray Reservation. However, the Dear Reader letter does not address specific tribes or concerned publics.

Letter/Comment: 1015/A

Issue: **1k. Commenters request that in the Executive Summary and throughout the document, the use of vague unquantified terms such as "virtually", "negligible", "minor", "unreasonable", "long-term" be avoided.**

Response: Many of these "vague" terms are terms that are defined for NEPA impact assessment. For example (**Section 4.0**) -

Duration of effects is defined as:

- Short-term - Short-term effects are defined as those effects that would not last longer than the life of the project, including initial reclamation.
- Long-term - Long-term effects are effects that would remain following completion of the project.

The thresholds of change for the intensity of an impact are defined as:

- Negligible - the impact is at the lowest levels of detection.
- Minor - the impact is slight, but detectable.
- Moderate - the impact is readily apparent.
- Major - the impact is a severe or adverse impact or of exceptional benefit.

The document has been searched for unnecessary vague terms.

Letter/Comment: 1015/E

TOPIC: 2. CHAPTER 1

Issue: **2a. Commenters observe that the Draft EIS includes a brief and general discussion of reclamation and financial assurance and states that the financial amount will be approved before ground-disturbing activities. Commenters recommend that the Final EIS disclose the estimated cost to reclaim and close the site in a manner that achieves the reclamation goals and post-mining land-use objectives. Commenters assert that the Final EIS will need to include more detailed information on the cost estimate and bonding instrument.**

Response: Reclamation bonding is part of BLM's inspection and enforcement program, but it is not an environmental impact or mitigation to be addressed under the NEPA. **Section 1.4.2** briefly explains that Agrium would prepare a reclamation performance bond after the project is approved. The reclamation bond will be calculated by Agrium, reviewed, adjusted, and approved by the Bureau of Land Management (BLM), the USFS, and Idaho Department of Lands (IDL) after Records of Decision (RODs) are signed. The following additional explanation has been added to the section on bonding (**Section 1.4.2**).

"The BLM has adopted a reclamation bonding guidance policy, Bond Requirement for Phosphate Mining Operations, September 10, 2013, which prescribes the procedures for ensuring that an accurate actual cost reclamation bond is in effect for phosphate mines in Idaho. The policy prescribes that a reclamation bond will be required after the ROD has been signed and an alternative selected. This ensures that the bond is based on an accurate bond scenario from which to calculate the cost of reclamation. It is only then that the final mine and reclamation plan is known and that the environmental monitoring and other details would be known upon which to calculate a reclamation bond.

The policy ensures that the bond:

- Covers an appropriate reclamation scenario that meets the requirements in the ROD or Decision Record (DR) and approved reclamation plan or plan modification.
- Uses unit costs, production factors, quantity take-off, tasks, and calculation methods that are reasonable and appropriately accurate for an "actual cost" estimate. Quantity take-off consists of using engineering drawings and figures to determine the quantity and types of materials that need to be handled or procured.
- Is equitable among operators (i.e., that one operator does not gain a competitive advantage by using more favorable, but unsupported unit costs, factors or methodologies to calculate their bond)."

Members of the public, NGOs, or other agencies are welcome to review BLM's bond analysis

Letter/Comment: 621/A, 579/O

Issue: **2b. Commenters note that NAGPRA (Native American Graves Protection and Repatriation Act) applies and should be added to this table [Table 1.4-1]. In addition, it should be made clear (where you think most appropriate in the document) that any identification of cultural/Native American artifacts or graves will cause a stop work until the Tribes and archaeologists can investigate and remove them from the site in an appropriate manner.**

Response: **Table 1.4-1** is a table of permits, approvals, and authorizations that may need to be obtained if this project is approved. NAGPRA and its implementing regulations must be followed in the implementation of the project, but it is not a permit, approval, or authorization. This is in contrast to Section 106 of the National Historic Preservation

Act (NHPA) which is an approval process that is a condition of other permits, approvals, or authorizations and is listed in this table.

NAGPRA has been added to the introduction to **Section 3.12**.

Letter/Comment: 1015/G

Issue: **2c. Commenters request that in Section 1.6.3, the IDFG WMA just south of the study area be identified in the bulleted items at the end of this section.**

Response: This is **Section 1.6.5** in the Final EIS. The bulleted list identifies resource categories for which no issues were identified and which are not analyzed for impacts in the EIS. The Blackfoot River Wildlife Management Area (WMA) is a specific resource, not a resource category, issues were identified for this resource, and it is analyzed for impacts in the EIS. Therefore, it is not included in this list.

Letter/Comment: 1015/I

Issue: **2d. Commenters request that in Table 1.6-1, the following row be added under the Vegetation heading: "What is the potential for impacts to culturally - sensitive plant species?"**

Response: This is not an indicator for impacts to vegetation. Culturally sensitive plant species have been added to the indicators for Tribal Treaty Rights and Interests and are also addressed in Special Status Plant Species (**Sections 3.8.3, 4.8.1.1.3,** and **4.8.1.2.3**).

Letter/Comment: 1015/J

Issue: **2e. Commenters request that in Table 1.6-1, the question under Tribal Treaty Rights and Interests be modified to read: "What are the potential impacts on the Shoshone-Bannock Tribal members to exercise their treaty rights in the Study Area and the potential impacts to natural resources and resources of cultural significance to Tribal members including diminishing or destroying the traditional value of sites?"**

Response: These issues and indicators have been reworded as two issues and seven indicators as listed below:

Issue

What are the potential impacts on the Shoshone-Bannock Tribal members to exercise their treaty rights in the Study Area?

Indicators

Changes in the quality and quantity of culturally valued resources on unoccupied public land, including ground and surface water, culturally significant plant species, grazing resources, and wildlife

Acres of traditional use areas that would be available or unavailable during mining activities

Issue

What are the potential impacts to natural resources and resources of cultural significance to Shoshone-Bannock Tribal members?

Indicators

Changes in uptake of COPCs by wildlife and vegetation in mining disturbed areas and areas that are reclaimed

Visibility of disturbances to adjoining areas

Known historic properties affected

Changes in the natural setting of the traditional resources that would diminish their value to traditional practices

Rendering of culturally important natural resources including culturally significant plant species unfit for harvest or consumption

Letter/Comment: 1015/K

Issue: **2f. Commenters request that in Table 1.6-1, the question under Environmental Justice heading be modified to read: "What disproportionately high and adverse human health or environmental effects on people of race, color, religion or income, including the Shoshone-Bannock Tribes population who practice treaty rights on federal lands, could be realized?"**

Response: Rewording of issue accepted.

Letter/Comment: 1015/L

TOPIC: 3. CHAPTER 2

Issue: **3a. Commenters observed that, after considering use of a GCLL liner in the cap-and-cover design, Agrium concluded that the minor benefits of reduced net percolation were not sufficient to justify the substantially more complex construction and higher cost of this liner, particularly on the steep slopes of Rasmussen Ridge.**

Response: The justification for eliminating this alternative element is discussed in **Section 2.8.9.** This section explains that the geosynthetic clay laminated liner (GCLL) would provide lower net percolation than other cap-and-cover designs that were considered, but at a very low efficacy-to-cost ratio, and would be the most technically challenging to construct. This cover would have substantially more complex construction associated with the haulage and compaction of borrow material for the bedding layer, installation of the GCLL on steep slopes, placement of a drainage layer, and installation of the overlying growth medium (GM) in phases consistent with concurrent reclamation. In addition, the synthetic materials and potential plugging of the drainage layer with roots and sediment could complicate the long-term performance and durability of this cover.

While the GCLL cover alternative provides the lowest net percolation rate, the IDEQ has determined that the 0.21 in/yr percolation rate predicted for Cover C would be adequate to protect the groundwater quality and maintain it below the groundwater standards outside of the mining area, as required under an IDEQ Point of Compliance (POC) determination.

Letter/Comment: 12/A, 16/A, 20/A, 44/A, 47/A, 71/A, 110/A, 117/A, 128/A, 129/A, 142/A, 176/A, 183/A, 189/A, 257/A, 274/A, 347/A, 363/A, 380/A, 426/A, 451/A, 468/A, 472/A, 507/A, 516/A, 535/A, 540/A, 581/A, 585/A, 660/A, 671/A, 700/A, 728/A, 752/A, 816/A, 823/A, 859/A, 895/A, 924/A, 935/A, 939/A, 984/A, 995/A, 996/A, 1000/A

Issue: **3b. Commenters recommend that graphics comparing the Proposed Action and RCA cover designs would be helpful for understanding the descriptions. The figures could include material compositions, thicknesses, hydrologic conductivities, and infiltration values. The illustrations for the RCA should also include the approved cap for the overburden moved to the South Rasmussen Mine.**

Response **Sections 2.3.7.1** and **2.5.1.8.3** of the Draft EIS include simple descriptions for the Proposed Action and the RCA of the materials that would be used in each layer of the cover and the minimum thickness of each layer. In **Section 2.5.1.8.3**, there is also a comparison of net percolation rates, runoff, and borrow material requirements.

A new table (**Table 2.5-4**, below) and a new figure (**Figure 2.5-7**) comparing the materials in each layer of the Proposed Action Cover, RCA Cover C, P4 South Rasmussen Mine Approved Backfill Cover, and RCA South Rasmussen Mine Backfill Cover, have been added to **Section 2.5.1.8.4** of the Final EIS.

As inserted in Chapter 2:

Table 2.5-4 Comparison of Cap-and-Cover Alternatives

Cover	Layer Description[a]			Net Percolation (in/yr)[b]
	Thickness (feet)	Material Type	Ksat (cm/sec)	
Proposed Action Cover				
RCA Cover C				

Table 2.5-4 Comparison of Cap-and-Cover Alternatives

Cover	Layer Description[a]			Net Percolation (in/yr)[b]
	Thickness (feet)	Material Type	Ksat (cm/sec)	
P4 South Rasmussen Mine Approved Backfill Cover				
RCA South Rasmussen Mine Backfill Cover				

Letter/Comment: 579/T

Issue: **3c. Commenters recommend that the bullet list for the Agency Preferred Alternative on page 2-56 (Section 2.7) should include the importance of relocating the overburden piles so that they do not overlie unstable ground and the potential for infiltration to surface water.**

Response: The importance of relocating the external overburden piles has been added to the bullet list by adding the following wording to the first bullet:

"...that would have the potential of draining contaminated runoff to these impacted surface waters and infiltrating to groundwater. Portions of these overburden piles were proposed to be located on potentially unstable slopes that could fail."

"…and by elimination of all temporary external Meade Peak overburden piles that would also have the potential to contaminate surface waters."

Letter/Comment: 579/U

Issue: **3d. Commenters recommend that in Table 2.9-1, Groundwater Quality should more clearly distinguish between the effects of the Proposed Action and the RCA and also include additional information on the potential effects of moving overburden to the South Rasmussen Mine.**

Response: The groundwater quality section in **Table 2.9-1** has been revised to expand the discussion about the impact to groundwater that would occur as a result of placing overburden from the Rasmussen Valley Mine as backfill in the South Rasmussen Mine pit, and to better distinguish between the impacts from the Proposed Action and RCA.

Letter/Comment: 579/V

Issue: **3e. Commenters observe that it is critical to limit water from contacting selenium. Therefore, the run-of-mine overburden and any backfill should be capped with a fully impermeable liner that can assure permanence and leak detection covered by a store-and-release cover that maximizes evapotranspiration through vegetation.**

Response: Cover Alternative C for the RCA is a natural soil cover that would limit net percolation to 0.6 percent of total precipitation at the site while offering several advantages over a synthetic cover system, including durability and reduced risk of failure. Cover Alternative C includes a relatively low-permeability layer underneath the GM to reduce percolation. The 2-foot-thick, 2- to 4-foot-deep layer has a laboratory-measured saturated hydraulic conductivity of 2.51E-06 centimeters per second. This layer would impede percolation during periods of high precipitation and snow melt, providing time for evapotranspiration (ET) to be effective. The 0.21 inch per year (in/yr) percolation rate predicted for Cover C has been determined to be adequate to protect the groundwater quality and maintain it within the groundwater standards required under an IDEQ Point of Compliance (POC) determination. A GCLL or compacted clay layer is not predicted to be necessary.

Letter/Comment: 621/H, 621/P, 621/AH, 627/B, 627/K, 627/P

Issue: **3f. The same cover design should be used for both the Rasmussen Valley overburden and backfill and for the backfill placed in the P4 South Rasmussen Mine pit. It is unclear why the Proposed Action cover has only 3 feet of non-Meade Peak-containing material under 2 feet of GM, while the South Rasmussen Mine cover is being held to 5 feet of limestone under 2 feet of GM.**

Response: P4 has reviewed the options of altering the cover to be placed on the portion of the South Rasmussen Mine Main Pit that will receive backfill from the RCA plan. The review estimated that inserting a 2-foot layer of material from the Rasmussen Valley external borrow area would result in an average net percolation rate of 0.21 inch, based on Agrium's cap-and-cover alternatives analysis, infiltration modeling results from the SVFlux model (BC 2015a, 2015b) and the Draft EIS (BLM 2015) and considering factors such as soil structure formation that are not addressed by laboratory testing or the SVFlux model.

Review of the infiltration modeling sensitivity analyses conducted for the RCA cover clearly demonstrates that the middle low-permeability layer provides the dominant control on net percolation (BC 2015a). Those sensitivity analyses show that:

- Predicted net percolation is insensitive to changes in the Ksat of the upper layer over a range spanning from one order of magnitude less to two orders of magnitude greater than the modeled value (from 3.6 E-06 cm/sec to 4.4 E-03 cm/sec)
- Predicted net percolation is insensitive to changes in thickness of the upper layer over a 1-foot range (from 0.5 foot to 1.5 feet)
- Predicted net percolation is insensitive to changes in thickness of the middle low-permeability layer over a 2-foot range (from 1.0 to 3.0 feet)
- Predicted net percolation is sensitive to increases in the Ksat of the middle low-permeability layer (modeled from 2.51 E-07 cm/sec to 2.51 E-05 cm/sec)

The current approved South Rasmussen Mine and Reclamation Plan backfill cover design includes two material layers described below from top to bottom (P4 2014; NewFields 2014):

- 1.5 feet of GM with an estimated Ksat of 6.90 E-06 cm/sec
- 5 feet of limestone fill with an estimated Ksat of 1.0 E-04 cm/sec

P4 has submitted a mine plan modification to incorporate the middle low-permeability layer found in the RCA preferred cover into the South Rasmussen Mine cover over the RCA backfill that will be placed in the South Rasmussen Mine main pit. The proposed modified South Rasmussen Mine cover will replace the upper 2 feet of limestone with 2 feet of external borrow material from the RCA, as described in the Draft EIS (BLM 2015). The layers of the proposed South Rasmussen Mine cover over the RCA backfill are described below from top to bottom:

- 1.5 feet of South Rasmussen Mine GM with an estimated Ksat of 6.90 E-06 cm/sec (unchanged)
- 2 feet of RCA low-permeability combined GM and alluvium/colluvium sourced from external borrow areas with an estimated Ksat of 2.51 E-06 cm/sec (new layer)
- 3 feet of South Rasmussen Mine limestone fill with an estimated Ksat of 1.0 E-04 cm/sec (reduced from 5 feet)

The functionality of this modified South Rasmussen Mine cover is expected to be nearly identical to the RCA preferred alternative cover, primarily because of the inclusion of the RCA low-permeability middle layer. This conclusion is supported by the extensive sensitivity modeling performed during the development of the RCA preferred alternative cover. Therefore, it is reasonable to apply the adjusted RCA preferred alternative predicted net percolation rate of 0.21in/yr to the modified South Rasmussen Mine cover for use in evaluating the transport of COPCs from the RCA backfilled portions of the reclaimed South Rasmussen Mine Main Pit.

Letter/Comment: 621/L, 623/D, 627/G, 1012/A

Issue: **3g. Commenters observe that there are inconsistent statements about whether overburden piles would contain Meade Peak- or non-Meade Peak-containing materials. There is a statement on page 2-15 that overburden piles would contain only non-Meade Peak-containing materials and would not be a source of COPCs. Commenters recommend that it should be clearly reconciled whether or not overburden piles are a potential source of COPCs**

Response: Overburden is defined in **Section 7.3** of the Final EIS as sub-economic, or non-ore material which overlies or interfingers with the ore and must be segregated and removed to allow recovery of a deposit of valuable material. Phosphate mines in southeast Idaho encounter several different geological layers that need to be excavated as overburden. Historical mining operations at southeastern Idaho phosphate mines have been found to release COPCs from certain overburden layers that can adversely impact water, vegetation, and wildlife. Other overburden strata may release COPCs at lower concentrations, but could still be of concern, while some strata are found to release COPCs at concentrations that would not cause any concerns with water quality. The Final EIS uses specific analysis of the actual layers to determine which layers are of concern. For mine planning purposes, Agrium made a qualitative assumption regarding the overburden they expected to encounter and named these two types of material “seleniferous” and “non-seleniferous or low-seleniferous” overburden in their Mine and Reclamation Plan and other documents. The actual concentration or impacts of COPCs released from the “seleniferous” and “non-seleniferous” overburden was not known before the EIS impacts analysis was undertaken. The EIS describes the COPC properties of the various sources of overburden. To avoid prejudging the COPC properties of any material before it is analyzed, the agencies have chosen to distinguish overburden according to the layers to be excavated rather than a presumption of COPC concentration and mobility. Overburden that does not include Meade Peak strata or specific Rex Chert material is referred to by Agrium as “low-seleniferous.” In the EIS, these materials are referred to more descriptively as “non-Meade Peak-containing material" or “non-Meade Peak overburden”. Overburden that may contain Meade Peak or specific Rex Chert material, which is referred to by Agrium as “seleniferous” or “SeW”, is designated in this EIS as “Meade Peak-containing material" or “Meade Peak overburden.”

There is no statement on page 2-15 (**Section 2.3.3.1.3** of the Draft EIS) that non-Meade Peak-containing materials will not be a source of COPCs. The statement is that these materials may have a lower but existing potential that the release of selenium and other COPCs would exceed surface water and groundwater quality standards. The impacts analysis found that overburden piles were predicted to have an adverse impact to groundwater and adjacent surface waters. Overburden piles are clearly identified as a potential source of selenium and other COPCs, and are addressed as such in **Chapter 4.**

Letter/Comment: 621/U, 627/A, 627/O, 1014/P

Issue: **3h. Commenters observe that alluvium to be borrowed from the WMA is not to be used in processing or refining phosphate, but would be used as part of capping material to protect water quality. It appears that the alluvium from the WMA may be the most readily available suitable material for proper capping. However, it is unclear how this alluvium is being classified under the terms of the BLM lease. It is recommended that the EIS include a section describing the resolution of potentially conflicting lease directions.**

Response: See also Comment 13b. The alluvium and topsoil on the WMA is owned by the Idaho Department of Fish and Game (IDFG). It is an IDFG decision whether to authorize the use of this material, including for cover construction. Any agreement would be between Agrium and the IDFG.

When the Draft EIS was released, Agrium was still discussing options for the locations of borrow and storage areas for GM, alluvium, and colluvium to be used for cover construction. It was subsequently decided that the best areas for borrow and storage in terms of quality of material, ease of a access to the backfill areas, and minimal impacts to resources were coincident with and overlapped the areas identified for external overburden piles in the Proposed Action. In order for Agrium to obtain sufficient material to build the RCA Cover C while reducing the need for borrow on the WMA, the North-North and North Main Borrow and Storage areas located on National Forest land was expanded for the Final EIS and incorporated into the RCA, and use of the South Main Borrow and Storage Area (located on the WMA) would be minimized. The second paragraph of the GM Storage and Alluvium Borrow subsection of **Section 2.5.1.3.3** Material Management has been changed to:

"GM and unconsolidated alluvium and colluvium would be used in the construction of the cover over the pit backfill. Three areas have been proposed for the borrowing of GM, alluvium, and colluvium for the construction of the cover over the pit backfill, and for GM storage for use throughout the project life. These areas are designated as the North-North Borrow and Storage Area, North Main Borrow and Storage Area, and South Main Borrow and Storage Area (Figure 2.5 4). These areas were identified as the maximum area needed for borrowing GM, alluvium, and colluvium for use in constructing the backfill cover and as areas where there would be minimal disturbance to sensitive resources. These borrow and storage areas include locations that were identified for external overburden piles in the Proposed Action, but the external overburden piles are eliminated in the RCA. GM, alluvium, and colluvium would be borrowed from or stored at the three storage areas throughout the mine operations and as needs dictate. The area would also be used for temporary storage of GM from the pit area that would be used for reclamation. The maximum potential disturbance of the North-North Borrow and Storage Area and the North Main Borrow and Storage Area would be 104.4 acres, and for the South Main Borrow and Storage Area would be 49.6 acres. None of the borrow and storage areas would impact wetlands.

If all of the identified borrow areas were used, and material was removed to a depth of 10 feet, they could yield 2.5 MBCY of GM, alluvium, and colluvium. Approximately 0.88 MBCY would be needed for backfill cover, including 0.19 MBCY for the South Rasmussen Mine backfill. Approximately 0.39 MBCY of GM would be required for final reclamation of the borrow areas (0.25 MBCY, if the maximum extent of the borrow areas are used) and South Rasmussen Mine backfill area (0.14 MBCY). Up to 0.84 MCBY of GM would be available within the borrow areas for these purposes. Therefore, there is flexibility in the choice of borrow areas to be used, allowing the disturbance in the WMA to be minimized. Disturbance from these borrow and storage areas would be graded to drain naturally without any ponding and fully reclaimed with a minimum of 12 inches of GM and revegetation after they are no longer needed."

Letter/Comment: 622/A, 622/C

Issue: **3i. Commenters were confused by the discussions of the overfill piles contiguous with and upslope of the backfill. The commenters questioned why this material was not backfilled. There needs to be a clearer explanation of the overfill areas.**

Response: Adverse concentrations of COPCs at historical southeastern Idaho phosphate mines appear to be most prevalent where precipitation and snowmelt is expressed in seeps and springs at the downslope toe of external overburden piles. External overburden piles were those located outside the pit crest. Technically speaking, the overfill piles are external overburden piles because they extend beyond the margins of the pit, but from an environmental impact perspective, are similar to backfill. This is because they are contiguous with the downslope backfill, do not have downslope toe, and overlay the same regional aquifer as the backfill. They function much as backfill does and thus are modeled the same. Other resources impacted by the overfill piles are similar to the backfill and are also analyzed the same. The overfill is effectively backfill and will be treated and reclaimed as part of the backfill. Additional clarification has been added to the discussion of the overfill piles in **Sections 2.3.4.1.3** and **2.5.1.3.3.**

Letter/Comment: 621/AI, 627/C

Issue: **3j. Analysis of the alternatives should provide uniform rigor in developing BMPs and other protection techniques. This should be applied equally to all aspects of the environmental analysis. The Final EIS should discuss why it may not be reasonable to apply equal environmental protection to all alternatives or to analyze the Proposed Action with functional BMPs commensurate with other alternatives.**

Response: All of the alternative elements considered were initially evaluated in a similar fashion to determine if they needed to be carried through for full analysis. During this process, each alternative element was compared to similar alternative elements affecting similar resources to select those alternative elements that should be carried forward. Some alternative elements dropped out of contention for full analysis because they obviously did not provide as much benefit as another alternative element. Those alternative elements that appeared to have significant merit were selected for full analysis. During this process, it became apparent that the best mutually exclusive alternative elements could be combined for analysis to produce an overall alternative: the RCA. This is because it was found in most cases that groups of alternative elements affected the same resource and were mutually exclusive, such as various haul road configurations, various cover designs, or various overburden pile locations. In most cases, one alternative element stood out above the others as offering substantially more benefit. These were the alternative elements that were bundled together in an overall alternative package and carried through full analysis in a fashion similar to that of the RCA.

Letter/Comment: 621/AF

Issue: **3k. Commenters disagree with the explanation of the elimination of the GCLL cover as a reasonable alternative element, arguing that GCLL covers have been used successfully at other mines in the region, and that if the cover were modeled with real-world values, it might prove to be the only cover capable of providing adequate protection of water quality. Each reason given for the elimination of this alternative element is discussed.**

Response: While the infiltration modeling results indicate that the geosynthetic clay laminated liner (GCLL) cover alternative would achieve the lowest net percolation, GCLL covers also present several potential disadvantages that earthen covers do not. GCLL covers are sensitive to the type of vegetation allowed to establish on the cover, potentially requiring monitoring and maintenance well beyond the end of mine life. The cover needs to be maintained with shorter rooted species, and encroaching native larger and longer rooted species must be kept to a minimum on the cover. Even then, the existence of a saturated zone in the drainage layer invites root growth, which could plug the drainage layer. A plugged drainage layer increases the risk that the overlying soil would become saturated and slide off, exposing the liner. By contrast, earthen store-and-release covers actually improve their transpiration performance when roots aggregate in the moister zones. The soil-based covers are also better able to accommodate the encroachment of native species, thus providing more wildlife habitat services, and could more easily adapt to climatic changes that could cause the GCLL to be more doughy or waterlogged because of the relatively thinner soil cover for water storage. Although the GCLL cover synthetic materials has an expected life of decades or longer, ultimately, the synthetics will degrade over time and will no longer perform as an effective barrier. The drainage layer would be covered with a geosynthetic filter fabric to prevent fines in the overlying GM layer from migrating into and plugging the drainage layer. However, the geosynthetic filter fabric will also degrade over time, and the drainage layer would eventually be prone to plugging. As noted above, when this occurs, the overlying GM layer can become saturated, resulting in slip failures. In addition to the above technical differences between cover designs, the cover needs to be sufficiently protective of groundwater contamination to meet the requirements of an IDEQ Point of Compliance Determination. For the RCA, the proposed Cover C fulfills that requirement.

With regard to the "real world" values, the soil properties used in the infiltration modeling for all cover alternatives were the result of laboratory analysis of GM and alluvium/colluvium samples collected from 20 test pits at the site. The samples were collected directly from the material sources to be used in the Rasmussen Valley covers, and the laboratory analysis incorporated testing under a representative range of compaction levels and moisture contents to capture the range of values that could be reasonably achieved during construction. The resulting values are both site-specific and material-specific. To account for "real world" changes in soil structure as the cover matures, the modeled percolation rate was increased by 50 percent from 0.14 in/yr to 0.21 in/yr to address the increased infiltration and percolation expected as the soil matures and develops clods and macro structure. See also response 6bs.

Letter/Comment: 627/R

Issue: **3l. Making a few more changes to the Proposed Action short of changing the cover would make the Proposed Action a better comparison with the RCA. For example, Phase 1 of the Proposed Action could be less deep and avoid mine dewatering, or the mine could be developed from north to south so that there would be a place to dispose of dewatering water if needed.**

Response: Each alternative element considered was initially evaluated on its own merits in a similar fashion regardless of other alternative elements. Each alternative element was also evaluated relative to other alternative elements that were mutually exclusive, such as haul road alignments. Through these initial and subsequent iterative evaluations, and comparison with public and internal scoping issues, it was determined that there were certain alternative elements that addressed the issues, such as surface water quality impacts and wetlands disturbance through avoidance, the most preferable mitigation method. Some impacts, such as those associated with regional groundwater quality, were mitigated by substantially reducing percolation of water through overburden. Wildlife habitat impacts were reduced by using a more diverse native seed mix and further addressed via off-site mitigation. Inserting individual alternative elements onto a Proposed Action would have essentially resulted in a set of actions that carried impacts ranging between less than the Proposed Action and greater than the RCA. The RCA contains those non-mutually exclusive alternative elements that provide the best mitigation and meet applicable water quality, land use plan, and other regulatory standards. Thus, in accordance with the National Environmental Policy Act (NEPA), the RCA (the preferred alternative), the Proposed Action, and the No Action Alternative were carried through full analysis in the EIS.

Letter/Comment: 1014/F

Issue: **3m. Commenters observe that in Section 2.3.3.1.3 of the Draft EIS, there is no agency-agreed upon definition of "low seleniferous". And the term "low-seleniferous" is not more accurate than "non-seleniferous". Please remove this discussion paragraph and replace with, "The Agencies will determine the definition of low- seleniferous material for the purposes of approving final capping materials or materials left exposed at the ground surface after the mine operations are complete."**

Response: This discussion (which has been moved to an earlier section of the chapter in the Final EIS, Previously **Section 2.3.2**, now **Section 2.3.3**) explains that the term non-seleniferous was used in the Mine Plan and some subsequent technical reports used low-seleniferous. The subsequent paragraph (see below) explains that these terms are not used in the EIS. All Meade Peak overburden will be capped to isolate plants from potential contact with COPCs and to limit percolation. Therefore, any definition of low-seleniferous is not relevant to the EIS.

"During their review, the Agencies (BLM, USFS, and Idaho Department of Environmental Quality [IDEQ]) determined that the terms “seleniferous” and “low-seleniferous” do not provide enough information to prepare an appropriately informative affects analysis and disclosure. In addition, the site-specific samples Agrium provided for each of the strata cannot be differentiated in accordance with this terminology thus requiring the site specific leachability tests performed for this impacts analysis. Consequently, the Agencies have taken a more descriptive approach to defining the overburden materials that would be segregated and placed in the different overburden piles and backfill. Overburden that does not include Meade Peak strata or specific Rex Chert material is referred to by Agrium as “low-seleniferous.” In the EIS, these materials are referred to more descriptively as “non-Meade Peak-containing material" or “non-Meade Peak overburden”. Overburden that may contain Meade Peak or specific Rex Chert material, which is referred to by Agrium as “seleniferous” or “SeW”, is designated in this EIS as “Meade Peak-containing material" or “Meade Peak overburden.”"

Letter/Comment: 1015/M

Issue: **3n. The commenters understand that the Habitat Equivalency Analysis (HEA) is at an advanced stage of development and that basic change requests are, at this time, not feasible. However, we respectfully request that future HEAs performed by this BLM office incorporate impacts to all natural resources, not just wildlife habitat, as we view it as an incomplete assessment of the full range of impacts to natural resources.**

Response: While the HEA could be used to evaluate impacts to various natural resource areas, the BLM Idaho in IM ID-2013-040 has decided to use it only to evaluate current and future impacts, whether direct or indirect, to vegetative and wildlife habitat areas. This is due to the BLM Idaho having analytic methods for these other areas, as well as for NEPA’s cumulative effects analysis, that are as reliable and as scientifically sound in this context as the HEA is to the vegetative and wildlife habitat areas..

Letter/Comment: 1015/O

Issue: **3o. The commenters request that "including culturally-significant plant species" be added to the end of the 12th bullet in Section 2.5.1.3.**

Response: This information was not available when the revegetation seed mixes were being developed. This information was not considered in the development of the RCA but the seed mix does contain many of the species in the list. See response to Issue 21r.

Letter/Comment: 1015/P

TOPIC: 4. GEOLOGY, MINERALS, AND PALEONTOLOGY

Issue: **4a. Commenters question whether selenite has a low environmental mobility in water as stated in the Draft EIS because selenite is a commonly encountered form of selenium in water. They also question the references that are used in this discussion. The EIS should clarify the issue of the mobility of selenium.**

Response: **Section 3.1.3.2** of the Final EIS has been revised for clarity to include a discussion about selenite mobility in water. For example, the first paragraph of **Section 3.1.3.2** has been changed to:

"Reduced forms of selenium, such as selenide (Se^{2-}), selenite (Se^{4+}), and elemental selenium (Se^{0}), have relatively low environmental mobility in water compared to oxidized forms, such as biselenate (Stewart and Howell 2003; Mebane 2015). Mobile forms of selenium can be transported in water and bioaccumulate in plants and organisms (Pickering et al. 1995; Hem 1989; Fessler et al. 2003; Masscheleyn et al. 1990). The pH and redox conditions of natural surface waters, including those in the region, generally promote higher mobility of selenate (Se^{6+}) than less oxidized forms, such as selenite (Mebane 2015; Brookins 1988)."

The authors of this section of the EIS note that, under oxidizing conditions at near-neutral pH (similar to those observed in surface water in the Blackfoot River watershed), selenite is significantly less soluble than selenate. This distribution of species is demonstrable using geochemical modeling programs such as the U.S. Geologic Survey (USGS) code PHREEQCi. Additional references have been added to the text to support the discussion of selenium mobility in water.

Letter/Comment: 579/H

Issue: **4b. Commenters recommend that the EIS should discuss the references used for the environmental mobility of selenium (Section 3.1.3.2) and include additional sources appropriate for the site. The commenters observe that the Seed et al. (2000) reference is a one-page conference abstract that did not address the environmental mobility of selenium and that there are many peer-reviewed sources on selenium pollution.**

Response: See response to Issue 4a.

Letter/Comment: 579/I

Issue: **4c. Commenters observe that the Draft EIS and supporting documents do not include appropriate information to evaluate the representativeness of the samples selected for baseline geochemical analysis. Commenters recommend that the EIS include additional information necessary to evaluate the representativeness of the samples.**

Response: A new section (**Section 3.1.3.3.1** Study Design and Test Materials) has been added to the Final EIS with information about the percentages of each material type that would be produced by the Proposed Action in a new table (**Table 3.1-2**). Another new table (**Table 3.1-3**) lists the number of A-Composite samples tested for each material type. **Table 3.1-2** from the Draft EIS has not had any information added, but is now **Table 3.1-4** in the Final EIS. The new discussion points out that sample representativeness is a complex issue requiring extensive spatial and geologic analysis and professional judgement. The new discussion also includes a description of the sample compositing and testing strategy that was used in the geochemical characterization study. With respect to the comment that the provided technical document *"Baseline Geochemistry Characteristics (Whetstone 2015a)" (sic)…. "does not include the information necessary to evaluate the representativeness of the samples selected for analysis",* we refer the commenter to the following sections of the document for information relevant to this topic:

- **Section 4 Geologic and Geochemical Setting** - This section provides an overview of the stratigraphy, lithology, and structural setting of the material (ore and overburden) that would be produced from the proposed mining operation. It is supplemented with a geologic map (Figure 6) and geologic sections (Figures 5, 7, and 8) showing the distribution of lithologic units within the planned pit. It also provides quantitative information about the volumes of each lithologic unit that would be produced from the mine.
- **Section 5 Geochemical Setting of the Phosphoria Formation** - This section provides a broad overview of the regional distribution, geologic residence, and environmental mobility of COPCs associated with phosphate mining in southeast Idaho. Phosphate deposits hosted by the Meade Peak Phosphatic Shale Member of the Phosphoria Formation have been the focus of extensive characterization work by the USGS and other researchers during the last 15 years and represent a well-studied class of deposit with well-documented litho-geochemical associations. This section provides the conceptual framework that supports the design of the sampling and testing program completed for the Rasmussen Valley Mine Project.
- **Section 6.1 and Tables 1, 2, 3** - This section and the associated tables provide information about the tonnages and percentages of each material type that would be produced from the pit broken out by the final destination of the material (i.e., placed as backfill or in various external dumps).
- **Section 6.3** - This section provides information about the rational, location, and number of samples that were used for the study. It also discusses the sampling methodology and details related to sample preparation and compositing. It is supplemented by a map (Figure 10) that shows the areal distribution of boreholes used for the study, a series of fence diagrams that correlate the lithology of the samples between boreholes (Figures 10 through 13), and a table (Table 4) that summarizes the footage of material obtained from each borehole. This section is also supported by Appendices A, C, and D, which present geologic cross sections completed at 400-foot intervals through the proposed pit (Appendix A), geologic logs for each borehole used in the testing program (Appendix C), and sample tracking/mass information for each individual sample that was used to generate the A composites submitted for synthetic precipitate leaching procedure (SPLP) testing (Appendix D).
- **Sections 6.5.4, 6.5.5, 6.5.6 and Appendices G, H, I.** - These sections provide documentation about the areal, vertical, and lithologic distribution of COPCs in samples that were used for SPLP testing including sulfur speciation and whole rock elemental content by inductively coupled plasma (ICP) and x-ray fluorescence (XRF) analysis.

The referenced sections of the Baseline Geochemistry Report provide extensive documentation that can be used to evaluate the representativeness and adequacy of the samples used for the testing program. We believe this information to be complete, but would address any specific concerns or omissions that are identified by reviewers.

Letter/Comment: 579/J

Issue: **4d. Commenters note that the sensitivity analysis for the performance of the cap-and-cover design is limited to Ksat (hydrologic conductivity) of the topmost and second layers, thickness of the topmost and second layers, and root growth and depth. It is not clear why the analysis was limited to these parameters. The commenters recommend that a more thorough sensitivity analysis be provided that also includes at least precipitation amount and vegetation cover transpiration rates.**

Response: While the performance of the cap-and-cover system is indeed dependent on several factors, some have more influence than others and can be controlled, while others cannot. For those factors that cannot be controlled, such as precipitation, the best available data were used to develop model input parameters that would represent average, long-term climate conditions based on a 100-year climate data set. It is understood that changes in precipitation amounts could affect the net percolation rate, but using the 100-year average provided the expected precipitation. These parameters were then equally applied to all cover alternatives during the infiltration modeling. For those physical factors that could be controlled, such as layer thicknesses and order, several modeling iterations were performed to identify optimal configurations and develop the cap-and-cover alternatives for further analysis. Through the iterative modeling process, saturated hydraulic conductivity (Ksat) and transpiration were determined to be the most critical parameters in limiting percolation.

The sensitivity analysis referred to in the comment and described in the Rasmussen Valley Mine Plan Cap and Cover Alternatives Analysis Report Addendum 3: Cover Alternative 6 Evaluation (BC 2015a) was intended only to show the sensitivity of the model for cover alternative 6 to the controllable physical parameters (i.e., Ksat and thicknesses of cover layers) and vegetation parameters that reflect the updated reclamation seed mix as well as long-term vegetation conditions (i.e., mature, established vegetation). Table 5 (BC 2015a) presents a summary of the key model input parameters and range of values evaluated. Results of the sensitivity analysis are discussed in the text (BC 2015a).

The transpiration/infiltration model for the Rasmussen Valley Mine used a singular leaf area index (LAI) of 2.0 to estimate possible infiltration simulations. LAI is the total projected one-sided leaf area of a plant per unit area of ground covered; it is a dimensionless measure, as both ground area and plant area are measured in the same units (Naylor-Murphy 2012). The LAI of 2.0 indicates a structurally diverse, multi-layer cover plant community. A grass-dominated plant community typically does not exceed an LAI of 1.0, but can exceed 2.0, while LAI for plant communities with taller forbs and shrubs or trees LAI can exceed 6.0 (Law and Waring 1994). The proposed seed mix for RCA includes 26 species including 13 grasses, six forbs, and seven shrubs, which were selected to create a complex, heterogeneous plant community on the reclaimed areas of the Rasmussen Valley Mine. A plant community with multiple strata and complexity increases interception of precipitation, which can reduce infiltration by 40 to 90 percent under certain circumstances (Dunne and Leopold 1978). An LAI of 2.0 could be considered a conservative estimate for a fully developed plant community near the Rasmussen Valley Mine, but would fluctuate based on the time from seeding and the time of year.

Letter/Comment: 579/K

Issue: **4e. Commenters observe that precipitation modeling does not sufficiently capture the potential range of precipitation and therefore does not adequately predict the performance of the cap. In particular, it is important to understand what may occur during years when precipitation amounts are at their highest. It is recommended that a more reasonable range of precipitation events, including high-runoff events, be evaluated and that the implications for cover performance be discussed.**

Response: Climatic parameters used in the infiltration modeling, including precipitation, temperature, relative humidity, wind speed, and solar radiation from a synthetic 100-year climate dataset, were produced specifically for the Rasmussen Valley Mine Project using the synthetic climate generation software WGEN (Richardson and Wright 1984). For the RCA cover, a 100-year simulation was performed. This simulation included higher and lower precipitation years ranging from 13.02 in/yr up to 37.36 in/yr. The 100-year simulation resulted in an average percolation rate of 0.13 in/yr, with the maximum percolation rate of 1.31 in/yr and a minimum of minus 0.86 in/yr as a result of water moving upwards from the bottom of the cover as a result of evapotranspiration.

Table C-1 and Figures C-6 and C-7 in the Rasmussen Valley Mine Cap and Cover Alternatives Analysis Report Addendum 3: Cover Alternative 6 Evaluation (BC 2015a) show the precipitation variability used in the model and the corresponding net percolation amounts for cover Alternative 6 (RCA Cover C). As would be expected from evaluating the average cover performance over a long-time period, there would be wetter-than-average years when the net percolation would exceed the modeled value, and there would be drier years when the net percolation would be less. As can be seen on Figure C-6, there is an approximate 44 percent chance the net percolation would exceed 0.21 inch in any given year.

The question of how the variation in net percolation rate through the cover affects the underlying groundwater was addressed by O'Kane Consultants in support of the 2008 Smoky Canyon Panels F&G Final EIS. The question arose as to the legitimacy of basing the cover performance solely on the average net percolation for the 100-year period. Comments were made suggesting that the final cover design should also take into consideration any multiple-year pulses that generate significant amounts of net percolation. The results of the report found that the thickness of underlying backfill and geologic layers would effectively dampen any pulses of net percolation from the cover. The model results of the study further showed that the backfill and geologic layers above the aquifer may provide additional storage capacity, which further reduces the amount of percolation reaching the aquifer until the additional capacity is filled. The study concluded that the average net percolation for the 100-year period is a legitimate basis for determining cover performance and input into a fate-and-transport model.

It should be noted that a specific "unacceptable percolation rate" has not been defined. The percolation rate of 2.4 inches mentioned in the comment is for the Proposed Action cover. It was determined to be unacceptable based on results of geochemical fate-and-transport modeling of potential impacts to groundwater and the agencies' understanding that Agrium could design and construct a cover with substantially less net percolation.

It should also be noted that the regional groundwater potentially affected by any COPCs leaching out of the backfill and overburden does not have a nearby connection to surface waters. Also, assuming global climate change, the overall rate of precipitation infiltrating the cover is expected to be lower, resulting in less overall net percolation to the underlying backfill and thus less COPC loading to groundwater.

Letter/Comment: 579/L

Issue: **4f. Commenters observe that Section 3.1.3.2.1 cites a TetraTech document that is difficult to locate. It is recommended that a more accessible alternative source for this information be provided.**

Response: The referenced document is provided in the project record and is readily available to the public and agency reviewers upon request. It is noted that the document, (TetraTech 2008) contains the results of field work and testing for similar mining sites in the area that are not published in other sources.

Letter/Comment: 579/W

Issue: **4g. Commenters recommend that the discussion of Acid-Base Accounting Analysis (Section 3.1.3.3.2 and Table 3.1-7) should point out that acid rock drainage has not been observed in the district and consequently, the percentage of samples was not assessed proportionately to the type of overburden and do not characterize the acid generation potential of the overburden as a whole.**

Response: The following text is from **Section 3.1.3.3.2** of the Draft EIS, and **Section 3.1.3.3.3** of the Final EIS addresses the comment in part:

"ABA results for Rasmussen Valley rocks are consistent with regional data for the Southeast Idaho Phosphate District. Whetstone (2009) compiled the results of 613 tests that were completed for several other phosphate mining sites in the region, including 19 tests from the Enoch Valley Mine, 61 tests from the Dry Valley Mine, 151 tests from the North Rasmussen Ridge Mine, and 382 test from the Smoky Canyon mine and determined that the average regional ANP:AGP ratio was 240:1. The median value of the regional data set exceeded the BLM criterion for material that has low potential to produce ARD by a factor of 10. The regional results and the ABA data from the Rasmussen Valley baseline geochemistry study are consistent with the observation that phosphate mining has occurred in the district for about 90 years with no report of acidic drainage from overburden piles and backfills."

*(*Note that the last sentence in the quoted paragraph has been modified to address **Issue 4h**. It now states: *"The regional results and the ABA data from the Rasmussen Valley baseline geochemistry study are consistent with the observation that phosphate mining has occurred in the district for about 90 years with only isolated reports of overburden associated seepage with pH below 6.0 s.u.")*

It is correct that the baseline geochemistry study did not use a strict proportional weighting scheme that related the number of samples to the volume of overburden. Instead, it used a compositing strategy that generated spatially distributed, length-weighted representative composites for individual testing units in individual boreholes. Text has been added to the geochemistry discussion in **Section 3.1.3.3.1** in the Final EIS to clarify the compositing approach that was used for the baseline study. This includes, but is not limited to the following paragraph:

"The baseline geochemistry study evaluated a total of 4,085 samples from 45 boreholes and nine surface trenches for use in the testing program. The samples were geologically logged and reviewed for adequacy based on location, volume of available material, and completeness of the intersected stratigraphy. Based on this review, material representing 2-foot intervals from five boreholes (629 samples) were analyzed for whole rock elemental content by x-ray fluorescence (XRF), and material from 27 boreholes (2,818 samples) and nine surface trenches (12 samples) were composited to form 158 samples (A-composite samples) that represented a single rock type from each borehole or trench. The A-composite samples were analyzed for elemental content by inductively coupled plasma atomic emission spectroscopy and mass spectrometry (ICP-AES/MS) and leaching characteristics by acid-base accounting (ABA), and synthetic precipitate leaching procedure (SPLP) tests. The number of A-composite samples tested for each rock type is summarized in **Table 3.1-3.**"

Letter/Comment: 579/X

Issue: **4h. Commenters observe that the statement "The regional results and the acid base accounting data from the Rasmussen Valley baseline geochemistry study are consistent with the observation that phosphate mining has occurred in the district for about 90 years with no report of acidic drainage from overburden piles and backfills." needs to cite a reference.**

Response: The sentence has been revised by modifying the last statement in **Section 3.1.3.3.3** of the Final EIS (formerly in the Draft EIS **Section 3.1.3.3.2**) to state: *"The regional results and the ABA data from the Rasmussen Valley baseline geochemistry study are consistent with the observation that phosphate mining has occurred in the district for about 90 years with only isolated reports of overburden-associated seepage with pH below 6.0 s.u."*

Letter/Comment: 579/Y

Issue: **4i. Commenters observe that the SPLP tests use a weakly acidic solution, while the column tests use deionized water, and question if this might underestimate the release of COPCs in the column tests in comparison to column tests using a weakly acidic solution to simulate precipitation. The Final EIS should discuss the impacts to the results of these tests.**

Response: The initial acidity of the synthetic precipitate leaching procedure (SPLP) head solution is unlikely to have significantly affected the chemistry of the resultant leachates. The SPLP head solution (pH 5) was unbuffered, and in most cases was neutralized by contact with carbonate minerals in the tested samples. The resultant leachates exhibited an average pH of 7.9 with a median value of 8.1 and a standard deviation of 1.3. The pH of the head solution for the column test was also unbuffered and weakly acidic (pH 5.9 to 6.4), but less so than the SPLP head solution. Acidity in the head solution for the column tests resulted from contact of the deionized water with atmospheric CO_2. The resultant leachates from the columns exhibited an average pH of 7.5 with a median value of 7.6 and a standard deviation of 0.7. For both test methods, the pH and chemistry of the resultant leachates were dominated by the chemistry of the tested materials.

It is noted that there are many reasons why the results of the SPLP and column tests are not directly comparable. Variations between the contact times, water-to-rock ratios, and air cycling for the two test methods have much greater impact on the chemistry of the leachates than does the initial pH of the head solutions. It is also noted that the concentrations for COPCs in column leachates are typically much higher than those observed in SPLP leachates. Given the difficulty in scaling any type of laboratory testing results to the field environment, the concept that one method or the other "underestimates releases" based on the starting pH of the head solution is an oversimplification of how the data were used and evaluated. There were many other factors considered during the analysis of the data.

The commenter also notes that, in addition to pH, redox conditions are an important control influencing selenium mobility in water. We agree, but note that the measurement and interpretation of redox data carry significant uncertainty. Lindberg and Runnells (1984) evaluated 611 samples of groundwater from diverse geographic areas and found that the Ehs (Redox Potential) calculated for different redox couples present in individual samples yielded values spanning as much as 1,000 millivolts (mV). They concluded that the computed Eh values for various redox couples do not agree with each other, nor do they agree with a single master value, such as that measured by a platinum electrode. This lack of agreement was attributed to the persistence of redox disequilibrium in natural waters, and they state that "*Because of internal disequilibrium, the use of any measured Eh value as input to equilibrium hydrogeochemical computer models would generally yield misleading results*." Runnells and Lindberg also state (1990) that *"it is becoming increasingly clear that the measured "master Eh" of most natural waters at low temperatures is generally meaningless; it neither reflects the overall redox status of the water nor correlates with any of the Eh values that can be calculated from individual redox couples."*

Given the uncertainty associated with the measurement and interpretation of redox potential, the column study used dissolved oxygen (DO) as a general indicator of the redox state of the head solution. Measured DO values for the column test head solution ranged from 4.49 to 5.25 mg/L, and are presented in Appendix L6 of the Baseline Geochemistry Report (Whetstone 2015a). These values indicate that the redox state of the head solution was moderately oxidized. It is noted that the unsaturated columns were also swept with air at a rate of about 0.5 L/m for 3 days during each leaching cycle to promote oxidation of the tested samples. Selenium and some other metals are more mobile in water under oxidizing conditions, but competing reactions (such as the precipitation of Fe^{3+}) may scavenge metals/metalloids from water and affect their concentrations. At best, any evaluation of metal mobility in column leachates based on the redox state of the head solution is qualitative and it should not be assumed that redox species are in equilibrium.

Because of the complex technical nature of this topic, a complete listing of the DO and pH measurements for the column head solution is unlikely to be meaningful to EIS reviewers. However, the method descriptions in **Chapter 4** have been modified to indicate that the head solution (distilled water) exhibited a pH between 5.9 and 6.4 and was from a common reservoir open to the atmosphere. This would allow a knowledgeable technical reviewer to infer that the head solution had moderately oxidizing conditions.

Letter/Comment: 579/AC

Issue: **4j. Commenters note that Figure 4.1-1 shows concentration plots of constituents for 12 leachate cycles of Rex Chert, but that only pH, total dissolved solids (TDS), and iron (Fe) are shown for all 12 cycles. Explain why final data are not presented for the other constituents.**

Response: Final data for the constituents are presented in the Draft EIS. The last paragraph of the Unsaturated Column Construction and Testing Method subsection of **Section 4.1.1.2** of the Draft EIS stated that:

"Leachates from the unsaturated columns were analyzed for an extensive suite of 65 water quality parameters for Cycles 1 through 8 and Cycle 11. A limited suite of parameters (pH, electrical conductivity [EC], alkalinity, TDS, total and dissolved iron) was also evaluated for cycles 9, 10, and 12 (column REX-U1 only)".

Under Unsaturated Column Testing Method in **Section 4.1.1.1.2** of the Final EIS, this description has been modified for clarity to state:

"Leachates for Cycles 0.5 through 8 were monitored for solution parameters (volume, temperature, pH, electrical conductivity [EC], DO, and ORP) at the time of collection and submitted for laboratory analysis of 65 parameters including dissolved and total metals. Column REX-U1 was operated for an additional four cycles after Cycle 8, and leachates for Cycles 9, 10, and 12 were analyzed for solution parameters and total and dissolved iron. The leachate from Cycle 11 was analyzed for solution parameters and the full laboratory suite of 65 parameters."

Letter/Comment: 579/AD

Issue: **4k. Commenters note that, in the numerical model, given the variability of the data, it may not be appropriate to use geomean values. A discussion of how variations in the data summarization might affect the results is needed.**

Response: The geometric mean (geomean) is a meaningful measure for representing the average of numbers on differing scales. The geomean normalizes the scales being averaged so that a larger scale will not dominate the weighting. This idea applies to sample values on an exponential scale. The geomean has been specifically used to report representative values of hydraulic conductivity (Ksat or K_s) in particular, as this soil property varies spatially across a site. According to Benson et al. (2007), "Geometric means are reported for K_s because [it is] log-normally distributed." Benson et al. (2007) base this approach on the work of Russo and Bouton (1992).

Saturated hydraulic conductivity (Ksat) was the sole infiltration model parameter for which data were summarized in the Rasmussen Valley Mine cover modeling using the geomean. Alternative data summaries that could have been used include the arithmetic mean and the median. The ranges of laboratory-reported Ksat values for the materials included in the RCA cover, along with the arithmetic mean, geomean, and median values, are provided below:

- Pit GM: Ksat ranged from 2.10E-06 to 4.40E-03 centimeters per second (cm/sec). The arithmetic mean was 5.83E-04 cm/sec, the median was 2.25E-05 cm/sec, and the geometric mean was 3.59E-05 cm/sec.
- External Area Combined GM and Alluvium/Colluvium Ksat ranged from 1.30E-06 cm/sec to 6.10E-06 cm/sec. The arithmetic mean was 2.80E-06 cm/sec, the median was 2.35E-06, and the geometric mean was 2.51E-06 cm/sec.
- Pit Alluvium/Colluvium Ksat ranged from 3.30E-06 cm/sec to 1.60E-02 cm/sec. The arithmetic mean was 2.13E-03 cm/sec, the median was 9.05E-05 cm/sec, and the geometric mean was 9.96E-05 cm/sec.

Comparison of the geomean with the alternative data summaries provided shows that, while more conservative than the median, the geomean is closer than the arithmetic mean to the median for each of the materials. Thus, the geomean better indicates the skewness of the data toward a certain scale. Also illustrated by the alternative summaries is the very low variability of the External Area Combined GM and Alluvium/Colluvium Ksat. This low variability is particularly important to note because the sensitivity analysis for the RCA Cover C, presented in Attachment E to Addendum 3 of BC (2015a), shows that the Ksat of the External Area Combined GM and Alluvium/Colluvium exerts the primary control on net percolation.

Letter/Comment: 579/AE

TOPIC: 5. AIR RESOURCES, CLIMATE, AND NOISE

Issue: **5a. Commenters observe that the Draft EIS considers ongoing mining operations that are very similar to the proposed mine and determines that the Rasmussen Valley Mine would be a continuation of the existing impacts of those mines, which would have concluded operations before the opening of the Rasmussen Valley Mine. This would result in no increase in impacts to air quality, noise, or climate change over existing conditions and no contribution to cumulative effects.**

Response: These issues are discussed in **Sections 4.2.1.1.1, 4.2.1.2.1,** and **5.2.1.6** of the Final EIS**.**

Letter/Comment: 4/A, 6/A, 7/A, 30/A, 38/A, 54/A, 56/A, 72/A, 79/A, 84/A, 87/A, 89/A, 92/A, 99/A, 106/A, 120/A, 121/A, 126/A, 135/A, 147/A, 152/A, 161/A, 164/A, 179/A, 185/A, 190/A, 192/A, 194/A, 195/A, 228/A, 233/A, 238/A, 239/A, 245/A, 250/A, 251/A, 256/A, 265/A, 267/A, 269/A, 273/A, 275/A, 276/A, 277/A, 278/A, 288/A, 289/A, 296/A, 316/A, 317/A, 320/A, 322/A, 335/A, 346/A, 348/A, 352/A, 353/A, 356/A, 367/A, 370/A, 388/A, 393/A, 396/A, 400/A, 405/A, 417/A, 418/A, 421/A, 425/A, 437/A, 438/A, 450/A, 454/A, 456/A, 484/A, 486/A, 489/A, 492/A, 493/A, 499/A, 500/A, 502/A, 504/A, 511/A, 519/A, 523/A, 525/A, 532/A, 533/A, 584/A, 588/A, 591/A, 592/A, 600/A, 602/A, 638/A, 640/A, 644/A, 649/A, 662/A, 664/A, 669/A, 675/A, 679/A, 681/A, 692/A, 697/A, 701/A, 703/A, 719/A, 724/A, 727/A, 736/A, 741/A, 759/A, 768/A, 769/A, 771/A, 773/A, 787/A, 792/A, 806/B, 815/A, 830/A, 831/A, 834/A, 836/A, 838/A, 844/A, 846/A, 850/A, 852/A, 853/A, 857/A, 874/A, 878/A, 891/A, 911/A, 913/A, 915/A, 919/A, 929/A, 936/A, 941/A, 945/A, 947/A, 951/A, 967/A, 989/A, 999/A

Issue: **5b. Commenters observe that the DEIS discusses the potential for increased greenhouse gas emissions from the mine and its implications for climate change. The Draft EIS concludes that greenhouse gas emissions would not differ from existing conditions. Commenters note, however, that the Draft EIS does not discuss the potential impacts of changing climate on the project. Commenters recommend that the Final EIS include a discussion of the implications of a changing climate on the project and on permanent reclamation features such as the cap and cover.**

Response: Based on data from 1895 through 2011, Mote et al. (2014) have predicted for the U.S. Northwest that: average annual temperatures will increase by up to 9.7 degrees Fahrenheit by 2099; warmer temperatures will reduce winter snowpack in mountains, resulting in an increase in winter runoff and a decrease in spring runoff; changes in annual average precipitation are uncertain and may range from a 10 percent decrease to an 18 percent increase by 2099; and summer precipitation may decrease by as much as 30 percent by the end of the century. The following paragraphs have been added to **Section 4.2.1.1.2** of the Final EIS.

The effects of climate change on the Proposed Action and RCA would be long-term. The U.S. Global Change Research Program (USGCRP) states "Changes in the timing of streamflow related to changing snowmelt are already observed and will continue, reducing the supply of water for many competing demands and causing far-reaching ecological and socioeconomic consequences" (Mote et al. 2014). Current climate models for the northwestern U.S. indicate that warmer winter temperatures will shift the average timing of snowmelt and surface water runoff to earlier in the year. Runoff and infiltration for the proposed cover systems is expected to increase during the winter months and early spring, but will be lower during the late spring and summer. Climate models also predict a 13 percent increase in storms with precipitation greater than 1 inch. This change would increase the average volume of runoff and infiltration generated by individual storms, but it is uncertain if the total volume of runoff and infiltration during an average year would be greater or less than currently predicted. These trends are projected starting several decades in the future and extending to the end of the century. The duration of the project, including initial reclamation, would be

5.8 years for the Proposed Action and 7.1 years for the RCA. Projected changes in climate over this period would are not expected to have appreciable impacts on the operation of the mine or initial reclamation activities.

An increase in precipitation may increase percolation rate and site-related COPC leaching through the proposed cover systems. However, increased infiltration will also increase groundwater flux resulting in greater dilution of leaching COPCs in the underlying aquifer systems. For decrease in precipitation under assumed global climate change, the overall rate of precipitation infiltrating the cover may be lower, but it may be offset by the increased percentage of storms with precipitation of more than 1 inch.

Letter/Comment: 579/P

Issue: **5c. Commenters observe that the potential impacts of fugitive dust, particularly to surface water, are unclear. Commenters recommend that the Final EIS include estimates of the distance that fugitive dust emissions are expected to travel before deposition to evaluate the area of impact and also additional information on the potential for windborne contaminants.**

Response: Typically, fugitive particulate emissions would not travel far from their sources, and the impacts from windborne particulates would be minimal. Under normal conditions, larger particles would settle from the atmosphere and travel shorter distances than the lighter particles. In **Section 3.2.1.1** the National Ambient Air Quality Standards (NAAQS) and IDEQ Air Quality Standards (AQS) are listed as the primary and secondary standards for the primary criteria pollutants including the standards for particulate matter pollution. Agrium would be required to obtain any necessary air permits and must comply with federal and state standards for these permits, as listed in **Table 3.2-1**. Estimated air emission for this project are presented in **Table 4.2-1** and, based on these estimates, a permit to construct (PTC) from the IDEQ would be required based on the Rules for the Control of Air Pollution (Idaho Administrative Procedures Act [IDAPA] 58.1.01.201-228). Agrium would have to comply with the Clean Air Act (P.L. 108-201), the Federal Land Policy and Management Act of 1976 (FLPMA; 43 U.S.C. 1701) administered by the BLM, BLM policies and guidance on the management of air resources (BLM 2016), and any applicable state permit statutes and regulations. Compliance with air statutes is not part of the impact assessment for this EIS. Compliance with the air permit would assure negligible impacts to surface water. Particulate matter may be the most complex pollutant because it is a mixture of dust, dirt, soot, or smoke; varies in size and shape; and can be made up of hundreds of different chemicals.

Larger coarse particles would settle out from the air more rapidly than fine particles and usually would be found relatively close to their emission sources. Fine particles, however, can be transported long distances by wind and weather and can be found in the air thousands of miles from where they originated, but disperse to very low concentrations.

By applying water to project activities that may generate dust, and using suitable vegetative covers on overburden and GM piles as wind barriers, fugitive dust emissions would be reduced. Other mitigation measures, such as lowering haul road speed limits, would also reduce fugitive dust emissions. These measures are all part of the Best Management Practices (BMPs) employed for dust control.

As part of the Environmental Monitoring Plan (EMP) and the Storm Water Pollution Prevention Plan, surface water monitoring would be established by the U.S. Environmental Protection Agency (USEPA) and IDEQ. Results from monitoring may trigger further analysis of the sources of air pollution to the surface water.

Letter/Comment: 579/Q, 623/F

Issue: **5d. Some measure of dust (a threshold) that would trigger the application of water or supplementary dust suppressants should be disclosed.**

Response: As described in Sections 5.2.4 and 6.5.8 of the Rasmussen Valley Mine Project Mine and Reclamation Plan (Agrium 2011), water trucks would be used to apply water to haul roads for dust suppression. Two water production wells would be constructed to provide water for dust suppression at the project. It is anticipated that between 80,000 and 200,000 gallons of water per day would be used through the months of April to November for spraying haul roads and other areas requiring the suppression of dust from mining operations. General mining control measures include watering active particulate dust sources to suppress airborne dust during activities such as loading, stacking, excavating, and hauling. Aggressive fugitive dust control is practiced at Agrium mines. Dust suppression is run on a see/no-see policy. Periodic checks with an opacity measuring device would be used to assure compliance with air quality permit stipulations. If fugitive dust is observed during operations, then dust suppression is initiated. All fugitive dust control procedures would be conducted in accordance with IDAPA rules and approved by the IDEQ.

Letter/Comment: 621/I, 627/D

Issue: **5e. Commenters observe that noise and human activity will disrupt wildlife use and recreational users. There was no analysis of the noise levels with distance from the mining operation and haul roads. Diesel trucks generate noise levels of near 100 dB or greater. Handling, loading, blasting, crushing, and grinding of material can be well above 100 dB; more like 130 dB. Sound levels decay with distance, and it will take many miles to decay to background.**

Response: In **Section 4.2.1.1.3** – Noise Resources, all environmental noise impact issues noted by the commenters have been adequately addressed. The nearest human sensitive receptor is a “seasonal” residence located approximately 0.5 mile to the south of the proposed Rasmussen Valley mining operations. This receptor represents both a residential location and the nearest worst-case outdoor recreational user. The nearest wildlife receptor is an active Greater Sage-grouse lek located approximately 7.8 miles southwest of the Study Area. The lek is on the other side of a mountain range from the project. Equipment noise levels associated with proposed mining operations have been clearly defined in **Table 4.2-3**, which lists worst-case mining operational equipment and related vehicle use based on industry standardized measurements (dBA Lmax) at a distance of 50 feet. The Study Area includes a unique topographic feature which would cause a significant reduction to operational mining noise at all surrounding sensitive receptor locations. The “boxed in” valley feature, surrounded by higher ridges, acts as a balanced natural sound attenuation barrier, where mining operational noise levels would be contained within the valley and diminished beyond the ridges. Moreover, the open land formations that surround the Study Area are known to reduce noise transmission over distance as a result of the ground absorption characteristics associated with this open terrain environment. As shown in **Table 4.2-3**, if mining equipment operations were to be combined, the resultant effects must be “logarithmically” added together to correctly yield a maximum worst-case sound pressure level of approximately 100 decibels A-weighted (dBA) on the valley floor, not 130 decibels. With attenuation resulting from distance and ground absorption, a worst-case combined noise level at the nearest sensitive receptor (“seasonal” residence at 0.5 mile), using the inverse square law of noise propagation, would yield an approximate result of 64 dBA, which is in compliance with the USEPA 24-hour environmental noise exposure level of 70 dBA (USEPA 1974) as described in **Section 3.2.2.2**. Furthermore, the Diamond Flat meteorological station has documented a dominant southwestern wind pattern. This weather station, located far east of the proposed Study Area, may not clearly represent the exact micro-climate conditions within Rasmussen Valley. Nevertheless, given the location of this meteorological station, it is safe to assume that within the Study Area the dominant wind pattern would carry mining operational noise levels to the southwest. However, this is in the direction of the nearest active Greater Sage-grouse lek at a distance of 7.8 miles. The noise section clearly concludes that, under this prevalent weather condition, the Greater Sage-grouse would be protected by distance along with sufficient beneficial topography associated with the Fox Hills and the Wooley Range, thus blocking the sights and sounds of all proposed mining operations during critical breeding and nesting seasons.

Letter/Comment: 626/D

TOPIC: 6. WATER RESOURCES

Issue: **6a. Commenters observe that the RCA includes improved measures to protect water resources including elimination of permanent external overburden piles, elimination of mining below the water table, and elimination of eight stream crossings by not using the haul road across the floor of Rasmussen Valley.**

Response: Potential impacts to water resources under the RCA, and the measures to be implemented to minimize those impacts, are discussed in **Sections 4.3.1.2** and **4.3.4.**

Letter/Comment: 2/A, 29/A, 86/A, 94/A, 98/A, 115/A, 119/A, 160/A, 162/A, 226/A, 287/A, 305/A, 308/A, 365/A, 381/A, 386/A, 412/A, 434/A, 444/A, 460/A, 515/A, 610/A, 611/A, 630/A, 657/A, 674/A, 677/A, 684/A, 686/A, 693/A, 695/A, 702/A, 704/A, 710/A, 721/A, 735/A, 748/A, 751/A, 786/A, 802/B, 811/A, 848/A, 861/A, 875/A, 880/A, 885/A, 903/A, 909/A, 934/B, 952/A

Issue: **6b. Commenters recommend that the EIS more clearly describe the intensity of impacts of each alternative to water resources and clearly compare the intensities. It is also recommended that the EIS include a clear discussion in the beginning of the document of whether or not the Proposed Action can comply with federal, state, and local regulations. The conclusions regarding surface water and groundwater impacts seem to characterize a Proposed Action that could be permitted, which may not be the case.**

Response: The sections on water resource impacts have been revised to more clearly compare the intensities of the Proposed Action and the RCA, explain how each does or does not comply with the federal, state, and local regulations, and determine whether the Proposed Action could be permitted.

Regarding whether the Proposed Action could or could not be permitted, the EIS does not determine if an activity can or cannot be permitted. It is the responsibility of the agencies having regulatory authority over specific activities and resources who determine the issuance of permits for those activities and resources. The fate-and-transport modeling of the Proposed Action predicted water quality standard exceedances in shallow and regional groundwater, beyond the mine disturbance boundary, beyond the Federal Lease boundary, and onto private property in some areas. These results triggered the need for Agrium to obtain a POC determination before mining could commence. As part of the process of setting POCs for this project, the applicant must demonstrate that the project has applied BMPs to the maximum extent practical. Agrium conducted and produced a Best Management Practices Analysis that included a detailed alternatives analysis to the IDEQ. See response to Issue 6g. The result of this analysis revealed that eliminating the downslope external overburden piles and improving the performance of the backfill and overfill cover could substantially reduce the extent and magnitude of the COPCs in groundwater exceeding water quality standards to the extent that an acceptable POC determination could be obtained.

Letter/Comment: 579/A

Issue: **6c. Commenters recommend that the EIS discuss the direct, indirect, and cumulative effects of activities to impaired stream segments. The model presented in the Draft EIS predicts that increases of selenium in stream concentrations in the Blackfoot River Reach 3 (303(d) listed) would be approximately the same as the method detection limit and therefore would not be measurable. The Draft EIS also states that impacts to the Blackfoot River would be minor and long-term. The Draft EIS also does not address the potential contribution of runoff or potential groundwater contributions. The discussion does not adequately capture the degree of impacts.**

Response: The listed 303(d) stream segments in the Study Area and Cumulative Effects Area (CEA) are summarized in **Section 3.3.1.1** and shown on **Figure 3.3-5** of **Chapter 3**. The EIS comprehensively discusses the potential direct and cumulative impacts to these listed segments in numerous locations in **Chapter 4** (direct impacts) and **Chapter 5** (cumulative impacts). Direct runoff from disturbed areas and mine facilities would be captured and would not be allowed to enter streams or wetlands under the Proposed Action or the RCA. Any contact-water sediment basins not within the pit footprint will be constructed to limit percolation into the alluvial aquifer using synthetic or compacted natural materials subject to BLM approval before construction. The contact water would be allowed to evaporate or would be pumped into the mine pit where it could be combined with stormwater runoff within the pit. Discussions of the water management practices designed to prevent contaminated runoff from entering surface water under the Proposed Action and RCA are presented in **Section 4.3.1.1.1** and **4.3.1.2.1**. Because runoff from disturbed areas and mine facilities would not be allowed to enter streams, no impacts to water quality from this mechanism are predicted. Potential changes in the volume of water available to streams from the Proposed Action and RCA are discussed in **Sections 4.3.1.1.4** and **4.3.1.2.5**. Cumulative effects related to changes in runoff from the Proposed Action and RCA are discussed in **Section 5.3.5**. Direct and cumulative impacts to surface water from contaminants transported in groundwater have been extensively analyzed and discussed in the EIS. Potential changes in surface water quality (COPC loading) from interaction with contaminated groundwater have been directly simulated and quantified by the numerical groundwater model and are shown in **Tables 4.3-12** and **4.3-13**. There are also thorough discussions of water quality impacts from groundwater contributions to streams in **Sections 4.3.1.1.4, 4.3.1.2.5,** and **5.3.5**. The criticism that the EIS does not address the potential contribution of runoff or potential groundwater contributions to 303(d) listed streams is not supported by review of the analysis presented in the document.

Letter/Comment: 579/B

Issue: **6d. Include a statement in the Executive Summary about the potential effects of the Proposed Action to 303(d) listed waters. It should be made clear early in the document that some of the surface waters being impacted are already 303(d) listed for selenium and that the Proposed Action would result in an increased loading of selenium, in violation of the Clean Water Act.**

Response: The discussion in the Executive Summary has been expanded to address the potential effects of the Proposed Action to 303 (d) listed waters. The following wording has been added to the first paragraph of **Section ES 4.3.3**:

Blackfoot River and Angus Creek are 303(d) listed streams for selenium near Rasmussen Valley requiring no measurable increase in the selenium concentrations in these listed stream segments from the mining activities. The Proposed Action would result in minor to moderate, local, and short-term and long-term impacts to surface water quality. The potential for impacts to these streams is discussed in **Section 4.3.1.1.4**."

Letter/Comment: 579/C

Issue: **6e. The selenium discussion in water quality describes USGS sampling for the Upper Blackfoot River since May 2001 and synoptic sampling every May. The sampling events are not specified, and it appears from the discussion that sampling has occurred only in May. However, the text also states that exceedances are "mostly in May," implying that sampling has also occurred in other periods. Additional details should be provided regarding surface water characterization, and the timing of sampling should be made clear.**

Response: The referenced section (first three paragraphs of **Section 3.3.1.2.1**) has been revised for the Final EIS to more clearly summarize the work by Mebane et al. (2015) and IDEQ. The expanded discussion for Mebane et al. 2015 indicates that an automatic sampler was used at U.S. Geological Survey (USGS) Station 13063000 to collect surface water samples based on the stage of the river, and that the samples were collected from late March or early April through mid-September to late October with approximately 80 percent of the exceedances being observed in May, and the remainder being observed in April (17 percent) and June (3 percent). Description of the spring synoptic surface water sampling events by IDEQ has been modified to more clearly indicate the timing of the monitoring events and differentiate IDEQ data from data reported by Mebane et al. 2015.

Letter/Comment: 579/D

Issue: **6f. Commenters recommended that the EIS should quantify the effects at the South Rasmussen Mine pit and include a figure illustrating the additional groundwater plumes. The quantitative assessment of effects should include relevant information on modeled predictions at the South Rasmussen Mine site.**

Response: A more complete summary of the P4 South Rasmussen groundwater modeling has been added to **Section 4.3.1.2.4**, including a quantitative assessment of modeling predictions. Additionally, a new **Figure 4.3-23** showing the P4 modeling predictions has been included to compare the P4 plume under the Proposed Action (no backfill from Rasmussen Valley Mine in P4 pit) versus the RCA (backfill from Rasmussen Valley Mine in the P4 pit).

Letter/Comment: 579/E

Issue: **6g. Commenters recommended that the EIS should include additional discussion of the need and process for POCs at the Rasmussen Valley Mine. It appears that the Proposed Action and the RCA would both exceed groundwater quality standards and, therefore, POCs would be necessary to comply with the Groundwater Quality Rule.**

Response: Mining activities must comply with state requirements, such as the *State Policy on Environmental Protection* (Idaho Code §39-102), the *Idaho Ground Water Quality Protection Act* (the Act; Idaho Code §39-120(1)), and the *Idaho Ground Water Quality Plan* (1996). The Act was enacted to include the *State Policy on Environmental Protection*, which states: “it is the policy of the state to prevent contamination of ground water from any source to the maximum extent practical” (Idaho Code §39-102(3) (a)) and “all persons in the state should conduct their activities so as to prevent the nonregulated release of contaminants into the ground water” (Idaho Code §39-102(3) (c)).

The Act provided for the development of an *Idaho Ground Water Quality Plan* (Plan), which was approved by the Idaho legislature in 1992 and later revised in 1996 to include the Agricultural Ground Water Quality Protection Program for Idaho.

Ground Water Protection Policy I-B of the Plan states: “the policy of the state of Idaho is that existing and projected future beneficial uses of ground water shall be maintained and protected, and degradation that would impair existing and projected future beneficial uses of ground water and interconnected surface water shall not be allowed.” In part, the intent of Ground Water Protection Policy I-B is to “ensure that the quality of ground water that discharges to surface water does not impair identified beneficial uses of the surface water.”

Ground Water Quality Prevention Policy II-C of the Plan states: “the policy of the state of Idaho is to protect ground water and allow for the extraction of minerals above and within ground water. Mining, by its very nature, may use ground water and impact ground water quality in a localized area. The localized contamination may result in ground water being unavailable for other beneficial uses at the site. The intent of the *Ground Water Quality Plan* is to strike a balance between ground water and mineral resources; both of which are vital to the State. The Ground Water Quality Plan directs the Department, in cooperation with other appropriate agencies, to develop guidelines, management practices, and rules to ensure that mining projects comply with the *Ground Water Quality Plan"* (1992, as amended 1996).

The Idaho Ground Water Quality Rule (Rule), Section 401, Mining, authorizes the Department to establish POCs, typically monitoring wells, that will allow mining while ensuring there is no injury to current or projected future beneficial uses of groundwater outside the mining area, and there is no violation of surface water quality standards to any interconnected surface water. Furthermore, the Department shall require groundwater monitoring that represents background groundwater quality and the groundwater quality passing through the POC(s) to determine compliance with groundwater quality standards or effectiveness of BMPs. In some cases, the mine operator may be required to submit for the Department's review and approval a work plan for determining the baseline/background concentration of their mine site.

Mine operators requesting a POC determination must provide a written application. An acceptable application will provide sufficient information to support and demonstrate that there will be no injury to current or projected future beneficial uses of groundwater outside of the mining area, and there is no violation of water quality standards to any interconnected surface waters.

The POC application must provide:

a. The hydrogeological characteristics of the mining area and surrounding land, including any dilution characteristics of the aquifer and any natural attenuation supported by site-specific data

b. The concentration, volume, and physical and chemical characteristics of contaminants resulting from the mining activity, including the toxicity and persistence of the contaminants

c. The quantity, quality, and direction of flow of ground water underlying the mining area

d. The proximity and withdrawal rates of current ground water users

e. A prediction of projected future beneficial uses

f. The availability of alternative drinking water supplies

g. The existing quality of the ground water, including other sources of contamination and their cumulative impacts on the ground water

h. Public health, safety, and welfare effects

The mine operator seeking a POC should conduct and submit a BMP determination to the Department for approval. The BMP determination uses the site conceptual model to evaluate different mining BMPs and best practical methods (BPMs) in order to select the most appropriate methods for the protection of groundwater resources to the maximum extent practical. The BMP determination report should be presented to the Department in an alternatives evaluation format. The report should include the following:

- Regional setting and land use(s)
- A summary of surface water bodies, geology, and hydrogeology within a 1-mile radius of the mine
- A discussion of existing and projected beneficial uses of groundwater at the mine and surrounding properties

- A detailed alternatives analysis of operational and post-mining BMPs and BPMs for all potential groundwater contaminant sources including, but not limited to ore stockpiles, waste rock storage areas, pits, storm water retention ponds, sediment basins, and haul roads
- Recommendations for BMPs and BPMs that will be used at the mine.

An EIS alternatives analysis may substitute for the BMP determination.

BMPs will be evaluated and approved by IDEQ with other federal and state agency participation, through the POC process as stated in IDAPA 58.01.11.401.

As part of the application of the POC process Agrium has obtained a POC determination from the IDEQ (the Department) for RCA.

A groundwater monitoring plan for the POCs and any required indicator wells must be approved by the Department. The monitoring plan shall include, but is not limited to, a sampling and reporting schedule, analyte list, well sampling procedures, and a description of the process for development of site background concentrations. If new wells are necessary, a well installation plan describing well locations, drilling method (s), anticipated well depths, construction details, and development methods will also need to be approved by the Department.

The effectiveness of the approved BMPs will be continually assessed through the required groundwater quality sampling of POC monitoring and indicator wells.

The modeling outputs for the Proposed Action and the RCA both predict levels of concentrations above the Idaho Groundwater Quality Standards directly downgradient from the mining area. The Idaho Groundwater Quality Rule (IDAPA 58.01.11.401) allows mining operators to apply for POCs. If an operator fulfills the application process to IDEQ, then the IDEQ is authorized to make a determination of the location of POCs, defining the mining area beyond which water quality standards must be met in order to protect beneficial uses.

Because the RCA represents a collection of BMPs that have been deemed to be the “maximum extent practical” for the project, this is the alternative which Agrium has proposed in their POC application and the alternative which demonstrates that beneficial uses are being protected.

The regulatory framework language has been expanded in **Section 3.3.2.3.1** of the Final EIS. In addition, a statement has been added to **Section 4.3.4** that the Proposed Action and the RCA are both predicted to exceed groundwater quality standards and, therefore, POCs would be necessary to comply with the Groundwater Quality Rule.

Letter/Comment: 579/F

Issue: **6h. Commenters recommend that the EIS should provide information regarding P4's POCs at the South Rasmussen Mine and identify the party responsible for compliance (including sampling, monitoring, and reporting) to ensure that groundwater and surface water quality are protected.**

Response: The groundwater monitoring for P4’s South Rasmussen Mine POC will be the responsibility of P4. This includes monitoring for groundwater impacts resulting from the Rasmussen Valley Mine overburden placed in the South Rasmussen Mine pit. Additional discussion about the POC process for the South Rasmussen Mine has been added to **Chapters 2**, **3**, and **4** of the Final EIS. See Response to previous Comment 6G.

Letter/Comment: 579/G

Issue: **6i. Commenters observe that Ksat (hydrologic conductivity) values for soils are an important input parameter for modeling infiltration and seepage and estimating loading to groundwater and surface water. However, the discussion presents a wide range in the Ksat values, and it is unclear how representative these are of the geomean conditions that might be expected in the field. Commenters recommend that additional information be provided on hydrologic conductivity and the methods used in reaching the conclusions that are presented.**

Response: The net percolation of the selected cover is primarily controlled by the hydraulic properties of the combined external areas alluvium/colluvium and GM and the transpiration capability of the vegetation. The data presented on Figure C-2 show that variability in the hydraulic conductivity of these two materials is considerably less than one order of magnitude, and that the geometric mean provides a valid measure of this property for inclusion in the model. Although the pit GM hydraulic conductivity data do span over three orders of magnitude, the sensitivity analyses presented in BC 2015a show that modeled estimates of net percolation are relatively insensitive to changes in this parameter when the material is used for the top 1-foot layer. As stated in BC 2014d, the geometric mean is a valid means of assessing the average of values that span multiple orders of magnitude. The hydraulic conductivity of pit GM may indeed vary over the range indicated on Figure C-1, but because of its location as the top 1-foot layer, and the effectiveness of the deeper layers, the net percolation is expected to be represented appropriately in the cover simulations.

Letter/Comment: 579/M, 627/J

Issue: **6j. Commenters observe that the sensitivity analysis considered only root growth depth. Commenters recommend that additional input values for vegetation be considered in the model, such as root depth over time, root distribution, leaf area index, and wilting point. The rationale for selecting values used in the model should also be discussed.**

Response: Conservative values were selected for model input parameters related to properties of plant growth on the revegetated overburden cover alternatives. For example, because the cover profile was 6 feet deep, a triangular root distribution was selected as being more representative of a soil profile containing both the short-rooted grasses and forbs and the longer-rooted shrubs. The alternative rectangular root distribution would be more representative if short-rooted sod-forming plants were the only species allowed to grow on the cover. The cover was modeled as if it were a mature cover because that is what is expected to be the condition over the 100 years that the cover was modeled and to represent the long-term climatological data used for modeling. As described in response to comment 4e, the increased percolation rate expected during the first few years before the vegetation has reached maturity is expected to be dampened out by the underlying overburden and geologic layers, resulting in the average long-term percolation rate dominating the fate-and-transport results.

The transpiration-infiltration model for the mine used a singular LAI of 2.0 to estimate possible infiltration simulations. LAI is the total projected one-sided leaf area of a plant per unit area of ground covered; it is a dimensionless measure as both ground area and plant area are measured in the same units (Naylor-Murphy 2012). The LAI of 2.0 indicates a structurally diverse, multi-layer cover plant community. A grass-dominated plant community typically does not exceed an LAI of 1.0, but could approach 2.0 (Law and Waring 1994). With taller forbs and shrubs or trees, the LAI can exceed 6.0. The proposed seed mix for RCA includes 26 species including 13 grasses, six forbs, and seven shrubs, which were selected to create a complex, heterogeneous plant community on the reclaimed areas of the mine. A plant community with multiple strata and complexity increases interception of precipitation, which can reduce infiltration by 40 to 90 percent under certain circumstances (Dunne and Leopold 1978). An LAI of 2.0

could be considered a conservative estimate for a fully developed plant community near the mine, but would fluctuate based on the time from seeding and the time of year. As described above, the fluctuations are expected to be dampened out by the underlying overburden and geologic layers before the percolation reaches the groundwater.

The model was used to simulate long-term conditions of the cover system. While changes in root depth over time would have some effect on the modeled cover performance over the first few years of plant development, it does not represent the mature vegetation that is representative of those long-term conditions.

Wilting point is defined as the moisture content below which plants cannot effectively transpire. Simulations conducted for the project soil moisture content used the defined 1,500 Kilopascals of suction pressure for the wilting point. This value is representative of the types of plants acclimated to this climate and used in the revegetation seed mix. When soil moisture conditions approach the wilting point during the driest portion of the summer months, the moisture content and corresponding unsaturated permeability of the soil are so low that little water movement occurs in the soil profile, resulting in net percolations near zero or even negative (upward). Changing the wilting point to a lower matrix potential only decreases the potential for percolation, while soil matrix potentials higher than negative 1,500 Kilopascals is not representative of the plants that grow in the area. It should be noted that warming and drier conditions resulting from potential climate change would result in plants with wilting points at even lower matrix potentials, resulting in even less water available to percolate through the cover.

Letter/Comment: 579/N

Issue: **6k. Commenters note that there are several assertions (e.g. pages 3-47, 4-73 and 4-74) that portions of Angus Creek and Blackfoot River-Reach 1 are losing segments under baseflow conditions in August, September, and October. These observations are based on a seasonally isolated dataset and exclude high-flow data. The observed conditions may not be representative of other seasons or of most flow conditions for these drainages. Commenters recommend clarification of this information.**

Response: By design, gain-loss surveys are intended to evaluate surface water-groundwater interaction under base flow conditions. It would be inappropriate to include high-flow data for this evaluation. Although the discussion at the end of **Section 3.3.1.1.1** (Surface Water Monitoring - Blackfoot River) clearly describes the conditions under which the gain-loss surveys were performed, the following statement has been added to the end of the paragraph: "The measured gains and losses on Blackfoot River represent late summer and fall baseflow conditions and may not be representative of gains or losses during spring runoff…"

The hydrographs presented on **Figures 3.3-6** and **3.3-7** indicate that high-flow conditions for Blackfoot River typically extend from May through July, a period of 4 months. Beginning in August, flows in the river typically approach baseflow conditions that persist through the winter, a period of 8 months. The measured flows in August, September, and October are therefore considered to be representative of flow conditions in the river during the majority of the year.

The discussion in **Section 3.3.2.3.2** (Baseline Groundwater Quality) is nuanced and states that baseline data indicate that Angus Creek is a losing stream over its length under most flow conditions. This is consistent with low-flow data presented in **Table 3.3-5** and monitoring data from other times of the year which indicate that patterns of flow in Angus Creek have the same seasonality that is observed for Blackfoot River. The section also discusses that numerical modeling suggests Angus Creek may gain 0.01 cubic feet per second (cfs) in Reach 2 above its confluence with Blackfoot River and further indicates that the streams' interaction with groundwater in the hyporheic zone is complex. The section is considered to be well balanced in the context of the discussion about the contaminant fate-and-transport model and appropriately reflects the uncertainty associated with the modeling assumptions. It is noted that the contaminant fate-and-transport model uses the most conservative assumption presented in the discussion (i.e., that Reach 2 of Angus Creek gains about 0.01 cfs from groundwater) and therefore indicates that Angus Creek could be impacted by COPCs transported shallow groundwater.

The following statement has been added to **Section 3.3.1.1.5:** "The measured gains and losses on Angus Creek represent late summer and fall baseflow conditions and may not be representative of conditions during spring or early summer."

Letter/Comment: 579/Z, 579/AL, 1014/Q

Issue: **6l. Commenters observe that Figure 4.3-21 South Rasmussen Ground Water Domain and Figure 4.3-22 Modeled Se Plume in the Wells Formation are difficult to compare because they are at different scales and because the features at the South Rasmussen Mine (e.g., pit and pit fill boundaries) are not shown.**

Response: **Figures 4.3-21** and **4.3-22** (now **Figure 4.3-23** in the Final EIS) have been revised for clarity and easier comparison.

Letter/Comment: 579/AB

Issue: **6m. Commenters note that the discussion of vegetation properties in the numerical models needs a context discussion about how the diverse sources that are cited were used to decide which values to use in the model.**

Response: The reference "Iio and Ito 2014" is included in the reference section of the Draft EIS. The sources listed assisted in determining LAI and transpiration rates for infiltration and seepage modeling. All sources were helped to determine estimated vegetation values used in the model. These references are scientifically valid, and are consistent with sources used for similar model simulations.

The transpiration/infiltration model for the Proposed Action used a singular LAI of 2.0 to estimate possible infiltration simulations. LAI is the total projected one-sided leaf area of a plant per unit area of ground covered; it is a dimensionless measure as both ground area and plant area are measured in the same units (Naylor-Murphy 2012). The LAI of 2.0 indicates a structurally diverse, multi-layer cover plant community. A grass dominated plant community typically does not exceed an LAI of 1.0, but may reach 2.0. With taller forbs and shrubs or trees the LAI can exceed 6.0 (Law and Waring 1994). The proposed seed mix for the RCA consists of 26 species including 13 grasses, six forbs, and seven shrubs, which were selected to create a complex, heterogeneous plant community on the reclaimed areas of the mine. A plant community with multiple strata and complexity increases interception of precipitation, which can reduce infiltration by 40 to 90 percent under certain circumstances (Dunne and Leopold 1978). An LAI of 2.0 could be considered a conservative estimate for a fully developed plant community near the mine, but would fluctuate based on the time from seeding and the time of year.

Because of concerns about the risk of plants uptaking selenium if their roots penetrate the backfill and overburden below the cap-and-cover system, Great Ecology (a consultant to Agrium) identified the effective rooting zone, maximum rooting depth, and root structure of potential reclamation species. A literature review was conducted to determine if species had roots that extended beyond 24 inches with the potential to penetrate to a depth of 60 inches of soil. The focus was on the effective rooting zone because this is where the majority of roots actively take up water and nutrients (Evans et al. 1996). The effective rooting zone is a better representation of the likely concentration of roots than the known maximum root depth because roots would only penetrate to areas where there are needed resources, such as water and nutrients

(Harris 1977). The maximum rooting depth is the rooting depth of a plant when grown in moist soil with no barriers or restrictions that inhibit root elongation (Evans et al. 1996). The selenium uptake potential of these species was also evaluated to understand the risk of selenium movement into the food web if plant-available selenium were found in the GM or potential cap layer. The evaluation used selection criteria to restrict or eliminate species from the seed mix that had longer roots if there was also a likelihood of selenium uptake that would exceed acceptable standards. The cap-and-cover system that is currently proposed, paired with the proposed seed mix would effectively prevent the movement of selenium to the surrounding areas or regional wildlife. The use of grasses and forbs with sod-forming shallow root systems and shrubs with longer roots in the proposed seed mix dictated the use of a 3-foot-deep triangular root geometry rather than a shallower rectangular root geometry more typical of only sod-forming grasses and forbs.

Letter/Comment: 579/AF

Issue: **6n. Commenters state that it is unclear how using different vegetation covers would affect the infiltration and seepage modeling. It is not clear what density of grass cover is being used in the model simulations and how representative this would be of the eventual vegetation cover.**

Response: Density of vegetation cover is represented in the SVFlux model by the LAI parameter. The density of the vegetation cover is incorporated into the LAI, which is typical of the cover that was modeled. The LAI is the ratio of total projected one-sided leaf area of a plant per unit area of ground covered. For example: 1 square inch of leaf surface over 1 square inch of ground surface would result in an LAI of 1.0. Because the LAI is a ratio, it is a dimensionless measure (Naylor-Murphy 2012). A grass dominated plant community typically does not exceed an LAI of 1.0, but a multistoried cover with taller forbs and shrubs or trees can exceed an LAI of 6.0 (Law and Waring 1994).

The proposed seed mix for the RCA (the preferred alternative) consists of 26 species including 13 grasses, six forbs, and seven shrubs, which were selected to create a multistoried, complex, and heterogeneous plant community on the reclaimed areas of the mine. To represent this cover, an LAI of 2.0 was selected. An LAI of 2.0 is a conservative estimate for the fully developed preferred alternative seed mix. The LAI is based on leaf surface area of the vegetation, not the plant species (it is noted that differing plant species will have different leaf surface area). Therefore, it is the proportions of grasses, forbs, and shrubs (and subsequently the evapotranspiration [ET] function of the model) that is the controlling variable for selecting the LAI and not the particular species per se. ET within the model will function the same regardless of the particular species included in the seed mix. The model would generate more water lost to ET and less water to percolate with higher LAI input value.

The particular species and mix of grasses, forbs, and shrubs were carefully selected to reestablish, to the best extent practical, the natural vegetative diversity found at the site. The preferred alternative seed mix has a high seeding rate and greater species diversity than is typically applied to reclamation in this region, which has been thoroughly vetted and approved by USFS Forest Botanist and District Ranger to meet reclamation cover objectives. Given that the preferred alternative seed mix is a mixture of grasses, forbs, and shrubs, the LAI will clearly be higher than 1.0 and could potentially reach an LAI of 3.0 or more. Achieving a mature multistoried plant community on the reclaimed mine site with an average leaf area to ground area ratio of 2.0 was determined to be reasonable if not conservative.

Letter/Comment: 579/AG

Issue: **6o. The supporting study for the discussions of percolation rate show large seasonal variations in percolation and runoff, but Table 4.3-3 lists average annual values. Commenters recommend that additional information should be added that conveys the wide seasonal variability.**

Response: Data presented in a revised **Table 4.3-3** (below) provide ranges in annual average values in inches. Details on seasonal variations are included in Appendix G of the Final Cap and Cover Alternatives Analysis Report (BC 2015a).

Table4.3-3 SVFlux Modeling Results for the Proposed Action and the RCA Covers

Cover	Precipitation (inches)	Sublimation (inches)	Runoff (inches)	Evaporation (inches)	Transpiration (inches)	Change in Storage (inches)	Net Percolation[3] (inches)
Proposed Action[1]							
Range of Monthly Values	0.01 to 4.37	0.00 to 0.86	0.00 to 1.15	0.00 to 2.22	0.00 to 2.56	3.84 to 3.80	0.39 to 2.37
Yearly Total	23.44	2.82	1.4	10.7	6.18	0.00	2.40
RCA Cover C[2]							
Range of Monthly Values	0.01 to 4.37	0.00 to 0.86	0.00 to 1.97	0.00 to 2.21	0.00 to 3.19	-3.90 to 2.97	-0.33 to 0.11
Yearly Total	23.44	2.82	3.47	10.66	6.41	0.02	0.14

Notes:

1 The Proposed Action Cover would consist of 2 feet of pit GM over 3 feet of non-Meade Peak overburden

2 The RCA cover would consist of 1 foot of pit GM atop 2 feet of either external alluvium or external GM, underlain by 3 feet of pit alluvium

3 The modeled RCA Cover C net percolation was multiplied by 1.5 (i.e., increased 50%) for the fate-and-transport modeling to account for expected increases in percolation as a result of cover weathering and soil structure development

Letter/Comment: 579/AH

Issue: **6p. Commenters recommend that the discussion of numerical models should include the expected time period for vegetation to reach fully mature root systems.**

Response: "Fully mature root systems were assumed for each cover system. In general, grasses reach maturity in 2 to 5 years, forbs in 1 to 2 years, and shrubs in 5 to 10 years."

"For the species that were considered in the seed mix, typical maturity timelines for grasses is 2 to 5 years (Bender et al. 2000, Baer 2003, Sheley et al. 2008), forbs is 1 to 2 years (Bender et al. 2000), and shrubs is 5 to 10 years (Paschke et al. 2003)."

Letter/Comment: 579/AI, 626/B

Issue: **6q. Commenters note that the discussion of numerical models assumes that the starting concentrations of COPCs are zero. To understand the cumulative effects, the total expected concentrations (existing conditions plus mine contributions) should also be presented.**

Response: **Table 4.3-6** was added to **Section 4.3.1.1.3** for the Proposed Action and **Table 4.3-16** was added to **Section 4.3.1.2.4** for the RCA (see below) to show the predicted total groundwater concentrations of COPCs at established groundwater monitoring well locations. It is explained that the predicted total concentrations of COPCs are the modeled maximum concentrations plus the existing baseline concentrations. The predicted concentrations are the sum of the statistically derived baseline concentrations at each monitoring location and the additional load predicted by the contaminant fate-and-transport model. The discussions for the Proposed Action and RCA have also been revised to better reflect the predicted impacts with consideration of the existing baseline groundwater chemistry.

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Table 4.3-6 Predicted Total Groundwater Concentrations of COPCs for the Proposed Action

		Aluminum	Antimony	Cadmium	Copper	Iron	Manganese	Nickel	Selenium	Sulfate	TDS	Thallium	Uranium	Zinc
Idaho Groundwater Standard		0.2[2]	0.006[1]	0.005[1]	1.3[1]	0.3[1]	0.05[2]	0.0520[3]	0.05[1]	250[2]	500[2]	0.002[1]	0.030[4]	5[2]
MW-6A	Baseline (Mean) Concentration (mg/L)	0.524	0.000	---	0.001	0.363	0.190	---	0.001	6.864	242.000	---	0.001	0.008
	Modeled Maximum Concentration (mg/L)	0.047	0.003	0.021	0.002	0.042	2.500	0.928	1.132	1401.467	2357.820	0.002	0.025	1.601
	Predicted Maximum Concentration (mg/L)	0.571	0.003	0.021	0.003	0.405	2.690	0.928	1.133	1408.330	2599.820	0.002	0.026	1.609
MW-8A	Baseline (Mean) Concentration (mg/L)	---	---	---	---	0.097	0.197	---	---	4.380	119.500	---	---	---
	Modeled Maximum Concentration (mg/L)	0.004	0.001	0.002	0.000	0.004	0.101	0.092	0.235	76.486	127.762	0.000	0.002	0.179
	Predicted Maximum Concentration (mg/L)	0.004	0.001	0.002	0.000	0.101	0.298	0.092	0.235	80.866	247.262	0.000	0.002	0.179
MW-9A	Baseline (Mean) Concentration (mg/L)	0.116	---	0.000	0.001	0.145	0.021	---	0.001	6.045	179.278	---	0.000	0.004
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.116	0.000	0.000	0.001	0.145	0.021	0.000	0.001	6.045	179.278	0.000	0.000	0.004
MW-10D	Baseline (Mean) Concentration (mg/L)	0.039	---	---	---	0.324	0.298	---	---	126.258	416.333	---	0.001	---
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.039	0.000	0.000	0.000	0.324	0.298	0.000	0.000	126.259	416.334	0.000	0.001	0.000
MW-4R	Baseline (Mean) Concentration (mg/L)	0.051	---	---	0.001	2.275	0.319	0.028	---	30.595	220.857	---	0.001	0.027
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.068	0.119	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.051	0.000	0.000	0.001	2.275	0.319	0.028	0.000	30.663	220.976	0.000	0.001	0.027
MW-5R	Baseline (Mean) Concentration (mg/L)	0.030	---	---	---	0.227	0.086	0.012	0.000	21.864	334.833	---	0.001	0.005
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.057	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.030	0.000	0.000	0.000	0.227	0.086	0.012	0.000	21.894	334.890	0.000	0.001	0.005
MW-11R	Baseline (Mean) Concentration (mg/L)	0.026	---	---	---	0.451	0.559	---	---	44.120	342.000	---	0.000	0.040
	Modeled Maximum Concentration (mg/L)	0.004	0.000	0.002	0.000	0.003	0.126	0.047	0.058	72.013	122.329	0.000	0.001	0.080
	Predicted Maximum Concentration (mg/L)	0.030	0.000	0.002	0.000	0.454	0.685	0.047	0.058	116.133	464.329	0.000	0.002	0.120
MW-14R	Baseline (Mean) Concentration (mg/L)	---	---	---	---	0.475	0.114	---	0.000	26.669	232.667	---	0.000	0.003
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.049	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.475	0.114	0.000	0.000	26.697	232.716	0.000	0.000	0.003
MW-1W	Baseline (Mean) Concentration (mg/L)	0.081	---	---	0.000	0.301	0.110	---	---	21.400	285.000	---	0.002	0.048
	Modeled Maximum Concentration (mg/L)	0.026	0.002	0.012	0.000	0.018	0.351	0.349	0.914	468.316	814.104	0.002	0.007	0.893

Table 4.3-6 Predicted Total Groundwater Concentrations of COPCs for the Proposed Action

		Aluminum	Antimony	Cadmium	Copper	Iron	Manganese	Nickel	Selenium	Sulfate	TDS	Thallium	Uranium	Zinc
Idaho Groundwater Standard		0.2[2]	0.006[1]	0.005[1]	1.3[1]	0.3[1]	0.05[2]	0.0520[3]	0.05[1]	250[2]	500[2]	0.002[1]	0.030[4]	5[2]
	Predicted Maximum Concentration (mg/L)	0.106	0.002	0.012	0.001	0.319	0.462	0.349	0.914	489.716	1099.104	0.002	0.010	0.941
MW-2W	Baseline (Mean) Concentration (mg/L)	0.206	---	---	0.001	1.161	0.075	---	0.000	362.100	938.600	---	0.002	---
	Modeled Maximum Concentration (mg/L)	0.003	0.000	0.001	0.000	0.001	0.048	0.040	0.097	53.831	94.021	0.000	0.001	0.095
	Predicted Maximum Concentration (mg/L)	0.209	0.000	0.001	0.002	1.162	0.123	0.040	0.097	415.931	1032.621	0.000	0.003	0.095
MW-3W	Baseline (Mean) Concentration (mg/L)	0.056	0.001	---	0.001	0.894	0.040	---	0.003	40.416	295.053	---	0.001	0.006
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.056	0.001	0.000	0.001	0.894	0.040	0.000	0.003	40.416	295.053	0.000	0.001	0.006
MW-12W	Baseline (Mean) Concentration (mg/L)	---	---	---	---	1.442	0.611	---	---	10.100	278.000	---	0.001	---
	Modeled Maximum Concentration (mg/L)	0.006	0.000	0.003	0.000	0.011	0.104	0.087	0.210	116.682	203.788	0.000	0.002	0.206
	Predicted Maximum Concentration (mg/L)	0.006	0.000	0.003	0.000	1.453	0.715	0.087	0.210	126.782	481.788	0.000	0.003	0.206
MW-13W	Baseline (Mean) Concentration (mg/L)	0.030	0.001	---	0.000	0.071	0.099	---	---	20.290	276.000	---	0.002	---
	Modeled Maximum Concentration (mg/L)	0.022	0.002	0.010	0.000	0.020	0.311	0.298	0.769	400.144	696.266	0.002	0.006	0.752
	Predicted Maximum Concentration (mg/L)	0.052	0.003	0.010	0.001	0.091	0.410	0.298	0.769	420.434	972.266	0.002	0.008	0.752
MW-16W	Baseline (Mean) Concentration (mg/L)	0.064	---	---	0.001	0.304	0.044	0.003	---	30.409	263.182	---	0.000	0.007
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.064	0.000	0.000	0.001	0.304	0.044	0.003	0.000	30.410	263.184	0.000	0.000	0.007
MW-17W	Baseline (Mean) Concentration (mg/L)	0.022	0.001	---	---	0.239	0.033	---	0.000	32.469	261.667	---	0.000	0.005
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.022	0.001	0.000	0.000	0.239	0.033	0.000	0.000	32.469	261.667	0.000	0.000	0.005
OW-1W	Baseline (Mean) Concentration (mg/L)	0.202	---	0.001	0.001	0.791	0.145	0.014	0.000	13.157	240.000	0.000	---	0.111
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.202	0.000	0.001	0.001	0.791	0.145	0.014	0.000	13.157	240.000	0.000	0.000	0.111

Notes:
Baseline concentration data are from Baseline Water Resources Technical Report (Whetstone 2015b)
'---' indicates insufficient number of results above the detection limit to calculate meaningful statistic

Table 4.3-16 Predicted Total Groundwater Concentrations of COPCs for the RCA

		Aluminum	Antimony	Cadmium	Copper	Iron	Manganese	Nickel	Selenium	Sulfate	TDS	Thallium	Uranium	Zinc
Idaho Groundwater Standard		0.2[2]	0.006[1]	0.005[1]	1.3[1]	0.3[1]	0.05[2]	0.0520[3]	0.05[1]	250[2]	500[2]	0.002[1]	0.030[4]	5[2]
MW-6A	Baseline (Mean) Concentration (mg/L)	0.524	0.000	---	0.001	0.363	0.190	---	0.001	6.864	242.000	---	0.001	0.008
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.524	0.000	0.000	0.001	0.363	0.190	0.000	0.001	6.864	242.000	0.000	0.001	0.008
MW-8A	Baseline (Mean) Concentration (mg/L)	---	---	---	---	0.097	0.197	---	---	4.380	119.500	---	---	---
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.097	0.197	0.000	0.000	4.380	119.500	0.000	0.000	0.000
MW-9A	Baseline (Mean) Concentration (mg/L)	0.116	---	0.000	0.001	0.145	0.021	---	0.001	6.045	179.278	---	0.000	0.004
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.116	0.000	0.000	0.001	0.145	0.021	0.000	0.001	6.045	179.278	0.000	0.000	0.004
MW-10D	Baseline (Mean) Concentration (mg/L)	0.039	---	---	---	0.324	0.298	---	---	126.258	416.333	---	0.001	---
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.039	0.000	0.000	0.000	0.324	0.298	0.000	0.000	126.258	416.333	0.000	0.001	0.000
MW-4R	Baseline (Mean) Concentration (mg/L)	0.051	---	---	0.001	2.275	0.319	0.028	---	30.595	220.857	---	0.001	0.027
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.051	0.000	0.000	0.001	2.275	0.319	0.028	0.000	30.596	220.860	0.000	0.001	0.027
MW-5R	Baseline (Mean) Concentration (mg/L)	0.030	---	---	---	0.227	0.086	0.012	0.000	21.864	334.833	---	0.001	0.005
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.030	0.000	0.000	0.000	0.227	0.086	0.012	0.000	21.864	334.833	0.000	0.001	0.005
MW-11R	Baseline (Mean) Concentration (mg/L)	0.026	---	---	---	0.451	0.559	---	---	44.120	342.000	---	0.000	0.040
	Modeled Maximum Concentration (mg/L)	0.004	0.000	0.002	0.000	0.003	0.126	0.047	0.058	72.013	122.329	0.000	0.001	0.080
	Predicted Maximum Concentration (mg/L)	0.030	0.000	0.002	0.000	0.454	0.685	0.047	0.058	116.133	464.329	0.000	0.002	0.120
MW-14R	Baseline (Mean) Concentration (mg/L)	---	---	---	---	0.475	0.114	---	0.000	26.669	232.667	---	0.000	0.003
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.475	0.114	0.000	0.000	26.670	232.668	0.000	0.000	0.003
MW-1W	Baseline (Mean) Concentration (mg/L)	0.081	---	---	0.000	0.301	0.110	---	---	21.400	285.000	---	0.002	0.048
	Modeled Maximum	0.002	0.000	0.001	0.000	0.002	0.045	0.034	0.086	32.250	53.907	0.000	0.001	0.061

Table 4.3-16 Predicted Total Groundwater Concentrations of COPCs for the RCA

		Aluminum	Antimony	Cadmium	Copper	Iron	Manganese	Nickel	Selenium	Sulfate	TDS	Thallium	Uranium	Zinc
Idaho Groundwater Standard		0.2[2]	0.006[1]	0.005[1]	1.3[1]	0.3[1]	0.05[2]	0.0520[3]	0.05[1]	250[2]	500[2]	0.002[1]	0.030[4]	5[2]
	Concentration (mg/L)													
	Predicted Maximum Concentration (mg/L)	0.083	0.000	0.001	0.001	0.303	0.156	0.034	0.086	53.650	338.907	0.000	0.003	0.109
MW-2W	Baseline (Mean) Concentration (mg/L)	0.206	---	---	0.001	1.161	0.075	---	0.000	362.100	938.600	---	0.002	---
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.501	0.000	0.000	0.001
	Predicted Maximum Concentration (mg/L)	0.206	0.000	0.000	0.001	1.161	0.076	0.000	0.001	362.100	939.101	0.000	0.002	0.001
MW-3W	Baseline (Mean) Concentration (mg/L)	0.056	0.001	---	0.001	0.894	0.040	---	0.003	40.416	295.053	---	0.001	0.006
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.056	0.001	0.000	0.001	0.894	0.040	0.000	0.003	40.416	295.053	0.000	0.001	0.006
MW-12W	Baseline (Mean) Concentration (mg/L)	---	---	---	---	1.442	0.611	---	---	10.100	278.000	---	0.001	---
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.006	0.004	0.011	4.183	6.993	0.000	0.000	0.008
	Predicted Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	1.442	0.617	0.004	0.011	14.283	284.993	0.000	0.001	0.008
MW-13W	Baseline (Mean) Concentration (mg/L)	0.030	0.001	---	0.000	0.071	0.099	---	---	20.290	276.000	---	0.002	---
	Modeled Maximum Concentration (mg/L)	0.001	0.000	0.000	0.000	0.001	0.026	0.019	0.049	18.317	30.618	0.000	0.000	0.035
	Predicted Maximum Concentration (mg/L)	0.031	0.002	0.000	0.000	0.072	0.125	0.019	0.049	38.607	306.618	0.000	0.002	0.035
MW-16W	Baseline (Mean) Concentration (mg/L)	0.064	---	---	0.001	0.304	0.044	0.003	---	30.409	263.182	---	0.000	0.007
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.064	0.000	0.000	0.001	0.304	0.044	0.003	0.000	30.409	263.182	0.000	0.000	0.007
MW-17W	Baseline (Mean) Concentration (mg/L)	0.022	0.001	---	---	0.239	0.033	---	0.000	32.469	261.667	---	0.000	0.005
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.022	0.001	0.000	0.000	0.239	0.033	0.000	0.000	32.469	261.667	0.000	0.000	0.005
OW-1W	Baseline (Mean) Concentration (mg/L)	0.202	---	0.001	0.001	0.791	0.145	0.014	0.000	13.157	240.000	0.000	---	0.111
	Modeled Maximum Concentration (mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Predicted Maximum Concentration (mg/L)	0.202	0.000	0.001	0.001	0.791	0.145	0.014	0.000	13.157	240.000	0.000	0.000	0.111

Notes:
Baseline concentration data are from Baseline Water Resources Technical Report (Whetstone 2015b)
'---' indicates insufficient number of results above the detection limit to calculate meaningful statistic

Letter/Comment: 579/AG

Issue: **6r. Commenters note that the Draft EIS states that aluminum, copper, and iron would not exceed applicable surface water quality standards if starting concentrations are zero. It is not clear if the values would remain below applicable standards if the contributions of these elements were added to existing concentrations.**

Response: See response to Issue 6q. The discussions for aluminum, copper, and iron under the Proposed Action and RCA have been revised to address the concern.

Letter/Comment: 579/AK

Issue: **6s. Commenters note that, in the discussion of selenium concentrations in the Upper Blackfoot River Watershed (p. 4-75 paragraph 2), it is stated that higher selenium concentrations are positively correlated with stream flow. Later in the same paragraph, it says that no increase in selenium concentrations in streams is predicted under high-flow conditions. This contradiction needs to be explained.**

Response: The following text is from p. 4-75, paragraph 2 of the Draft EIS (**Section 4.3.1.1.4** Impacts to Surface Water Resources, subsection Angus Creek):

*"Baseline selenium concentrations in the Upper Blackfoot River Watershed tend to correlate positively with the streamflow (e.g., high concentrations typically observed with high stream flows; Mebane et al. 2015). This trend was also observed during baseline monitoring performed on Angus Creek between 2010 and 2014. Baseline selenium concentrations, as measured during this period at SW-AC1, SW-AC2, and SW-AC-3, averaged 0.001mg/L during low flow conditions and 0.003 mg/L during high flow conditions (BC 2015b). Predicted peak chemical loading of 0.55 lbs/yr would result in increase of selenium concentrations in AC Reach 2 by 0.0004 mg/L during low flow conditions (**Table 4.3-11**). No increase in selenium concentrations in streams is predicted under high flow conditions Concentrations for all other COPCs in groundwater that would flow to AC Reach 2 are predicted to meet applicable surface water standards."*

Note that the statement indicating correlation between high stream flows and increased concentration is in reference to the existing baseline conditions. The second statement references the predicted impact from the Proposed Action. Although the section seems relatively clear in the context of the discussion in **Section 4.3.1.1.4**, the second to last sentence in the paragraph has been modified in the Final EIS for clarity to state:

"No measurable increase in selenium concentrations in streams is therefore predicted under high-flow conditions from the Proposed Action."

Letter/Comment: 579/AM

Issue: **6t. Commenters note that an important feature that is emphasized for the RCA is that there would be no mining below the water table. However, on Figure 4.3-18, the pit and water table for the RCA are shown, and the water table in the Rex Chert is shown to be above the maximum depth of the pit. This apparent discrepancy needs to be explained.**

Response: Discussions for the Proposed Action and RCA that reference the elevation of mining relative to groundwater have been modified for clarity to better explain that the RCA pit would not extend below the regional groundwater table, but would intersect areally limited groundwater contained within the Rex Chert. Primarily, the following explanation has been added to **Section 4.3.1.2.1** for the RCA:

"Although mining would not intersect the regional aquifer, limited volumes of groundwater would be encountered at higher elevations in the pit. This inflow would originate from alluvium, the Rex Chert, and, to a lesser extent, the Meade Peak. Experience at other mines in the region indicate that these strata would drain rapidly after being opened, but could generate water intermittently during the spring snowmelt or in response to precipitation events. Agrium's proposal to handle water that accumulates in the pit from runoff, precipitation, or groundwater inflow would be to collect it in a sump at the bottom of the pit. If needed, the sump water would then be pumped or hauled to unreclaimed backfill areas, where it would be dispersed and allowed to infiltrate."

Letter/Comment: 579/AN

Issue: **6u. Commenters ask for an explanation of why only selenium and manganese are considered in the groundwater transport model. Why is there no discussion of a wider range of COPCs?**

Response: The groundwater predictive simulations for the South Rasmussen Mine were performed to support the State of Idaho's POC application process. Geochemical source terms were developed for the following COPCs: aluminum, cadmium, calcium, copper, magnesium, manganese, nickel, selenium, sodium, zinc, and chloride (NewFields 2014). "Only manganese and selenium were predicted to leach from source area backfill at concentrations exceeding Idaho groundwater quality standards. For this reason, only manganese and selenium were simulated in the solute transport modeling..." (NewFields 2013)

Agrium provided P4 the synthetic precipitate leaching procedure (SPLP) data set from Rasmussen Valley boreholes in the RCA Phases 1 through 4 (Whetstone 2015a). These boreholes represent the materials from these mine phases that would be placed in the South Rasmussen Mine main pit as part of the RCA. The SPLP results were used to develop the source term for the RCA overburden in the South Rasmussen Mine fate-and-transport modeling. The RCA Phases 1 through 4 data included the analytical results from 37 samples. Analysis of these data supports the continued modeling of only selenium and manganese to support the South Rasmussen Mine POC determination process.

Letter/Comment: 579/AO

Issue: **6v. On page 4-92, the Draft EIS states that modeling predicts that there would be no impacts to shallow groundwater quality under the RCA. However, on page 4-86, it mentions that modeling results predict that selenium concentrations occur at levels higher than applicable water quality standards. Commenters request a clarification of this contradiction.**

Response: **Section 4.3.1.2.4,** under the subheading "Impacts to Groundwater Quality in the Wells Regional Aquifer", discusses impacts to regional groundwater quality from the RCA and states:

"Modeling (Arcadis 2016) results predict that contaminant plumes of selenium and other COPCs would still form beneath the backfilled pit soon after commencement of mining. However, only selenium and manganese would migrate northwest in the Wells Regional Aquifer toward the intersection of the Rasmussen Fault and Enoch Valley Fault at concentrations higher than the applicable water quality standard".

Section 4.3.1.2.5, under the subheading "Impacts to Shallow Groundwater and Surface Water Quality," discusses impacts to shallow groundwater and surface water from the RCA and states:

"The modeling predicts that there would be no impacts to surface water and shallow groundwater quality under the RCA."

Section 3.3.2.1.2 of the Final EIS provides additional discussion that was not in the Draft EIS that differentiates between the regional groundwater flow system and shallow groundwater flow systems. This differentiation is carried through to many sections in **Chapter 4** and seems clearly stated; however, the title of the last subsection in **Section 4.3.1.2.5** has been changed from "Impacts to Water Quality" to "Impacts to Shallow Groundwater and Surface Water" to help the reader track this subject.

Letter/Comment: 579/AP, 627/I

Issue: **6w. Commenters recommended that the Final EIS should examine the potential for and probability of worst-case impacts to environmental resources, particularly to surface water resources and groundwater with equal rigor for all alternatives. This should be incorporated into a review of the RCA Cover C specifications to confirm that the model of cover performance reflects the system-wide performance for the life of the cover. Because of the nature of regional groundwater resources, by the time groundwater contamination is detected, mining may have been completed, and there may be little recourse for the agencies or producers.**

Response: The cover analyses presented in the EIS are based on the expected impacts from the Proposed Action and RCA. Conservative assumptions are incorporated into many aspects of the cover evaluations where input parameters or conditions are uncertain. One example is the use of soil property data from minimally compacted samples. Typically greater compaction results in lower Ksats, which tends to be a controlling factor for cover performance, but lab testing of the external borrow materials to be used for the cover appeared to be relatively insensitive to the degree of compaction. The modeling was performed using lab values from multiple samples representative of the entire area proposed to be used for cover construction. These samples were composited and tested for hydraulic properties under minimal compaction. Using the data from these samples resulted in a percolation rate adequate to meet the requirements for a POC determination when applied to a fate-and-transport model. The compactive effort applied to the tested samples was representative of the compaction achieved by simple spreading of the soil with a dozer, a conservative assumption. The model percolation results were adjusted upward to account for expected changes in the cover over time that were not part of the model based on the expected properties of a mature cover. Some worst-case scenarios could include failure of vegetation to establish (thus reducing transpiration) and extensive and intensive erosion of the cover reducing its thickness (thus reducing its storage capacity), but these circumstances have a very low risk of occurrence. The risk of vegetation failure has been addressed by including a seed mix using both localized native species and aggressive non-native species shown to be effective, robust, and vigorous, both at the Rasmussen Valley location and elsewhere in the region. The risk of whole-scale erosion of the cover is addressed both by ensuring robust vegetation and by ensuring that the cover's final slopes are no more than 3H:1V, a slope that has been shown to be stable at nearby mines.

Letter/Comment: 621/E, 621/AC

Issue: **6x. Sediment runoff basins that discharge into any stream or drainage (perennial, intermittent, or ephemeral) should be sampled for selenium, ammonia, and nitrogen before each discharge. In addition, if road material may potentially contain COPCs and road runoff is collected in sediment basins, the procedure for discharging the collected runoff in a manner that does not affect surface or groundwater needs to be described. This description should also include how water that does not meet water quality standards will be handled.**

Response: These activities must all be designed and operated to ensure compliance with USEPA's Clean Water Act multi-sector stormwater discharge permit for the mine. This includes sampling if any ponds overflow. All contact stormwater runoff from active mining areas, unreclaimed overburden, and haul roads would be directed to sediment basins with infiltration-restricting liners and would not be discharged to surface waters. Contact stormwater that accumulates in these sediment basins would either evaporate, be transported to other approved lined water management structures, or be transported to the pit and allowed to infiltrate. No stormwater from these basins would be discharged to natural drainages unless the water meets applicable water quality criteria, as determined through testing. Stormwater runoff from the temporary GM stockpiles would be directed to sediment basins, where the water would be temporarily detained to allow sediments to settle out. Water in these basins would not contact overburden, and would be considered clean. Once water in these basins meets surface water criteria, it could be discharged to the natural drainages downslope of the pit.

Letter/Comment: 621/J, 626/H, 627/E, 627/F

Issue: **6y. Commenters recommend that, to properly characterize and compare the model results, all of the alternatives should be run with the same 2-D model, and the 2-D cover modelling should be redone using Ksat (saturated hydrologic conductivity) values that reflect reality.**

Response: The two covers modeled with 2-D simulations were the Compacted Alluvium Barrier cover and the geosynthetic clay laminated liner (GCLL) synthetic cover. These covers were modeled with 2-D simulations because it was expected that lateral water movement within the cover profile would be substantial enough to warrant modeling the movement as it progresses downslope, ultimately exiting at the toe of the slope, where it would need to be handled as stormwater. The Proposed Action and RCA covers, both store-and-release covers, were evaluated with the 1-D simulations because they were not anticipated to have significant lateral movement of infiltrated water. This does not mean that lateral movement would not happen, but it was assumed the simulated vertical column of cover would maintain conservation of mass in the lateral direction, and thus would be a conservative estimate of net percolation. This means that any water lost laterally downslope would be replenished by water entering the simulation from upslope or the water would become part of the net percolation. In essence, the 1-D modeling is a more conservative approach, requiring any water that infiltrates the cover profile to either move vertically in response to gravity and matrix potentials or to be transpired out of the profile by plant roots without the benefit of lateral movement. Using a 2-D simulation would be less conservative.

The cover will be constructed with earthen material that has been excavated, then reformed to construct the cover layers, similar to the physical collection and reforming used to test hydraulic conductivity properties of the material. Figure C-1 in BC 2015a illustrates the very tight clustering of laboratory Ksat values for the external borrow areas GM and alluvium/colluvium and the position of the Ksat value used in model simulations within that grouping. The Ksats were measured on loosely compacted samples to represent the initial conditions of the constructed cover. The lab testing does not account for the changes in cover properties that result from establishment of plant roots, wet-dry cycles, and the formation of soil structure. The modeled net percolation rate of the RCA Cover C was multiplied by 1.5 to account for the predicted change.

Letter/Comment: 621/M, 621/N, 627/H

Issue: **6z. Commenters stated that the models for the Store-and-Release Cover C and the Geosynthetic Clay Liner Laminate Synthetic Cover from the Draft EIS have net percolation results that are unrealistic. These percolation rates are instrumental in driving the groundwater model predictions for selenium contamination. As a result, the groundwater model predictions for selenium contaminant plumes are probably underestimated. This underestimation could be significant.**

Response: During the laboratory analysis of material properties and subsequent numerical modeling of the cap-and-cover design, saturated hydraulic conductivity (Ksat), layer thickness, and root distribution were found to be critical parameters in limiting percolation rate through the cover system. As such, sensitivity analyses and infiltration modeling were performed on saturated hydraulic conductivity of the GM (topmost layer) and external alluvium/colluvium (second layer), the thicknesses of the topmost and second layers, and different root growth trajectories for the RCA Cover C.

However, the laboratory analysis and numerical infiltration modeling could not account for all the unknowns and field conditions including gross soil properties, soil structure, ambient weather conditions, and normal variations in soil placement. When the soils and GM are excavated or dozed, loaded into trucks, dumped, and spread, it effectively destroys the in-place soil structure that might have existed. The modeled percolation rate represents the cover when it is first placed without soil structure. The effect of soil structure could not be evaluated because sample collection, preparation processes, and laboratory testing apparatus eliminated the soil structure existing at the sample sites, and the soil structure will take time to develop once the cover is constructed. Consequently, the laboratory testing did not measure the gross soil properties as they would be in the cover once it develops structure, a component that is also needed for healthy vegetation, and a key requirement for effective evapotranspiration (ET). The infiltration model (SVFlux) used the laboratory data that did not account for soil structure, nor does the model itself account for the development of soil structure.

Considering that not all the unknowns could be evaluated through laboratory testing and numerical infiltration modeling, the percolation rate for the RCA was multiplied by 1.5, resulting in a net percolation rate of 0.21 in/yr, which was then used to in the fate-and-transport modelling of COPCs and their subsequent impact assessment to the surrounding environment. Simulated contaminant plumes of selenium and other COPCs for a percolation rate of 0.21 in/yr are considered to be reflective of anticipated long term conditions.

For additional explanation, please refer to response to comment 6bs.

Letter/Comment: 621/O

Issue: **6aa. Commenters recommend that the location, design, and implementation of all runoff and sediment control facilities need to be identified and evaluated in the EIS before any agency decision-making or permitting.**

Response: The runoff and sediment control features are described in **Section 2.3.5.1** and on **Figure 2.3-5** for the Proposed Action and in **Section 2.5.1.7** for the additional water management features required for the RCA. Together, these sections describe how Agrium plans to handle stormwater runoff. Stormwater runoff from exposed backfill, overburden areas, pre-stripped pit phases, and haul roads would be directed into lined contact water sediment basins, where the water would be allowed to evaporate or would be pumped to an open mine pit for infiltration through the pit bottom. Stormwater runoff from unreclaimed natural ground or GM and alluvium and colluvium storage areas would be directed to unlined non-contact water sediment basins, where the water would be allowed to evaporate, infiltrate, or be pumped into an open mine pit to discharge to natural drainages. Runoff from natural, undisturbed ground that has not contacted overburden, backfill, or unreclaimed areas would be allowed to flow directly to surface waters as it did before mining. The impacts from these water management scenarios are described in **Section 4.3.1.1.4** and **Section 4.3.1.2.5**.

Appendix C, an updated Surface Water Management Plan (SWMP) for the RCA is equivalent to the Proposed Action SWMP included as Appendix F in the 2011 Rasmussen Valley Mine and Reclamation Plan (Agrium 2011).

Letter/Comment: 621/R

Issue: **6ab. Commenters recommend that Table 3.3-6 should include the number of observations in each range.**

Response: **Table 3.3-6** in **Section 3.3.2.1.1** has been revised to show the number of observations in each range. Note that the requested information is also provided in **Table 3.3-7** in the same section**.**

Letter/Comment: 621/S, 1014/AX

Issue: **6ac. Commenters recommend that Table 3.3-11 should include the screen depths, depth to water, and groundwater elevation for each well.**

Response: **Table 3.3-11** is a list of wells and vibrating wire piezometers (VWPs). Two new tables have been added to the Final EIS **Section 3.3.2.2.1** (**Table 3.3-12** Summary of Well Construction Details and **Table 3.3-13** Summary of Vibrating Wire Piezometer Construction Details) to summarize construction details for wells and VWPs including depth. The locations of the monitoring wells and VWPs are shown on **Figure 3.3-17**.

Letter/Comment: 621/T, 1014/AY

Issue: **6ad. Commenters recommend that the EIS should develop a consistent handling of input values and constraints among models and should use a single complete model for both the Rasmussen Valley Mine and the South Rasmussen Mine groundwater systems. The model should fulfill the requirements for evaluation of connected actions and cumulative effects combined with other activities adjacent to and downgradient of the mines.**

Response: The South Rasmussen Mine is located on State of Idaho land and is permitted through the IDL. P4 has a state phosphate mineral lease to mine on state land. Water quality is under the jurisdiction of the IDEQ. P4 has been working with the IDL and the IDEQ for approximately the past 6 years to install monitoring wells and gather groundwater data. As data were gathered, they were used to formulate a groundwater fate-and-transport model of the mine to determine potential future impacts to groundwater and to aid in the preparation of a POC application for submission to the IDEQ. The IDEQ has since issued a POC Determination to P4, which includes existing wells to be used for compliance monitoring. The BLM considers the South Rasmussen Mine fate-and-transport model developed by P4 to be adequate to disclose the predicted impacts from the Mine. The groundwater fate-and-transport model developed for the Rasmussen Valley Mine used groundwater monitoring data obtained from the study area for the mine, and was calibrated to those data. While neither of the models has a domain large enough to cover both projects in their entirety, model domains of each project cover some portion of the other project area. It isn't necessary to model both projects with a single model because each model is sufficient to disclose the impacts from each project and to disclose cumulative effects.

Letter/Comment: 621/V, 621/W, 621/AA, 1014/H

Issue: **6ae. Commenters observe that in several locations, the BC (2015b) reference is cited as a source for surface water baseline statistics. However, the BC (2015b) reference in the bibliography is a statistical analysis of groundwater chemistry.**

Response: The statistical analyses for groundwater and surface water have been updated to include monitoring data through the end of 2014. Groundwater statistics in **Tables 3.3-19** through **3.3-22** have been updated accordingly. The reference for the statistics in **Section 3.3.2.3.2** has been changed to Whetstone 2015b.

Letter/Comment: 621/X, 1014/X

Issue: **6af. Commenters recommend that a "definitive trigger" (criteria) should be defined for implementing the option to divert surface flow before it enters the pit.**

Runoff should not be allowed to contact exposed Meade Peak-containing material.

Response: Agrium will install upslope runon diversion ditches at the start of mining and proceeding concurrently with the mining phases as mining progresses from north to south in the RCA. Surface water runoff will be addressed in the SWMP, which is equivalent to Appendix F of the Rasmussen Valley Mine and Reclamation Plan (Agrium 2011) for the RCA, and will include diversion of runon as necessary to control contact to exposed Meade Peak-containing materials.

Letter/Comment: 621/Y, 627/M, 627/N

Issue: **6ag. Commenters observe that IDEQ has listed portions of the Blackfoot River and several of its tributaries as Category 5 impaired water bodies under Section 303(d) of the Clean Water Act. The most frequently identified causes of impairment are selenium, dissolved oxygen, Escherichia coli, and temperature. These designations are important because they indicate a situation where cumulative effects to surface water have reached a regulatory threshold at which actions to reduce existing impacts must be undertaken and newly proposed activities cannot add impacts or load.**

Response: Comment noted. The contaminant fate-and-transport analysis for the Rasmussen Valley Mine project indicates that the RCA is not projected to increase selenium loads to any of the Category 5 listed surface water bodies.

Letter/Comment: 621/Z

Issue: **6ah. Commenters recommend that cumulative buildup of selenium in drainage areas should be evaluated. Low-level selenium movement in drainage areas can accumulate over time, resulting in time-dependent buildup of excessive selenium in the soils surrounding these drainage areas. This buildup can then result in forage uptake that could be toxic to ingesting animals.**

Response: The majority of contact-water management structures would be located along the haul roads or within the pit footprint. As described in **Section 2.3.6.2** of the Rasmussen Valley Mine Project Alternative Elements Feasibility Analysis Amendment (BC 2015c), water management structures associated with the haul roads would be lined and cleaned of any potential Meade Peak-containing materials before the originally excavated materials are used to backfill the structures. Contact-water sediment basins that are within the pit footprint would be reclaimed and covered with backfill and the pit backfill cover. Any other contact-water management structures would be inspected before reclamation and cleaned of potential Meade Peak-containing materials if needed. Any contact-water sediment basins not within the pit footprint would be constructed to limit percolation into the alluvial aquifer using synthetic or compacted natural materials subject to BLM approval before construction.

Letter/Comment: 623/C

Issue: **6ai. The model fails to simulate changes due to pit excavation and backfill, which would have significant changes in the distribution of backfill seepage into the groundwater. Backfill has significantly higher K than simulated, but the bedrock beneath the pit would have lower K. Failing to adequately model the pit backfill while simulating saturated model layers within the pit (that partly correspond to the intermediate aquifers) prevents selenium-laden seepage from model layer 3 flowing from the pit.**

Response: The commenter failed to realize that the simulated shallow model layers (upper fate-and-transport model layers 1 through 8) are mostly dry and only partially saturated (residual saturation) towards the eastern portion of the model, including the pit backfill area. These partially saturated portions of the model layers do not prevent any downward flow of water. Although the pit backfill area would have a higher hydraulic conductivity after reclamation, it would remain mostly dry and only partially saturated, reducing any potential for extended lateral migration, which the commenter failed to understand and thus provided an erroneous conceptualization of lateral flow migration. All the percolating water would move freely downward to the bottom of the pit at the reclaimed backfill area and would then migrate to the Wells Regional Aquifer. This process was simplified by applying the COPC sources directly over the Wells Formation footprint within the pit backfill area. **Figures 4.3-12, 4.3-13,** and **4.3-14** have been modified for enhanced understanding of the model simulated results.

Letter/Comment: 1014/A, 1014/D

Issue: **6aj. In the groundwater flow and transport model (GFTM), the Enoch Valley Fault is simulated to be very transmissive. More than 50 percent of model flow is through the fault. Most of the flow in the Wells Formation is forced to flow into the fault where the large flow passing through the model dilutes it. The GFTM should be redone with an improved model structure. Each model layer should represent specific geologic formations to better simulate flow through the bedding, which would have a higher hydraulic K parallel to the bottom of the formation.**

Response: The commenter incorrectly assumed that the layers of the numerical groundwater model do not represent a specific geologic formation. In fact, each model layer generally represents a separate geologic formation. The model structure reveals that model layer elevations vary considerably across the model domain because they represent the actual dip of various formations. Because of the complex structure being represented, it should, however, be noted that in some areas, a hybrid approach was used where model layers also include multiple hydrostratigraphic units corresponding to the observed geological setting.

Regarding flow through the Enoch Valley Fault, the commenter provided a misleading estimate of 50 percent of model flow passing through the fault. In fact, mass balance analysis indicates that less than 15 percent of upper member of the Wells Formation layers simulated flow passes through the Enoch Valley Fault.

Letter/Comment: 1014/B, 1014/C

Issue: **6ak. Commenters note that, in Section 3.3.2.1.1, Applicable Groundwater Standard, the Draft EIS cites IDAPA 58.01.11.301.02, which stipulates that activities must be managed so groundwater is maintained and improved. This provision in the State Groundwater Rule does not apply to mining activities, which are pursuing a point of compliance (POC). The correct IDAPA reference should be to 58.01.11.401, which is specifically for mining and the POC process and differs from 58.01.11.301. Commenters recommend that the Final EIS should clarify and correct this section.**

Response: **Section 3.3.2.1.1** of the Draft EIS has been revised for the Final EIS (**Section 3.3.2.3.1**) to read:

Idaho water quality standards for groundwater are contained in IDAPA 58.01.11. Aquifers in Idaho are classified as Sensitive Resources, General Resources, or Other Resources based on the vulnerability of the groundwater, existing and projected beneficial uses of the water, existing water quality, and social and economic considerations (IDAPA 58.01.11.150.02). Groundwater is spelled as two words (ground water) in IDAPA 58.01.11 and Idaho statistical Guidance Documents (IDEQ 2009, 2014). This convention is observed for direct citations, but otherwise, groundwater is spelled as one word for consistency in this EIS. Groundwater classified as a Sensitive

Resource receives the highest degree of protection, and applicable water quality standards for these resources may be stricter than those listed in IDAPA 58.01.11.200. Currently, the Rathdrum Prairie Aquifer, located approximately 440 miles northwest of the Study Area, is the only aquifer listed as a Sensitive Resource in the State of Idaho (IDAPA 58.01.11.300.1). All other aquifers are categorized according to IDAPA 58.01.11.300.02, which defines a General Resource as:

"All aquifers or portions of aquifers where there are activities with the potential to degrade groundwater quality of the aquifer, unless otherwise listed in subsection 300.01 or 300.03. Once an activity with the potential to degrade the ground water quality of an uncategorized aquifer or portion of an aquifer is initiated, the uncategorized aquifer shall automatically become General Resource unless petitioned into the Sensitive Resource, or Other Resource category."

No aquifers are currently listed as an Other Resource in the State of Idaho (IDAPA 58.01.11.300.03). Based on the aquifer classification system described in the Idaho Administrative Code, groundwater in the Study Area is classified as a General Resource and is subject to numerical standards contained in section 58.01.11.200 and modified in subsections 200.03, 301.02.a., and 401.01.

Subsection 200.03 states:

"If the natural background level of a constituent exceeds the standard in this section, the natural background level shall be used as the standard."

Subsection 301.02 states:

"Activities with the potential to degrade General Resource aquifers shall be managed in a manner which maintains or improves existing ground water quality through the use of best management practices and best practical methods to the maximum extent practical."

Subsection 401.01 states:

"At the request of a mine operator, the Department [IDEQ] *shall set a point of compliance, or points of compliance, at which the mine operator must meet the ground water quality standards as described in Subsection 150.01. If a request is not made, the mine operator must meet the ground water quality standards in ground water both within and beyond the mining area unless the Department establishes the point(s) of compliance consistent with Subsection 401.03. Mining activities must be managed using the level of protection appropriate for the aquifer category in accordance with Subsection 150.02 and Section 301."*

Finally, considerations for setting points of compliance are provided in subsection 401.3 which states:

The point(s) of compliance shall be set as close as possible to the boundary of the mining area, taking into consideration the relevant factors set forth in Subsections 401.03.a. through 401.03.h., but in no event shall the point(s) of compliance be within the boundary of the mining area. The mining area boundary means the outermost perimeter of the mining area (projected in the horizontal plane) as it would exist at the completion of the mining activity. The point(s) of compliance shall be set so that, outside the mining area boundary, there is no injury to current or projected future beneficial uses of ground water and there is no violation of water quality standards applicable to any interconnected surface waters. The Department's determination regarding the point(s) of compliance shall be based on an analysis and consideration of all relevant factors including, but not limited to:

a. The hydrogeological characteristics of the mining area and surrounding land, including any dilution characteristics of the aquifer and any natural attenuation supported by site-specific data;
b. The concentration, volume, and physical and chemical characteristics of contaminants resulting from the mining activity, including the toxicity and persistence of the contaminants;
c. The quantity, quality, and direction of flow of ground water underlying the mining area;
d. The proximity and withdrawal rates of current ground water users;
e. A prediction of projected future beneficial uses;
f. The availability of alternative drinking water supplies;
g. The existing quality of the ground water, including other sources of contamination and their cumulative impacts on the ground water; and
h. Public health, safety, and welfare effects.

Agrium has requested that POCs be established for the Rasmussen Valley Mine. Numerical groundwater quality standards for Idaho are presented in **Table 3.3-17** and are based on total concentration. Background levels are determined using methods described in Statistical Guidance for Determining Background Ground Water Quality and Degradation (IDEQ 2014b).

Letter/Comment: 628/B

Issue: **6al. Commenters note that the Draft EIS concludes that newly proposed activities cannot add impacts or loads to Section 303(d)-listed waters (see for example Section 5.3.3). The applicable law in this area is much more nuanced and depends on IDEQ's interpretation of state water quality standards and site-specific considerations. If a proposed activity does not measurably increase surface water concentrations in a 303(d) water, it is still authorized, even if a molecular load might be added to the water body.**

Response: The second to the last sentence of **Section 5.3.3** of the Final EIS has been modified, and now reads:

"These designations are important, as they represent a situation where cumulative effects to surface water have reached a regulatory threshold where actions to reduce impacts to the water bodies must be undertaken, and newly proposed activities cannot add measurable impacts or chemical loads to the water bodies."

Letter/Comment: 628/C

Issue: **6am. Commenters note that the broadly recognized geochemical process of COPC sorption to the aquifer matrix was not incorporated in transport simulations conducted for the Draft EIS, despite the fact that laboratory testing indicated that sorption will occur along the transport pathway in the regional aquifer. Because this process was excluded in the simulations, the mobility of some of the COPCs in the regional aquifer is likely far less than is characterized in the transport modeling conducted for the Draft EIS.**

Response: As the commenters acknowledge, the scaling of COPC sorption results of laboratory-scale batch attenuation testing to field-scale attenuation is problematic. Because the scaled attenuation factors calculated by Whetstone indicated that attenuation would not significantly affect COPC concentrations predicted by the groundwater fate-and-transport model, the decision was made to not include attenuation in the model. We acknowledge that this provides some conservatism for this aspect of the groundwater model. Many of the assumptions used in the groundwater fate-and-transport model require substantial professional judgment. These assumptions have been reviewed by the Agency inter-disciplinary team and are considered to represent the expected conditions with appropriate conservatism to safeguard water resources.

Letter/Comment: 628/D

Issue: **6an. Selenium-impacted streams need to be treated at the pollutant source to remove hazardous materials. Hazardous materials must be prevented from entering streams and groundwater. The groundwater will likely end up in the Blackfoot River and thus impact the quality of water and potentially agriculture served by the Fort Hall Irrigation Project.**

Response: The Draft EIS has extensively analyzed the likely migration pathways and potential impacts of selenium and other COPCs on surface-water and groundwater resources originating from Rasmussen Valley Mine source areas (overburden piles and pit backfill) as a result of mining activities. To aid in the evaluation process, a three-dimensional numerical groundwater model was used for predicting fate-and-transport of all 13 site-related COPCs (including selenium) for an extended period of time (500 to 700 years). Because all potential impacts to streams and rivers from Rasmussen Valley mining activities have already been accounted for through incorporation of the Rasmussen Valley Mine COPC source areas, treating streams and other surface water bodies as pollutant sources would double-count the contaminant mass associated with the project. As described in the Draft EIS, the long-term impacts of selenium and other Rasmussen Valley Mine-related COPCs on water resources under the preferred reclamation alternative (the RCA) are expected to be negligible.

Letter/Comment: 1013/G

Issue: **6ao. Page 4-7 Geochemistry - Column Tests. Given the important role redox conditions and pH have in influencing selenium mobility, what was the pH and redox potential of the head solution used in the column tests?**

Response: See response to Issue 4i.

Letter/Comment: 579/AR

Issue: **6ap. Page 4-44 Groundwater flow and transport model - The text states that the model "has several enhancements that improve its numerical stability and ability to solve matrices with steep gradient." What is meant by this statement?**

Response: MODFLOW-SURFACT, the model used for groundwater flow, fate, and transport, has the ability to effectively and efficiently solve numerical equations for cells where rewetting is simulated. Complex model structure with steep dipping layers and partially saturated cells can be better handled using SURFACT compared to standard USGS MODFLOW code.

Letter/Comment: 579/AS

Issue: **6aq. Page 4-47 Groundwater flow and transport model - The different leaching cycles resulted in different concentrations of COPCs. It is not clear which values, and the relevance of values selected from these, test for incorporation into the groundwater modeling.**

Response: All the concentration values for the COPCs from different leaching cycles (as presented in **Table 4.3-5** for the Proposed Action and in **Table 4.3-15** for the RCA) were used in the predictive simulations of groundwater flow-and-transport model. Detailed descriptions on the incorporation process of the COPC concentrations into the numerical groundwater model have been presented in the Final Groundwater Modeling Report (Arcadis 2015). The following sections are excerpts from the modeling report:

"Potential changes in COPC loading over time were simulated using a pore volume approach where concentrations from each source changed as successive volumes of water equal to the estimated pore space were modeled to move through the material. The effective porosity of the stored material which is defined as the interconnected hydraulically active pore spaces that would transmit the majority of the seepage is assumed to be 15 percent consistent with previous modeling in the district (ARCADIS

2009). Pore volume times for the unsaturated Proposed Action and RCA source terms (Table 11) are calculated based on the volume of material that would be stored in each facility, an assumed effective porosity of 15 percent, and percolation rates developed by Brown and Caldwell (BC 2015a and 2015b).

"The time period for each predictive simulation was divided into "stress periods" within which specified stresses, such as pumping and loading of COPC mass from source areas, are maintained constant. Each stress period is assigned a time length and further divided into a series of timed steps. MODLFOW-SURFACT then solves the finite-difference equations for groundwater flow and solute transport, and yields heads and COPC concentrations within the model domain at the end of each time step."

Letter/Comment: 579/AT

Issue: **6ar. How will lateral drainage for the cover be drained?**

Response: Only two cover alternatives, the compacted barrier layer cover and the geosynthetic clay laminate liner (GCLL) cover, incorporate a drainage layer and would have lateral drainage. The lateral drainage from these two cover alternatives would be managed by one or a combination of the following: 1) allowing the lateral drainage to emanate from a toe drain at the bottom of the backfill slope, where it would commingle with surface runoff, 2) installing a plunge pool or trench along the toe of the slope to infiltrate the lateral drainage into the alluvial aquifer, 3) concentrating the flow into the natural drainages and allowing it to daylight and commingle with stormwater flow in the drainages, or 4) collecting the drainage in lateral drainage pipes embedded within the cover drainage layer that would carry water to central holding and management ponds or drainage structures. These two cover alternatives were not selected for full analysis because other alternatives provided sufficient protection without the need for infrastructure to handle water emanating from drainage layers.

Letter/Comment: 621/AG

Issue: **6as. Commenters observe that the groundwater flow and transport model simulates wetlands east of Angus Creek as an evapotranspiration boundary. This modeling essentially prevents shallow groundwater flow for either alternative from reaching the creek. The head values in the creek are also set so high as to prevent seepage into the creek.**

Response: A wetland area located along Angus Creek contains vegetative cover that would intercept shallow groundwater and would transpire water. Given the nature of the wetland area east of Angus Creek, it has been appropriately simulated in the groundwater model; no direct discharge to Angus Creek from the wetlands is expected. The comment inaccurately states that shallow groundwater is prevented from reaching Angus Creek. While the wetland area does remove some shallow groundwater, there is still discharge to Angus Creek according to the mass balance reports in the model. The numerical model was also tested by assigning gradational stage along the reaches of Angus Creek. The model testing results indicated no significant changes in discharge rate to Angus Creek.

Letter/Comment: 1014/E

Issue: **6at. Commenters observed that there are significant differences in the modeling of source concentration for the Rasmussen Valley Mine backfill and the South Rasmussen Mine backfill. For example, different selenium concentrations were used for each model, and in both cases they were inappropriate for modeling seepage.**

Response: The source term P4 used for their overburden from the South Rasmussen Mine was developed using SPLP test results from overburden specifically from the South Rasmussen Mine and by comparison with the source terms from other Southeast

Idaho phosphate mines. The source term for the Rasmussen Valley Mine overburden to be placed in the South Rasmussen Mine as part of the RCA has been revised to address this comment, and is now derived from SPLP data results from the phases of the Rasmussen Valley Mine that are scheduled to be placed in the South Rasmussen Mine. All SPLP results were multiplied by 20 to simulate the expected COPC concentrations in overburden leachate. These two source terms were used for the fate-and-transport modeling of the current South Rasmussen Mine plus RCA.

It is true that there is a difference among the various source terms, but they all are within the geochemical concentration variability seen in source terms determined for other Southeast Idaho phosphate mines and are thus judged appropriate for modeling fate and transport for the South Rasmussen Mine. The fate-and-transport simulation indicates that the current POC monitoring wells would be appropriate for the existing P4 backfill with the additional RCA backfill. The source term determination and fate-and-transport simulation for the Rasmussen Valley Mine will be evaluated by the IDEQ under a separate POC determination with its own set of compliance and indicator wells.

Letter/Comment: 1014/G

Issue: **6av. Commenters observe that optional diversion of runoff from drainage areas 3 and 4 to drainage area 20 would cause runoff to enter the Blackfoot River farther upstream than current conditions. The increase in flow rates, especially during stormflows or high snowmelt, could cause morphologic changes along the Blackfoot River upstream of Angus Creek. The EIS should discuss the resulting flow rates and the impacts to water quality.**

Response: Diversion of runoff from drainage areas 3 and 4 to drainage area 20 would only occur under the Proposed Action (**Figure 2.3-5**); no runoff would be diverted to drainage area 20 under the RCA (**Figure 2.5-6**). Under the Proposed Action, the peak estimated flow resulting from a 100-year, 24-hour storm event that would be diverted to drainage area 20 is 45 cfs. Based on stream flow data from a dedicated stream gage at monitoring station SW-BF1 (**Figure 3.3-4**), located on the Blackfoot River approximately 0.5 mile downstream of the confluence with drainage area 20, the estimated peak flows in 2011, 2012, and 2013 were 2,312 cfs, 541 cfs, and 230 cfs, respectively. Assuming that the peak flow of 2,312 cfs in 2011 is representative of a 100-year event, the diverted runoff from drainage areas 3 and 4 would only contribute an additional 2 percent. This small amount would be negligible and would have no significant effect on the stream morphology or water quality.

Letter/Comment: 1014/I

Issue: **6aw. Commenters note that the assertion that runoff from reclaimed backfill and overfill would have the same chemical characteristics as runoff from undisturbed ground is incorrect. In addition to water that does not enter the soil, runoff includes interflow and shallow groundwater flow. These flow components would have dissolved constituents that would not occur in water that simply ran off the ground surface. The Draft EIS does not adequately consider these factors or disclose the associated impacts to water quality.**

Response: Both the Proposed Action cover and the RCA Cover C are thick enough, and the 3H:1V slope is shallow enough, that re-emergence of infiltrated water that contacts underlying overburden or backfill is not expected (Lu et al. 2011; Sinai and Dirksen 2006). GM that is salvaged and stockpiled for use in reclamation would exhibit chemical characteristics similar to its chemistry before excavation. Therefore, runoff or shallow interflow that contacts the GM would have chemical characteristics similar to runoff from the GM at the time of salvage.

Letter/Comment: 1014/J

Issue: **6ax. Commenters observe that the project would intercept runoff from up to 589 acres during mining and that the Draft EIS describes this as reduced runoff. However, the Draft EIS does not discuss how this reduced runoff could affect recharge. This could also increase the amount of water percolating through disturbed material with a high potential to leach selenium.**

Response: Impacts to groundwater levels from changes to recharge under the Proposed Action are discussed in **Section 4.3.1.1.3** of the Final EIS, Impacts to Groundwater subsection, which states:

"It is anticipated that capping of the permanent overburden piles and pit backfill under the Proposed Action would permanently reduce the amount of recharge reporting to groundwater by approximately 8 percent from a pre-mining 2.6 inches per year to a permanent 2.4 inches per year for those areas of covered overburden and backfill. Modeling results indicate that, under post-reclamation conditions, groundwater levels in the shallow, intermediate, and regional groundwater systems near the reclaimed mine facilities would decrease by approximately 1 to 5 feet, 0.5 to 1 foot, and 0 to 0.05 foot, respectively. Long-term decreases in shallow groundwater levels by reduced infiltration and percolation through areas reclaimed by cover systems would therefore be long-term, minor, and localized. Long-term reduction in groundwater levels in the Wells Regional Aquifer would be negligible."

A similar discussion has been added to **Section 4.3.1.2.4** of the Final EIS for the RCA.

Letter/Comment: 1014/K

Issue: **6ay. Commenters note that the temporary and permanent overburden piles would have perimeter ditches to capture and transport runoff around the piles. The Draft EIS discusses this water as removed from the pile. However, every time the ditches fill with water, they create seepage into the piles. Each runoff occurrence would create a slug of water entering the piles and leaching COPCs. Any ditch upstream of the pit would provide a path for water to enter the backfill. The COPC modeling should account for these occasional slugs.**

Response: Water management is discussed in **Section 2.3.6** for the Proposed Action and **Section 2.5.1.7** for the RCA in the Final EIS. There are two distinct water management systems proposed for the project. Runoff from undisturbed and reclaimed areas would be kept separate from runoff that contacts overburden, backfill, or pit walls. Ditches would capture non-contact runoff and direct it to non-contact water sediment basins or directly to surface water drainages. A separate water management system would capture and contain runoff from un-reclaimed overburden, such as the external overburden piles, and direct it to that system's contact-water sediment basins, where it would be contained. Some of the ditches may be within the overburden pile area. These ditches would allow seepage into the overburden, but no more than if the water were allowed to continue as sheet flow across the pile. Ultimately, the runoff water would be collected in ditches at the toe of the pile and directed into contact water sediment basins, where it would evaporate or be removed to an approved area such as an open mine pit. Seepage from the ditches would occur during storm events and spring runoff and would report to shallow groundwater below the piles. The added COPC load from the seepage is captured by the fate-and-transport modeling of the overburden piles. The RCA alternative would eliminate external overburden piles, the associated perimeter ditches, and impacts to shallow groundwater.

Letter/Comment: 1014/L

Issue: **6az. Commenters observe that both alternatives would leave a portion of headwall exposed in the pit, including some that would remain after reclamation. The headwall would be Wells Formation. The exposed headwall would provide a direct connection from the surface to the regional groundwater aquifer. The EIS should analyze the potential for COPCs to reach groundwater through this pathway.**

Response: The numerical flow and transport model actually assumed that a majority of the COPC transport from the pit would reach groundwater through this Wells Formation pathway. The source term in the model was defined in a way that the COPC source contributes directly to the Wells Regional Aquifer.

Letter/Comment: 1014/M

Issue: **6ba. Commenters noted that pit excavation would intersect "localized pockets of water" (perched aquifers) above the regional water table. Mining through these aquifers removes a layer that prevents or limits natural recharge of meteoric water and contaminants to deep aquifers. The EIS should discuss the resources attached to the perched water including localized springs, seeps, and wetlands.**

Response: Additional discussion has been added to **Sections 4.3.1.1.3** and **4.3.1.2.4** of the Final EIS to clarify potential impacts to shallow groundwater, wetlands, and seasonal seeps resulting from interception of perched groundwater by the Proposed Action and RCA pits.

Letter/Comment: 1014/N

Issue: **6bb. Commenters observe that there are extensive wetland areas west of the proposed mine that may be supported in part by groundwater discharge. The groundwater model simulates discharge to the wetlands, but fails to estimate the changes in discharge as a result of mining. These potential impacts should be analyzed.**

Response: Mass balance evaluation of pre- and post-mining numerical simulations suggest no significant changes in groundwater discharge to wetland areas as a result of mining activities. The following statement, summarizing this mass balance evaluation, has been added to the discussion of Angus Creek and associated wetlands and springs in **Section 4.3.1.1.4.**

"It is likely that the wetland area west of the proposed mine may be supported in part by shallow groundwater discharge. However, mass balance analysis from numerical modeling of pre- and post-mining conditions suggest no significant changes in groundwater discharge to wetland areas as a result of mining activities under the Proposed Action."

Letter/Comment: 1014/O

Issue: **6bc. Commenters note that future mines, such as the Rasmussen Valley Mine, would add selenium to predicted groundwater plumes. In addition, if covers increase the evapotranspiration from the area, baseflow in streams and rivers could be reduced and baseflow selenium concentration increased. Currently, the majority of decreases in downstream selenium concentrations are a result of dilution rather than attenuation.**

Response: Following reclamation, the cover system is expected to reduce infiltration of meteoric water to the shallow groundwater but increase surface runoff contribution reporting to streams and rivers. The impact of increased runoff would likely be observed in streams and rivers before that of decreased baseflow as a result of the migration pathways of the runoff and baseflow components. As a result, during high precipitation – high-flow conditions, there would be increased dilution and greater reduction in selenium and other COPC concentrations in streams and rivers compared to current conditions. However, during low precipitation, low-flow conditions, in-stream concentrations of selenium and other COPCs may slightly temporarily increase, but the long-term impacts to stream flows and water quality after reclamation would be negligible.

Letter/Comment: 1014/R

Issue: **6bd. Commenters observe that the Draft EIS barely considers cumulative impacts of mining to water resources. A proper cumulative impacts analysis would include the development of two groundwater models to improve understanding of the long-term effects of mining on groundwater flow and baseflow selenium contamination. The results would allow coordinated local and regional planning to remediate past contamination and prevent future contamination.**

Response: This is beyond the scope of the EIS.

Letter/Comment: 1014/S

Issue: **6be. Commenters recommend that groundwater monitoring should occur along all potential groundwater flow pathways, and that different aquifer levels should be sampled because of heterogeneities in the vertical profiles of the formations. The groundwater monitoring plan proposed in Appendix A is insufficient. The monitoring wells do not cover potential flow paths from the site, and the sampling frequency is insufficient to capture seasonal trends.**

Response: See response to Issue 6bg.

Letter/Comment: 1014/T

Issue: **6bf. Commenters observe that there are only 11 groundwater monitoring wells proposed. Each of these wells contains only one open interval and cannot be sampled at multiple depths. The monitoring sites show no apparent forethought in their locations, and there are no wells west of the site, even though maps and modeling show wetlands and groundwater flow through that area.**

Response: See response to Issue 6bg.

Letter/Comment: 1014/U

Issue: **6bg. The Draft EIS proposes semiannual groundwater monitoring. This is insufficient to capture seasonality and annual variability. It is unlikely that semiannual monitoring could capture the high or low concentration, and it would be virtually impossible to estimate load flowing through groundwater. It would be preferable to sample monthly during mining and initial reclamation, and decrease to quarterly monitoring for a decade after closure. Surface water monitoring suffers from similar issues. Because selenium concentrations vary rapidly during the runoff period, it is unlikely that one sample during the spring would coincide with the peak concentration.**

Response: The location, depth, monitoring frequency, and analyte list for monitoring groundwater will be determined by IDEQ, in coordination with the BLM and USFS, as part of the POC determination that Agrium will apply for because of the level of COPCs predicted by the fate-and-transport modeling. See response to Issue 6b for description of POC process. The sampling plan for both the groundwater and surface water will be designed to meet the state regulatory compliance requirements and to provide adequate information on water quality trends that could affect compliance.

Letter/Comment: 1014/V

Issue: **6bh. Comments observe that, in the water budget model, eight layers that are above the calculated water table are not dry. By simulating more than 500 feet of mostly Wells Formation that is otherwise dry as saturated, the flow is calculated with a much higher transmissivity than actually occurs. This suggests a gross conceptualization problem in the conceptual flow model.**

Response: This is a misunderstanding and misrepresents the model. Please refer to the response to comment 6ai. A closer look at the model results would reveal that the numerical model appropriately simulates the western portion of the model, including backfill in the upper eight layers as partially saturated, not saturated as the commenter incorrectly stated. It should also be noted that water budget analysis indicates that the only noteworthy flow through the dry cell area of the top eight model layers is recharge that passes through the partially saturated layers. It is, in fact, consistent with the model conceptualization, which in turn, is representative of Rasmussen Valley Mine site conditions.

Letter/Comment: 1014/Y

Issue: **6bi. Commenters observe that alternating high positive and low negative fluxes through a portion of the General-Head Boundary (GHB) 0 indicate that there is a problem with how the model simulates fluxes. The extreme variability is not justified by the hydrogeology of the site and may be a source of the water balance error in layer 6. This is a significant problem with how the conceptual flow model was input to the numerical model.**

Response: The alternating flows (inflow and outflow) along the boundary and flow balance error was associated with high hydraulic conductivity in the GHB cells in model layer 6 (AMEC 2010). However, the numerical discrepancy was confined only to a limited portion of GHB cells. Model testing was performed by reducing the conductance values of concerned GHB cells, which eliminated the localized flow balance error. This testing also indicated that conductance changes had no influence on the simulated flow and transport within the model domain or Study Area.

Letter/Comment: 1014/Z

Issue: **6bj. Commenters observe that, in the groundwater model, the constant head boundary in layers 9 through 12 and a no-flow boundary in layers 8 through 1 causes all flow to plunge downward. Effectively, the numerical model dams flow from exiting the domain through the upper layers, which are about 500 feet thick in this area. Conceptually, this is highly unrealistic. By drawing flow deep into the domain, the model also draws all contaminants away from the surface and from Angus Creek. For the RCA model, the contaminants enter the domain only at depth (through the bottom of the pits, as discussed further below), the model forces flow downward and prevent any contaminant transport upward.**

Response: The comment mischaracterizes the simulated flow condition in the numerical model. Please refer to the response to comment 6ai. Mass balance analysis for the Wells Regional Aquifer indicates that almost all the flow in model layer 12 originates from the constant head boundary on the upgradient end of the fault rather than from downward flow from the upper Wells Formation. Additionally, groundwater flow is mostly horizontal in the upper portion of Wells Regional Aquifer, and less than 14 percent of the simulated flow in the upper portion of the Wells Regional Aquifer passes through the Enoch Valley Fault.

Letter/Comment: 1014/AA

Issue: **6bk. Commenters observe that specifying K with parameter zones causes very sharp changes in K at the boundary between zones, unlike that which occurs on the ground where folds are likely to result in continuous changes in K with distance from the anticline. Arcadis should have used more parameter zones to transition from the extremely high K centered on the anticline and extending under the proposed pit to the very low K zones west of the pits.**

Response: Based on available site-specific data, the hydraulic conductivity zonation and distribution in the numerical model is appropriate. The hydraulic conductivity values of each hydrogeologic unit in the model represent average conductivity values for respective geologic formation. Because of limited site-specific hydraulic data, increased parameter zonation would have resulted in over parameterization of the numerical model and less individual sensitivity of hydraulic conductivity zones.

Letter/Comment: 1014/AB

Issue: **6bl. Commenters observe that, in the groundwater model, the general head boundary in layer 6 is no flow in all of the layers beneath the river. This conceptualization of the surface/groundwater interactions may artificially force water into the river.**

Response: The comment indicates flawed understanding of site conceptualization and numerical flow simulations. The GHBs in model layer 6 represent regional discharge for the intermediate aquifer system only. No flow contribution from layer 6 GHBs occurs to the river cells in model layer 1.

Letter/Comment: 1014/AC

Issue: **6bm. Commenters observe that, in the groundwater model, parameter zones drain reaches 1, 2, and 3, representing Angus Creek, are not well described. All reaches are specified to have a constant head, which means the model does not account for slope along the reach.**

Response: The numerical model was tested by assigning gradational stage along the reaches of Angus Creek. The model testing results indicated no significant changes in discharge rate to Angus Creek.

Letter/Comment: 1014/AD

Issue: **6bn. Commenters observe that it is concluded that a groundwater contaminant plume approaches but does not enter Angus Creek, but comment that this conclusion appears to be a product of the assumed evapotranspiration boundary preventing selenium-laden groundwater flow from reaching Angus Creek.**

Response: Please refer to the response to comment 6as. In addition to discharging shallow groundwater, the ET boundary was simulated to intercept contaminant mass representing plant uptake in the wetland area.

Letter/Comment: 1014/AE

Issue: **6bo. Commenters observe that the pit backfill is not simulated in either predictive simulation. This is critically important because all layers are simulated as saturated, even though the regional water table may be below the pit bottom.**

Response: See the response to comment 6ai.

Letter/Comment: 1014/AF

Issue: **6bp. Commenters observe that the conceptualization in the predictive simulation for the RCA of an unchanged K value after replacing a Meade Peak zone with backfill slows the passage of the seepage and causes drawdown mounds to**

occur in the model, as shown on Figure 17. Similar mounds appear after changes in seepage in the Proposed Action simulations. The mounds correspond to changed recharge near extremely low K zones. The presence of these mounds also suggests that the model may have had difficulty converging due to large water balance errors in specific cells near these mounds.

Response: See the response to comment 6ai. It should also be noted that the mounding information and mass balance errors have been highly exaggerated, which is likely because of the lack of thorough review of the numerical model results. The apparent mounds mentioned in the comment are discrete, localized, and occur around a few active cells within an otherwise simulated dry or partially full cell. The mass balance errors in those areas are extremely low (1E-06 percent or less); the overall flow balance error for the model is 1.5 percent, and the transport mass balance is 1E-9 percent. It should further be noted that, because the COPC sources were applied directly over the Wells Formation footprint in the backfill area, there was no delay in contaminant mass transport through the backfill area.

Letter/Comment: 1014/AG

Issue: **6bq. Commenters observe that the descriptions of the RCA pit excavation for the simulation suggest that excavation would be at least to model layer 5 in the southern portion of the pit and into layer 8 farther north. Layer 8 is completely below the Meade Peak Formation so that excavating to that point would expose seepage directly to the Grandeur Tongue, which is often considered the upper member of the Wells Aquifer. If the K within the pit in layers above this layer 8 was increased so that seepage could occur through it, there would be seepage from the backfill into more than just the Wells Formation on the east side of the pit. This would increase the transport and likely increase the concentration in any plume moving away from the pit.**

Response: See the response to comment 6ai.

Letter/Comment: 1014/AH

Issue: **6br. Commenters state that the failure to simulate changed K for backfill in the pit is a fatal error in the simulation of impacts from this project. The results of modeling contaminant transport are very incorrect and probably vastly underestimate the impacts of this proposed project.**

Response: See the response to comment 6ai. It needs to be further iterated that the conceptualization and numerical model representation of site conditions are appropriate. Commenter’s perception of a fatal error is likely a result of insufficient review or based on an incomplete understanding of the numerical model setup and simulation results.

Letter/Comment: 1014/AI

Issue: **6bs. Commenters observe that several aspects of the infiltration modeling effort contribute to the estimated rate being biased too low. First, the parameters for the different materials used to construct the cover were determined by testing samples recovered from the area. Samples were composited for testing, but the method used would create a sample more homogeneous than would occur as a result of construction in the field. Heterogeneities in the field cause preferential flow, including finger flow, that are not simulated in any modeling. Finger flow leads to a certain amount of flow reaching the backfill far sooner than predicted using the Richards equation (the unsaturated flow formula used in SVFlux). The composite samples did not include material larger than 3 inches in diameter. It does not specify whether a similar cutoff would be used for the actual covers. Larger particles lead to preferential flow around the particles and generally cause**

the smaller particles to sort leaving large pore spaces downgradient of the particles.

Response: The objective of the on-site cap-and-cover materials investigation was to characterize the available on-site materials for potential use in the cap-and-cover system. GM and alluvium/colluvium samples were collected from both within the pit footprint and from the external borrow areas to determine if these soils would be appropriate for cover construction. These samples and the corresponding analysis are representative of the actual materials that would be used in the cap-and-cover system.

The methodology used to form the composite samples is a widely used and professionally accepted approach. The saturated and unsaturated permeabilities of the material were adjusted to account for the oversized material percentage.

Very little stone and cobble content was observed in the on-site test pits, particularly in the external borrow area. Where present, the cobbles tended to be at depth and not in the shallow surface soils. As would be expected on higher slopes, rock content of soils collected from within the pit footprint varied more than the external borrow area, but still consisted primarily of gravels.

The top layer of the cap-and-cover would consist of pit GM. It is expected that this top layer could weather to a more permeable state, but as demonstrated in the infiltration model sensitivity analysis, when the hydraulic conductivity of this layer is varied within reasonable limits, it has minimal influence on the overall performance of the cover. The intent of this layer is to support vegetation, provide moisture storage for ET, provide a protective cover for the underlying lower-permeability layer of external area material, and reduce the freeze-thaw risk in the important deeper layers. Some degree of rock and cobble content in the top layer would tend to armor the surface from erosion. Nonetheless, material from rocky areas within the pit footprint will not be used in the cap-and-cover, and was excluded from the estimated volumes of available material.

The middle lower-permeability cover layer would consist of combined GM and alluvium/colluvium from the external borrow area. The material from this area contains very little rock and cobble. The borrow material with excessive cobbles would be avoided and would not be used for critical cap components.

The deepest layer in the cover would consist of pit alluvium/colluvium. Similar to the top layer, rock and cobble content in this layer would not have a significant effect on the overall cover performance.

However, the laboratory analysis and numerical infiltration modeling could not account for all the unknowns and field conditions including gross soil properties, soil structure, ambient weather conditions, and normal variations in soil placement. Soil structure is a well-known property of mature soils and develops with time. Structure is typified by the soil developing clods separated by cracks that are preferential pathways for percolation. The development of soil structure has the effect of broadening the pore size distribution, thus reducing the air entry suction and increasing the overall saturated permeability of the soil (Taylor 1972, Brady 1974, Hillel 1980, NRCS 2001). The increased permeability as a result of structure is typically more pronounced in the vertical direction. The structure is caused by roots, freeze-thaw, and wet-dry cycles enhanced by root water uptake. Soil structure formation can include, but does not require, the shrink-swell properties of expanding clays. It is also developed in lean soils through the action of capillary forces, microbial activity, roots, and annelids (worms). During the winter, roots will die back and ultimately decay, resulting in open pathways for water movement. The looser a soil, the less effort and time required to develop structure. For successful root growth, soil oxygen needs to be at sufficient levels. Soils without structure tend to have less oxygen at root depth. The development of soil structure is needed for healthy roots.

When the soils and GM are excavated or dozed, loaded into trucks, dumped, and spread, it effectively destroys the in-place soil structure that might have existed. The modeled percolation rate represents the cover when it is first placed without soil structure. The effect of soil structure could not be evaluated because sample collection and preparation processes, and laboratory testing apparatus eliminated the in situ soil structure. Consequently, the laboratory testing did not measure the gross soil properties as they would be in the cover once it develops structure, a component that is also needed for healthy vegetation, and a key requirement for effective ET. The infiltration model (SVFlux) used the laboratory data, which did not account for soil structure, nor does the model itself account for the development of soil structure.

Considering that not all the unknowns could be evaluated through laboratory testing and numerical infiltration modeling, the percolation rate for the RCA was increased by 50 percent to 0.21 in/yr, which was then used in the fate-and-transport modeling of Rasmussen Valley Mine-related COPCs and their subsequent impact assessment to the surrounding environment.

Letter/Comment: 1014/AJ

Issue: **6bt. Commenters state that the reduction of precipitation due to sublimation is not justified. Sublimation reduced annual precipitation by 12 percent indicates that sublimation is a major parameter in the water balance; an overestimation that would lead to much less water remaining for percolation.**

Response: As stated in Section 5.1.1 of the Rasmussen Valley Mine Cap and Cover Alternatives Analysis Report, the application of this reduction for sublimation is consistent with empirical data from the reclaimed Enoch Valley Mine, which indicated that 20 to 50 percent of the snowpack was lost to sublimation (O'Kane 2013). The southeast edge of the reclaimed Enoch Valley Mine is approximately 2.0 miles northwest of the Rasmussen Valley Mine at a similar elevation. Portions of the reclaimed mine across the divide in the Enoch Valley have a southwestern aspect similar to the Rasmussen Valley Mine. The low end of the range of sublimation (20 percent) was applied to the Rasmussen Valley Mine precipitation data, reducing the annual precipitation volume by approximately 12 percent. This range of sublimation is also consistent with measured sublimation reported for an exposed, southwestern aspect site at the Reynolds Creek Experimental Watershed (RCEW) in southwestern Idaho (Reba et al. 2011). The study reports that 41 percent of the snowpack sublimated during a year when 90 percent of average snowpack was received, and 16 percent of the snowpack sublimated during a year when 128 percent of average snowpack was received. The studied site at the RCEW ranges in elevation from approximately 6,650 ft to 7,000 ft above means sea level (amsl), and has an average annual precipitation of approximately 22 in/yr, similar to that of the Rasmussen Valley Mine Project.

Letter/Comment: 1014/AK

Issue: **6bu. Commenters recommend that, for the infiltration modeling, it would be preferable to estimate how the factors that control Ksat vary across the cover to better understand how Ksat varies. Using that variability, it would be possible to estimate locations or amount of the cover with much higher percolation. Small areas with Ksat an order of magnitude higher than the average could vastly increase the percolation, but nothing in this analysis considers this likely variability.**

Response: The objective of the infiltration modeling was to assess the overall long-term average performance of the cap-and-cover system. All of the data and input parameters used in the modeling were developed with this objective in mind. The estimated net percolation rates for each cover alternative represent the long-term average condition and not a best-case or worst-case scenario. While some degree of variability is unavoidable, there is no way to accurately assess or estimate the spatial variability of the cap-and-cover system. However, using the mean hydraulic conductivity, those cover areas that have a saturated hydraulic conductivity (Ksat) greater than the estimated design Ksat would be balanced by those areas with a Ksat lower than the estimated design Ksat, and it is expected that these higher and lower Ksat areas would not predominate in one area of the cover. Thus, the overall cover should have an average Ksat equal to the estimated design Ksat.

Letter/Comment: 1014/AL

Issue: **6bv. Commenters observe that, in the infiltration modeling, the percolation for the cover is assumed to be the long-term average and is used as recharge to the pit backfill for the GFTM to predict the movement of contaminants. In addition to failing to consider temporal variability, the reported averages reveal at least one additional error with the analysis. Evaporation ranges from just 10.7 to 10.72 in/y, and transpiration ranges from 3.11 to 4.71 in/y (BC 2015a, p 6-1). The breakdown between the components of evapotranspiration (ET) suggests that something is wrong in the model's analysis of ET. Transpiration for a good grass cover with LAI should be much higher, but this suggests that much of the available water is lost to evaporation. This could be due to the wind speed being higher when soil moisture is higher, as suggested above; it could lead to ET being higher than a proper analysis would result in. Even if transpiration should be higher, the evaporation could be lower.**

Response: Temporal variability in cover performance is detailed in Appendix C of BC (2015a) in the results of a 100-year simulation. These results show that simulated net percolation rates are correlated with applied precipitation, illustrated by Figures C-7 through C-11, covering all aspects of water balance variability with changes in annual climatic conditions.

The partitioning of water loss between evaporation and transpiration is one of the most poorly understood processes in ecohydrology, and is the subject of continuing research. Investigators have reported transpiration/actual evapotranspiration (T/AET) ratios ranging between 1 and 70 percent (Laurenroth and Bradford 2006). The T/AET ratio may be affected by many factors, including soil texture, precipitation characteristics, and slope aspect. The AET is generally much better understood.

O'Kane (2013) reports that AET varied between 58 and 72 percent of annual precipitation for the instrumented overburden cover at the Enoch Valley Mine. The southeast edge of the reclaimed Enoch Valley Mine is located near Rasmussen Creek, approximately 2.5 miles northwest of the Rasmussen Valley Lease. The Enoch Valley Mine area extends to the northwest, and the main portions of the mine area have a southwest aspect, similar to that of the Proposed Action. The modeled AET for the Proposed Action cited by the commenter ranges from 58 to 65 percent of annual precipitation, which is consistent with the O'Kane findings for the Enoch Valley Mine. Model results for the modified plant growth parameters presented in Addendum 3 to BC (2015a) indicate an AET that is approximately 72 percent of annual precipitation for both the Proposed Action and RCA covers, which is also reasonable in consideration of the Enoch Valley Mine results.

The model simulations to assess overburden cover performance were performed using the SVFlux unsaturated moisture flow software, which uses state-of-the-art methods for estimating this partitioning. The well-recognized Penman (1948) method is used for estimating potential evaporation, and the Wilson (1990) method is used for estimating actual evaporation. These methods consider air temperature, relative humidity, net solar radiation, and wind speed daily in the simulated removal of near-surface water in the model. Model inputs controlling the estimation of transpiration include descriptions of LAI, the soil suction properties that affect water uptake by plants, a prescribed rooting depth, and a generalized prescribed root distribution. These evaporation and transpiration models have been verified through comparison to experimental data, and have demonstrated to be quite accurate.

The partitioning of AET between evaporation and T in the model results is reasonable in the context of current scientific understanding, and the modeled AET results are consistent with the measured performance of the Enoch Valley Mine cover.

Letter/Comment: 1014/AM

Issue: **6bw. Commenters observe that the report describes model simulation in section 5.4, but leaves out two very simple but necessary factors. It does not specify the time step, but the simulation of precipitation events occurring in less than a day suggest the time step is less than a day, perhaps as short as 2 hours. It also does not state what month the simulation commences.**

Response: Time steps in the model are variable, and range from $1X10^{-5}$ days to 0.2 day. The modeling code adjusts time steps downward to meet closure criteria as necessary, and expands them upward if closure criteria are achievable at larger time steps. The model simulations begin on October 1.

Letter/Comment: 1014/AN

Issue: **6bx. Commenters observe that, for the infiltration modeling, initial conditions were established by setting pressure "equal to -50 KPa" (p 5-2), which is slightly drier than field capacity. Commenters recommend that the report should specify whether that means all through the model profile, from surface to the bottom of the 3 feet of simulated backfill. It should also provide a graph showing how the moisture content actually varies because a suction pressure corresponds to different moisture content depending on the grain-size distribution.**

Response: Initial conditions were set to -50Kpa throughout the profile. It is acknowledged that this produces different moisture contents in materials with differing grain-size distributions. It should be noted that, after initial conditions were applied, the models were allowed to equilibrate with input parameters until the change in storage was zero or negligible, a total of 5 to 13 years of simulation depending on the type of material. Therefore, the initial conditions discussed were only for purposes of a starting condition, and have negligible effect on model predictions.

Letter/Comment: 1014/AO

Issue: **6by. Commenters observe that, in the modeling for the South Rasmussen Mine pit, there is no explanation for the solute transport parameters in the model (Stringer 2013, p 7). The longitudinal dispersivity was set at 100 feet, a reasonable value considering the scale of the transport pathways used. Often, the horizontal and vertical transverse dispersivity is set at 0.2 and 0.1 of the longitudinal dispersivity. Stringer used 30 feet and 0.1 foot for these dispersivity values. The 30 feet is high, and 0.1 foot vertical dispersivity is unacceptably low. It would prevent the contaminant from dispersing vertically and essentially confine it to the layer it is injected into unless advection would cause it to move vertically. There should have been an explanation of the choice of vertical dispersion.**

Response: As noted, the transverse dispersivity of 0.1 foot used in the P4 South Rasmussen Mine fate-and-transport model will tend to keep the contaminant confined to the injected layer. This would result in a higher amount of contaminant mass remaining in the injected layer and will cause the contaminant plume to travel farther downgradient. The horizontal transverse dispersivity of 30 feet is comparable to the commenter's suggestion of 20 feet, and along with the low vertical transverse dispersivity of 0.1 foot, should still represent a conservative approach for disclosing the potential impact to groundwater.

Letter/Comment: 1014/AP

Issue: **6bz. The method presented in Draft EIS Table 3.3-10 relates recharge only to annual precipitation, ignoring geology, which can significantly limit the amount of precipitation that infiltrates past the soil water zone. Myers' (2013) recharge estimate implicitly accounts for all factors in the watershed that affect recharge. Underestimating recharge, as was apparently done for this Draft EIS, effectively decreases the rate at which contaminants could move through the groundwater.**

Response: Although it is correct that geology is one of many factors that affect the percentage of precipitation recharged to groundwater, the commenter's statement that recharge is underestimated in the groundwater model is unsupported. The Rasmussen Valley model contains more hydrogeologic detail and resolution than presented in Myers (2013) for the Study Area, and variation in simulated recharge was estimated based on a variety of factors including topography, hydrogeology, and climatic variables. The lack of resolution in Myers (2013) model actually results in over-prediction of transmissivity at the Study Area, which resulted in the higher recharge estimate. The Rasmussen Valley model recharge values are the best average estimates available for the Study Area.

Letter/Comment: 1014/AQ

Issue: **6ca. The model leaves out two factors from the calculation that could result in higher percolation. First, the runoff calculated above would run off over the liner downhill. There would be heterogeneities in the properties, and runoff could infiltrate somewhere downhill. The modeling does not account for this. There could also be horizontal flow through the cover. Whenever the vertical downward movement is impeded, a gradient could develop to allow horizontal flow. This interflow would move downgradient to another point, where vertical motion could continue. In the modeling as done here, this water would back up, keeping the soil moisture higher nearer the surface, thereby preventing additional infiltration. The cover modeling should be done in two dimensions to account for the downhill infiltration of runoff and the downgradient flow of interflow.**

Response: See response to Issue 6y. The Proposed Action and RCA covers, both store-and-release covers, were evaluated with the 1-D simulations because they were not anticipated to have significant lateral movement of infiltrated water. This does not mean that lateral movement would not happen, but it was assumed that the simulated vertical column of cover would maintain conservation of mass in the lateral direction, and thus be a conservative estimate of net percolation. This means that any water lost laterally downslope would be replenished by water entering the simulation from upslope, or the water would become part of the net percolation. In essence, the 1-D modeling is a more conservative approach, requiring any water that infiltrates the cover profile to either move vertically in response to gravity and matrix potentials or be transpired out of the profile by plant roots, without the benefit of lateral movement. Using a 2-D simulation would be less conservative. Two-dimensional modeling is only needed when there is a significant lateral flow component that needs to be handled downslope, which generally requires a high Ksat drainage layer overlaying a very low Ksat clay, or synthetic barrier layer.

The infiltration model used to simulate the Proposed Action and RCA covers simulates runoff as precipitation or snowmelt that exceeds the hydraulic conductivity at the cover soil surface. It is correct that natural variations in cover material properties and construction could result in areas of higher and lower infiltration capability. Some of the variation was revealed in the soil and alluvium laboratory results. Variations in the precipitation and snowmelt are also expected. To capture these variations, the average (geometric mean) was used for the model because it would properly simulate the performance of the cover as a whole. Some areas could exhibit higher runoff or infiltration, but they would be balanced by areas with lower runoff or infiltration. That is why an average was used.

It is correct that horizontal flow can occur where the saturated hydraulic conductivity of the soil is less than the amount of water attempting to percolate through it. This is, in effect, how runoff occurs. It is expected that periods of saturated soils may occur during heavy precipitation events or during snowmelt, and that downslope movement of water may occur during a relatively short period. That said, each portion of the cover would be experiencing the same situation. As water moves downslope on top of a low-permeability zone, water from a saturated zone would move in from above to take its place.

Letter/Comment: 1014/AR

Issue: **6cb. The modeling technique simulated 100 years of weather data, but then used the most average year possible to estimate percolation. The modeling simulated 1 year repeatedly until there was no change in soil moisture. This completely ignores the possibility that, during some wet years, much more percolation could occur while in very dry years, there may be no percolation. Annual percolation from a time series of 100 years would not yield an average of 0.14 in/y because the high-percolation years would have a large effect on the average. Statistically, the average is the expected value of a normal distribution, but any set of data that is bounded by zero also has relatively very high values. If all else is equal, an average of a 100-year data set would be higher, perhaps significantly so, than the result of the single observation from one "average" year. Even if no other changes are made to the modeling of the cover seepage rate, the Draft EIS should use the proper average rather than the one used.**

Response: While the modeled average net percolation of 0.14 in/yr is based on an average climate year selected from the 100-year dataset, the net percolation was also modeled for each of the 100 years. The results were presented in Table C-1 in the Rasmussen Valley Mine Cap and Cover Alternatives Analysis Report Addendum 3: Cover Alternative 6 Evaluation (BC 2015a), which shows the precipitation variability used in the model and the corresponding net percolation amounts for each year. As expected over a long time period, the annual precipitation and net percolation totals vary from year to year. However, the average of the 100 annual net percolation values is 0.13 in/yr, which is almost identical to the modeled net percolation rate (0.14 in/yr) for the average climate year (year 34 of the data set) used in the modeling. Therefore, the reported average net percolation rate of 0.14 in/yr does capture the seasonal variability and is representative of the 100-year data set. The modeled net percolation rate was also multiplied by 50 percent to account for the expected increase in overall cover Ksat as the cover matured and developed soil structure.

The objectives of the infiltration modeling were to assess relative performance of cap-and-cover alternatives and to obtain a percolation rate to use in the fate-and-transport modeling. To meet this objective, climatic parameters used in the infiltration modeling, including precipitation, temperature, relative humidity, wind speed, and solar radiation from a synthetic 100-year climate dataset were produced specifically for the Rasmussen Valley Mine Project using the synthetic climate generation software WGEN (Richardson and Wright 1984). For the RCA cover, a 100-year simulation was performed using 100 years of simulated climate. This simulation included higher and lower precipitation years ranging from 13.02 in/yr up to 37.36 in/yr. The 100-year simulation resulted in an average percolation rate of 0.13 in/yr, with the maximum percolation rate of 1.31 in/yr and a minimum of minus 0.86 in/yr moving upwards from the bottom of the cover during that dry year.

Table C-1 and Figures C-6 and C-7 in the Rasmussen Valley Mine Cap and Cover Alternatives Analysis Report Addendum 3: Cover Alternative 6 Evaluation (BC 2015a) show the precipitation variability used in the model and the corresponding net percolation amounts for cover Alternative 6. As would be expected from evaluating the average cover performance over a long time period, there would be wetter-than-average years when the net percolation would exceed the modeled value, and there would be drier years when the net percolation would be lower.

Variations in net percolation rate through the cover would be damped by the thickness of underlying backfill and geologic layers, and the backfill and geologic layers above the aquifer may provide additional storage capacity, which further reduces the amount of percolation reaching the aquifer until the additional capacity is filled. A 2006 study by O'Kane Consultants titled "Predicted Seepage Rates into the Aquifer beneath Backfilled Panels for 100-year Period" in support of the 2008 Smoky Canyon Panels F&G Final EIS concluded that using the average net percolation for the 100-year period is a legitimate basis for determining cover performance and input into a fate-and-transport model. Also see responses to comments 4d and 4e.

Letter/Comment: 1014/AS

Issue: **6cc. The covers would result in changes to the natural recharge rate at the pit, with the change being large due to the RCA cover. This would eliminate a significant source of meteoric water to the groundwater. Changes in recharge due to covers could change groundwater levels in the underlying aquifers. This is a stress caused by the project (Draft EIS, p 4-92, 93). The Draft EIS has not estimated changes in groundwater levels, discharges from wetlands, or discharge to streams that could result from changes in recharge.**

Response: The commenter's statement that the Draft EIS does not evaluate changes in groundwater levels, discharges from wetlands, or discharge to streams that could result from changes in recharge by the construction of the RCA cover is incorrect. Changes to recharge rates from the construction of overburden cover systems under the Proposed Action and RCA are directly simulated and evaluated in the contaminant fate-and-transport models. Changes to groundwater levels and groundwater discharge to wetlands and streams under the Proposed Action are discussed at length in **Sections 4.3.1.1.3** and **4.3.1.1.4** of the Draft EIS. Changes to groundwater levels under the RCA are discussed in **Sections 4.3.1.2.4** and **4.3.1.2.5**. The discussion in **Section 4.3.1.2.5** is part of a broader discussion about the predicted impacts to streams and wetlands.

Letter/Comment: 1014/AT

Issue: **6cd. The Draft EIS indicates that the expected Se concentration from leachate from South Rasmussen Mine Pit Backfill is 0.4805 mg/L. Presumably, this is the value used for simulations in the model for that mine. This is overburden that could have been backfilled at Rasmussen Valley Mine, where the Se concentrations would have been simulated at values discussed above. It is entirely inappropriate to treat Rasmussen Valley Mine overburden at South Rasmussen as if it originated at South Rasmussen. The Draft EIS should consider impacts at South Rasmussen based on using Rasmussen Valley Mine overburden.**

Response: The source term for the Rasmussen Valley Mine overburden to be placed in the South Rasmussen Mine has been revised to account for the potential differences between the overburden obtained from the South Rasmussen Mine. Agrium provided the synthetic precipitate leaching procedure (SPLP) data set from the RCA (Whetstone 2015a). Samples from the boreholes in RCA Phases 1 through 4 were analyzed to develop source terms for use in the South Rasmussen Mine fate-and-transport modeling because only the materials from these mine phases would be placed in the South

Rasmussen Mine main pit. The RCA Phases 1 through 4 data included the analytical results from 37 samples. The average selenium and manganese concentrations from the SPLP data set for each lithology were weighted according to the percentage of the total materials from RCA Phases 1 through 4 to be placed in the South Rasmussen Mine pit. The source term for use in the South Rasmussen Mine fate-and-transport modeling was then calculated according to the process detailed in the South Rasmussen Mine POC application filed with and approved by the IDEQ. Source term concentrations of 0.76 mg/L for selenium and 0.94 mg/L for manganese were developed for the RCA material to be placed at South Rasmussen Mine. See also response to comment 6at.

Letter/Comment: 1014/AU

Issue: **6ce. The Se plume in the Wells Formation extends to the NW boundary, meaning there are exceedances to and probably beyond the boundary. The model should be extended by moving the boundary further north to estimate how far the Se actually goes.**

Response: The extents of the Rasmussen Valley Mine numerical model domain are sufficient to disclose that the groundwater COPC plumes would extend a substantial distance within the Wells Regional Aquifer, to determine if local surface waters would be impacted, and to allow for an evaluation that the Proposed Action needed a POC determination. It was the POC determination requirement that prompted Agrium to propose the RCA, which resulted in elimination of the surface water impacts above applicable regulatory criteria and also significantly smaller predicted COPC plumes, well within the extents of the numerical model domain. No extension or changes to the Rasmussen Valley Mine numerical model domain are needed.

Letter/Comment: 1014/AV

Issue: **6cf. Both alternatives would allow runoff from uphill and from previously backfilled areas to accumulate in a sump, although the description of disposal varies (Draft EIS, p 4-30, p 4-79). The Proposed Action would move water that accumulates in a pit from runoff to unreclaimed backfill area and allowed to infiltrate (p 4-30). The Draft EIS does not analyze the fate of contaminants that would be leached due to the infiltration of such meteoric water. Also, runoff from uphill would enter the backfilled pits under each alternative, but the modeling of seepage through the backfill does not consider this source. For the Proposed Action, runoff from a 663-acre slope NE of the pit would run onto the backfill (Draft EIS, p 4-33). It is not to be allowed to pond there, but runoff clearly could infiltrate into the backfill. The Draft EIS should complete a fate-and-transport analysis of rainfall falling into and runoff entering the pits during mining and after closure. Draft EIS Table 4.3-3 does not include runoff from uphill as an annual output.**

Response: Precipitation that falls on uncovered backfill and into the open pit would be allowed to infiltrate into the backfill or into the bottom of the pit. Given the rate of mining, this is expected to be less than 1 year's worth of precipitation for each panel. Some panels mined during the summer may actually have very little meteoric water to manage. The water that remains after sublimation and evaporation is expected to be either stored in the backfill as residual moisture or percolate downward through the cover and through the backfill at a rate corresponding to its unsaturated hydraulic conductivity. The moisture is expected to percolate into the groundwater at a rate similar to the long-term percolation rate simulated in the fate-and-transport modeling.

Letter/Comment: 1014/AW

Issue: **6cg. The anisotropy found for the Wells Formation in the pump test reviewed above is not included in the parameters for the model.**

Response: During the PW-1W constant-rate pumping test, observed drawdowns at OW-2W and MW-3W (located approximately 101 feet north and 250 feet northwest of PW-1W, respectively) were found to be of similar magnitude, suggesting generally isotropic conditions in the vicinity of these wells. Drawdown values at distal downgradient wells MW-2W and MW-12W (located approximately 3,119 feet and 7,495 feet northwest of PW-1W, respectively) exhibited equal drawdown, suggesting that these wells likely reside along a structure lineament that is hydraulically connected to the pumping well. Measured data from the pumping test also showed no measurable drawdown at LC-MW-1W and LC-MW-4W (located approximately 3,667 feet and 2,426 feet northeast of PW-1W, respectively), suggesting that those wells likely reside in a low-conductivity zone of the Wells Formation. The Rasmussen Ridge along the hinge of the Snowdrift Anticline is conceptually a more highly fractured zone with higher permeability than the surrounding bedrock based on pumping test data from well PW-1W. As such, a high hydraulic conductivity zone was delineated for Rasmussen Ridge along the anticline hinge area, whereas the hydraulic conductivity zones on either side of this area were assigned a lower value based on observation from the PW-1W pumping test and regional information. Given the assignment of the two hydraulic conductivity zones, the distribution pattern of the two zones, and estimation of the hydraulic conductivity during the model calibration, assignment of any anisotropy was not deemed necessary.

Letter/Comment: 1014/AZ

Issue: **6ch. BC (2015a) used the finite element code SVFlux to model seepage through the cover to the backfill underlying the cover. SVFlux is a proprietary code that has not undergone public peer review, so the BLM should not use it without proper testing.**

Response: SVFlux is a commercially available software package widely used in industry to evaluate percolation through engineered cover systems. The modeling package was reviewed by the Agencies for use at Rasmussen Valley and was determined to produce results consistent with the expected performance of cover systems under field conditions (Arcadis 2014). The selection of SVFlux over public domain modeling codes, such as Hydrus 1D and UNSAT-H, was based on a number of software features that facilitated the modeling process and evaluation of the results. The conclusions of the SVFlux model review are discussed in a memorandum prepared by Arcadis on behalf of BLM (Arcadis 2014).

Letter/Comment: 1014/BA

Issue: **6ci. BC set the modeled wind speed at a constant 5.4 miles per hour (mph) (BC 2015a, p 5-3). This would remove moisture faster at certain times; after a precipitation event, it could increase the evaporation and remove soil water before it has a chance to percolate. Although averaging wind speed might seem to just balance the highs and lows, because wind speed may be less just after precipitation, it might increase the rate at which moisture is lost. This would have the effect of decreasing percolation by removing water from the cover layer faster. Additionally, the higher wind gusts could quickly dry the soil so that much of the wind energy is expended on dry ground.**

Response: According to wind speed data from the Diamond Flat Interagency Remote Automatic Weather Station, which was used in developing the 100-year climate data set for the infiltration modeling, wind speeds are highest in the spring (i.e., April, May, and June), which corresponds with the spring rainy season (Whetstone 2014). The data also show that the prevailing wind direction is predominantly from the west and southwest. Because the highest winds generally occur during the rainy season, and because the predominant southwest wind direction is normal to the slope (aspect) of the proposed pit backfill and cover system, wind will have a more significant impact on evaporation for the Proposed Action at Rasmussen Valley Mine than at a site with a different aspect or mixed aspects. Therefore, the use of an average wind speed in the infiltration modeling likely provides a conservative estimate of evaporation at the site. This approach is also consistent with infiltration modeling performed by O'Kane (2009) to evaluate soil cover alternatives at the Blackfoot Bridge Mine, where they used an average wind speed of 5.4 mph.

Letter/Comment: 1014/BB

Issue: **6cj. Setting leaf area index equal to 2 assumes that reclamation activities have been successful. Prior to the completion of reclamation and in the future after a dry period puts the grassland into poor condition, it may be too high. This assumption decreases percolation at least during some periods.**

Response: See also the response to comment 4d. The LAI of 2.0 indicates a structurally diverse, multi-layer cover plant community and is considered a conservative estimate for the reclaimed areas of the Rasmussen Valley Mine. One of the infiltration modeling objectives was to assess performance of cap-and-cover alternatives under average, long-term conditions. While the LAI will vary from year to year, the value should remain relatively consistent based on the proposed seed mix and the anticipated prevalent long-term species. Therefore, an LAI of 2.0 is used in the infiltration modeling to represent long-term average conditions at the site.

Letter/Comment: 1014/BC

Issue: **6ck. The soil water characteristic curves (SWCCs), which relate moisture content to suction pressure, show even more variability; through the use of equations, K as a function of Ksat may be determined for any moisture content. BC Figure 5-1, reproduced here as Figure 18, shows the SWCCs for the various materials used in the modeling. Figure 19, however, shows that the modeling uses an average and does not consider any variability. Figure 20 shows the variability of the observed points around the final average SWCC for growth media, the K of which primarily controls runoff. Ksat varies over several orders of magnitude for most of the materials, including the within-pit growth media (Figure 20).**

Together, these figures demonstrate the variability in the conductivity data for which the modeling results (BC 2015a) assume an average. Averaging the curves does not give a representation of the variability that could be found around the cover. Even if just a small proportion of the cover allows percolation that is an order of magnitude higher than the average over the backfill, the overall percolation estimate through the backfill would change significantly. The variability shown on Figures 18 through 20 indicates that order of magnitude increases in percolation are likely (order of magnitude decreases could also occur, but going from 0.14 to 0.014 in/y will not make a substantial difference in overall percolation).

Response: The variability of cover hydraulic properties was assessed through the sensitivity analyses presented in Attachment E to Addendum 3 of BC (2015a). The sensitivity analysis showed that varying the saturated hydraulic conductivity of the GM over a range greater than three orders of magnitude induced a change in predicted net percolation of only 0.01 in/yr. This sensitivity analysis covered the entire range of laboratory-reported saturated hydraulic conductivity values for the GM. Although the predicted net percolation was sensitive to changes in saturated hydraulic conductivity of the low-permeability layer underlying the GM, Figure C-1 of BC (2015a) shows that the material intended for use in this layer, the external borrow areas combined GM, alluvium, and colluvium, displays very low variability in hydraulic conductivity, and is appropriately characterized by the geometric mean of the laboratory values. These results indicate that the uniform nature of hydraulic properties of the low-permeability layer of the cover will help ensure that significant differences in net percolation across the extent of the cover will not occur.

Letter/Comment: 1014/BD

Issue: **6cl. The field investigation was of shallow surficial soils up to 10 feet deep (BC 2015a, p 3-2). The report should address how much of the material would be drawn from these shallow depths and how much would be drawn from much deeper.**

Response: The field investigation focused on a practical maximum cover soil borrow excavation depth of 10 feet. The estimated available on-site cover soil quantities are based on a depth of 10 feet and are much greater than needed for the preferred cover alternative. Therefore, Agrium does not anticipate borrowing cover soils from a depth of greater than 10 feet. As with all soils to be used for cover construction, if excavation greater than 10 feet is required, the soils would be tested to ensure compatibility with cover design.

Letter/Comment: 1014/BE

Issue: **6cm. The RCA model is run in steady-state flow with transient solute transport, similar to the modeling at Rasmussen Valley Mine. Steady-state flow simulations prevent consideration of significant recharge events that could input a slug of Se to the groundwater flow.**

Response: Coupling transient solute transport with steady-state flow solutions is a common practice for predicting mine impacts to groundwater for the southeast Idaho phosphate mining area and for mining projects in general. The steady-state flow solution represents average groundwater flow conditions, and is generally considered to be the best approach for predicting the long-term transport of water quality constituents in underlying groundwater systems. Over a long period of time (e.g., 100 years or more), some years are anticipated to include greater amounts of precipitation recharge (and net percolation), and some years are anticipated to include lesser amounts of precipitation recharge (and net percolation) compared to the overall average value as a result of variation in precipitation volumes and patterns. This variability has been captured in Table C-1 and Figures C-6 through C-11 in the Rasmussen Valley Mine Cap and Cover Alternatives Analysis Report Addendum 3: Cover Alternative 6 Evaluation (BC 2015a), which presents the net percolation results from simulation of 100-year synthetic climate record with the infiltration model. The response to comment 4e includes a discussion of climate variability on infiltration model predictions used to predict volumes of net percolation through reclaimed pit backfill.

Letter/Comment: 1014/BF

Issue: **6cn. Stringer (2015) Attachment C provides the makeup of the different South Rasmussen backfills, including the lithology by fraction of the backfill and selenium concentration. Of the various lithologies, the Meade Peak members all have selenium concentrations equal to 0.82 mg/L, the highest simulated for South Rasmussen. The first pore volume leachate concentration for Rasmussen Valley Mine overburden is much higher than the concentration reported for South Rasmussen (0.48 mg/L). Although Stringer does not state it anywhere, the selenium concentration (and that for other contaminants) used for estimating source concentrations appears to be close to the average for the seven pore volumes analyzed for Rasmussen Valley Mine. This is the most likely explanation because it is very unlikely that rock at South Rasmussen would contain so much less Se than rock at Rasmussen Valley Mine, less than 1 mile away.**

Response: It appears that the commenter is questioning the method employed to develop the source terms for the South Rasmussen Mine fate-and-transport modeling. The commenter questions whether the source terms used in the South Rasmussen Mine fate-and-transport modeling were derived from averaging the leachate results of the first seven pore volumes from the Rasmussen Valley Mine geochemical study plan. This would not be possible. The Rasmussen Valley Mine geochemical column study was not completed and finalized until 2015. The South Rasmussen Mine POC application, which included the development of the South Rasmussen Mine selenium source term, was submitted to the IDEQ in 2014.

The source terms used in the fate-and-transport modeling for these two discrete projects were developed independently. The data and methodology used to develop the source terms for the Rasmussen Valley Mine fate-and-transport modeling are presented in detail in the Revised Final Baseline Geochemistry Study Rasmussen Valley Mine Project submittal to the BLM (Whetstone 2015). The data and methodology used to develop the source terms for the South Rasmussen Mine fate-and-transport modeling were presented to the Agencies in February 2016 (Agrium 2016).

Letter/Comment: 1014/BG

Issue: **6co. The model simulates precipitation of Se in lower layers due to expected reducing conditions beneath the water table as decay with a half-life of 365 days (Stringer 2013, p 7) and simulated retardation to simulate the adsorption of Se to the aquifer matrix in shallow groundwater (Stringer 2015, p 2). There is no explanation or reference given for choosing the decay rate. This differs from the modeling at Rasmussen Valley Mine, which treated Se transport as conservative. The sensitivity analysis shows that treating Se as conservative would allow it to flow deeper into the model domain (Stringer 2013, p 7, Figure 14)**

Response: A fully detailed discussion of the decay factor used in the referenced modeling is supplied in the publicly available Appendix D of P4's Request for Setting POC application submittal to the IDEQ (NewFields 2014). The fate-and-transport model for the Wells Formation for the South Rasmussen Mine was developed and run both with and without the previously mentioned decay factor. The commenter is correct, as would be expected the modeling without decay shows more migration of selenium than the modeling with the decay of selenium. The predicted selenium plumes from the South Rasmussen Mine were submitted in the June 2014 POC application without attenuation. "Results shown on Figure 8 are conservative in that they assume no natural attenuation, adsorption or precipitation of selenium will occur within the saturated zone..." (p. 23). Therefore, the modeling for the Rasmussen Valley Mine and the modeling submitted for the original South Rasmussen Mine POC application both applied conservatism to the transport of selenium in the Wells Regional Aquifer by not incorporating any attenuation. In consideration of the Rasmussen Valley Mine's permitting schedule, results of P4's fate-and-transport modeling, without inclusion of decay, have been made available to the BLM for the Final EIS. This submission did not include decay, or the potential impacts of the RCA backfill that will be placed in P4's South Rasmussen Mine Main Pit. Submission of this information to the BLM was ahead of P4's submittal of the same information to the IDEQ for the South Rasmussen Mine POC determination, to address placement of RCA backfill in P4's South Rasmussen Mine Main Pit.

Letter/Comment: 1014/BH

Issue: **6cp. Commenters note that Section 2.5.1.8.3 should define the storage capacity of Cover C and indicate in the text that it will perform appropriately with actual precipitation amounts for the mine area and the dormancy period of vegetation on the cover material.**

Response: The infiltration model considers various physical and climatic parameters and processes, including storage capacity and precipitation. The effects of these parameters are accounted for in the model results discussed in **Section 4.3.1.1.2**.

Letter/Comment: 1015/Q

Issue: **6cq. Commenters note that in the first sentence of Section 3.3.2.2.1 [now Section 3.3.2.1.1], "that participates" should be changed to "may participate," and that this "30+ year old conjecture" [Ralston 1983] is not supported by data.**

Response: The definition of a regional-scale aquifer is that it participates in inter-basin transfers of groundwater and has long flow paths that are characterized by discharge at springs with nearly constant annual flows (Cannon and Ralston 1980; Ralston et al., 1983).

The consensus among the group of hydrogeologists working on the Rasmussen Valley EIS is that Ralston's "30-year old conjecture" is quite accurate. The group agrees without question that recharge in the Blackfoot River watershed near the Webster Range, Dry Ridge, Schmidt Ridge, and the Aspen Range discharges at high-flow springs located in both the Bear River watershed and the Blackfoot River watershed. This is shown on **Figure 3.3-16** of the EIS.

The aquifer therefore meets all conditions of the definition including inter-basin transfers of water, long flow paths, and discharge at springs with nearly constant annual flows. Ralston's 30-year old work is cited because he understood the system correctly and was the first one to publish this insight in hydrogeologic literature for the district.

Letter/Comment: 1015/S

Issue: **6cr. Commenters request that in the first sentence of Section 3.3.2.2.2 [now Section 3.3.2.1.2] "… and Rex Chert are intermediate-scale aquifers" be changed to "… and Rex Chert <u>host</u> intermediate-scale aquifers."**

Response: The suggested change has been made.

Letter/Comment: 1015/T

Issue: **6cs. Commenters observe that the percent recharge numbers by Buck and Mayo (2004) used in Table 3.3-10 [now Table 3.3-11] are extreme underestimates of recharge. Commenters suggest considering another source of recharge estimates, particularly during the design phase of the final cap.**

Response: The consensus of the group of hydrogeologists working on the Rasmussen Valley Mine Final EIS is that the recharge estimates developed by Buck and Mayo are the current best estimates of average recharge rates in the district. The group disagrees with the commenter's characterization that the values are "extreme underestimates" and believes that on an average basis, the estimates tend to over predict recharge in many areas because of low-permeable geologic units exposed at the surface. It is noted that Buck and Mayo's estimates are scaled for annual precipitation using the only quantitative data available for the area (Ralston 1977). The data are from little Long Valley which is located 6 miles away from the Study Area and forms the headwaters of Angus Creek.

Letter/Comment: 1015/U

Issue: **6ct. Commenters note that in Section 4.3.1.2.3, based on the modeling, the Rasmussen Collaborative Alternative has a low probability of impacting the shallow groundwater, Angus Creek and the Blackfoot River, but COPCs will contaminate the regional aquifer at concentrations well above surface water and ground water standards. Is the expansion of the Rasmussen Valley mine and inevitable contamination of the regional aquifer contrary to the goals and objectives of the CERCLA activities occurring in the Southeastern Idaho**

Phosphate Patch? Please add text to describe that measures being taken prevent groundwater and surface water from becoming contaminated to the point of creating another CERCLA site.

Response: The numerical modeling analysis of the RCA that is presented in the Final EIS indicates that the project is expected to meet applicable regulatory standards for groundwater. Given this conclusion, it is unclear why the commenter believes that the project would impact ongoing CERCLA activities and goals within the district.

The Final EIS and supporting documents including the SWMP and EMP provide extensive detail about the measures that will be used to mitigate potential impacts to water resources under the RCA. The authors of the EIS believe this information to be comprehensive. It is unclear what additional information the commenters believe is needed to describe mitigation measures to prevent or reduce potential impacts to water resources.

Letter/Comment: 1015/Y

TOPIC: 7. SOILS

Issue: **7a. There are apparently conflicting statements in Chapter 3 that concentrations of trace elements in soils in the Study Area are within known suitability criteria, and that trace metals of potential environmental concern are widely distributed throughout the overburden and ore. Commenters recommend that the Final EIS should clarify whether or not this distinction is related to the depth from which the samples are taken.**

Response: Concentrations of trace metals in soils presented in AECOM (2012) were determined through analysis of surface soil profile samples collected from a depth of approximately 5 feet or less in hand-excavated soil pits. These soils are proposed to be used for reclamation GM. By contrast, the x-ray fluorescence (XRF) and inductively coupled plasma-atomic emission spectrophotometry/mass spectrometry (ICP-AES/MS) analyses were conducted on composite samples of rock collected via drilling. Only one sample submitted for whole-rock geochemical analysis was collected entirely from depths shallower than 5 feet (RV12-P5-ALV, 0 to 4 feet; Whetstone 2015a). This sample was collected in an area of soil map unit HAX, near the type pedon of the Agassiz component. In this area, approximately 14 inches of soils rated as fair to poor for use as GM are expected to be present (**Section 3.4.3**). Because of the thin nature of salvageable soils in the area of sample RV12-P5-ALV, the geochemical characteristics of this sample are not considered to be representative of soils that would be used for GM.

Because these analyses were conducted on different materials that would be used for different purposes, there is no conflict between data or interpretations. As such, no changes have been made to the EIS in response to this comment.

Letter/Comment: 579/AA

Issue: **7b. Commenters note that, in the discussion of trace elements in soils (Section 3.4.2.2), it is unclear what is meant by "plant-available selenium." Please clarify if this is referring to specific species of selenium.**

Response: **Section 3.4.2.2** has been revised to define plant-available selenium. The revised section now reads,

“Trace elements are important soil nutrients, but can also limit the use of a soil as GM if plants are able to uptake high concentrations of potentially harmful elements. Uptake of trace elements by plants depends on the species and other factors, such as soil pH. The Caribou National Forest (CNF) Revised Forest Plan (RFP; USFS 2003) and Pocatello Field Office (PFO) Approved Resource Management Plan (ARMP; BLM 2012a) do not establish reclamation suitability criteria for trace element concentrations in soils to be used for reclamation.

The Order 2 soil survey (AECOM 2012) analyzed the total concentrations of many trace elements in Study Area soils. All soil samples were also analyzed for plant-available selenium (i.e., the amount of selenium that may be uptaken through a plant’s roots). In addition, composite samples of GM and alluvium/colluvium were analyzed for plant-available selenium as part of the investigation of potential cap-and-cover materials (BC 2015a).The maximum reported selenium value was 0.03 ppm from the 30- to 58-inch layer of the Chubbflat soil (AECOM 2012). The CNF RFP (USFS 2003) and PFO ARMP (BLM 2012a) do not establish reclamation suitability criteria for plant-available selenium in soils to be used for reclamation. No soils or composite samples of GM and alluvium/colluvium proposed for use in reclamation or cover construction are considered unsuitable because of selenium concentrations."

Letter/Comment: 579/AQ

TOPIC: 8. VEGETATION, RIPARIAN AREAS, AND WETLANDS

Issue: **8a. Commenters observe that the Draft EIS identifies considerable efforts to avoid impacts to wetlands and sensitive riparian environments and outlines mitigation of any lost functions or value from wetlands allowing for direct impacts that are local and minor and cumulative impacts that are negligible. In addition, the RCA would reduce wetlands impact to 0.3 acre in comparison to 20.5 under the Proposed Action, a reduction of nearly 99 percent.**

Response: The potential impacts to wetlands and riparian environments, and the measures to minimize those impacts, are discussed in **Sections 4.5.1.2** and **4.5.4.**

The comment is appreciated. One of the primary drivers for the development of the RCA was to reduce impacts to riparian and aquatic resources, including wetlands. Additional revisions to the RCA as described in **Section 2.5.1** of the Final EIS have eliminated impacts to wetlands. Agrium continues to look for alternatives to infrastructure and operations to the extent practicable to reduce or eliminate impacts to aquatic resources.

Letter/Comment: 9/A, 14/A, 15/A, 23/A, 31/A, 37/A, 41/A, 43/A, 53/A, 55/A, 59/A, 62/A, 63/A, 68/A, 74/A, 93/A, 127/A, 131/A, 145/A, 149/A, 180/A, 196/A, 197/A, 198/A, 199/A, 200/A, 201/A, 202/A, 203/A, 204/A, 205/A, 206/A, 207/A, 208/A, 209/A, 210/A, 211/A, 212/A, 213/A, 214/A, 215/A, 216/A, 217/A, 218/A, 219/A, 268/A, 312/A, 314/A, 325/A, 343/A, 354/A, 357/A, 369/A, 375/A, 390/A, 399/A, 402/A, 411/A, 416/A, 443/A, 458/A, 467/A, 487/A, 490/A, 491/A, 514/A, 522/A, 541/A, 543/A, 544/A, 545/A, 546/A, 547/A, 548/A, 549/A, 550/A, 551/A, 552/A, 553/A, 554/A, 555/A, 556/A, 557/A, 558/A, 559/A, 560/A, 561/A, 562/A, 563/A, 564/A, 565/A, 566/A, 567/A, 568/A, 569/A, 570/A, 571/A, 572/A, 573/A, 574/A, 575/A, 576/A, 577/A, 578/A, 676/A, 685/A, 690/A, 698/A, 705/A, 706/A, 731/A, 742/A, 749/A, 758/A, 774/A, 826/A, 833/A, 842/A, 855/A, 871/A, 877/A, 916/A, 982/A, 983/A, 985/A

Issue: **8b. Commenters observe that reclamation seed mixes often contain non-native grasses and forbs because they are known to grow and survive on reclaimed mine surfaces. These seed mixtures effectively contribute to accomplishment of reclamation goals that include erosion control and perhaps livestock forage. However, they do not provide the desired diversity for wildlife that native grass/shrub/forested habitats provided prior to mine activities. Commenters recommend that more emphasis be given to native seed mixes to accomplish these wildlife habitat reclamation needs.**

Response: The objective of revegetation is to provide a self-regenerating cover that controls erosion, establishes easily, meets the vegetation COPCs concentration action levels in the PFO ARMP, and establishes a plant cover suitable to post-mining multi-land uses (cattle grazing, recreation, and wildlife habitat).

Two seed mixes are included in the Proposed Action and were designed to meet the aforementioned objective. Both seed mixes include primarily native grass, forb, and shrub species. The seed mix for southwest aspects (drier sites) does include non-native annual rye; however, this species only constitutes 5 percent of the proposed grass mixture. For northeast aspects (moister sites), non-native timothy and redtop bentgrass are included but collectively constitute only 10 percent of the grass mixture. These non-native grass species were included for erosion control (as they establish easily) and because they are colonizers, so it is expected that native taxa would establish and coexist or replace the non-native taxa in subsequent years. Note that field observations indicate that both native and non-native plants species occur throughout the Study Area (e.g., timothy, Kentucky bluegrass, orchardgrass, and intermediate wheatgrass are widespread in big sagebrush rangeland). Therefore, the native and non-native species component of the seed mixes is representative of baseline conditions.

To place further emphasis on native plants, an alternative seed mix with alternate species was developed for the RCA. This seed mix includes a greater variety of native plant species (including sagebrush and supporting species). The added variety in native seeds and flexibility to interchange species, depending on location/setting, would allow for greater success in returning disturbed areas to baseline conditions.

The seed mixes described in **Section 2.5.1.8.6** of the Final EIS under the RCA and listed in **Table 2.5-5** are a response to public comments asking for a more diverse mix of native species to restore and enhance wildlife habitat in reclaimed areas. The alternative seed mix was created to address these concerns and increase the diversity of post-mining vegetation community to include site-specific native wildlife important species. The alternative seed mix would accomplish reclamation goals for soil stability and erosion control as well as provide a diverse mix of native wildlife important species. While the species composition of the seed mix would not replicate pre-mine vegetation communities, it contains important wildlife and structural components to establish a vegetation community beneficial to wildlife. With time, it is anticipated that surrounding native species would re-establish on the reclaimed areas.

Letter/Comment: 620/D

Issue: **8c. Commenters observe that vegetation monitoring is described in just two lines and is focused on reclamation. There is no mention of monitoring for selenium uptake in vegetation. In addition, wetland vegetation near Angus Creek should be sampled at least annually for many years to assess whether groundwater has transported selenium to the wetlands and whether or not the wetlands attenuate the selenium concentrations.**

Response: Under the RCA, the elimination of permanent external overburden piles would address issues associated with mobilization of COPCs (including selenium) into surface waters. In contrast to the Proposed Action, under the RCA, there would be no measurable loading of COPCs into surface waters, wetlands, and riparian areas. The RCA would also virtually eliminate the potential for adverse selenium uptake by reclamation vegetation because the RCA Cover C is thick enough to separate the majority of the plant roots from the selenium that would be potentially present in the underlying overburden or backfill.

The RCA would also eliminate the proposed North, South Main, and South-South External Overburden Piles, which are the predicted sources of COPC loading to shallow and intermediate groundwater and connected surface waters under the Proposed Action. As a result, no impacts to water levels and water quality in shallow groundwater systems or connected surface waters under the RCA are predicted. Therefore, adverse selenium uptake by vegetation is not predicted, and the need for monitoring is not expected. However, as described in the EMP document, groundwater and surface water monitoring would be conducted to evaluate COPCs levels, among other things. Should data indicate that groundwater has transported significant levels of selenium to wetlands or other surface waters, the Agencies could require monitoring of associated vegetation for selenium uptake. Should there be a need for this monitoring, the EMP document would be updated with details regarding sampling methods and analytical testing.

Letter/Comment: 1014/W

TOPIC: 9. TERRESTRIAL WILDLIFE

Issue: **9a. For the purposes of water management, it is recommended that any basins constructed to hold water be constructed in a way as to minimize use by wildlife; particularly for those basins that may contain water with elevated contaminant concentrations.**

Response: All sediment basins proposed for the project (under both the Proposed Action and RCA) would be designed to hold water for only short periods of time during stormwater or runoff events. If any basin is found to hold water for an extended period, Agrium would use BMPs to minimize use of the basin by wildlife. **Section 2.3.5** was updated to reflect this information.

Non-contact water, clean water, and sediment basins associated with the GM and alluvium piles will be located some distance from the active mining areas and may be an attraction for wildlife. These sediment basins would be earthen-lined and constructed with 2H:1V side slopes and a 3H:1V sloped inlet to allow safe access for wildlife. Angus Creek and large wetland areas downslope of the site will provide a more attractive and easily accessible drinking water source for wildlife.

Contact-water sediment basins will be located along the haul road and other areas close to active mining operations. The mine operates 7 days per week, 24 hours per day. The constant human activity so close to these sediment basins should inhibit use by wildlife. In addition, operations maintains these contact water sediment basins as “dry basins.” Every attempt is made to keep these sediment basins empty to ensure that sufficient storage capacity is available at all times. Therefore, these ponds store water for a very limited time, and when the sediment basins do contain water, the storm or snowmelt event should result in other water sources readily available for wildlife.

Letter/Comment: 542/C

Issue: **9b. Any removal of trees as part of the Proposed Action or RCA should be coordinated, to the extent practicable, outside of the migratory bird nesting season.**

Response: Removal of trees and other ground-clearing activities will not be allowed to take place during migratory bird nesting season. This statement has been included in **Section 4.6.1.1.2.**

Also note that the Draft EIS includes this general mitigation in **Section 4.6.1.1.2,** Birds.

Letter/Comment: 542/D

Issue: **9c. Should a power line be constructed in lieu of use of a generator, and given the proposed mine's proximity to the Blackfoot River Wildlife Management Area, effort should be made to site and mark the power line to minimize the risk of power line bird strikes.**

Response: The Draft EIS states that Agrium would construct the power line in accordance with the Avian Power Line Interaction Committee (APLIC) standards in **Section 4.6.1.1**. Additional language was added to **Section 4.6.1.1.2,** Migratory Birds, to clarify that Agrium would make an effort to install evenly spaced bird diverters on the top grounding wire of the power line per APLIC standards.

Letter/Comment: 542/E

Issue: **9d. In Section 4.6.1.1.2, reference is made to Ratti et al. (2006) and the study conducted on American robin and red-winged blackbird. In order to include the full suite of bird studies conducted in the phosphate patch, data should also be presented in this section from Skorupa et al. (2002).**

Response: The conclusions of Skorupa et al.'s (2002) document were added to **Section 4.6.1.1.2,** Migratory Birds)\.

Letter/Comment: 542/F

Issue: **9e. Sage-grouse, pygmy rabbits, sandhill crane, sage thrasher, sage sparrow, raptors, mule deer, moose, and other species should be of concern in planning. New construction and infrastructure will change crucial habitat for these species. Construction should be avoided in any designated areas or lands for special management of these species. Additional analysis is needed on potential impacts and how best to avoid, minimize, and mitigate any impacts.**

Response: **Sections 4.6** and **4.8** of the Draft EIS address potential impacts and mitigation for the species mentioned in this comment (note, available literature suggests that the pygmy rabbit is not likely to occur in the Study Area because of the lack of suitable habitat and would therefore not be affected by the Proposed Action or RCA). **Section 4.5.1** of the Draft EIS acknowledges that there may be a change to plant species composition/community structure and a long-term net negative impact on wildlife habitat under the Proposed Action and, to a lesser degree, the RCA.

The preferred alternative, the RCA, was developed in part to help reduce impacts on wildlife and their habitats resulting from COPCs. As mentioned above, there would be a long-term net negative impact on wildlife habitat. The RCA would greatly reduce impacts to surface waters/aquatic habitat, eliminate external overburden piles to avoid mobilization of COPCs (including selenium) into surface waters, and include seed mixes with a greater variety of native plant species.

Under both the Proposed Action and RCA, disturbed areas would be reclaimed in accordance with revegetation objectives and land use plans. Further, construction would, to the extent feasible, be avoided in any designated wildlife areas or lands for special wildlife use areas as described in **Sections 4.6** and **4.8**. For example, there would be no impacts to key, important, or general sage-grouse habitats (as mapped by BLM and IDFG), and surface disturbance would only take place outside the avian nesting season.

Note also that a HEA was conducted to assess the amount and type of off-site mitigation that could offset impacts to wildlife from the mine inside and outside the Blackfoot Wildlife Management Area. The HEA reports are available to the public on request. The Proponent has proposed to fund a third-party conservation organization to complete off site mitigation work (as directed by BLM, IDFG, and other wildlife and land regulators) in lieu of performing an actual mitigation project based on residual wildlife habitat impacts calculated by the HEA. The conservation organization would use the funds to select and implement wildlife mitigation projects in southeast Idaho with emphasis on the Final EIS wildlife cumulative impacts area.

Letter/Comment: 621/B

Issue: **9f. Wildlife species that rely on shrub or forest habitats will suffer a net loss of suitable habitat for the foreseeable future with the measures proposed. The implication that lost habitat will be insignificant due to other available habitat in the vicinity does not account for permanent displacement of wildlife.**

Response: The commenter expressed concern that shrub- and forest-dependent wildlife species would suffer a net loss of suitable habitat for the foreseeable future. The Draft EIS confirms this impact and acknowledges that mining activities would result in a long-term net negative impact to wildlife habitat under both the Proposed Action and, to a lesser extent, the RCA.

The Draft EIS acknowledges that impacted aspen habitat would be permanently lost through the removal of root systems. However, field efforts for the project indicate that the loss of these aspen stands would not adversely affect landscape-scale age class evenness of aspen forest, as the stands are all in old-mature age classes, which are over-represented on the landscape. This is not to say that the overall minor impact on aspen habitat would not result in some permanent displacement of wildlife, and the Draft EIS acknowledges this issue through language such as: "As mining proceeds, terrestrial wildlife may also displace into adjacent areas to establish temporary or long-term (potentially permanent) territories and home ranges. Displacement to already occupied habitats would likely result in increased competition for available resources." Per comment concerns, language was added to **Section 4.6.1.1.1** Big Game subsection in the Final EIS to emphasize the benefits of aspen habitat to big game (particularly mule deer fawning and elk for annual recruitment).

For concerns about sagebrush impacts, note that the RCA provides more flexibility to return disturbed plant communities (including sagebrush) to their baseline conditions through use of more robust, native seed mixes (the Draft EIS acknowledges that there would be impacts on sagebrush-dependent wildlife species over the long-term until baseline conditions are restored). As stated in the EMP for the project, vegetation monitoring would be conducted in accordance with land use plans during mining and reclamation operations to ensure revegetation success.

Note also that a HEA was conducted to assess the amount and type of off-site mitigation that could offset impacts to wildlife from the mine inside and outside the Blackfoot Wildlife Management Area. The HEA reports are available to the public upon request. The Proponent has proposed to fund a third-party conservation organization that would carry out mitigation in the local area to offset the losses.

Letter/Comment: 620/B

Issue: **9g. The Idaho Mule Deer Initiative assigns very high value to the fawning habitat and overall forage production associated with aspen stands. Commenters recommend that these aspen areas be returned to the habitat conditions currently existing as appropriate mitigation. A more detailed habitat analysis should be conducted in these areas, followed by monitoring to ensure successful rehabilitation of aspen complexes.**

Response: Language was added to **Section 4.6.1.1.1** of the Final EIS to emphasize aspen stand importance to mule deer fawning and annual elk recruitment. With regard to the commenter's recommendation to ensure rehabilitation of aspen complexes, note that it would not likely be feasible to return disturbed aspen areas to baseline conditions given that root systems would be removed, and soil composition may change. Note also that aspen stands in the Study Area are patchy and of one age class (mature age class, which is overrepresented- on the landscape). Therefore, the loss of aspen stands under the Proposed Action and RCA would not adversely affect landscape-scale age class evenness of aspen forests.

Also a HEA was conducted to assess the amount and type of off-site mitigation that could offset impacts to wildlife from the mine inside and outside the Blackfoot Wildlife Management Area. The HEA reports are available to the public upon request. The Proponent has proposed to fund a third-party conservation organization that would carry out mitigation in the local area to offset the losses.

Letter/Comment: 620/C

Issue: **9h. The HEA should consider scarcity effects, as ecosystem services will be more valuable in the future. Scarcity effects may be a greater driver than social rate of time preference. This potential can be accounted for under the discount factor "r". For example, the "r" factor could be calculated as r = d + s, where d = discount and s = scarcity. The amounts/impacts would need to be identified through peer-reviewed literature.**

Response: There are several possible approaches for incorporating scarcity into the HEA: (1) adjusting the discount factor, “r”, as suggested, (2) incorporating scarcity into a metric that measures the value of scarcity, and (3) incorporating scarcity in the decision for selecting the mitigation project. The first, a negative discount rate (“r”), is one way to model scarcity, but it provides an incentive for the Proponent to delay a mitigation project’s start date to reduce costs. If acres are worth more in the future, fewer acres are needed for mitigation than are required in the present. In contrast, a positive discount rate due to social rate of time preference provides incentive for an early start date for a mitigation project, and therefore was the approach taken because the emphasis of the HEA was on quickly replacing wildlife losses. If the scarcity factor and discount factor are added, they would potentially cancel each other out (e.g., r = 3 + -3 = 0), providing no discount factor and no incentive for early mitigation. For these reasons, scarcity was not modeled with the r factor.

The second approach is to provide greater service value to habitats that are becoming scarce over time. This was indirectly accomplished through the metric chosen, RICHCOVWET, which assigns higher value to habitat types that have been decreasing in abundance over time: aspen and wetlands. Aspen stands mainly have been declining from fire suppression. Wetlands have been declining from agriculture, grazing, recreation, and mining.

The third approach is to identify mitigation projects that focus on habitats that are becoming scarce over time. The Proponent has proposed to fund a third-party conservation organization to perform mitigation. The payment will be based on residual wildlife habitat impacts calculated by the HEA. The conservation organization, with oversight by a multi natural resource and land management steering committee led by BLM and IDFG, assisted by public input, would use the funds to select and implement wildlife mitigation projects within the Final EIS wildlife cumulative impacts area.

Letter/Comment: 1013/A

TOPIC: 10. FISHERIES AND AQUATIC RESOURCES

Issue: **10a. The cumulative effects analysis of fisheries and aquatic (Section 5.7.6) needs to define/describe what long-term and minor means for these resources. This analysis should be quantitative rather than qualitative for streams in the CEA.**

Response: The introduction to **Chapter 4** of the Final EIS defines duration of effects (short-term or long-term) and thresholds of change for the intensity of an impact (negligible, minor, moderate, or major). Long-term is defined as, "Long-term effects that would remain following the completion of the project." A minor impact is defined as, "the impact is slight, but detectable." These definitions are consistent across resources. The definition of long-term (meaning lasting after the project) was reiterated in **Section 5.7.6**.

Potential impacts to surface water, riparian areas, and water quality are closely linked to potential impacts to fisheries and aquatics. **Section 5.7.6** describes that the Proposed Action would result in the direct disturbance of 20.5 acres of surface waters/riparian areas and 80 acres of Aquatic Influence Zone (AIZ) as mapped by the USFS in the CEA. Within the CEA, which encompasses the Upper Blackfoot River Watershed and Lanes Creek-Diamond Creek Watershed from the headwaters of Lanes Creek to Blackfoot Reservoir about 10 miles to the west, there are approximately 13,767 acres of surface waters that could be used by fisheries and aquatic resources (see **Table 5.5-2** of Draft EIS). Therefore, the Proposed Action would result in the direct disturbance of 0.05 percent of fisheries and aquatic resources habitat in the CEA. In comparison, the RCA (designed to mostly avoid direct impacts to surface waters/riparian areas [fisheries and aquatic resources]) would eliminate direct disturbance of surface waters/riparian areas and reduce the AIZ to 11 acres (totaling less than 0.01 percent of the CEA).

As discussed in **Section 5.3.3**, cumulative impacts to surface water quality would occur primarily as a result of contaminated runoff from overburden at the previously approved mines to nearby surface water features. The Proposed Action or RCA would be located downstream from the Wooley Valley, Enoch Valley, and Rasmussen Ridge Mines. Tributaries to Angus Creek are within areas of previous mining disturbance from the above mentioned mines and could result in cumulative impacts to Angus Creek. Additionally, direct recharge through mine features, such as overburden disposal areas, can impact surface water features through migration via shallow groundwater, or leaching from contaminated shallow or intermediate groundwater.

As discussed in **Section 5.3.3**, the Blackfoot River has been impacted by increased selenium concentrations from phosphate mining activities in the CEA. The predicted project-related selenium load under the Proposed Action would result in minor increases of instream concentrations in Blackfoot River and moderate increases of instream concentrations in Angus Creek. Based on the impact analysis discussed in **Section 4.3.1.2.3**, there would be no project-related impacts from selenium loading to surface water features under the RCA. Consequently, while cumulative effects to surface water quality resulting from past, present, and other foreseeable activities in the CEA are moderate to major (as discussed in **Section 5.3.5**), effects under the RCA (limited direct disturbance to fisheries and aquatic resources and no selenium loading) would be negligible within the CEA.

Note also that CERCLA investigations and remedial actions are being conducted at phosphate mining sites within the CEA. Remedial activities are designed to mitigate sources of COPCs associated with mining sites in the CEA and ultimately minimize existing impacts to water quality, fisheries, and aquatic resources.

Letter/Comment: 1013/D

TOPIC: ***11. THREATENED, ENDANGERED, OR SENSITIVE SPECIES***

Issue: **11a. Section ES 4.8 should be updated. On October 2, 2015, the U.S. Fish and Wildlife Service (USFWS) announced a 12-month finding on petitions to list the greater sage-grouse *(Centrocercus urophasianus),* both range wide and the Columbia Basin population, as an endangered or threatened species under the ESA. After review of the best available scientific and commercial information, the USFWS found that the Columbia Basin population does not qualify as a distinct population segment, and that listing the greater sage-grouse is not warranted at this time.**

Response: **Chapter 3** was updated to reflect the new listing status. The greater sage-grouse discussion in **Chapters 3** and **4** have also been moved from the threatened and endangered species sections to the USFS Sensitive Species and Management Indicator Species (MIS) sections.

Letter/Comment: 542/B, 628/E

Issue: **11b. The EIS should include additional discussion of sage and sharptail grouse habitat and an explanation of why the habitat in the Study Area was not considered optimum. This should include a discussion of the criteria that were used for BLM mapping of key habitats.**

Response: For greater sage-grouse, **Chapter 3** of the Draft EIS explains that greater sage-grouse populations are allied closely with contiguous stands of sagebrush, among other things. The chapter goes on to explain that field observations indicate that sagebrush habitat in the Study Area is patchy, and that grasses and forbs (which would contribute to nesting/brood-rearing habitat) generally grow in moderate to sparse quantities among the sagebrush. Further, the Draft EIS explains that there are no greater sage-grouse habitat management areas within the Study Area. As described in the Draft EIS, greater sage-grouse management areas are those designated by the USFS and BLM as part of their jointly developed Approved Resource Management Plan Amendment (ARMPA) for Idaho and southwestern Montana. The ARMPA identifies three categories of management areas: Priority Habitat Management Areas (PHMAs) encompass areas with the highest conservation value to greater sage-grouse based on presence of larger leks, habitat extent, important movement and connectivity corridors, and winter habitat; Important Habitat Management Areas (IHMAs) encompass areas of moderate conservation value and contain additional habitat and populations that provide a management buffer for the PHMA and to connect patches of PHMA; and General Habitat Management Areas (GHMAs) encompass areas of lower conservation value and habitat outside of PHMAs or IHMAs that contains approximately 10 percent of the occupied leks that are also of relatively low male attendance.

USFS and BLM delineated these habitat management areas based on best available information, and the areas cover the vast majority of known habitat and leks in the sub-region (as mapped by IDFG). Therefore, the lack of these habitat management areas in the Study Area is an indicator that habitat in the area is marginal or of lower value to greater sage-grouse. In addition, no indication of breeding or nesting activity was recorded in the Study Area, only one lek was confirmed as occupied (within the last 5 years) within 10 miles of the Study Area, and no more than three sage-grouse individuals were ever observed at any one time in the Study Area. Finally, no active leks were identified within 6.2 miles of the Study Area, and the ROD for the ARMPA provides a reference (page 31) that indicates 90 percent of sage-grouse nesting occurs within 6.2 miles of active leks in Idaho. The absence of leks within 6.2 miles of the Study Area supports the lack of breeding or nesting activity recorded in the Study Area. The EIS was updated to include all information presented in this response.

For Columbian sharp-tailed grouse, **Chapter 3** of Draft EIS explains that preferred habitat for this species includes shrub-steppe, grasslands, and riparian areas. The

Draft EIS acknowledges that all of these habitats are present in the Study Area. In contrast to the comment, the Draft EIS does not specifically state that habitat for this species is sub-optimum in the Study Area. **Chapter 4** concludes that impacts to this species would be minor because no Columbian sharp-tailed grouse leks were observed during baseline surveys, and the Study Area does not appear to support a breeding population. As such, the Proposed Action and RCA could primarily affect individuals, if present, during the non-breeding season.

Letter/Comment: 626/E

Issue: **11c. Commenters recommend that the discussion of Canada lynx linkage habitat should include a map of "the corridor" and records of lynx observations or tracking in the CEA.**

Response: The USFS (2007) Northern Rockies Lynx Management Direction Final EIS, which was referenced in the Draft EIS, provides a figure (Figure 1-1) which shows locations of potential linkage areas. Further, linkage habitat is shown on Map 1 (page D-74) of the Final EIS for the CNF RFP. Both figures indicate that all of the Soda and Montpelier Ranger Districts encompass lynx linkage habitat. Based on this information, all of the Study Area was assumed to be linkage habitat; therefore, there was no need to create a specific map for the EIS. Any impacts from the project footprint were calculated as potential impacts to linkage area habitat, as described in the Draft EIS. Note that the term “corridor” was removed from the EIS lynx discussion because linkage habitat (as described on page D-77 of the CNF RFP Final EIS [USFS 2003]) consists of landscape-level linkages, and not discrete corridors or travel pathways. As such, the Study Area only potentially supports habitat that may be used by transient lynx (there is not a known distinct corridor within or near the Study Area that lynx would repeatedly use).

Letter/Comment: 626/G

TOPIC: 13. LAND USE, ACCESS, AND TRANSPORTATION

Issue: **13a. Commenters note that mining and mine-related activities may impair access to fishing in the Blackfoot River Wildlife Management Area (WMA). Measures should be taken to assure access, perhaps through private land.**

Response: **Section 4.10.1.1.3** explains that mining and mine-related activities would not impair access to fishing on the Blackfoot River in the WMA. The two main fishing streams within the WMA are the Blackfoot River and Angus Creek. The Proposed Action would not affect access to either of these water bodies. **Section 4.10.1.1.3** discusses impacts to recreational activities within the WMA. It is pointed out that the mining and the realignment of the county roads would relocate one parking area in the Blackfoot River WMA. There are three other parking areas and several trails; therefore, access to the Blackfoot River WMA for fishing would not be impaired.

Letter/Comment: 21/B, 22/A

Issue: **13b. Commenters observe that, under the terms of the BLM phosphate lease, BLM must consider continuing existing uses. In the case of the extraction of alluvium from the WMA as use in the cap and cover, continuing existing uses would include both maintaining the Blackfoot River WMA in an undisturbed state and for the mineral estate, allowing development of the phosphate lease. However, further fragmenting the habitat near the WMA is problematic. The Draft EIS does not adequately address concerns about the WMA. One of the missions of the WMA is to protect and manage wildlife resources as a mitigation for habitat loss in other areas. How can impacts to an area designated as mitigation be mitigated?**

Response: See also Comment 3h. The phosphate mineral estate, Known Phosphate Lease Area, and Federal Phosphate Lease were all in place before the Blackfoot River Wildlife Management Area was established. The Federal Phosphate Lease was originally issued in 1955, and through subsequent transfers is currently owned by Agrium. The WMA was established in 1994, when the land was sold to the IDFG. The phosphate Lease gives Agrium the legal right to recover the phosphate on the Lease. The 1955 Federal Phosphate Lease established an existing use. That said, Agrium has agreed to provide off-site mitigation for wildlife habitat impacts resulting from the mine, and the IDFG has the authority to negotiate mitigation for impacts on the WMA. The IDFG owns the alluvium and topsoil on the WMA, and can decide whether to authorize its use.

Letter/Comment: 621/AD, 622/B

Issue: **13c. Commenters are concerned about the constraints on grazing in the Rasmussen Valley area as a result of further mine development, as well as the direct effects on livestock from fugitive dust created by the haul vehicles, by possible contamination of the water through selenium leaching from seleniferous overburden being exposed to the elements, and from other dissolved metals, and by excessive noise and collision hazard created by the many passing trucks and equipment.**

Response: To conservatively assess the maximum potential impacts to livestock grazing, analysis for the Proposed Action assumes total elimination of grazing on lands within the Proposed Action. The impacts analysis also quantifies numbers and potential dollar value loss and to account for individual impacts. Note that, under the RCA, no private lands that are currently grazed would be impacted. Therefore, there would be no impacts to livestock grazing on private lands.

As stated in **Section 4.5.1.1.2**, the generation of dust would be mitigated or minimized by the application of water to the haul road and, as necessary, supplementation with dust suppressants such as magnesium chloride or calcium chloride. Further, Agrium would implement other BMPs, including limiting the speed of haul trucks and other vehicles, as necessary to ensure compliance with the terms of air permit(s). These measures would reduce the amount of dust generated. Additionally, the haul road represents a narrow linear feature, and dust generated from haul trucks and other vehicles would settle relatively close to their emission sources (in a narrow corridor along the alignment of the haul road). Given that the narrow, linear area where dust deposition may occur is small compared to the large area of potentially affected parcels on which cattle are grazed, and that livestock are mobile and can move from potentially affected areas, direct impacts to livestock are anticipated to be negligible. Note that, under the RCA, the haul road would not be routed across private lands that are currently grazed. Therefore, the negligible impacts to livestock from fugitive dust emissions under the Proposed Action would not occur.

As disclosed in **Section 4.3.1**, the Proposed Action would result in the release of COPCs in shallow groundwater and surface waters at concentrations that exceed applicable Idaho standards. However, under the RCA, modeling predicts that there would be no impacts to surface water and shallow groundwater quality. Based on the modeling results, all COPC concentrations in groundwater would be several orders of magnitude lower than the quantifiable limit, and as such are predicted to meet applicable surface water standards. Therefore, there would be no contamination of the water under the RCA.

The current knowledge on the sensitivity of cattle to noise is limited; however, studies indicate that sudden, novel sounds seem to affect behavior more than continuous noise that can be predicted by the animals. In the short term, livestock may react negatively to haul truck-generated noise because it would be new to the environment. However, as operations continue, haul truck movements and associated noise would come to form part of the background, baseline noise in the area, and impacts to livestock from passing trucks and equipment would be minor. Further, the haul road is a narrow linear feature; affected livestock individuals could move away from the haul road as necessary. The noise from haul truck traffic is not anticipated to have any deleterious effects on livestock. Note that, under the RCA, the haul road would not be routed across private lands that are currently grazed. Therefore, there would be no impacts to livestock resulting from haul truck noise.

The speed limit on the haul road would be 30 miles per hour for all vehicles; haul trucks may be limited to slower speeds depending on, among other factors, environmental conditions. Livestock losses from collisions with haul trucks and other vehicles would be negligible given adequate landowner protections (e.g., fencing) and the strict enforcement of speed limits on the haul road. Note that, under the RCA, the haul road would not be routed across private lands that are currently grazed. Therefore, there would be no collision-related impacts to livestock under the RCA.

The potential for collisions between cattle and mining vehicles has been mitigated by removing cattle from the Angus Creek Unit during mining. As such, there would be no grazing areas contiguous with mining operations. Agrium has committed to voluntarily mitigate the temporary loss of this unit by developing the Long Valley Unit for grazing. Mitigation measures to minimize direct and indirect impacts to air resources are explained in **Section 4.2.4**. Agrium would take measures to reduce the impact to air resources. The RCA eliminates the need for external storage of Meade Peak overburden, reducing potential coarse particulate matter air transport from the overburden piles proposed in the Proposed Action. Additionally, with the removal of the external storage of overburden downslope of the pit, the RCA eliminates the potential pathway for introduction of COPCs to surface waters. The RCA Mine Reclamation Plan would identify measures to reclaim the proposed mining activities that would reduce exposure to potential air resource impacts and contamination of water. Approved mining BMPs would be used to reduce air and noise emissions. Agrium would obtain an air permit from the IDEQ for proposed mining operations and would be in compliance with the Clean Air Act.

The EMP, Appendix A explains monitoring requirements of surface and groundwater before, during, and after mining to identify current and future conditions to ensure that surface and groundwater standards are met. The EMP outlines the surface and groundwater monitoring that was conducted to establish baseline conditions and the surface and groundwater monitoring plan to be employed during and after mining to ensure that there is no contamination of water by COPCs that could affect livestock.

Letter/Comment: 624/A

Issue: **13d. Commenters are concerned that reclaimed area vegetation is not as productive for livestock when compared to native vegetation, resulting in more cattle movement, more labor for herding, decreased weight gain, poorer mother cow body condition, and specialized mineral requirements, which means increased costs to ranchers.**

Response: As stated in **Section 4.5.1**, the seed mixtures selected for reclamation, and reviewed and approved by the agencies, contain a variety of native grass, forb, and shrub species, some of which are currently present on the site. The seed mixtures have been selected to provide forage for livestock and wildlife (see also the response to Issue 8b for information regarding seed mixes). It is expected that this seed mix would result in establishment of high-elevation rangeland plant communities, and in recovery of the disturbed areas and the restoration of those areas to suitable rangeland. Therefore, no long-term loss of productivity of the lands for livestock grazing is anticipated.

Letter/Comment: 624/B

Issue: **13e. Commenters observe that the discussion of livestock grazing in Chapter 3 grossly understates the impact to cattle grazing in the area. The assertion that there are no private or state lands impacted is false. In addition, the livestock numbers and length of grazing season are not accurate.**

Response: **Section 4.10.1.1.1** of the Final EIS has been revised to include information on livestock grazing on allotments on IDL-managed lands and on private lands, and the impact analysis has been revised accordingly.

Letter/Comment: 625/A

TOPIC: 14. CULTURAL RESOURCES

Issue: **14a. Commenters note that there may be undocumented cultural resources in the project area, and that adequate monitoring measures should be implemented to identify and protect those resources.**

Response: As discussed in **Section 3.11.3**, the area of potential effects (APE) of the mine and associated activities has been searched for important cultural resources, and no National Register of Historic Places (NRHP) eligible properties were found. This section also observes that there is low potential for undiscovered cultural resources. **Section 4.11.1** points out that no NRHP-eligible resources would be affected. **Section 4.11.4** briefly outlines measures that would be taken if undocumented cultural resources are discovered during mining or associated activities.

Letter/Comment: 21/A

Issue: **14b. Commenters observe that there is no indication in the Executive Summary who conducted the cultural survey and whether they actually visited the site or whether they were Tribal archaeologists or Tribal members. Please add text describing who conducted the survey and whether Tribal members/cultural resource specialists were present and participated.**

Response: This level of detail is not appropriate for the Executive Summary. This is an overview of baseline surveys and results. Most of the cultural surveys were unrelated to the NEPA assessment or took place before the NEPA assessment began. Additional details are provided in **Section 3.11.3** (see response to Issue 14c)**.**

Letter/Comment: 1015/F

Issue: **14c. Commenters request that text be added to Section 3.11.3 to indicate if or whether the Shoshone-Bannock Tribes were involved in any of these studies. The commenters realize that the Tribes may not have been as engaged as they could have been in the preliminary phases of this project. Some indication stating involvement or no involvement needs to be made in the first paragraph of this section.**

Response: The early part of **Section 3.11.3** (first three paragraphs) summarize earlier investigations that were not associated with this EIS.

Text was added in two locations in the discussion (paragraph 1 previous investigations for the project and paragraph 4 survey for expanded study area) to indicate that the Tribes were not involved in these cultural resource surveys. The Tribes were offered the opportunity for involvement at staff-to-staff meetings with the BLM on January 12, 2011 and February 9, 2012, but did not become engaged in the 2012 survey to complete coverage of the Study Area.

Letter/Comment: 1015/V

TOPIC: 15. TRIBAL TREATY RIGHTS AND INTERESTS

Issue: **15a. Loss of unoccupied lands from development needs to be mitigated - there should be a fund established to purchase land and put into trust status to provide for perpetual hunting, fishing, and gathering opportunities. There will also be spiritual harm to "sogobia" (Mother Earth). 448 acres of the Proposed Action will result in loss to exercising treaty rights. Nobody wants to hunt in a mined area, and this is a loss. The HEA does not account for this loss.**

Response: The purpose of the HEA is to evaluate mitigation needed to offset wildlife habit and the associated wildlife impacts. The Proponent would pay for mitigation by a third-party conservation organization. The mitigation resulting from this fund is intended to improve wildlife habitat, thus improving hunting, fishing, and gathering opportunities either directly or indirectly. Impacts from the project to wildlife habitat values would be mitigated to the extent feasible to preserve or restore the land for multiple uses. The loss of access to resources on unoccupied public land because of mining would be long-term in the sense that it would extend beyond mining and initial reclamation, but it would not be permanent because surrounding native species would ultimately repopulate the formerly disturbed areas. Impact to “sogobia” (Mother Earth) would be irreversible and irretrievable.

Letter/Comment: 1013/C

Issue: **15b. Commenters request that following text be added to the Dear Reader letter, the Executive Summary, and Chapter 1 in appropriate locations, "The Federal Agencies involved in this evaluation of alternatives for the Rasmussen Valley Mine Environmental Impact Statement fully recognize and conduct actions that adhere to the federal Indian trust responsibility that holds the United States legally responsible for the protection of tribal lands, assets, resources, and treaty rights. The Supreme Court suggests that the Federal Indian Trust Responsibility entails legal duties, moral obligations, and the fulfillment of understandings and expectations that have arisen over the entire course of dealings between the U.S. and the tribes, including the Shoshone-Bannock Tribes."**

Response: The issue here is tribal treaty rights under the Fort Bridger Treaty of 1868 between the U.S. and the Shoshone and Bannock Tribes (U.S. Congress 1868). Federal trust responsibilities apply more directly to Indian lands, property and financial responsibilities. However, federal responsibility for the protection of treaty rights have the same legal status as trust responsibilities whether or not they are directly associated with trust responsibilities and are legally enforceable without reference to trust responsibilities (Morisset 1999). The Secretary of the Interior has issued an order affirming American Indian Trust responsibilities (USDI2014). The Secretarial Order “reaffirms the Department's obligations and demonstrates our continuing commitment to upholding the important federal trust responsibility for Indian Country.” The U.S. has a trust duty to protect treaty rights and federal management of treaty rights such as fisheries and hunting is a moral obligation and legally equivalent to trust responsibilities. In the absence of documentation of the Supreme Court suggestion, the wording provided by the commenters was not added. The following brief wording has been added to paragraph 6 of the Dear Reader letter.

"The federal agencies recognize the treaty rights and interests of the Shoshone-Bannock Tribes and will adhere to their federal Indian Trust responsibilities."

Wording has been modified more extensively in **Section ES.3** and **Section 1.6.4** to**:**

"The 1868 Fort Bridger Treaty, between the United States and the Shoshone and Bannock Tribes, reserves the Tribes right to hunt, fish, gather, and exercise other traditional uses and practices on unoccupied federal lands. In addition to these rights, the Shoshone Bannock have the right to graze tribal livestock and cut timber for tribal use on those lands of the original Fort Hall Reservation that were ceded to the federal government under the Agreement of February 5, 1898, ratified by the Act of June 6, 1900. Under this treaty and those agreements, the federal government has a unique trust relationship with the Shoshone-Bannock Tribes. BLM has a responsibility and obligation to protect treaty rights and trust resources and to consider and consult on potential effects to natural resources related to the Tribes treaty rights or cultural use."

Letter/Comment: 1015/B, 1015/D, 1015/H

Issue: **15c. Commenters request that the Native American Graves Protection and Repatriation Act (NAGPRA) be added to Section 3.12.**

Response: The following sentence has been added to the first paragraph of **Section 3.12**:

"The Native American Graves Protection and Repatriation Act (NAGPRA) requires that concerned tribes be consulted if human remains that may be Native American or objects of cultural patrimony are discovered."

Letter/Comment: 1015/W

Issue: **15d. Commenters request that the last paragraph of Section 3.12 reference the document that contains the most updated list of Shoshone-Bannock culturally significant plant species. Add NAGPRA to the discussion in this section. Shoshone-Bannock Exposure Scenario for Use in Risk Assessment: Traditional Subsistence Lifeways, February 2016**

Response: There are no discussions of specific resources in this section. The document is not referenced here. Culturally sensitive plants are addressed in **Sections 3.8.3**, **4.8.1.1.3** and **4.8.1.2.3** discussing special status plant species. Any modification to the revegetation seed mix will consider culturally significant plants.

Letter/Comment: 1015/X

TOPIC: 16. SOCIAL AND ECONOMIC CONDITIONS

Issue: **16a. Commenters observed that the proposed mine would contribute to prolonged economic benefit, both locally and in neighboring counties. At the same time, continued mining would not cause a population increase, and would not overly tax available services or infrastructure. The mine's impact to both economic and social conditions would be substantial and is identified in the Draft EIS as an exceptional benefit.**

Response: The social and economic benefits of continued mining through the operation of this mine are discussed in **Sections 4.13, 4.14, 5.13,** and **5.14**.

Letter/Comment: 25/A, 32/A, 75/A, 82/A, 125/A, 130/A, 148/A, 167/A, 178/A, 182/A, 187/A, 225/B, 235/A, 248/A, 252/A, 253/A, 298/A, 306/A, 323/A, 329/A, 340/A, 364/A, 371/A, 383/A, 384/A, 394/A, 463/A, 464/A, 509/A, 520/A, 534/A, 636/A, 658/A, 689/A, 699/A, 738/A, 740/A, 757/A, 785/A, 873/A, 920/A, 926/A, 978/A

TOPIC: 18. HAZARDOUS MATERIALS AND SOLID WASTES

Issue: **18a. Commenters observed that mining activity has the potential to generate waste. The Draft EIS has identified effective handling and disposal practices and the availability of adequate storage capacity. This results in minimal environmental effects.**

Response: This has been addressed in **Section 4.15.1**.

Letter/Comment: 27/A, 45/A, 57/A, 90/A, 103/A, 104/A, 122/A, 151/A, 157/A, 263/A, 282/A, 303/A, 311/A, 333/A, 334/A, 355/A, 459/A, 497/A, 503/A, 527/A, 529/A, 637/A, 650/A, 663/A, 678/A, 691/A, 714/A, 756/A, 780/A, 817/A, 822/A, 825/A, 832/A, 863/A, 865/A, 890/A, 981/A, 990/A, 992/A

TOPIC: 20. CUMULATIVE EFFECTS

Issue: **20a. Commenters observe that the RCA adds important measures to the Proposed Action to protect resources including air resources, water resources, wetlands, and cultural resources and to prevent cumulative effects to these resources.**

Response: This comment presents several natural resource topics that are addressed in **Sections 5.1** through **5.8.**

Letter/Comment: 1/A, 3/A, 18/A, 19/A, 24/A, 35/A, 36/A, 39/A, 42/A, 50/A, 51/A, 60/A, 69/A, 88/B, 123/A, 133/A, 141/A, 165/A, 170/A, 172/A, 174/A, 177/A, 186/A, 191/A, 220/A, 232/A, 242/A, 246/A, 247/A, 249/A, 259/A, 260/A, 271/A, 284/A, 293/A, 294/A, 300/A, 315/A, 324/A, 326/A, 330/A, 332/A, 345/A, 351/A, 368/A, 376/A, 378/A, 389/A, 439/A, 455/A, 465/A, 475/A, 477/A, 498/A, 513/A, 595/A, 596/A, 604/A, 612/A, 613/A, 616/A, 635/A, 648/A, 655/A, 665/A, 673/A, 708/A, 711/A, 713/A, 718/A, 744/A, 745/A, 753/A, 754/A, 762/A, 763/A, 809/A, 813/A, 814/A, 819/A, 820/A, 829/A, 841/A, 849/A, 886/A, 901/A, 907/A, 912/A, 914/A, 944/A, 950/A, 964/A, 966/A, 969/A, 972/A, 973/A, 977/A, 986/A

Issue: **20b. Commenters recommend that the analysis should take a more thorough look at the cumulative effects of the alternatives and develop strategies to mitigate for these effects.**

Response: Like the comment about examination of potential effects of the alternatives (Comment 1i), the commenters were vague about in what way they felt that analysis needed to be more thorough. A commenter noted that the proposed Hooper Springs Transmission Line was not included in the analysis. This is incorrect. Where the proposed transmission line was within the CEA of a resource, it was included in the cumulative effects analysis. The most extensive considerations of the transmission line are discussed in **Section 5.5**, **Section 5.6** and **Section 5.8**. The preparers feel that the analysis is thorough.

Letter/Comment: 621/AB

TOPIC: 21. MITIGATION

Issue: **21a. Commenters noted that the mitigation measures identified for the RCA address short-term effects, concurrent reclamation throughout the mining process, and assurance that any cumulative effects will be negligible to minor. Of the total project disturbance, 96 percent or more would be reclaimed, and there would be no open pit left after mining. In addition to backfilling and reclamation of the Rasmussen Valley mine pit, overburden from early phases of Rasmussen Valley will be put in P4's partially backfilled South Rasmussen Mine pit and increase the reclaimed area at the South Rasmussen Mine.**

Response: Reclamation strategies for the RCA are discussed in **Section 2.5.1.8.**

Letter/Comment: 34/A, 40/A, 65/A, 73/A, 91/A, 95/A, 102/A, 105/A, 137/A, 144/A, 146/A, 150/A, 154/A, 155/A, 156/A, 168/A, 181/A, 222/A, 224/A, 231/A, 258/A, 264/A, 266/A, 283/A, 285/A, 307/A, 313/A, 318/A, 319/A, 321/A, 377/A, 382/A, 395/A, 397/A, 407/A, 413/A, 414/A, 423/A, 466/A, 469/A, 471/A, 474/A, 480/A, 483/A, 485/A, 488/A, 512/A, 524/A, 601/A, 605/A, 607/A, 615/A, 641/A, 643/A, 651/A, 652/A, 653/A, 682/A, 683/A, 709/A, 725/A, 732/A, 737/A, 743/A, 778/A, 784/A, 837/A, 843/A, 851/A, 862/A, 876/A, 879/A, 884/A, 887/A, 888/A, 889/A, 893/A, 894/A, 898/A, 899/A, 943/A, 946/A, 948/A, 952/B, 971/A, 998/A

Issue: **21b. Commenters noted that, under the RCA, in addition to backfilling and reclamation of the Rasmussen Valley mine pit, overburden from early phases of Rasmussen Valley will be put into P4's partially backfilled South Rasmussen Mine pit and increase the reclaimed area at the South Rasmussen Mine.**

Response: See response to Issue 21a.

Letter/Comment: 96/A, 101/A, 223/A, 272/A, 328/A, 331/A, 361/A, 374/A, 385/A, 392/A, 430/C, 441/A, 447/A, 453/A, 473/A, 510/A, 526/A, 537/A, 586/A, 587/A, 599/A, 608/A, 617/A, 639/A, 645/A, 659/A, 670/A, 672/A, 730/A, 775/A, 779/A, 783/A, 788/A, 802/A, 835/A, 860/A, 897/A, 900/A, 905/A, 918/A, 922/A, 940/A, 960/A, 963/A, 970/A, 974/A, 976/A, 993/A, 997/A

Issue: **21c. Use of the HEA method is a credible, scientifically defensible method that is quantitative rather than qualitative. Evaluating mitigation with the more rigorous and objective HEA method goes a long way towards ensuring the public's resources are adequately considered when BLM makes decisions to permit new mining operations.**

Response: Comment noted.

Letter/Comment: 542/A

Issue: **21d. Commenters recommend that actual standards to measure the success or failure of both concurrent and post-closure revegetation need to be established and described.**

Response: The EMP states that disturbed areas would be revegetated. Standards for monitoring revegetation success would be in compliance with the PFO ARMP, and the CNF RFP standards and guidelines. Land use plans direct that revegetation efforts be effective in stabilizing disturbed areas with perennial vegetation communities, restoring the land use for multiple use management, and preventing the dominance of invasive species or noxious weeds. The land use plans require reclaimed land to meet or suitably trend toward meeting applicable Standards (BLM 1997) and post-development land use objectives. Revegetation success criteria and monitoring methods (using best available science) would be developed for the project. Doing so would help the project meet the following guideline as specified in Appendix A of the PFO ARMP: "A habitat restoration plan shall be developed…and shall identify revegetation, soil stabilization, and erosion reduction measures that shall be implemented to ensure that all temporary use areas are restored."

Monitoring goals and objectives would be identified in the Conditions of Approval (COAs) of the ROD after the Final EIS is published. Monitoring goals would be in compliance with BLM and USFS reclamation requirement under their land use plans. The EMP would reflect the COA and contain specific reclamation milestones required to consider reclaimed areas complete. The final approved EMP would include revegetation performance requirements as well as reporting timelines. The final approved EMP would apply adaptive management if reclamation milestones are not reached. The EMP would be an adaptive document that could be modified if monitoring objectives are not achieved or to adapt to other changes.

Letter/Comment: 621/Q, 627/L

Issue: **21f. Project impacts to wildlife resources within and outside the WMA need to be fully mitigated. Potential measures include long-term habitat improvements for focal species (Yellowstone cutthroat trout, mule deer, Brewer's sparrows, and Northern leopard frog); improved monitoring; noxious weed treatments; and improved outreach, education, and enforcement efforts that pertain to the WMA objectives. Any mitigation strategies need to be integrated on a watershed scale so that benefits of any individual projects are coordinated with other restoration activities.**

Response: A HEA was conducted to assess the amount and type of off-site mitigation that could offset impacts to wildlife from the mine inside and outside the WMA. The HEA reports evaluated hypothetical mitigation projects with benefits into perpetuity that can offset impacts. The cost of the final hypothetical mitigation project selected would be estimated to determine the funds contributed by the Proponent for mitigation. A third-party conservation organization then would use the funds to develop one or more mitigation projects, with oversight by a steering committee of agencies and stakeholders. The steering committee would evaluate many options including habitat improvement for focal species, need for easements or land transfers, and obtaining water rights when designing the mitigation project. The project would be implemented by a third party that can integrate the project with other restoration efforts within and across watersheds. The wildlife habitat mitigation projects would improve habitat for all wildlife species that occupy that ecosystem, including those listed in the comment that inhabit the mitigated area.

Agrium is also working with the IDFG to develop additional mitigation to offset impacts the project would have within the Blackfoot River WMA. This mitigation would involve enhancements for recreational use and/or wildlife on the WMA.

Letter/Comment: 621/C, 621/D

Issue: **21g. Commenters observe that the preparation of a Habitat Equivalency Analysis (HEA) to estimate wildlife habitat effects from mining and associated activities will be a key step towards identifying specific mining effects on wildlife and wildlife habitats and will inform all parties of restoration options. Commenters look forward to discussions concerning specific, detailed mitigation proposals commensurate with HEA findings.**

Response: Comment noted.

Letter/Comment: 620/E

Issue: **21h. Commenters noted that, to appropriately establish cap depth for reclamation, it is necessary to evaluate the potential rooting depth of native and introduced plants in the area and in the reclamation seed mixes. Deep-rooted plants can penetrate the cap layer and bring selenium to the surface vegetation. Some of the plants listed in the reclamation seed mixes are deep-rooted.**

Response: In 2014, Great Ecology (a consultant for Agrium) prepared a report (reviewed and revised as directed by BLM) for the project that summarizes effective and maximum rooting depths for plant species included in the proposed seed mixtures. The report focuses on the effective rooting zone because this is where the majority of roots actively take up water and nutrients and where the majority of any plant available selenium uptake could occur. The Great Ecology report acknowledges that some plants have maximum root depths that extend beyond 5 feet, but deep roots are typically only present in moist soils with no barriers or restrictions that inhibit root elongation. The proposed RCA cover is 6 feet thick, and contains little if any detectable plant available selenium. The cap thickness is designed to provide sufficient moisture within the cover, thus providing little incentive for plants to extend roots below the cover depth. For this reason, significant root elongation beyond the cap layer is not expected, and any potential COPC uptake is expected to be minimal, if any, with negligible impacts on the environment.

Rooting depth of proposed reclamation seed mixes was considered in the Cap and Cover Analysis (BC 2015a). While the potential for deep-rooted plant species exist in both seeding establishment and natural recruitment, the design of the cap would help retain water in the upper levels of the cap-and-cover system. Water and nutrient availability in the cover would promote root growth in the upper soil layers. There is a small potential for deep-rooted species to establish and develop root systems deeper than the cap-and-cover system over time. Aboveground plant tissue would be monitored to track selenium levels in plant tissue.

Letter/Comment: 623/A

Issue: **21i. The proposed cap and cover includes the use of local alluvium. Alluvium from this area has high concentrations of selenium. The use of alluvium in the cap could result in significant plant uptake of selenium.**

Response: The commenter expresses concern that the use of local alluvium in cap design could result in deleterious plant selenium uptake. The commenter also states the opinion that alluvium from this area has high concentrations of selenium. The various soil horizons representing topsoils and subsoils are formed by physical and chemical weathering, including leaching. The alluvium in the area has undergone this same process, and comprises topsoils and subsoils that have been transported by water and mass wasting. Chemical analysis of soil and alluvial samples from those areas where borrow material would be used for cover construction had plant-available selenium concentrations below the detection level of 0.02 parts per million, with one exception at 0.03 parts per million as reported in AECOM 2012, and in the cap-and-cover material geochemical characterization report (BC 2015a). These concentrations are well below any that have been found to produce adverse concentrations of selenium in plants. As such, it is reasonable to conclude that the potential uptake of selenium by plants with roots into the alluvium and colluvium portion of the cap-and-cover system would be a less than significant impact under both the Proposed Action and RCA.

Letter/Comment: 623/B

Issue: **21j. Commenters felt that the use of the HEA was too abstract for the public and that this method needs to be more quantitative, and demonstrate how payment to a third party offsets losses. Commenters recommended that there needs to be more discussion of the success of this new method on other phosphate mines in terms of benefits to the plants, soils, fish and wildlife, water quality of intrinsic value, as well as human use (recreation, wildlife-watching, hunting, fishing). Commenters would like an explanation of how mitigation in a location far from the mine site will replace local lost resources.**

Response: The HEA method is quantitative, as detailed in the equations and spreadsheet examples provided in the HEA methodology reports (Baseline and Predictive Metrics Reports) and final report. Citations to the scientific literature are provided in the reports that support the decisions on the model inputs. The full HEA spreadsheets with calculations on the debit and credit side are available to the public. The final hypothetical mitigation project and the cost of the project used to determine the funds contributed by the proponent would be disclosed in the ROD. A steering committee of agencies and wildlife trustees would oversee the mitigation implementation and its success. This committee would consider many factors in selecting the mitigation project including proximity to the lost local resources. The HEA focused on mitigation of wildlife resources. Other resources are addressed through the U.S. Army Corps of Engineers (USACE) 404 permitting process or in the appropriate EIS sections.

Letter/Comment: 626/F

Issue: **21k. Overburden should be considered as fill for high walls.**

Response: The pit walls would be covered to the extent practical. Some exposure of pit wall is unavoidable. Reclamation slopes are limited to a maximum slope of 3H:1V by agency directive in order to maintain the risk of surface erosion and slope failure within acceptable levels. Slopes of greater than 3H:1V would be required to fully reclaim all high walls.

Letter/Comment: 1013/B

Issue: **21l. Residual Discount Service Acre Years (DSAYs) must be mitigated under the HEA. This should not be voluntary, as there are actual losses of ecosystem services. There should be an action [standard?] that informs when Agrium does not offset this loss.**

Response: Agrium has agreed to fully fund the mitigation of all residual DSAYs as a result of the Rasmussen Valley Mine. Agrium will fund a third-party conservation organization to implement mitigation projects within the local watersheds. Under the guidance of a steering committee of stakeholders, the third-party conservation organization is being tasked with overseeing implementation and success of off-site mitigation funded by the Proponent.

Once written into the BLM ROD, depositing these funds would then be mandatory. BLM would obtain assurance by including this amount into the mine performance bond until it has been paid.

Letter/Comment: 1013/E

Issue: **21m. Seed/planting restorations need to have established objectives by species to ensure plantings are successful. This needs to be monitored.**

Response: See response to Issue 21d. Monitoring goals and objectives would be identified in the COA of the ROD after the Final EIS is published. Monitoring goals would be in compliance with BLM and USFS reclamation requirement under their land use plans. The EMP would reflect the COA and contain specific reclamation milestones required to consider reclaimed areas complete. The final approved EMP would outline cover requirements as well as reporting timelines. The final approved EMP would apply adaptive management if reclamation milestones are not reached. The EMP would be an adaptive document that could be modified if monitoring goals are not achieved or to adapt to changes. A reclamation performance bond would be provided by the Proponent to hold assurance of reaching reclamation standards.

Letter/Comment: 1013/F

Issue: **21n. Commenters recommend working with the State of Idaho and the Idaho Department of Fish and Game on a comprehensive mitigation strategy for impacts to the integrity of the Blackfoot River WMA.**

Response: The State of Idaho and the IDFG have been participants in the EIS process since the beginning. The Federal Land Management and Policy Act requires that the mine mitigate any unnecessary or undue impacts. This requires the mine to adhere to any rules, regulations, and standards that apply to the project, including the Blackfoot River WMA. It also requires that the mine not create impacts that are above those which are necessary to undertake open pit mining of the property. The EIS addresses mitigation for impacts to the Blackfoot River WMA resulting from the proposed Rasmussen Valley Mine.

Letter/Comment: 621/AE

Issue: **21o. The intent of the mine pit/backfill cap is to prevent or limit the exposure of overburden with COPCs from exposure to water, which would allow leaching of COPCs into groundwater. Because leaching of minerals into groundwater is of concern, the pumping of mine pit water into backfill seems counterproductive. It is also suggested that pit water might be used for dust suppression. What water quality standards would be used to establish the suitability of water for use in dust suppression?**

Response: **Section 4.3.1.1.3** of the Final EIS indicates that re-infiltration of pit dewatering discharge through previously backfilled areas would not be possible under the Proposed Action because backfilled areas would not exist at the time that pumping would be required. **Section 2.3.6** Water Management, has also been revised to remove the discussion that pit water may be used for dust suppression and to clarify that well PW-1W or the well at the Rasmussen Ridge Mine shop would be the source of water used for dust suppression.

Letter/Comment: 623/E

Issue: **21p. The Draft EIS indicates that water accumulated in sediment basins would be expected to percolate to alluvial aquifers. This would be unacceptable if there is a potential for contamination of runoff. If there is potential for contamination of runoff, lining the sediment basins would be an appropriate BMP.**

Response: Sediment basins that would receive contact water (stormwater runoff from un-reclaimed overburden, mining areas, haul roads, and temporary overburden piles) would be constructed to prevent percolation into an underlying alluvial aquifer. Any contact-water sediment basins not within the pit footprint will be constructed to limit percolation into the alluvial aquifer using synthetic or compacted natural materials subject to BLM approval before construction. The contact water would be allowed to evaporate or would be pumped into the mine pit, where it could be combined with stormwater runoff within the pit basins to inhibit infiltration. Sediment basins that would receive non-contact water (clean stormwater runoff from the GM, alluvium, and colluvium stockpiles) would not be lined. These basins would be designed as flow-through structures that temporarily retain the non-contact water and allow the sediment to settle out.

Letter/Comment: 627/P

Issue: **21q. In the Dear Reader letter and throughout the document: Agrium will be responsible for the design and implementation of BMPs to control erosion and sedimentation, which federal agency will review the designs and conduct inspections to ensure the BMPs are in place and functioning correctly?**

Response: Assignment of responsibility is not the purpose of the Final EIS. This matter will be addressed in the BLM and USFS RODs.

Letter/Comment: 1015/C

Issue: **21r. Please add to the first paragraph of Section 2.3.6.8, and where appropriate and throughout the document, "Revegetation decisions shall also consider the culturally-sensitive plant species (types and volumes) that were destroyed during mine development and accommodations made accordingly, as practicable.**

Response: Information on culturally sensitive plants was received late in the EIS process and is not included in the impact assessments. Seed mixes were chosen to optimize the performance of the cover and to restore wildlife habitat. The ROD will specify that any revisions to the proposed seed mixes would consider restoration of culturally sensitive plant species.

Letter/Comment: 1015/N

Issue: **21s. Commenters request that Table 2.5-4 [Table 2.5-5 in the Final EIS] indicate which grasses, forbs, and shrubs are listed in the Shoshone- Bannock Tribes Risk Scenario February 2016 (Shoshone-Bannock Tribes 2016) document as culturally significant plants for the Tribes**

Response: The referenced document was not available when the Draft EIS was prepared. Forbs and shrubs that are listed as culturally sensitive plant species in the 2016 document have been highlighted in the seed mix tables (**Table 2.3-4** and **Table 2.5-5**). Grasses are not listed individually in the 2016 culturally significant plants list.

Note that this Risk Scenario is oriented to the potential for exposure to COPCs. The mine operation and reclamation have been designed to avoid any greater than natural concentrations of COPCs in soils. There will not be a greater than natural potential for plants to accumulate COPCs.

Letter/Comment: 1015/R

Issue: **21t. Commenters note that Section 4.3.4 indicates Agrium will be responsible for the design and implementation of BMPs to control erosion and sedimentation, and ask which federal agency will review the designs and conduct inspections to ensure the BMPs are in place and functioning correctly. They request that text be added to the last paragraph of this section to clarify and explain.**

Response: The Final EIS is an assessment of impacts and mitigation measures. The Final EIS does not assign responsibility. This will be addressed in the RODs.

Letter/Comment: 1015/Z

TOPIC: 22. OTHER

Issue: **22a. Commenters noted that it is apparent that Agrium is willing to accept additional costs to achieve an improved final plan that will increase environmental protection.**

Response: Comment noted.

Letter/Comment: 96/A, 101/A, 223/A, 272/A, 328/A, 331/A, 361/A, 374/A, 385/A, 392/A, 430/C, 441/A, 447/A, 453/A, 473/A, 510/A, 526/A, 537/A, 586/A, 587/A, 599/A, 608/A, 617/A, 639/A, 645/A, 659/A, 670/A, 672/A, 730/A, 775/A, 779/A, 783/A, 788/A, 802/A, 835/A, 860/A, 897/A, 900/A, 905/A, 918/A, 922/A, 940/A, 960/A, 963/A, 970/A, 974/A, 976/A, 993/A, 997/A

Issue: **22b. Commenters expressed support for the mine without mentioning specific issues.**

Response: Comment noted.

Letter/Comment: 76/A, 77/A, 116/A, 244/A, 508/A, 790/A, 800/A, 803/A, 805/A

Issue: **22c. The agencies should have recommended and provided a 120-day public review of the Draft EIS. Future project proposals of this scale should take into account the public's need to secure resources both financial and in expertise to conduct a thorough review and provide the time necessary for that public review.**

Response: Existing NEPA regulations provide for a 45-day public comment period. These regulations were not changed for this EIS. Scoping issues are made public and allow for securing appropriate financing and expertise for public review before public release of the document.

Letter/Comment: 621/F

Issue: **22d. In the process of public scoping, the Agencies should provide the public with an open forum without preconceived preferences regarding alternatives, allowing the public to participate in the definition of key issues and appropriate alternatives for consideration.**

Response: Comment noted.

Letter/Comment: 621/G

Issue: **22e. Commenters were pleased with the incorporation of the HEA and recommend that the HEA should be further refined over time, and that project goals should be defined through the permitting process to ensure a predictable, consistent, reasonable, and fair process to address habitat loss.**

Response: Comment noted.

Letter/Comment: 621/K

Issue: **22f. The EIS does not analyze the sources of selenium in surface and groundwater which have caused the majority of streams in the area to be 303(d) listed for selenium. There are no analyses of population trends of wildlife such as mule deer, sage and sharptail grouse, elk, Yellowstone cutthroat trout, and other special status species in the Study and Cumulative Effects Areas. These are needed to evaluate the effectiveness or lack of effectiveness of mitigations for previous mining operations by Agrium and others.**

Response: The purpose of this EIS is to evaluate the potential effects of the Proposed Action and alternatives. It is not within the scope of this EIS to analyze past sources of selenium contamination unless they bear directly on this analysis. It is not within the scope of this EIS to analyze population trends that are not related to this project, and unless they have a bearing on the evaluation of the proposed mitigations, it is not within the scope of this EIS to evaluate the effectiveness of mitigations from previous mining operations.

Letter/Comment: 626/A

Issue: **22g. The commenters indicate that they understand that the HEA hypothetical mitigation project is located on State of Idaho land and that the Tribes have no jurisdiction over those lands, per Gary Billman with the Idaho Department of Lands. However, because the State land parcel containing this mitigation project is located within the ancestral lands of the Shoshone-Bannock, it is respectfully requested that any timber not used in the mitigation project be made available to Tribal members for firewood use.**

Response: Comment noted. IDL has been informed of this request.

Letter/Comment: 1015/AA

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APPENDIX B

ENVIRONMENTAL MONITORING PLAN

Rasmussen Valley Mine Environmental Monitoring Plan

Prepared for

Nu-West Industries, Inc., doing business as
Agrium Conda Phosphate Operations

Soda Springs, Idaho

July 29, 2016

Rasmussen Valley Mine
Environmental Monitoring Plan

Prepared for

Nu-West Industries, Inc., doing business as Agrium Conda Phosphate Operations

Soda Springs, Idaho

July 29, 2016

Job No. 148743

FINAL

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List of Abbreviations

Agrium	Nu-West Industries Inc., doing business as Agrium Conda Phosphate Operations
ARMP	Approved Resource Management Plan
BLM	Bureau of Land Management
BMP	best management practice
CCC	criterion continuous concentration
Cherty Shale	Cherty Shale Member of the Phosphoria Formation and the Dinwoody Formation
CMC	criterion maximum concentration
COPC	constituent of potential concern
EIS	Environmental Impact Statement
EMP	Environmental Monitoring Plan
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
ft ags	feet above ground surface
ft amsl	feet above mean sea level
ft bgs	feet below ground surface
Grandeur Tongue	Grandeur Tongue Member of the Park City Formation
HUC	hydrologic unit code
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IDL	Idaho Department of Lands
IF&G	Idaho Department of Fish and Game
Lease	Federal Phosphate Lease I–05972 and associated Lease Modifications, Private Agreements, Special Use Permits, and Temporary Use Permits
Meade Peak	Meade Peak Phosphatic Shale Member of the Phosphoria Formation
mg/L	milligram per liter
Mine Plan	Rasmussen Valley Mine and Reclamation Plan
MP	measuring point elevation
PFO	Pocatello Field Office
PUP	Pesticide Use Proposal
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
Rex Chert	Rex Chert Member of the Phosphoria Formation and the Dinwoody Formation
RFP	Caribou National Forest Revised Forest Plan
ROD	Record of Decision
RVM	Rasmussen Valley Mine
TDS	total dissolved solids
TOC	total organic carbon

USACE	United States Army Corps of Engineers
USFS	United States Forest Service
USGS	United States Geological Survey
Whetstone	Whetstone Associates, Inc.
WRTR	Water Resources Technical Report

Section 1

Introduction

Nu-West Industries, Inc., doing business as Agrium Conda Phosphate Operations (Agrium), is proposing to develop an open-pit phosphate mine near the south end of Rasmussen Ridge in Caribou County, Idaho. The proposed Rasmussen Valley Mine (RVM) is located approximately 18 miles (28 road miles) northeast of Soda Springs (Figure 1). The mining operation would develop phosphate ore reserves contained within Federal Phosphate Lease I–05972 and associated Lease Modifications, Private Agreements, Special Use Permits, and Temporary Use Permits (Lease) in portions of Sections 5, 6, 8, and 9, T7S, R44E and Section 36, T6S, R43E. The Lease encompasses approximately 706 acres and is depicted on Figure 1.

The federal mineral lease for the project is administered by the United States Bureau of Land Management (BLM). Surface ownership in the project area includes state-owned land (Idaho Department of Lands [IDL] and Idaho Department of Fish and Game [IF&G]), federally-owned land (BLM and United States Forest Service [USFS]), and private land (owned by Agrium). In accordance with the requirements of the National Environmental Policy Act and the Federal Land Policy and Management Act, the BLM and USFS are preparing an Environmental Impact Statement (EIS) for the RVM project. The Idaho Department of Environmental Quality (IDEQ) and United States Army Corps of Engineers (USACE) are Cooperating Agencies for the EIS. The IDL and IF&G are also participating in the review and development of the EIS. The BLM, USFS, USACE, and IDEQ are collectively referred to as the Agencies for the purposes of this document.

This Environmental Monitoring Plan (EMP) identifies the potential environmental sampling and monitoring activities to be conducted during mining operations and post mining to assure compliance with environmental standards, regulations, and land use plans and the effectiveness of best management practices (BMPs) and mitigation measures. The EMP identifies which resources will be monitored and describes monitoring and sampling locations, approved monitoring and sampling methods, duration and frequency of sampling, and data reporting requirements. Some of the environmental monitoring, such as groundwater monitoring, was begun during baseline data collection to establish baseline conditions.

Stormwater will be monitored under a Stormwater Pollution Prevention Plan, and air monitoring requirements will be included in an air permit; therefore, stormwater and air monitoring are not detailed in this EMP. A final EMP will be prepared after the Record of Decision (ROD) and in accordance with the Conditions of Approval and will include a detailed description of monitoring locations, frequency and duration of monitoring, field and laboratory sampling and analysis, and quality assurance/quality control (QA/QC) plans.

1.1 EMP Objectives and Approach

The overall objective of this EMP is to describe the monitoring programs which will be implemented during mining operations and post mining to ensure that mining activity at the RVM does not adversely impact the environment. A Construction QA/QC Plan for the overburden cover (Cover C) is included as Appendix A. Quality Assurance Project Plans (QAPPs) and media-specific Field Sampling Plans (FSPs) will be presented in the final EMP. Updates to this EMP and associated appendices may be necessary according to directives, if any, in the ROD.

1.2 Site Description

Detailed information about the site is provided in the Rasmussen Valley Mine and Reclamation Plan (Mine Plan) (Agrium, 2011). Federal Phosphate Lease I–05972 is owned by Agrium, and the property on which it is located is owned/managed by a collection of entities including the USFS, BLM, IDL, IF&G, IDEQ, and Agrium. This lease, as modified, plus associated private agreements, special use permits, and temporary use permits, is approximately 706 acres in size and located on the western slope of the southern end of Rasmussen Ridge in portions of Sections 5, 6, 8, and 9, T7S, R44E and Section 36, T6S, R43E. A summary of the pertinent information for this EMP is provided below.

Topography in the RVM area is characterized by a series of north- to northwest-trending mountain ranges separated by broad valleys. Topographic relief at the site exceeds 400 feet, with elevations ranging from 6,540 feet at the eastern edge of the RVM area near Lanes Creek Road to over 7,200 feet near the northeastern extent of the Lease.

1.2.1 Location

The RVM area is accessed from Soda Springs by traveling north on State Highway 34 for approximately 12 miles. Continue east on the Blackfoot River Road and travel approximately 15 miles. To access the north end of the Lease, continue west onto Rasmussen Valley Road and travel approximately 1.27 miles to the north access gate. To access the south end of the site, continue along Blackfoot River Road approximately another 1.25 miles and continue east onto Lanes Creek Road. Continue on Lanes Creek Road for approximately 0.25 miles to the south access road (Figure 2).

1.2.2 Site Area Background

The RVM area is located in the Western Phosphate Field. Previous exploration in the RVM area is discussed by Lee (2001). The phosphate resource in the RVM area was first explored by the United States Geological Survey (USGS) and others beginning in the early 1900s. No mining has occurred on the Lease, but the Lease has been and continues to be explored to fully define the ore deposit in preparation for mining.

1.2.3 Geology and Hydrogeology

1.2.3.1 Geology

The RVM is located in the Western Phosphate Field, which is generally characterized by folded and faulted Paleozoic and Mesozoic sedimentary successions overprinted by more recent extensional faulting, alluvial deposition, and volcanism. The RVM is on the southwest-dipping limb of the northwest-trending Snowdrift Anticline, the axis of which generally parallels Rasmussen Ridge. Along the ridge, the structural dip generally increases to the north, ranging from an average of 32 degrees to the southwest near the south end of the anticline to nearly vertical or over-turned near the north end.

The stratigraphic section at the RVM includes a thick sequence of Paleozoic to Mesozoic carbonate and clastic sedimentary rocks overlain by Pliocene to Quaternary-age unconsolidated deposits and basalt. Mining of the RVM will extract phosphate ore from the Meade Peak Phosphatic Shale Member (Meade Peak) of the Phosphoria Formation. The Meade Peak is stratigraphically overlain by the Rex Chert Member (Rex Chert) and Cherty Shale Member (Cherty Shale) of the Phosphoria Formation and the Dinwoody Formation. It is underlain by the Grandeur Tongue Member of the Park City Formation (Grandeur Tongue) and the Wells Formation. A brief summary of each major stratigraphic unit, as referenced in the Rasmussen Valley Mine Project Baseline Water Resources Technical Report (WRTR) (Whetstone Associates, Inc. [Whetstone], 2015), is provided below.

Alluvium and Colluvium. Quaternary-age alluvial deposits are present along valley floors adjacent to Angus Creek, Lanes Creek, and the Blackfoot River. The deposits may have thicknesses exceeding 100 feet and are composed of stratified clay to pebble-size material with occasional larger cobbles. Locally-derived colluvium and alluvium consisting of angular cobbles, pebbles, and finer-grained sediments also occur on hillsides. The thicknesses of the hillside colluvial/alluvial deposits are variable (about 0 to 60 feet) but generally increase toward the valley floor.

Basalt. Dark gray fine-grained basalt of Pleistocene or Pliocene age crops out at the surface in the southern project area. The basalt is often vesicular and was emplaced over pre-existing alluvial deposits. Geologic cross sections indicate that the basalt may be up to 150 feet thick. The observed thickness of basalt in boreholes for the project ranged from 29 to 57 feet. The observed thickness of the underlying alluvial deposits has ranged from 6 to 145 feet. The basalt is unsaturated where it has been observed in boreholes for monitoring wells OW-1W, MW-17W, and MW-19B.

Thaynes Formation. The youngest unit in the bedrock section exposed in the RVM area is the Triassic-age Thaynes Formation. It is present on the north side of the Rasmussen Fault, northeast of the RVM, and has been mapped as containing 11 members with an aggregate thickness of between 1,000 and 1,600 feet. It is composed of dark gray interbedded limestone, shale, and siltstone at its base that transitions upward into sandstone and gray limestone at the top.

Dinwoody Formation. The Triassic Dinwoody Formation is exposed at the base of Rasmussen Ridge in the northwestern portion of the study area. It forms the top of the sedimentary bedrock section at the RVM and ranges in thickness from about 1,700 to 2,200 feet. It consists of two members. The upper Dinwoody Formation is composed of interbedded gray limestone and olive to greenish-brown siltstone with discontinuous shale that grades downward into calcareous gray to black shale and siltstone with thin limestone layers. The lower Dinwoody Formation is composed of calcareous siltstone, thin-bedded claystones, and mudstones.

Phosphoria Formation. The Permian-age Phosphoria Formation underlies the Dinwoody Formation and is divided into three members that include the Cherty Shale, Rex Chert, and Meade Peak, in descending stratigraphic order. The Cherty Shale consists of interbedded dark gray to black mudstone and cherty shale to argillaceous chert that ranges from about 100 to 200 feet in the RVM area.

The Rex Chert is composed of thick-bedded black to bluish-white or occasionally reddish-brown chert with lesser amounts of interbedded mudstone and lenticular limestone. The thickness of the Rex Chert ranges from about 30 to 80 feet in boreholes that were completed for monitoring wells at the RVM. Regionally, the Rex Chert and Cherty Shale are difficult to distinguish in drill cuttings and are often mapped together as the Rex Chert.

The underlying Meade Peak is the host of the phosphate ore and consists of mudstone, siltstone, cherty phosphorite, and phosphatic mudstone. The aggregate thickness of the Meade Peak is typically between 110 and 180 feet at Rasmussen Valley.

Grandeur Tongue Member of the Park City Formation. The Permian-age Grandeur Tongue Member of the Park City Formation underlies the Phosphoria Formation. It is composed of thick- to massively-bedded gray dolomite that is occasionally sandy or argillaceous and may be recrystallized. Locally, the Grandeur Tongue is about 65 to 100 feet thick. The Grandeur Tongue is lithologically similar to the upper member of the Wells Formation and is often mapped together as part of the Wells Formation in the Western Phosphate Field.

Wells Formation. The Pennsylvanian to Permian-age Wells Formation is at the base of the stratigraphic section exposed in the RVM area. It is divided into two members. The Upper Member is between 1,350 and 1,450 feet thick and is composed of buff-colored sandy limestone, gray to reddish brown sandstone, dolomitic limestone, and interbedded gray limestone and dolomite. The Lower Member is 850 to 950 feet thick and consists of medium-bedded, gray cherty limestone with some interbedded sandstone.

1.2.3.2 Groundwater Presence and Flow

General patterns of groundwater movement in the Western Phosphate Field are broadly controlled by flow from areas of recharge at higher elevations to areas of discharge at lower elevations. This flow occurs in local-, intermediate-, and regional-scale systems defined by topography, geology, and the continuity of the water-bearing units. Aquifers are defined as porous and permeable geologic strata that transmit groundwater in economically usable quantities and include the alluvium, Dinwoody, Rex Chert (where fractured), and Grandeur Tongue/Wells Formation. The Meade Peak and Cherty Shale Members typically have low permeability and are considered to be aquitards (leaky barriers to groundwater flow) (Ralston et al., 1977; Winter, 1980).

General characteristics of the groundwater flow systems in the area are presented below. Additional details are provided in the WRTR (Whetstone, 2015) and the Final Groundwater Model Report (ARCADIS, 2015).

1.2.3.2.1 Regional Aquifer

The Grandeur Tongue and Wells Formation form a regionally extensive aquifer (Wells Regional Aquifer) that participates in inter-basin transfers of groundwater (Ralston et al., 1977, 1983; Winter 1980; ARCADIS, 2015). Regional aquifers are characterized by long flow paths, inter-basinal flow, and large springs with nearly constant annual discharges. They contain large quantities of groundwater and are typically hosted by thick, aerially extensive formations that have relatively high permeability.

Groundwater in the Wells Regional Aquifer may be confined or unconfined depending on the location. The Wells regional aquifer is typically confined where capped by the Meade Peak aquitard and unconfined in areas of surface outcrop. A confined aquifer has a water level that will rise above the top of the aquifer where tapped by a well. An unconfined aquifer is characterized by a water level that is below the top of the aquifer and open to the atmosphere through the overlying permeable material.

The regional flow directions and hydraulic gradients in the Wells Regional Aquifer at the RVM are interpreted to be controlled by the dominant structural features in the study area, including the Enoch Valley Fault, Lanes Creek Fault, Snowdrift Anticline, and Rasmussen Fault (ARCADIS, 2015). The overall groundwater flow direction within the Wells Regional Aquifer is to the northwest of the RVM area and is conceptualized to discharge in areas adjacent to the Blackfoot Reservoir (Henry Group springs delineated by Ralston et al., 1980; 1983) or the Enoch Valley Sinkhole, situated on the trace of the Enoch Valley Fault northwest of the Blackfoot Reservoir. These potential discharge locations are approximately 10 to 18 miles northwest of the RVM area, respectively, (ARCADIS, 2015).

1.2.3.2.2 Intermediate Aquifers

The Dinwoody Formation and the Rex Chert are intermediate-scale aquifers in the study area (Ralston et al., 1977, 1983; Winter 1980; ARCADIS, 2015). Intermediate-scale aquifers recharge and discharge within the same basin and have the capacity to store and transmit appreciable amounts of groundwater to adjacent geologic formations, springs, and surface water bodies when fractured (Cannon and Ralston, 1980; Ralston et al., 1983).

The intermediate flow system in the Dinwoody Formation may be separated from the Rex Chert by the Cherty Shale, which acts as an aquitard where the unit is well developed and not fractured. In the vicinity of the Site, groundwater flow within the intermediate-scale aquifers is generally southwesterly following bedding and topography away from outcrop recharge areas adjacent and parallel to the axis of the Snowdrift Anticline. Outcrops of the Dinwoody Formation and the Rex Chert Member are found along the southwestern limb of the Snowdrift Anticline, below the unconsolidated alluvial deposits west of the proposed RVM pit.

Flow in the intermediate-scale aquifers is conceptualized as being controlled by bedding, structure, and topography with groundwater moving to the southwest on the western side of the anticline toward the Enoch Valley Fault zone. The Enoch Valley Fault zone is believed to act as a conduit that moves groundwater northwesterly away from Rasmussen Valley toward distal discharge points (Ralston and William, 1979). Additionally, there are minor faults present that could create localized hydraulic connections between intermediate flow systems and the regional flow system (ARCADIS, 2015).

Baseline monitoring data indicate that groundwater in the intermediate units is unconfined in shallow wells near outcrop areas and confined at depth (Whetstone, 2015).

1.2.3.2.3 Local Aquifers

Local-scale groundwater flow systems are hosted by unconsolidated alluvial and colluvial deposits in the area (Ralston et al., 1977, 1983; Winter 1980; ARCADIS, 2015). Unconsolidated deposits are typically saturated at the base of the ridges and beneath the valleys but have been observed to be dry or seasonally saturated in the upper portions of the ridges (Whetstone, 2015). Flow is typically lateral and controlled by topography, although a component of vertical flow is likely because of the downward gradient between the unconsolidated deposits and bedrock.

Shallow groundwater may be present in basalt in some areas of the water resource study area, but it has not been observed in boreholes and wells completed for the Final Baseline Water Resources Technical Report (Whetstone, 2015).

Flow directions in the unconsolidated deposits on the slope west of the proposed pit are southwesterly toward Angus Creek (Whetstone, 2015). Flow in the alluvium/colluvium in Rasmussen Valley follows Angus Creek toward its confluence with the Blackfoot River. Angus Creek and the Blackfoot River gain/lose flow by interacting with alluvial groundwater in the hyphoreic zone depending on seasonally fluctuating water levels and stream flows (Whetstone, 2015).

Section 2

Monitoring Programs

This EMP describes proposed monitoring programs to be conducted during mining operations and post-mining period that are designed to do the following:

- monitor surface water quality
- monitor groundwater quality
- monitor reclamation success and selenium concentrations in reclamation vegetation
- monitor and control the presence of noxious weeds
- provide guidance for identifying and segregating of mined overburden
- monitor construction and integrity of the overburden cover system

Quality assurance for the monitoring programs will be described in the project-specific QAPPs. Currently, there are work plans and QAPPs in place for surface water, groundwater, and noxious weeds monitoring. These work plans and QAPPs will remain in effect till such time as work plans and QAPPs are completed for RVM operations. A work plan and QAPP for vegetation monitoring will be completed prior to beginning reclamation at the RVM.

2.1 Surface Water Monitoring

2.1.1 Surface Water Baseline

The RVM is located within the Blackfoot Sub-Basin, a USGS 4th level Hydrologic Unit Code (HUC) sub-basin (HUC 17040207) that drains into the Snake River Basin. The RVM area is located in two of the 5th level HUCs (watersheds) within the sub-basin. The RVM area directly drains to the Lower Lanes Creek (HUC 170402070102) and the Angus Creek-Blackfoot River (HUC 170402070205), both 6th level HUCs. Table 2-1 lists the watersheds and sub-watersheds within the RVM area.

Table 2-1. RVM Area Watersheds

Watershed (HUC 5)	Sub-Watershed (HUC 6)	Acres
Lanes Creek-Diamond Creek (HUC 1704020701)	Lower Lanes Creek (HUC 170402070102)	26,865
	Diamond Creek (HUC 170402070104)	25,214
	Subtotal	52,079
Upper Blackfoot River (HUC 1704020702)	Angus Creek-Blackfoot River (HUC 170402070205)	19,167
	Subtotal	71,246

Acronyms:

HUC = hydrologic unit code.

RVM = Rasmussen Valley Mine.

Primary commercial activities in the RVM area include agriculture, livestock grazing, and phosphate mining. Recreational uses include fishing and hunting. Streams within the analysis area support aquatic life and are used for agricultural water supply and recreational activities such as fishing for salmonids.

Data for the baseline surface water analysis were compiled from public domain sources and site-specific baseline studies. This information included reports, maps, and databases prepared by governmental agencies, private entities, university researchers, non-governmental organizations, and site-specific baseline studies that were completed between April 1, 2010, and June 30, 2013. The baseline studies were prepared under the direction of the Agencies. A complete description of the surface water baseline monitoring program and the final results is presented in the WRTR (Whetstone, 2015).

Water quality standards for surface water are contained in Idaho Administrative Procedures Act (IDAPA) 58.01.02. According to IDAPA 58.01.02, streams and lakes are classified and managed by beneficial use. Designated beneficial uses for a water body may include warm- or cold-water aquatic life; salmonid spawning; seasonal cold water or modified aquatic life; primary- or secondary-contact recreation domestic, agricultural, or industrial water supply; wildlife habitat; and aesthetics. If more than one beneficial use is recognized for a water body, the most stringent water quality standard is applicable. Standards for cold-water aquatic life, primary or secondary-contact recreation, agricultural water supply, industrial water supply, wildlife habitat, and aesthetics are applicable to all undesignated non-private surface water bodies in the state of Idaho. Water quality standards are not applicable to mine water management and impoundment facilities, such as sedimentation ponds and pit impoundments.

The Blackfoot River has designated beneficial uses including cold-water aquatic life, salmonid spawning, primary-contact recreation, and domestic water supply. All other surface water bodies in the RVM area are undesignated, and applicable criteria include cold-water aquatic life and primary- or secondary-contact recreation (IDAPA 58.01.02).

2.1.2 Surface Water Monitoring Objectives

The objective of surface water monitoring during operations is to provide a monitoring network and sampling frequency which will identify any changes from baseline surface water conditions that could potentially be caused by operations. During the development of the baseline conditions within the RVM area, the following occurred:

- monitoring of 13 stream stations
- monitoring of 16 intermittent drainages
- monitoring of 14 springs
- gain-loss surveys on the upper Blackfoot River
- gain-loss surveys on Angus Creek

As the goals of the baseline study work and the EMP differ, the monitoring strategies under the EMP differ from the monitoring under the baseline study. The WRTR (Whetstone, 2015) provides the assessment of baseline conditions prior to mining activities, while the goals of the EMP are to monitor for changes in surface water conditions, such as changing levels of constituents of potential concern (COPCs), directly tied to activities at the RVM.

2.1.3 Surface Water Monitoring Plan

During mine operations, surface water will be monitored at seven locations during the spring and fall of each year (two events per year) to be representative of high and base flow conditions until there is enough data to justify ending monitoring. The actual dates of the monitoring will depend on weather and sampling location accessibility but are anticipated to occur in April or May and September or October. Groundwater monitoring activities will be conducted as close as is practical to the surface water sampling activities to best compare the data. Proposed locations are shown on Figure 3 and described in Table 2-2.

Table 2-2. Surface Water Sampling Locations						
Monitoring Station	Water Body	Description	Elevation (ft amsl)	Northing	Easting	Property Owner
SW-AC5	Angus Creek	Upstream location on Angus Creek	6,486	4743535.94	470413.22	USFS
SW-AC4	Angus Creek	Angus Creek discharge to Blackfoot River	6,420	4741301.66	472671.06	IDL
SW-BF4	Blackfoot River	Blackfoot River upstream of SW-SPC2	6,424	4741500.97	474510.77	IDL
SW-BF5	Blackfoot River	Blackfoot River downstream of SW-SPC2	6,421	4741447.72	474481.28	IDL
SW-BF6	Blackfoot River	Blackfoot River upstream of SW-AC4	6,409	4741233.62	472716.66	IDL
SW-BF7	Blackfoot River	Blackfoot River downstream of SW-AC4	6,411	4741258.84	472657.49	IDL
SW-SPC2	Spring Creek	Spring Creek discharge to Blackfoot River	6,421	4741454.86	474551.24	IDL

Acronyms and abbreviations:

ft amsl = feet above mean sea level.

IDL = Idaho Department of Lands.

USFS = United States Forest Service.

The surface water monitoring program will be finalized as the ROD is completed and will include the following items:

- Measurement of field parameters:
  - pH
  - temperature
  - specific conductance
  - oxidation-reduction potential
  - dissolved oxygen
  - turbidity
- Manual measurement of stream flow
- Collection and laboratory analysis of water samples

The surface water analyte list, analytical methods to be followed, and associated surface water criteria will be finalized as the ROD is completed and will include items such as those presented in Table 2-3.

Table 2-3. RVM Potential Surface Water Analyte List					
		Surface Water Standards (mg/L) (Aquatic Standards from IDAPA 58.01.02)			
		Cold Water Biota[1]		Standards for Human Health Based on Consumption of:	
Analyte	Analytical Method	CMC	CCC	Water and Organisms	Organisms Only
Major Ions and Solution Parameters					
pH	SM 4500H+B	–	–	–	–
Specific conductance	SM 2510B	–	–	–	–
Alkalinity, total (as $CaCO_3$)	SM 2320B	–	–	–	–
Alkalinity, carbonate (as $CaCO_3$)	SM 2320B	–	–	–	–
Alkalinity, bicarbonate (as $CaCO_3$)	SM 2320B	–	–	–	–
Alkalinity, hydroxide (as $CaCO_3$)	SM 2320B	–	–	–	–
Bromide	EPA 300.0	–	–	–	–
Calcium	EPA 6010B	–	–	–	–
Chloride	EPA 300.0	–	–	–	–
Fluoride	EPA 300.0	–	–	–	–
Hardness as $CaCO_3$	SM 2340B	–	–	–	–
Magnesium	EPA 6010B	–	–	–	–
Potassium	EPA 6020A	–	–	–	–
Sodium	EPA 6010B	–	–	–	–
Sulfate	EPA 300.0	–	–	–	–
TSS	SM 2540D	–	–	–	–
TDS (measured)	SM2540C	–	–	–	–
TDS (ratio)	Calculation	–	–	–	–
TDS (calculated)	Calculation	–	–	–	–
TOC	SM 5310C	–	–	–	–
Turbidity	EPA 180.1	–	–	–	–
Nutrients					
Nitrate/nitrite as nitrogen	EPA 353.2	–	–	–	–
Nitrogen, ammonia	EPA 350.1	–	–	–	–
Phosphorus	SM4500-P-E	–	–	–	–
Metals					
Aluminum	EPA 6010B	–	–	–	–
Antimony	EPA 6020A	–	–	0.0056	0.64
Arsenic	EPA 6020A	0.34[2]	0.15[2]	0.01[3]	0.01[3]
Barium	EPA 6010B	–	–	–	–
Beryllium	EPA 6020A	–	–	–	–
Boron	EPA 6020A	–	–	–	–
Cadmium	EPA 6020A	0.001[4]	0.0006[4]	–	–
Chromium (total)	EPA 6020A	–	–	–	–
Copper	EPA 6020A	0.017[4]	0.011[4]	–	–
Iron	EPA 6010B	–	–	–	–

Table 2-3. RVM Potential Surface Water Analyte List					
		Surface Water Standards (mg/L) (Aquatic Standards from IDAPA 58.01.02)			
		Cold Water Biota[1]		Standards for Human Health Based on Consumption of:	
Analyte	Analytical Method	CMC	CCC	Water and Organisms	Organisms Only
Lead	EPA 6020A	0.065[4]	0.0025[4]	–	–
Manganese	EPA 6010B	–	–	–	–
Mercury	EPA 7470A	–	–	–	–
Molybdenum	EPA 6010B	–	–	–	–
Nickel	EPA 6010B	0.47[4]	0.052[4]	0.61	4.6
Selenium	EPA 6020A	0.02	0.005	0.17	4.2
Silver	EPA 6020A	0.003[4]	–	–	–
Thallium	EPA 6020A	–	–	0.00024	0.00047
Uranium	EPA 6020A	–	–	–	–
Vanadium	EPA 6020A	–	–	–	–
Zinc	EPA 6010B	0.12[4]	0.12[4]	7.4	26

Acronyms and Abbreviations: CCC = criterion continuous concentration; chronic.

CMC = criterion maximum concentration; acute.

EPA = Environmental Protection Agency.

IDAPA = Idaho Administrative Procedures Act.

mg/L = milligram per liter (i.e., part per million).

RVM = Rasmussen Valley Mine.

TDS = total dissolved solids.

TOC = total organic carbon.

TSS = total suspended solids.

Notes:

— No standard has been established.

[1]Cold Water Biota based on 100 mg/L Total Hardness and Water Effect Ratio of 1.

[2]Standards for CMC and CCC are the presented values multiplied by the Water Effect Ratio.

[3]Standards for human health apply to inorganic arsenic only.

[4]Hardness-dependent CMC and CCC standards. Hardness is analyzed to calculate the appropriate water quality criteria.

An updated FSP, including locations, methodologies, analytical testing, and a QAPP, will be developed after the ROD has been issued.

2.2 Groundwater Monitoring

2.2.1 Groundwater Baseline

Groundwater data for the region are available from reports, maps, and databases prepared by the USGS, Idaho Department of Water Resources, and other public domain sources. These data are supplemented by a site-specific groundwater investigation completed under the direction of the Agencies (Whetstone, 2015). The baseline groundwater investigation for the study area included the following:

- Installation of 20 wells and 11 vibrating wire piezometers within the study area
- Quarterly monitoring (spring through fall) of groundwater levels and water quality starting April 1, 2012, and extending through June 30, 2013

- Single-well permeability tests (pneumatic slug and pump and recovery tests) in 13 monitoring wells
- An aquifer test in the Wells Regional Aquifer near the southeastern end of the proposed pit

The RVM area consists of three general groundwater systems as described in Section 1.2.3.2: deep, intermediate, and shallow aquifers. The Wells Regional Aquifer is a deep aquifer that is generally formed by the Grandeur Tongue and Wells Formation. The Dinwoody Formation and Rex Chert form the intermediate-scale aquifers within the RVM. The alluvial aquifer is the shallow aquifer.

Data for the baseline groundwater analysis were compiled from public domain sources and site-specific baseline studies. This information included reports, maps, and databases prepared by governmental agencies, private entities, university researchers, non-governmental organizations, and site-specific baseline studies that were completed between April 1, 2010, and June 30, 2013. The baseline studies were prepared under the direction of the Agencies. A complete description of the groundwater baseline monitoring program and the final results are presented in the WRTR (Whetstone, 2015).

Idaho water quality standards for groundwater are contained in IDAPA 58.01.11. Aquifers in Idaho are classified as Sensitive Resources, General Resources, or Other Resources based on the vulnerability of the groundwater, existing and projected beneficial uses of the water, existing water quality, and social and economic considerations. All aquifers within the RVM area are classified as General Resource or are currently unclassified.

2.2.2 Groundwater Monitoring Objectives

Compliance with Idaho's Groundwater Quality Standards for the RVM will be established through a project-specific Point of Compliance determination from the IDEQ under IDAPA 58.01.11.401. The goal of groundwater monitoring under this EMP is to monitor for changes in groundwater conditions, such as changing COPC concentrations, resulting from activities at the RVM. The groundwater that potentially may be impacted by the RVM was identified in the Rasmussen Valley Mine Final EIS (BLM, 2015).

2.2.3 Groundwater Monitoring Plan

Groundwater will be monitored on a semi-annual basis in coordination with the surface water monitoring schedule at all existing site monitoring wells. Efforts will be made to sample the wells as close as is practical to when the surface water samples are collected (in the spring and fall) in order to best compare the data. The construction and location information for the well network that currently exists is provided in Table 2-4; these well locations are shown on Figure 4. This network is subject to change as various events occur, including, but not limited to, selecting an alternative or issuing a Point of Compliance determination. This EMP assumes the Preferred Alternative is selected. Certain monitoring wells are located within the planned disturbance area of the mine and will be abandoned as necessary to facilitate mining. These wells are indicated in the table below and will be monitored until abandoned.

If the monitoring well network is modified in the future, the new well locations and well construction details will be updated in the EMP as appropriate.

Table 2-4. Current RVM Groundwater Monitoring Well Network

Well ID[1]	Date Completed	Geologic Unit	NAD 83 UTM Zone 12N Northing (meters)[2]	NAD 83 UTM Zone 12N Easting (meters)[2]	Survey Elevation (MP) (ft amsl)	Ground Elevation (ft amsl)	Stick Up (ft ags)	Screened Interval (ft bgs)	Total Depth (ft bgs)[3]
MW-6A	7/30/2012	Alluvium	4743169.24	471449.09	6,584.89	6,582.47	2.42	40–60	65
MW-8A	7/20/2011	Alluvium	4742010.63	472626.63	6,461.20	6,459.44	1.76	45–65	70
MW-9A	12/22/2010	Alluvium	4741644.67	473598.46	6,544.58	6,542.95	1.63	63–83	90

Table 2-4. Current RVM Groundwater Monitoring Well Network									
Well ID[1]	Date Completed	Geologic Unit	NAD 83 UTM Zone 12N Northing (meters)[2]	NAD 83 UTM Zone 12N Easting (meters)[2]	Survey Elevation (MP) (ft amsl)	Ground Elevation (ft amsl)	Stick Up (ft ags)	Screened Interval (ft bgs)	Total Depth (ft bgs)[3]
MW-15A4	7/3/2012	Alluvium	4743132.37	472008.95	6,700.92	6,698.93	1.99	16–36	41
MW-19B	6/16/2012	Basalt/Alluvium	4741556.25	474064.33	6,520.63	6,518.50	2.13	30–60	65
MW-10D[4]	2/28/2012	Dinwoody	4743638.45	470925.59	6,636.86	6,634.57	2.29	70–130	135
MW-4R[4]	7/26/2011	Rex Chert	4742671.88	472749.31	6,567.31	6,564.21	3.10	153–173	178
MW-5R[4]	1/8/2011	Rex Chert	4741706.82	473724.08	6,552.11	6,550.28	1.83	250–270	275
MW-11R[4]	8/12/2012	Rex Chert	4743135.31	472000.31	6,701.24	6,699.17	2.07	265–285	290
MW-14R[4]	7/27/2011	Rex Chert	4742660.82	472742.31	6,566.10	6,564.21	1.89	30–50	55
MW-1W[4]	9/19/2012	Wells Formation	4743794.02	470858.44	6,762.54	6,760.55	1.99	440–480	484.6
MW-2W	7/1/2012	Wells Formation	4742596.03	473303.92	6,852.06	6,850.10	1.96	540–560	565
MW-3W	12/18/2010	Wells Formation	4741992.42	473945.16	6,570.41	6,568.83	1.58	236–256	261
MW-12W[4]	7/27/2012	Wells Formation	4743437.25	472269.09	6,883.39	6,882.47	0.92	615–635	640
MW-13W	7/29/2012	Wells Formation	4743779.58	471496.93	7,043.47	7,041.44	2.03	740–760	765
MW-16W	2/15/2012	Grandeur Tongue	4742224.63	473207.18	6,678.66	6,674.95	3.71	755–775	780
MW-17W	12/12/2011	Grandeur Tongue	4741690.43	473704.48	6,551.95	6,548.75	3.20	740–760	765
Aquifer Test Monitoring Wells[5]									
OW-1W	9/3/2011	Wells Formation	4741661.02	474106.50	6,531.21	6,529.36	1.85	418–508	513
OW-2W	10/6/2012	Wells Formation	4741996.56	474030.25	6,557.54	6,555.39	2.15	219–309	314
PW-1W	11/8/2012	Wells Formation	4741968.41	474017.56	6,558.42	6,556.39	2.03	218–368	373

Acronyms and abbreviations:

ft ags = feet above ground surface.

ft amsl = feet above mean sea level.

ft bgs = feet below ground surface.

MP = measuring point elevation (either top of casing or top of well casing cap).

Notes:

[1]Well ID = monitoring well identification. See Figure 4 for monitoring well locations.

[2]Wells surveyed in RVM Mine Grid Coordinate System. Conversions to NAD 83 (Northing and Easting) are approximate.

[3]Total depth is constructed well depth (not boring depth).

[4]Indicates well is located within mine disturbance area and will be removed during mining.

[5]Included for reference only, not part of Environmental Monitoring Plan.

The proposed groundwater monitoring program will be finalized as the ROD is completed and will include the following items:

- Measurement of field parameters:
  - pH
  - temperature
  - specific conductance
  - oxidation-reduction potential

- – dissolved oxygen
- – turbidity

- Measurement of groundwater depth to calculate groundwater elevation
- Collection of water samples for laboratory analysis

The groundwater analyte list, analytical methods to be followed, and associated groundwater criteria will be finalized as the ROD is completed and will include items such as those presented in Table 2-5.

Table 2-5. RVM Potential Groundwater Analyte List

Constituent	Analytical Method	Idaho Groundwater Standards (mg/L)	
		Primary	Secondary
Major Ions			
Alkalinity, bicarbonate (as CaCO3) (Total)	SM 2320B	–	–
Alkalinity, carbonate (as CaCO3) (Total)	SM 2320B	–	–
Alkalinity, hydroxide (as CaCO3) (Total)	SM 2320B	–	–
Alkalinity, total (as CaCO3) (Total)	SM 2320B	–	–
Bromide (Total)	EPA 300.0	–	–
Calcium (Dissolved)	EPA 6010B	–	–
Chloride (Total)	EPA 300.0	–	250
Conductivity @25°C (Total)	SM 2510B	–	–
Fluoride (Total)	EPA 300.0	4	–
Hardness (as CaCO3) (Dissolved)	Calculation	–	–
Ion balance (Total)	Calculation	–	–
Magnesium (Dissolved)	EPA 6010B	–	–
pH (Total)	SM 4500H+B	–	–
Potassium (Dissolved)	SM 2540C	–	–
Sodium (Dissolved)	EPA 6010B	–	–
Sulfate (Total)	EPA 300.0	–	250
Sum of anions (Total)	Calculation	–	–
Sum of cations (Total)	Calculation	–	–
Suspended solids (residue, non-filterable) (Total)	SM 2540D	–	–
TDS (calculated) (Total)	SM 2540C	–	–
TDS (ratio – measured/calculated) (Total)	SM 2540C	–	–
TDS (Total)	SM 2540C	–	500
Total organic carbon (Total)	SM 5310B	–	–
Turbidity (Total)	EPA 180.1	–	–
Nutrients			
Nitrate-nitrite (as N) (Total)	EPA 353.2	10	–
Ammonia (as N) (Total)	EPA 350.1	–	–
Phosphorus, total (Dissolved)	SM4500-P-E	–	–

Table 2-5. RVM Potential Groundwater Analyte List			
		Idaho Groundwater Standards (mg/L)	
Constituent	Analytical Method	Primary	Secondary
Metals			
Aluminum (Dissolved)	EPA 6010B	–	–
Aluminum (Total)	EPA 6010B	–	0.2
Antimony (Dissolved)	EPA 6020A	–	–
Antimony (Total)	EPA 6020A	0.006	–
Arsenic (Dissolved)	EPA 6020A	–	–
Arsenic (Total)	EPA 6020A	0.05	–
Barium (Dissolved)	EPA 6010B	–	–
Barium (Total)	EPA 6010B	2	–
Beryllium (Dissolved)	EPA 6020A	–	–
Beryllium (Total)	EPA 6020A	0.004	–
Boron (Dissolved)	EPA 6020A	–	–
Boron (Total)	EPA 6020A	–	–
Cadmium (Dissolved)	EPA 6020A	–	–
Cadmium (Total)	EPA 6020A	0.005	–
Chromium (Dissolved)	EPA 6020A	–	–
Chromium (Total)	EPA 6020A	0.1	–
Copper (Dissolved)	EPA 6020A	–	–
Copper (Total)	EPA 6020A	1.3	–
Iron (Dissolved)	EPA 6010B	–	–
Iron (Total)	EPA 6010B	–	0.3
Lead (Dissolved)	EPA 6020A	–	–
Lead (Total)	EPA 6020A	0.015	–
Manganese (Dissolved)	EPA 6010B	–	–
Manganese (Total)	EPA 6010B	–	0.05
Mercury (Dissolved)	EPA 7470A	–	–
Mercury (Total)	EPA 7470A	0.002	–
Molybdenum (Dissolved)	EPA 6010B	–	–
Molybdenum (Total)	EPA 6010B	–	–
Nickel (Dissolved)	EPA 6010B	–	–
Nickel (Total)	EPA 6010B	–	–
Selenium (Dissolved)	EPA 6020A	–	–
Selenium (Total)	EPA 6020A	0.05	–
Silver (Dissolved)	EPA 6020A	–	–
Silver (Total)	EPA 6020A	–	0.1
Thallium (Dissolved)	EPA 6020A	–	–

Table 2-5. RVM Potential Groundwater Analyte List			
Constituent	Analytical Method	Idaho Groundwater Standards (mg/L)	
		Primary	Secondary
Thallium (Total)	EPA 6020A	0.002	–
Uranium (Dissolved)	EPA 6020A	–	–
Uranium (Total)	EPA 6020A	–	–
Vanadium (Dissolved)	EPA 6020A	–	–
Vanadium (Total)	EPA 6020A	–	–
Zinc (Dissolved)	EPA 6010B	–	–
Zinc (Total)	EPA 6010B	–	5

Acronyms and abbreviations:

mg/L = milligram per liter (i.e., part per million).

RVM = Rasmussen Valley Mine.

TDS = total dissolved solids.

Notes:

— Indicates that no standard has been established.

Details regarding sampling methodologies and analytical testing will be fully developed in the RVM Groundwater FSP in coordination with the Final EIS and ROD.

2.3 Reclamation Monitoring

2.3.1 Soils

The soils to be used for reclamation and cover construction will be obtained on-lease or from adjacent borrow areas. Analysis of the soils, presented in Addendum 2 to the cap and cover report (Brown and Caldwell, 2015a) predict that salvage, storage, handling, and use of the soils for reclamation are not expected to result in COPCs in reclamation vegetation above the Pocatello Field Office (PFO) Approved Resource Management Plan (ARMP) Action Levels. The performance standard for soils is the concentration of selenium in vegetation grown in the soil, which will be monitored; therefore, soil monitoring for selenium will not be required.

2.3.1.1 Growth Medium Availability

At no time will disturbance be performed if stockpiled or salvageable growth medium is insufficient to cover the new disturbance.

2.3.2 Vegetation

The objective of the vegetation monitoring plan in this EMP is to monitor re-vegetation to determine compliance with the Caribou National Forest Revised Forest Plan (RFP) standards and the PFO-ARMP Action requirements.

2.3.2.1 Annual Monitoring

The RFP Prescription 8.2.2(g) Standard states that "vegetation monitoring to determine reclamation success on reclaimed sites shall be conducted annually and reported to the USFS by the operator until reclamation is accepted and the reclamation bond is released." Agrium's annual vegetation monitoring will include visually inspecting for dead spots, weeds, or damaged areas of vegetation and reseeding if necessary. Yearly photos at established locations will be taken to document landscape level cover. Photos and documentation of the monitoring will be included in the Annual Operations Report.

2.3.2.2 Vegetation Surveys

Agrium will conduct detailed cover vegetation surveys no sooner than 2 and 4 years after seeding and no later than 2 and 4 years after completion of final mine reclamation to determine reclamation success. Vegetative cover estimates will be conducted along survey transects starting 500 feet from the north end of the reclamation and running true east-west with the following frequency:

- Mine Pit – one transect per 1,000 feet (approximately 13 transects total). These transects will include the growth media storage areas between the mine pit and the West Side Haul Road.
- Haul Road – one transect located as an extension of each Mine Pit transect.
- External Borrow Areas – one transect every 1,000 feet starting 500 feet from the north end of each separate borrow area.

Visual Estimates. The ARMP Action requirements ME-1.1.4 and ME-2.2.1 state that reclamation will be designed to meet the Idaho Standards for Rangeland Health (BLM, 1997). Visual estimates of reclamation vegetation success, including cover percentage and richness in accordance with RFP and ARMP requirements, will be conducted using the Daubenmire system, or similar system, at randomly selected locations on reclaimed areas along each transect. The same locations will be used for subsequent events. The number of locations along each transect include the following:

- Mine Pit – seven locations per transect.
- Haul Road – one location per transect.
- External Borrow Areas – locations per transect will be at the same density as the average distance between transect locations on the pit transects (i.e., approximately 100 feet apart).

Sampling. Vegetation sampling will be conducted 2 and 4 years after completion of final mine reclamation, at the same locations as defined in the visual estimate transects, at the same time each year, at the end of the growing season. The Agrium Operations team will have the flexibility to reevaluate this frequency in concurrence with the Agencies.

Samples of reclamation vegetation will be analyzed for the constituents listed in Table 2-6, with the exact lab analysis methods to be determined later. The recorded level for selenium in reclamation vegetation will also be used as the performance standard for selenium in reclamation soils.

Table 2-6. Mine Reclamation Vegetation Suitability Standards

Constituent	Action Level (mg/kg dry weight)
Selenium	5.0
Cadmium	4.2
Chromium	30.6
Nickel	35.5
Vanadium	55.9
Zinc	615.0

Abbreviations:

mg/kg = milligram per kilogram.

2.4 Noxious Weed Control

Noxious weed monitoring will be a continuous process during mining activities and periodically during post-closure activities. Noxious weed monitoring and spraying during post closure will occur annually, at a minimum, until the lease is relinquished by the BLM. Weed species and locations will be documented as part of the weed control program. A Pesticide Use Proposal (PUP) will be developed and submitted for approval by the USFS and BLM. Application and reporting of pesticides will be in accordance with the PUP. Annual reporting of noxious weed management will be submitted in the Agrium Annual Operations Report.

2.5 Overburden Segregation

2.5.1 Overburden Baseline

As defined in the EIS, the overburden that contains Meade Peak (center waste shale, hanging wall mud, and footwall muds) and certain strata within the Rex Chert Member and Cherty Shale Member (dark colored chert) have the potential for releasing COPCs including selenium. This overburden is called "Meade Peak material" or "Meade Peak overburden." Overburden not containing this material, and designated as "Non-Meade Peak material" or "Non-Meade Peak overburden," typically does not contain leachable COPCs at levels that would prevent it from being used for constructing roads and other ancillary foundations. The Non-Meade Peak material typically includes the alluvial/colluvial deposits, hard sparry lighter colored layers of the Rex Chert Member, the Dinwoody Formation, the Grandeur Tongue, and the Wells Formation.

2.5.2 Overburden Segregation Objectives

The objective of the overburden segregation program is to ensure that roads and other ancillary features are only constructed with Non-Meade Peak material. In addition, Meade Peak and Non-Meade Peak material will be properly identified in the field to ensure that proper segregation occurs in an accurate and timely manner.

2.5.3 Overburden Segregation Plan

Non-Meade Peak material to be used for constructing roads and other ancillary structures will be visually identified in situ by trained operators, marked with wooden stakes and/or colored flagging, and segregated during mining as necessary. These materials will be handled according to the approved Mine Plan.

2.6 Final Cover Monitoring

2.6.1 Cover Material Baseline

The RVM cap and cover alternatives analysis included an evaluation of available materials' physical, chemical, and hydrologic characteristics (Brown and Caldwell, 2015a, 2015b). This evaluation determined the following:

1. For the preferred cover alternative, the infiltration model sensitivity analysis found that the saturated hydraulic conductivity of the middle layer of combined borrow material is the primary controlling factor for limiting deep percolation, as it slows percolation through the root zone so that transpiration can remove a large quantity of water.
2. The infiltration model sensitivity analysis found that the middle layer must be a minimum of 1 foot thick to limit deep percolation to the designed performance.

2.6.2 Cover Construction QA/QC Plan

A construction QA/QC program has been developed for the RVM to ensure that the cover is constructed within the parameters of the design. The Cover Construction QA/QC Plan is presented in Appendix A.

The objectives of the RVM Cover Construction QA/QC Plan are to ensure that material selected using the proposed methods for material identification has the appropriate physical characteristics and that selected material is placed with proper construction methods to achieve the target hydraulic properties and layer thicknesses so that the final cover can support vegetation and limit percolation of meteoric water through underlying overburden.

2.6.3 Cover Monitoring Plan

The integrity of the cover, especially in regard to maintaining appropriate thickness of the primary middle layer in the root zone, and sufficient vegetation for removal of water via transpiration, is essential to ensuring its performance. Therefore, post-construction, the final cover will be monitored for vegetative coverage, as described in Section 2.3.2 herein, as well as for excess erosion.

Section 3

Data Validation and Reporting

Data quality objectives, data validation, and other QA/QC procedures will be defined in the QAPPs of the Final EMP, and field procedures will follow the yet-to-be-defined media-specific FSPs. The field procedures and laboratory results will be reviewed and evaluated by the project manager and quality assurance officer to confirm that the data obtained from the work is valid and meets all data quality objectives as will be defined in the QAPPs.

Section 4

Limitations

This document was prepared solely for Agrium in accordance with professional standards at the time the services were performed and in accordance with the contract between Agrium and Brown and Caldwell dated January 6, 2011. This document is governed by the specific scope of work authorized by Agrium; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by Agrium and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

This document sets forth the results of certain services performed by Brown and Caldwell with respect to the RVM. Agrium recognizes and acknowledges that these services were designed and performed within various limitations, including budget and time constraints. These services were not designed or intended to determine the existence and nature of all possible environmental risks (which term shall include the presence or suspected or potential presence of any hazardous waste or hazardous substance, as defined under any applicable law or regulation, or any other actual or potential environmental problems or liabilities) affecting the Property. The nature of environmental risks is such that no amount of additional inspection and testing could determine as a matter of certainty that all environmental risks affecting the Property had been identified. Accordingly, THIS DOCUMENT DOES NOT PURPORT TO DESCRIBE ALL ENVIRONMENTAL RISKS AFFECTING THE PROPERTY, NOR WILL ANY ADDITIONAL TESTING OR INSPECTION RECOMMENDED OR OTHERWISE REFERRED TO IN THIS DOCUMENT NECESSARILY IDENTIFY ALL ENVIRONMENTAL RISKS AFFECTING THE PROPERTY.

Further, Brown and Caldwell makes no warranties, express or implied, with respect to this document, except for those, if any, contained in the agreement pursuant to which the document was prepared. All data, drawings, documents, or information contained in this report have been prepared exclusively for the person or entity to whom it was addressed and may not be relied upon by any other person or entity without the prior written consent of Brown and Caldwell unless otherwise provided by the Agreement pursuant to which these services were provided.

Section 5

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Figures

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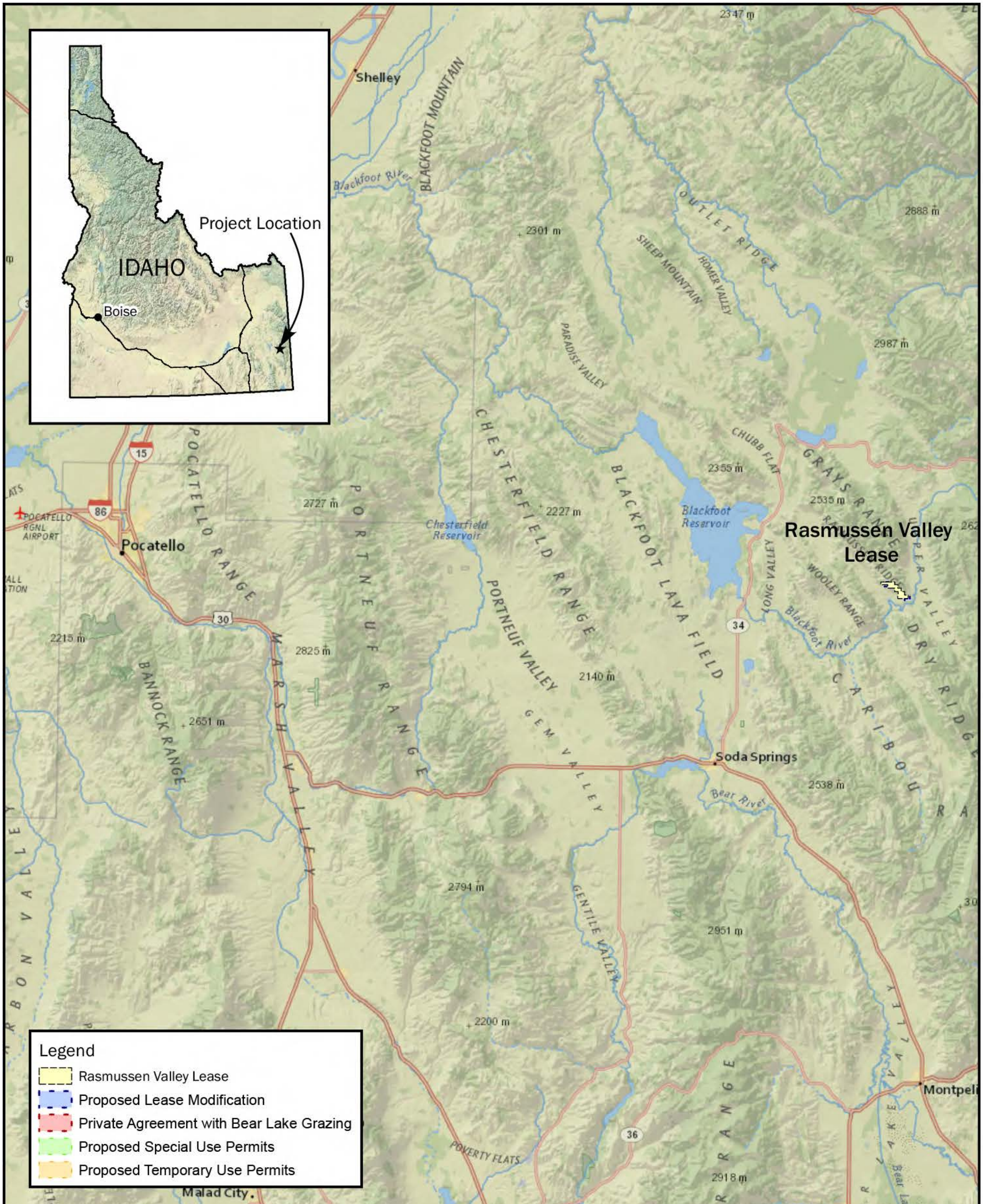

Brown AND Caldwell

Date: 02/22/16

Project No: 148743

Client: Agrium

Basemap: National Geographic

0 5 10 20 Miles

N

Figure 1
Site Location Map
Draft Environmental Monitoring Plan
Rasmussen Valley Mine Project

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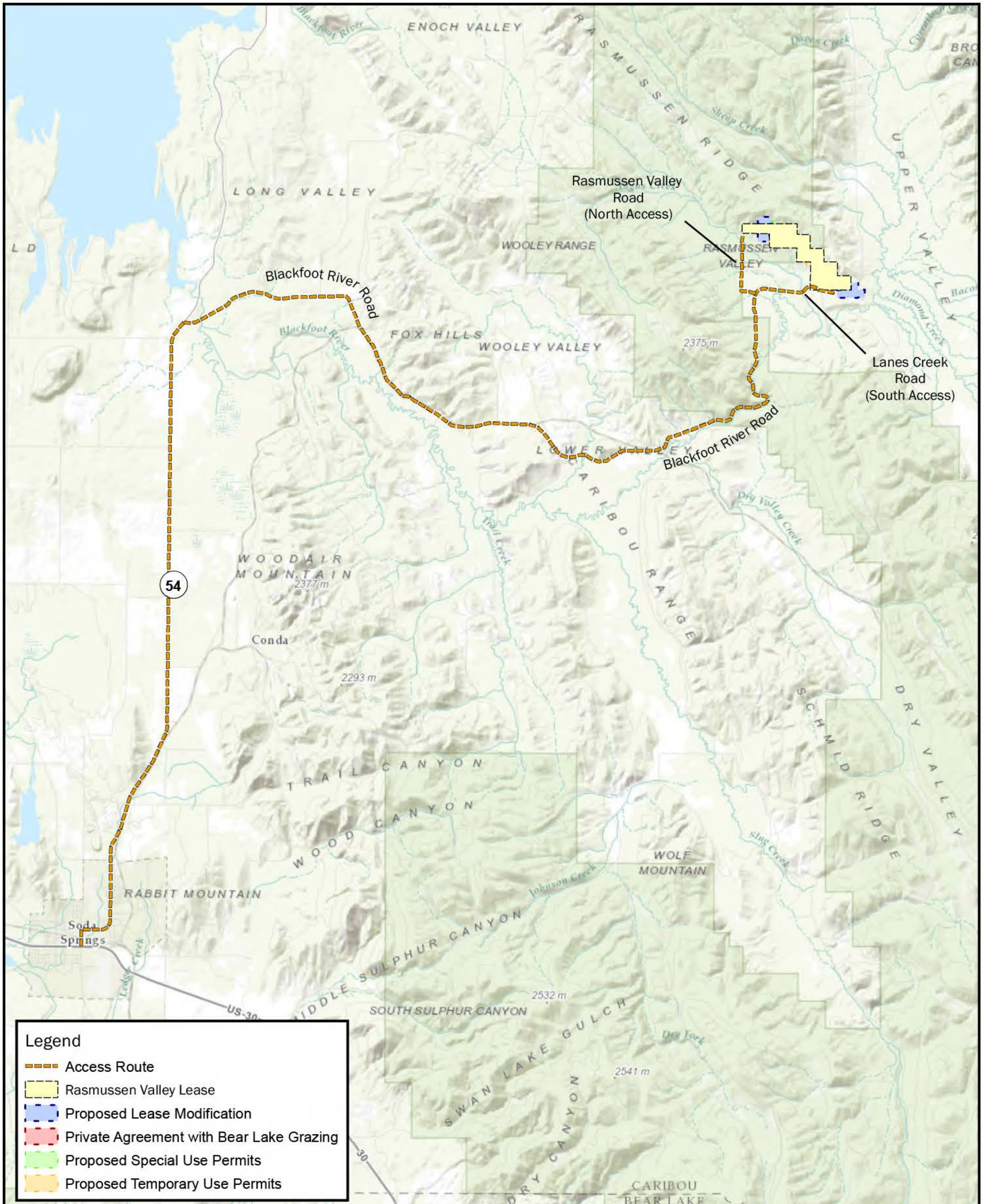

Brown AND Caldwell

Date: 02/22/16
Project No: 148743
Client: Agrium

Basemap: National Geographic

0 1.25 2.5 5 Miles

N

Figure 2
Site Access Map
Draft Environmental Monitoring Plan
Rasmussen Valley Mine Project

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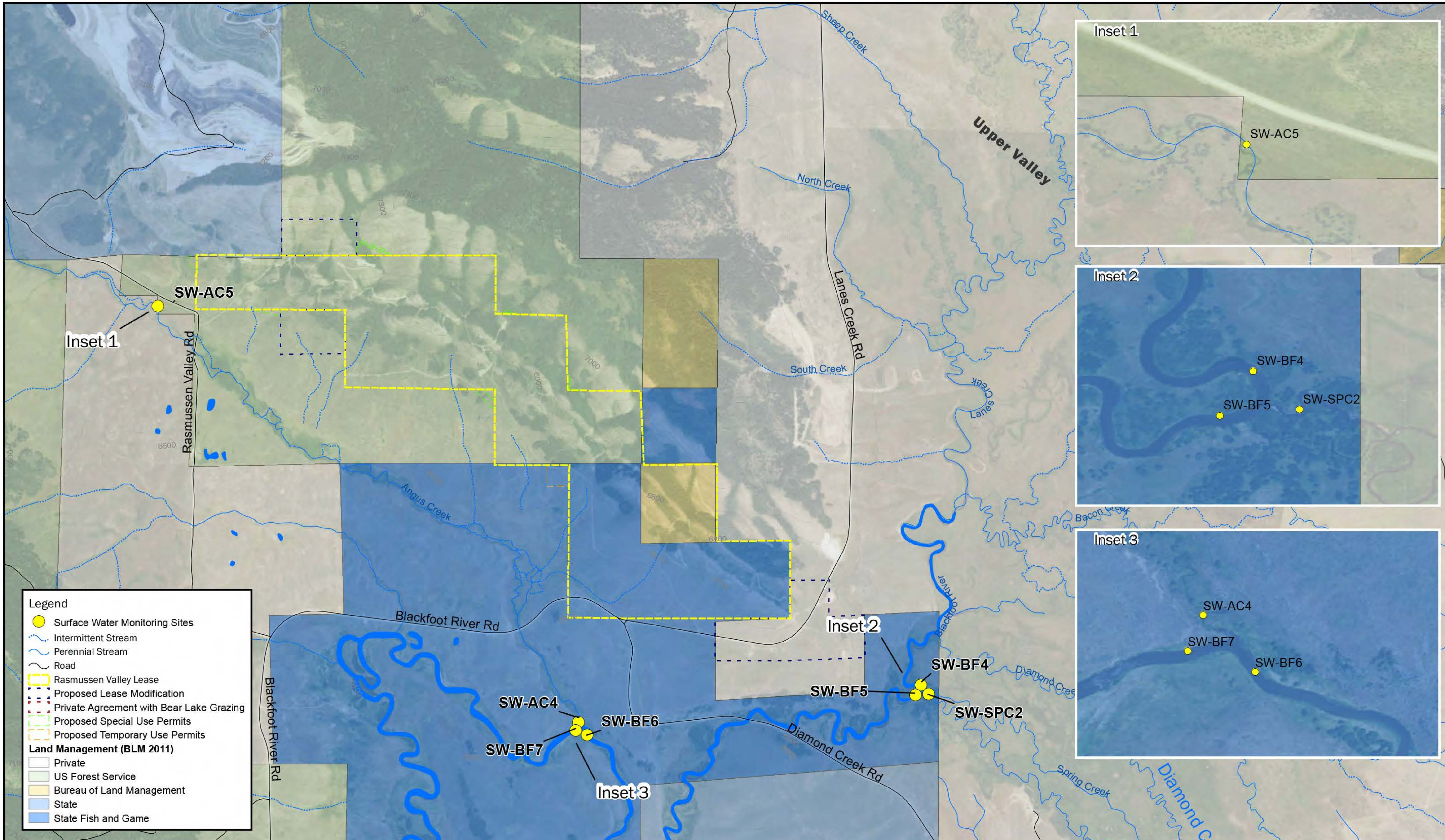

Brown AND Caldwell

Date: 2/24/2016
Project No: 148743
Client: Agrium

0 800 1,600 3,200 Feet
1 in = 1,600 ft

N

Figure 3
Surface Water Monitoring Locations
Draft Environmental Monitoring Plan
Rasmussen Valley Mine Project

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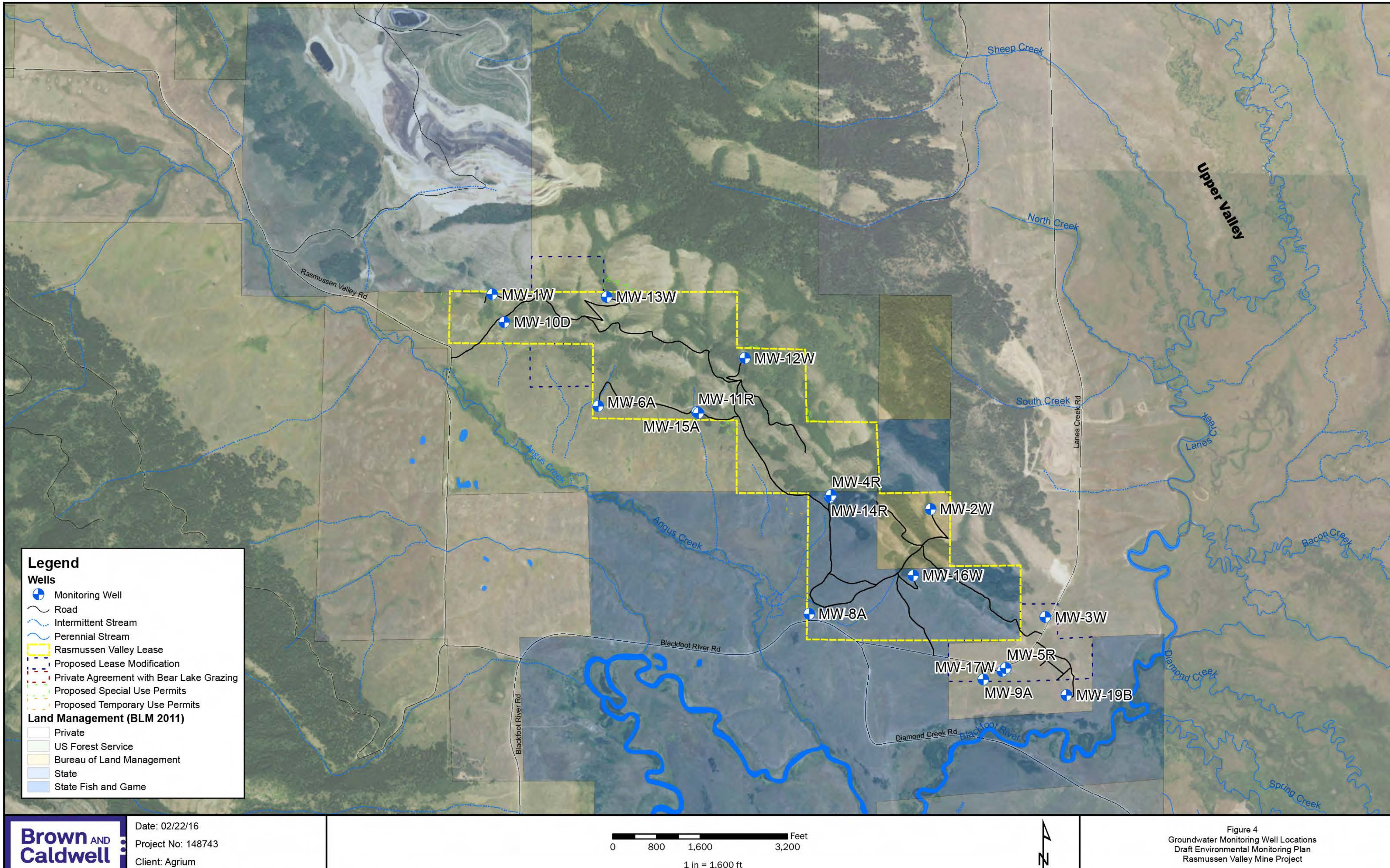

Brown AND Caldwell

Date: 02/22/16

Project No: 148743

Client: Agrium

Figure 4
Groundwater Monitoring Well Locations
Draft Environmental Monitoring Plan
Rasmussen Valley Mine Project

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Appendix A: Cover Construction Quality Assurance/Quality Control Plan

Rasmussen Valley Mine
Cover Construction QA/QC Plan

Prepared for

Nu-West Industries, Inc., doing business as

Agrium Conda Phosphate Operations

Soda Springs, Idaho

July 29, 2016

Rasmussen Valley Mine Cover Construction QA/QC Plan

Prepared for

Nu-West Industries, Inc., doing business as

Agrium Conda Phosphate Operations

Soda Springs, Idaho

July 29, 2016

Job No. 148743

FINAL

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List of Abbreviations

Agrium	Nu-West Industries, Inc., doing business as Agrium Conda Phosphate Operations
ASTM	American Society for Testing and Materials
BLM	U.S. Bureau of Land Management
Borrow Material	external area combined growth medium and alluvium/colluvium
cm/sec	centimeter per second
Cu	coefficient of uniformity
EIS	Environmental Impact Statement
ft	foot
H	horizontal
Ksat	saturated hydraulic conductivity
Pit Alluvium	pit alluvium/colluvium
Pit GM	pit growth medium
QA	quality assurance
QA/QC Plan	Construction Quality Assurance and Quality Control Plan
QC	quality control
ROM	run-of-mine
RVM	Rasmussen Valley Mine
RVMP	Rasmussen Valley Mine Project
SWMP	Surface Water Management Plan
V	vertical
yd^3	cubic yard

Executive Summary

This plan develops construction quality assurance and quality control requirements to verify that all steps of the construction process of an earthen reclamation cover have been performed in accordance with specifications. Requirements are included herein for three layers of material that compose the cover, as well as the surface of the overburden, including pit backfill, on which the cover will be placed.

Nu-West Industries Inc., doing business as Agrium Conda Phosphate Operations, currently owns the leases associated with the Rasmussen Valley Mine. Run-of-mine (ROM) overburden that analysis in the Final EIS has shown could release constituents of concern, including selenium, into surface waters and groundwater, will be produced as part of the planned mine operation. Agrium has proposed to construct a cover system that would limit water percolation into the overburden. The proposed cover system (Cover) utilizes layers of alluvium/colluvium and topsoil salvaged from the planned pit area and borrow materials sourced from an area adjacent to the proposed West Side Haul Road and downslope from the mine pit. The Cover, referred to as the Rasmussen Collaborative Alternative (RCA) cover system, Store-and-Release Cover C, or Alternative 6 in previous Rasmussen Valley Mine Project documents, consists of (from surface to base) the following:

- 1 foot (ft) of growth medium salvaged from within the pit footprint
- 2 ft of combined growth medium and alluvium/colluvium borrowed from designated external sources adjacent to the West Side Haul Road and downslope of the mine pit
- 3 ft of alluvium/colluvium salvaged from within the pit footprint

The Cover layers must be constructed of materials that meet specific properties and in a manner that will support vegetative growth and minimize percolation of meteoric water into overburden.

This Construction Quality Assurance and Quality Control Plan outlines the quality assurance (QA) testing of source materials prior to salvage or borrow and the quality control (QC) testing of the constructed cover layers. The cover materials, salvaged from the pit area or borrowed from external sources, are subject to visual inspection and QA verification of intrinsic material physical characteristics prior to acceptance for use in the cover system. QC testing during construction is primarily focused on ensuring the thickness, moisture content, and density of the placed lifts of cover materials. An initial area of cover will be tested during and after construction to verify the in-place properties and refine construction methods, if needed, to ensure cover properties are equivalent to those used in the Final EIS cover infiltration modeling.

Section 1

Introduction

This Construction Quality Assurance and Quality Control Plan (QA/QC Plan) was developed to verify material characteristics and material placement conditions meet those parameters used in the modeling of the Cover performance in the Final Environmental Impact Statement (EIS). The QA/QC Plan was developed based on field investigations and laboratory analysis completed during the Rasmussen Valley Mine Project (RVMP) Cap and Cover Alternatives Analysis (Brown and Caldwell, 2015). The objective of the quality assurance (QA) portion of this plan is to ensure that material salvaged or borrowed for use in the cover meets the specified criteria. The objective of the quality control (QC) portion of this plan is to ensure that the cover is constructed according to the preferred alternative presented in the Final EIS. The objectives of the Cover are to support vegetation and limit percolation of meteoric water through mine backfill at the Rasmussen Valley Mine (RVM).

The Cover consists of layers of alluvium/colluvium and growth medium from two sources on the RVM site—external to and within the mine pit footprint. The Cover from top down will consist of the following materials and minimum thicknesses:

- 1 feet (ft) of growth medium salvaged from within the pit footprint
- 2 ft of combined growth medium and alluvium/colluvium borrowed from external sources adjacent to the pit
- 3 ft of alluvium/colluvium salvaged from within the pit footprint

This QA/QC Plan is intended to ensure that materials salvaged or borrowed for use in the Cover meet or exceed certain property targets and that the Cover is constructed in accordance infiltration modeling of the preferred alternative from the Final EIS.

This QA/QC Plan is organized into the following sections:

- Introduction
- Project Personnel and Responsibilities
- Quality Assurance
- Construction Quality Control
- Phase 1 Testing and QA/QC Refinement
- Deficiencies
- Documentation and Reporting

Section 2

Project Personnel and Responsibilities

This section describes the various project personnel and their responsibilities, authority, and required qualifications as related to the implementation of this QA/QC Plan.

2.1 Owner

Nu-West Industries Inc., doing business, as Agrium Conda Phosphate Operations (Agrium) will develop the RVM for the recovery of phosphate ore reserves contained within Federal Phosphate Lease I-05975 (Lease), as directed by the Mineral Leasing Act of 1920. The Lease conveys to Agrium the exclusive right and privilege, subject to the terms and conditions of the Lease, to explore and develop the federally owned mineral estate and to use the surface within the Lease for related mining activities.

2.2 Quality Assurance/Quality Control Manager

All aspects of the QA/QC process will be overseen by the QA/QC Manager. The QA/QC Manager may also serve as a QA/QC Inspector. The QA/QC Manager's responsibilities include the following:

- Verify Cover QA/QC measures are being followed
- Document proposed or initiated changes to the QA/QC Plan procedures, with Agency approval
- Determine whether material meets specifications and appropriate salvage or borrow depths
- Oversee QC sampling and reviewing of test results
- Decide, with agency approval, a path forward if a construction QC test is failed
- Oversee QA/QC Inspector(s), Trained Operators, salvage and borrow operations, and Cover construction
- Develop and implement QA/QC training, documentation, and reporting

The QA/QC Manager will possess at least 40 hours of experience or training with material identification, cover construction, and general salvage/borrow and reclamation practices. The QA/QC Manager will understand the importance of the material properties and construction requirements contained herein and the role he/she plays in ensuring the Cover achieves its objectives. The QA/QC Manager will have a thorough understanding of the construction QA/QC requirements contained in this plan. Documentation of the QA/QC Manager’s qualifications will be provided to the Agencies for their approval.

2.3 Quality Assurance/Quality Control Inspector(s)

Construction QA/QC Inspectors may also serve as Trained Operators. It is anticipated there will be multiple QA/QC Inspectors to cover multiple shifts. They will perform the following duties:

- Oversight of salvage/borrow and construction procedures including equipment used
- Oversight and/or performance of salvage and borrow materials visual screening and testing

- Oversight of Cover construction
- Oversight and/or performance of materials testing during placement operations for moisture content and density
- Oversight of operator training
- Documentation of daily operations and QA/QC testing
- Reporting of observations and test results to the QA/QC Manager
- Oversight and/or performance of any retests as prescribed in the QA/QC Plan or ordered by the QA/QC Manager

The QA/QC Inspector(s) will possess at least 20 hours of experience or training with material identification, cover construction, and general salvage and reclamation practices. The QA/QC Inspector(s) will be trained in applicable testing methodologies. The QA/QC Inspector(s) will understand the importance of the material properties and construction requirements and the role he/she plays in ensuring the Cover achieves its objectives. The QA/QC Inspector(s) will have a thorough understanding of the construction QA/QC requirements contained in this QA/QC Plan.

2.4 Trained Operators

Trained Operators are individuals trained on the specifics of this QA/QC Plan who will be operating the equipment directly engaged in the salvage/borrow or placement of materials for the Cover. This group includes, but is not limited to, dozer and excavator operators. Trained Operator responsibilities include the following:

- Borrow, salvage, and segregation of materials as per the direction of the QA/QC Inspector(s)
- Inspection of the thickness of cover layers during dozing
- Visual screening and handling of material that is being borrowed or salvaged from the source areas and segregation of growth medium from alluvium/colluvium in the pit area
- Visual screening and handling of material that is being placed, spread, and graded on the Cover
- Notification of the QA/QC Inspector(s) or QA/QC Manager of any anomalies identified or materials which do not appear to meet the visual observation requirements of this QA/QC Plan

2.5 Agency Oversight

An agency representative will periodically review and document compliance with QA/QC activities. This review may include, but may not be limited to, examination of documentation and field activities related to cover construction, geometry, QA/QC activities, field and lab testing procedures and results, and training. Agency review and documentation of compliance with this QA/QC Plan may include localized destructive sampling of the constructed cover, i.e., excavation of a small pit through the constructed cover to confirm cover geometry and or placed material properties. Agrium, at its expense, will facilitate the excavation of such a pit and reconstruction of the cover. The agency representative will provide Agrium reasonable notice if there is a need to mobilize equipment for use in destructive testing. The agency representative may facilitate this review and documentation through the hiring of a contractor of the agency's choosing.

Section 3

Material Screening Quality Assurance

The objective of the QA process is to assure the properties of the Cover at RVM. The management of the borrow area and decisions on where to obtain the material within the borrow area that meets the specification for the Cover is Agrium's responsibility and not a part of this QA. Key steps will be taken during salvage and borrow operations to ensure that selected materials are appropriate for their designated function. Salvage or borrow operations will not be conducted without prior approval of the area by a QA/QC Inspector(s) or unless a QA/QC Inspector(s) or the QA/QC Manager is on the project site.

3.1 Material Descriptions and Source Areas

The Rasmussen Valley Mine Project Cap and Cover Alternatives Analysis Report (Cap and Cover Report [BC, 2015]) detailed the site material investigations conducted as part of the development of cover alternatives during the Agencies' National Environmental Policy Act analysis of the RVMP. The cover alternatives analysis that led to the Agencies' selection of the Cover as the preferred alternative is detailed in the Cap and Cover Report and Final RVMP Cap and Cover Alternatives Analysis Report Addendum 3: Alternative 6 Evaluation (BC, 2015). This Cover, from top down, will consist of the following materials placed at these minimum thicknesses and with minimal compaction as modeled in the Final EIS.

- 1 ft of pit growth medium
- 2 ft of external area combined growth medium and alluvium/colluvium
- 3 ft of pit alluvium/colluvium (Pit Alluvium)

Pit Growth Medium. Pit growth medium (Pit GM) will be salvaged from within the RVM pit footprint. The depth of the Pit GM varies throughout the site but is typically the top 1 to 4 ft of soil (AECOM, 2012; AECOM, 2014; BC, 2015). However, there are small areas, typically associated with rock outcrops, where the depth of Pit GM will be zero. Pit GM is a loam with moderate to significant coarse content and fines ranging from 20 to 70 percent by weight. Pit GM in general classifies as a silty sand with gravel and is typically slightly plastic. Pit GM is primarily dark brown, dark yellowish brown, or very dark greyish brown in color and may contain organic matter. Pit GM contains gravels of chert, limestone, and shale, and is typically well-graded. During the excavation of pit alluvium for cover construction material, excavation of underlying Meade Peak Formation or Rex Chert will be avoided.

Pit Alluvium/Colluvium. Pit Alluvium will also be salvaged from within the RVM pit footprint. Pit Alluvium generally extends from the bottom of the Pit GM to approximately 10 ft below the surface; however, there are small areas, typically associated with rock outcrops, where the depth of Pit Alluvium will be zero. There are also areas, typically associated with draws, where the Pit Alluvium may extend much deeper than 10 ft. Pit Alluvium is typically a loam to sandy loam with moderate to significant coarse content and fines ranging from 15 to 85 percent by weight. Pit Alluvium in general classifies as a silty gravel with sand and is typically slightly plastic. Pit Alluvium is primarily dark brown or dark yellowish brown in color and inorganic. Pit Alluvium contains gravels of chert, limestone, dolomite, and shale with calcite veins. Pit Alluvium is typically well-graded and has occasional cobbles and boulders. During the excavation of pit alluvium for cover construction material, excavation of underlying Meade Peak Formation or Rex Chert will be avoided.

External Area Combined Growth Medium and Alluvium/Colluvium. External area combined growth medium and alluvium/colluvium (Borrow Material) will be borrowed from designated borrow areas located on the alluvial/colluvial pediments of the west slope of Rasmussen Ridge. Borrow Material has been shown to extend to depths in excess of 10 ft below the surface in these borrow areas. It is typically a loam or silt loam with low to moderate coarse content and fines content ranging from 30 to 90 percent by weight. Borrow Material in general classifies as a lean clay with sand and is typically slightly to medium plastic. Borrow Material is primarily reddish to brownish yellow or strong brown in color and may contain trace organic matter near the surface. It contains gravels of weathered chert, shale, and sandstone, and is typically well-graded.

3.2 Quality Assurance Test Methods and Frequencies

This section outlines screening methods to be employed to ensure that the cover is constructed of materials similar to those previously tested in the laboratory and used to model the Cover performance. Agrium will examine the characteristics of alluvial materials in the pit and external source areas through visual screening in advance of material salvage or borrow. In the pit area, the QA/QC Manager will identify the Pit GM and Pit Alluvium for segregation during salvage. In the external borrow areas, visual screening will be used to guide the excavation. Samples from the material to be used for the Cover construction will be collected for laboratory testing to determine material properties.

Whenever cover materials are being salvaged or borrowed from a source area, the QA/QC Manager or a QA/QC Inspector(s) will inspect the source area and meet with Trained Operators at least once daily to communicate the salvage/borrow plan. The QA/QC Manager will plan excavation based on observations and tests performed under this QA/QC Plan or obtained as part of Agrium's borrow area planning and management process.

3.2.1 Salvage and Borrow Material Visual Screening

Continuous visual screening of borrow material will be conducted by Trained Operators during salvage and borrow operations. In the pit area, Trained Operators will be responsible for segregating Pit GM from Pit Alluvium. In any source area, if deleterious materials such as cobbles and boulders, large roots or branches, frozen material, or refuse is encountered, the material will be left in place or disposed of as run-of-mine (ROM) in the pit backfill. If material does not meet gravel content requirements, the deficiency will be corrected or the material will not be salvaged/borrowed. Table 3.1 presents the visual screening criteria for salvage and borrow materials.

Table 3-1. Visual Screening QA Criteria for Salvage and Borrow Material

Salvage/Borrow	
Pit GM	No boulders ≥ 6 inches
Pit Alluvium	No boulders ≥ 1 foot
Borrow Material	No boulders ≥ 6 inches
All	Rock content ≤ 25% [a] No tree limbs or roots greater than 1 inch diameter and 2 feet long

	No frozen material
	No refuse

Notes:

[a]Visual inspection of material for rock content will be according to the Natural Resources Conservation Service Field Book for Describing and Sampling Soils V3.0.

The designated QA/QC Manager and/or QA/QC Inspector(s) will be responsible for training operators on proper visual screening techniques and thresholds. The QA/QC Manager and/or QA/QC Inspector(s) will periodically (at least once per year) review the training with the operators. The QA/QC Manager and/or QA/QC Inspector(s) will also periodically (at least twice per week during salvage or borrow operations) confirm the proper implementation of the visual screening performed by the Trained Operators.

If materials fail visual screening, the Trained Operator will notify a QA/QC Inspector(s) of the deficiency. The QA/QC Inspector(s) will then inspect the material and determine if the material can be used, requires testing to determine usability, or cannot be used in the Cover. Determination and application of potential remedial actions to address material deficiencies will be the responsibility of the QA/QC Manager. Potential remedial actions include, but are not limited to, screening materials to remove unwanted components.

Visual screening by the QA/QC Inspector(s) will also be relied on to notify the QA/QC Manager when material type changes are outside of the required properties and additional judgment sampling might be needed.

3.2.2 Borrow Material Testing

Periodic laboratory testing of certain Borrow Material properties will be conducted by the QA/QC Inspector(s) or an independent lab. Laboratory testing will be conducted to ensure that borrowed material meets certain requirements for the middle layer of the Cover. Periodic duplicate samples totaling 10 percent of the total number of samples will be prepared and sent to a second laboratory for confirmatory analyses. If Borrow Material does not meet material property QA requirements, the deficiency will be remedied, as described below, or the material will be left in place. Table 3-2 presents the required material properties and standard QA testing methods. These criteria are based on material properties testing performed on the external borrow material as presented in the Rasmussen Valley Mine Project Cap and Cover Alternatives Analysis Report (BC, 2015) and dictate a lean, well-graded soil with high fines content.

Table 3-2. Borrow Material Property QA Screening

Material			
Borrow Material	≥ 62% by weight passes #200 sieve [a] Cu ≥27 [b]	29% ≤ liquid limit ≤ 47% [c]	ASTM D6913-04 ASTM D4318-10

Abbreviations:

ASTM = American Society for Testing and Materials.

Cu = coefficient of uniformity.

QA = quality assurance.

Notes:

[a]Minimum percent fines in a tested sample that met the design saturated hydraulic conductivity.

[b]Cu criteria based on external borrow area preliminary lab results.

[c]Liquid limit criteria based on external borrow area preliminary lab results.

The QA/QC Inspector(s) and designated QA/QC Manager will be responsible for ensuring that Borrow Material is tested according to this QA/QC Plan.

If Borrow Material does not meet material property QA requirements in a certain location of the borrow area, the QA/QC Inspector(s) will notify the QA/QC Manager of the deficiency. The QA/QC Manager will determine if the material can be used, requires additional sampling and testing to determine usability, or cannot be used in the Cover. Determination and application of potential remedial actions to address material deficiencies will be the responsibility of the QA/QC Manager. Potential remedial actions include, but are not limited to, blending of materials or applying additives to materials to achieve specific material properties.

3.2.3 Borrow Material Sampling Frequency and Methods

Borrow Material will be sampled for QA testing according to the prescribed frequency and methods presented in Table 3-3.

Table 3-3. Borrow Material QA Sampling Frequency

Material	Particle Size Distribution	
Borrow Material	15,000 yd^3	15,000 yd^3

Abbreviations:

yd^3 = cubic yard.

QA = quality assurance.

Notes:

[a]These are the minimum testing frequencies. Numbers have been rounded.

A sample of the Borrow Material will be collected in a representative manner every 15,000 cubic yards (yd^3) and tested for particle size distribution and Atterberg limits.

3.2.4 Operations and Reporting

During salvage and borrow operations, the QA/QC Manager or QA/QC Inspector(s) will inspect the source area and meet with Trained Operators at least once daily to communicate the salvage/borrow plan. The QA/QC Manager will plan excavation based on observations and tests performed by the QA/QC Inspector(s) and Trained Operators. The QA/QC Inspector(s) will maintain records that will document, at a minimum, the following:

- Field test or sample locations
- Laboratory test results
- QA/QC Inspector(s) observations, checklists, and notes
- For Borrow Material only, locations and depths of borrow
- Volumes of all salvaged and borrowed material by type

These records will be incorporated into the Annual Operations Report that is filed with the Agencies.

Section 4

Construction Quality Control

Constructing the Cover requires placing and grading select native materials to certain specifications. Construction QC will be performed during the construction process to ensure that the Cover achieves the objectives of supporting vegetative growth and limiting net percolation.

4.1 Pit Backfill Subgrade Preparation

To ensure the integrity of the Cover, it is essential that the pit backfill be prepared as a stable subgrade for the cover. Steps shall be taken during earthwork, grading, and compaction of the pit backfill to produce an appropriate subgrade for the Cover, and a survey will be conducted on the final backfill surface prior to beginning the cover construction. The pit backfill subgrade will be graded such that depressions are absent and ponding of water does not occur.

4.1.1 Earthwork

Prior to the placement of any Pit Alluvium as a component of the cover system, the pit backfill surface shall be dozed to produce a stable and relatively smooth surface. The pit backfill surface will be approved by visual inspection by the QA/QC Manager.

4.1.2 Compaction

To prevent differential settlement and intermixing of the cover materials with the backfill materials, the pit backfill surface will be somewhat compacted. This effort will consist of passing over the pit backfill surface with tracked heavy machinery until rutting less than 2 inches with equipment and displacing greater than 12 pounds per square inch ground pressure.

4.1.3 Grading and Surveying

The final backfill surface will be graded to ensure a minimum 2 percent slope and a maximum 3 ft horizontal to 1 ft vertical (3H:1V) slope. A virtual grid will be established on the final backfill surface to provide survey control and sampling and testing locations. This grid will divide the reclamation area into 0.2-acre parcels (approximately 100 ft x 100 ft). The approximate center of each parcel will be surveyed and used as the location to determine lift thickness and to establish locations for required QC testing.

4.2 Cover Material Placement

4.2.1 Bottom Layer: Pit Alluvium

The bottom 3-ft layer of Pit Alluvium will be placed in no less than two lifts by dumping, dozing, and grading. Construction QC tests, described in Section 4.4, herein, will be conducted on the completed lifts to ensure placed material properties meet specifications. The final surface will be graded to produce a stable and relatively smooth surface. The Pit Alluvium layer will be a minimum of 3 ft thick with a vertical survey accuracy of 0.1 ft. The final layer surface will be approved by visual inspection by the QA/QC Manager.

4.2.2 Middle Layer: Borrow Material

The 2-ft layer of Borrow Material will be placed in the reclamation area in two lifts by dumping, dozing, and grading. Construction QC tests will be conducted on the completed lifts to ensure placed material properties meet specifications. The Borrow Material layer will be a minimum of 2 ft thick with a vertical survey accuracy of 0.1 ft. The final layer surface will be approved by visual inspection by the QA/QC Manager.

4.2.3 Top Layer: Pit GM

The 1-ft layer of Pit GM will be placed in the reclamation area in one loose lift by dumping, dozing, and grading. Construction QC tests will be conducted on the completed lifts to ensure placed material properties meet specifications. The Pit GM layer will be a minimum 1 ft thick and a maximum of 2 ft thick with a vertical survey accuracy of 0.1 ft.

4.3 Re-Established Channel Construction

Several existing drainages will be re-established during mine reclamation. These drainages will be re-established according to the design provided in the Rasmussen Valley Surface Water Management Plan (SWMP).

Subgrade preparation will be completed as described in Sections 4.2.1 and 4.2.2 of this document and in accordance with the geometry provided in the SWMP. Riprap will be selected according to the SWMP and placed such that the geosynthetic filter fabric is not damaged. Installation of the riprap will be under the direct supervision of the QA/QC Manager or QA/QC Inspector(s).

4.4 QC Test Methods and Frequencies

Moisture content testing. Material will be tested for moisture content, as a percentage by weight, prior to placement in the Cover. For the base Pit Alluvium layer, appropriate moisture content is necessary to ensure the layer is a stable base for the middle Borrow Material layer. For the Borrow Material layer, target saturated hydraulic conductivity (Ksat) has been shown to be achievable at Reduced Proctor density as long as the material had the specified moisture content at placement. Time between sample collection, testing, and placement will be minimized to ensure material is placed at proper moisture content.

During cover construction, moisture content of materials to be used in the Cover will be tested daily or upon changing sources (i.e., from direct excavation to a stockpile) per ASTM D4944-11: Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester. The apparatus utilized for testing will be maintained, calibrated, and operated according to the manufacturer’s specifications. Specified moisture content limits prior to placement are presented in Table 4.1.

Material			Testing Method	Frequency
	Target [b]	Acceptable Deviation		
Pit Alluvium (if fine [c])	18.3	-2 to +5	ASTM D4944-11 [d]	Daily during placement operations or upon switching sources
Pit Alluvium (if coarse [c])	13.3	-2 to +5		
Borrow Material (if fine [c])	17.5	-2 to +5		Daily during placement operations or upon switching sources
Borrow Material (if coarse [c])	16.6	-2 to +5		

Abbreviations:

ASTM = American Society for Testing and Materials.

QC = quality control.

Notes:

[a]Percent moisture content of soil based on wet weight.

[b]Laboratory optimum moisture content at Reduced Proctor.

[c]Fine is defined as less than 25% gravel content by weight; coarse is defined as greater than or equal to 25% gravel content by weight.

[d]The calcium carbide method will be calibrated against the more universally reliable oven-dry method.

If the material is not within the specified moisture content range, it will not be placed in the Cover. If remedial measures are undertaken to correct the moisture content, the soil will be retested according to this section prior to placement. All moisture content testing will be performed by the QA/QC Manager or a QA/QC Inspector.

Density testing. Placed cover materials will be tested for bulk density. The density of the base Pit Alluvium layer will play into its quality as a working surface for the essential Borrow Material layer. The density of the middle Borrow Material layer must be within the defined criteria to ensure Ksat is on target. During cover placement operations, density will be tested daily per ASTM D6938-15: Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) or other BLM-approved Method. The apparatus utilized for testing will be maintained, calibrated, and operated according to the manufacturer's specifications.

Density testing will be performed after the placement of each lift. Density testing will be performed at a minimum at locations collocated with the survey grid described in Section 4.1.3. The minimum acceptable placed soil density is presented in Table 4-2.

Source Material		Testing Method	Frequency
Pit Alluvium (if fine)	1.64 (102.4)	ASTM D6938-15	Prior to placement of next lift at survey grid
Pit Alluvium (if coarse)	1.85 (115.5)		
Borrow Material (if fine)	1.60 (99.9)		Prior to placement of next lift at survey grid
Borrow Material (if coarse)	1.68 (104.9)		

Abbreviations:

ASTM = American Society for Testing and Materials.

QC = quality control.

Notes:

[a]Gram per cubic centimeter (pound per cubic foot).

[b]Minimum density represents 95% of the Reduced Proctor.

If soil is not at or above minimum density specification, the subsequent lift will not be placed. Remedial measures will be undertaken to correct the deficient soil density, as described in Section 6, herein. The soil density will be retested according to this section prior to placing any subsequent lift. All soil density testing will be performed by a QA/QC Inspector(s) or the QA/QC Manager.

A QA/QC Inspector(s) or the QA/QC Manager will be on-site during placement of the Pit GM layer to ensure the integrity of the middle layer is maintained. The ability to establish vegetation in the Pit GM layer is more crucial to the performance of the cover than is meeting a minimum density in that layer. Therefore, no minimum density QC criterion is established for that layer. Rather, prior to seeding an area, the QA/QC Manager or QA/QC Inspector(s) will conduct an inspection to determine if the Pit GM has become overly compacted. Areas that are determined to be overly compacted will be loosened prior to seeding. Determination of whether over compaction has occurred will be governed by the professional judgment of the QA/QC Manager or a QA/QC Inspector(s). The final Pit GM layer will be approved by visual inspection by the QA/QC Manager prior to seeding.

Section 5

Phase 1 Testing and QA/QC Refinement

The Phase 1 pit backfill area will be tested to confirm that the QA/QC methods prescribed herein are adequate to ensure that the Cover is built to specification and meets the properties used in the Final EIS performance modeling. A virtual grid will be established over the approximately 10-acre area on the final surface to provide sampling and testing locations. This grid will divide Phase 1 into 0.5-acre parcels (approximately 150 ft x 150 ft). Permeability testing on the middle layer will be performed at the approximate center of each 0.5-acre parcel for a total of 20 tests.

5.1 Documentation of Placement Methodology

Since the Ksat of the cover material is related not only to the material's intrinsic properties such as particle size distribution, but also to the placement properties such as compaction and moisture content, it is important during Phase 1 construction to document the placement methodology. This will allow for the same methodology to be used throughout the cover construction to ensure consistent placement properties and thus consistent Ksats. Activities that need to be documented include number of passes each piece of equipment makes over an area as the material is placed and spread. This relates to the compactive effort applied to each lift and thus the resulting density. Other items to note are weather and timing of activities since properties change as material dries out or receives precipitation and areas of differing material properties such as rocks, etc. that may affect Ksat. This documentation could be critical in determining why some areas of the cover may not meet specifications.

5.2 Borehole Infiltration Testing of Middle Layer

A borehole infiltration test will be performed on the middle layer of each 0.5-acre parcel to confirm Ksat. Testing will be performed according to ASTM D6391-11: Standard Test Method for Field Measurement of Hydraulic Conductivity Using Borehole Infiltration. The apparatus used for testing will be maintained, calibrated, and operated according to the manufacturer's specifications. Prior to performing a borehole infiltration test, a density test (ASTM D6938-15) will be performed on the middle layer at the test site and the result recorded.

Sampling. Immediately subsequent to performing the borehole infiltration test, a representative sample of the tested middle layer material will be collected from the test site. The sample will be collected by removing a small area of the top layer (1 ft) of the Cover and exposing the middle layer. A spade or backhoe bucket will be used to collect 10 gallons of the middle layer material saturated by the borehole infiltration test. This material will be collected and blended, then split into two 5-gallon buckets, sealed, and identified for testing. This material will be tested as follows:

- Particle size distribution (ASTM D6913-04)
- Atterberg limits (ASTM D4318-10)
- Reduced proctor (ASTM D1557-12 modified to use 15 blows, rather than 25, in accordance with U.S. Army Corps of Engineers EM 1110-2-1906 Appendix VI Change 2)

- Ksat (ASTM D5084-10) at measured field density and optimum moisture

Borehole infiltration testing will be performed twice. Initial testing will be performed within 12 months of seeding. Final testing will be performed 12 months after initial testing. Locations for the second test will be 25 ft from the location of each of the initial borehole infiltration test sites. Testing and sampling locations per grid parcel are graphically represented in Figure 5-1.

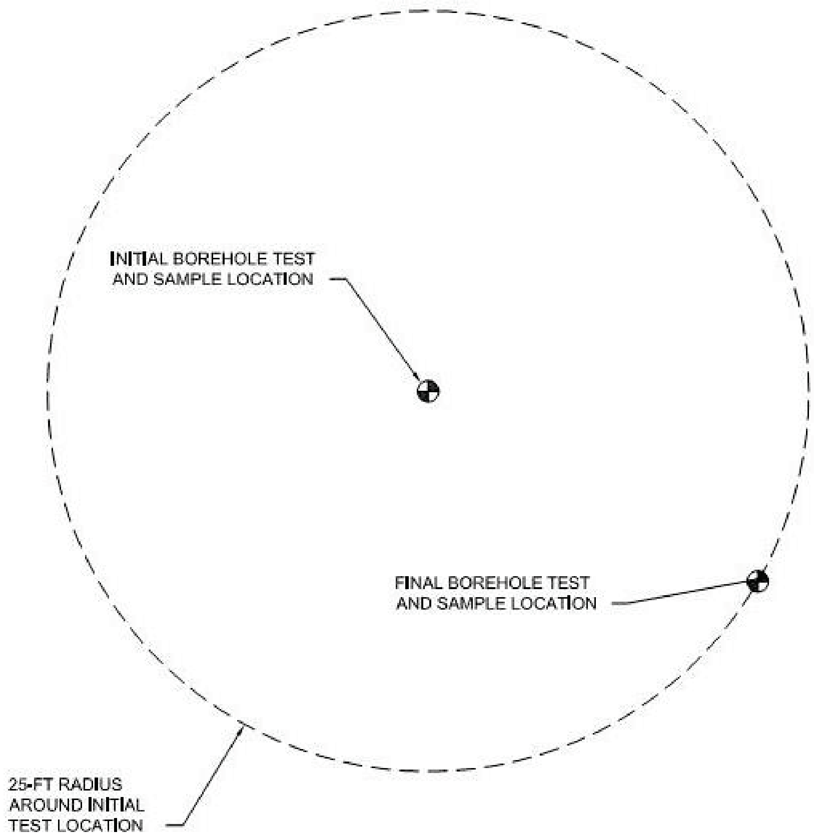


Figure 5-1. Phase 1 Initial and Final Borehole Infiltration Testing and Sampling Relative Locations

Results from the permeability tests and laboratory tests will be recorded and incorporated into the Annual Operations Report that is filed with the Agencies.

For each of the test periods, initial and final, the geometric mean of all 20 tests will be calculated. If the geometric mean of the final test period Ksat values is less than or equal to 4E-6 centimeters per second (cm/sec), the construction means and methods shall be considered satisfactory to construct a cover that meets the Cover's objectives. If the geometric mean of the final test period Ksat values is greater than 4E-6 cm/sec, the following steps shall be taken, at the direction of the QA/QC Manager:

- **Review laboratory test results.** Have an engineer review the laboratory test results alongside the field test results to aid in determining possible failure methods.
- **Additional testing.** Perform three additional borehole infiltration tests triangulated around any failing borehole test site and 50 ft away from it. If the geometric mean Ksat of all the new boreholes is less than 4E-6 cm/sec, the 0.5-acre will be deemed to have passed QC. Alternatively, a second field permeability test method may be employed to rule out failure due to

limitations of the borehole infiltration test. Additional testing locations in relation to final tests are graphically represented in Figure 5-2.

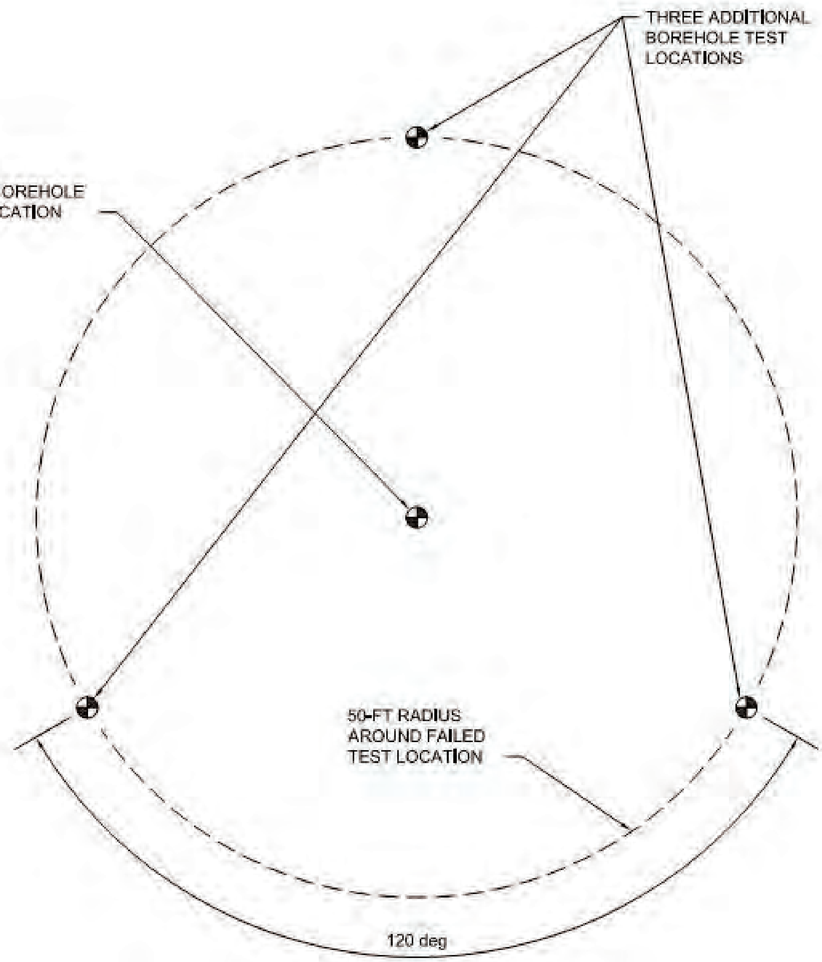


Figure 5-2. Phase 1 Optional Additional Testing Locations Relative to Failed Tests

- **Refine material screening.** Document the percent fines along with the conductivity results. If tests continue to pass for material above a specific percent fines content and continue to fail for material below this percent fines content, the QA portion of this QA/QC Plan shall be revised to screen borrow material below a greater percent fines content.
- **Refine construction methods.** Adjust construction methods to reduce lift thickness, adjust moisture, and/or increase compactive effort, and construct another 0.5-acre section of the Cover. Conduct another borehole infiltration test. If Ksat is still greater than 4E-6 cm/sec, the QA/QC Manager will continue to direct the next steps for subsequent 0.5-acre sections of Phase 1. If Ksat is less than or equal to 4E-6 cm/sec, revise the QC portion of this QA/QC Plan as necessary to ensure construction means and methods produce acceptable Ksat results.

Section 6

Deficiencies

Salvage/borrow material deficiencies. If pit area alluvium/colluvium materials fail the QA visual screening or testing, the materials will be disposed of as ROM. If external area material fails the QA visual screening or testing, the material will be left in place. The reason for failure will be documented along with global positioning system coordinates and elevation so that should material availability become a concern as mining progresses, informed decisions may be made regarding the path forward.

Moisture content deficiencies. If a moisture content test produces a failing result, the following corrective measures are options:

1. Perform three additional tests in the area represented by the failed test. If the arithmetic mean value of all three new tests passes, the failed test is overturned and the area passes. If the arithmetic mean value fails, the second option must be taken.
2. Perform moisture conditioning or remove the failed material and replace with new material.

Density deficiencies. If a density test produces a failing result, the following corrective measures are options:

1. Perform three additional tests in the area represented by the failed test. If the arithmetic mean value of all three new tests passes, the failed test is overturned and the area passes. If the arithmetic mean value fails, the second option must be taken.
2. Perform a minimum of two passes with a track-mounted piece of equipment and retest.
3. If the retest produces a failing result, Agrium may elect to conduct in situ permeability testing at the retest location. If the results indicate acceptable in situ permeability, the area will be approved as acceptable. However, if the results do not meet the required maximum permeability, the failed material will be removed.
4. Agrium may designate the failed material as unacceptable for use in the pit backfill cover or it may elect to submit a sample of the material to the laboratory for Ksat testing at Reduced Proctor to determine whether the material can be used elsewhere and at what density and moisture content.

Thickness deficiencies. If a survey highlights a failure in lift thickness, the following corrective measure is an option:

1. Place additional material to a lift that is too thin.

Section 7

Documentation and Reporting

All pertinent results of the cover construction QA/QC, including observations, test results, and survey points will be reported to the Agencies within the Annual Operations Report. Where applicable, all numerical data recorded, calculated, and reported will conform with ASTM D6026-13 Standard Practice for Using Significant Digits in Geotechnical Data.

For each day an inspection is performed, the QA/QC Inspector(s) will prepare daily field notes that document the chronological history of the project. An example Daily Field Form is included in Appendix A. Daily field notes will be provided to the Bureau of Land Management (BLM) upon request. At a minimum, daily field notes will record the following, as applicable:

- date
- weather conditions
- summary of the day's work activities, including locations of work performed, personnel, and equipment used
- if soil is salvaged or borrowed for use in the cover, the specific source of the material and an estimated volume of material
- if cover material is placed, the specific location and layer/lift and an estimated volume of material placed
- summary of the performed QA/QC tests (type, quantity, and location)
- non-compliance and deficiencies, if any
- resolutions by Agrium to any non-compliance or deficiency noted
- summary of decisions made regarding acceptance of specific portions of work and/or remedial actions implemented in cases of inconsistent or deficient test results
- summaries of any meetings held and actions recommended or taken
- calibrations or re-calibrations of test equipment, including actions taken as a result of inadequate calibration
- names of any visitors to the construction site
- dated photographs

The QA/QC Inspector(s) will prepare weekly field reports summarizing the daily notes for the specific week. Weekly reports will be provided to the BLM. At a minimum, each weekly report will record the following, as applicable:

- dates
- weather conditions
- summary of the week's work activities, including locations of work performed, personnel, and equipment used
- if soil is salvaged or borrowed for use in the cover, the specific source of the material and an estimated volume of material
- if cover material is placed, the specific location and layer/lift and an estimated volume of material placed

- summary of the performed QA/QC tests (type, quantity and location)
- results of QA/QC tests
- non-compliance and deficiencies, if any
- resolutions by Agrium to any non-compliance or deficiency noted
- summary of decisions made regarding acceptance of specific portions of work and/or remedial actions implemented in cases of inconsistent or deficient test results
- summaries of any meetings held and actions recommended or taken
- calibrations or re-calibrations of test equipment, including actions taken as a result of inadequate calibration
- names of any visitors to the construction site
- dated photographs
- signature of QA/QC Inspector(s)

Section 8

Limitations

This document was prepared solely for Nu-West Industries, Inc., dba Agrium Conda Phosphate Operations (Agrium) in accordance with professional standards at the time the services were performed and in accordance with the contract between Agrium and Brown and Caldwell dated January 1, 2016. This document is governed by the specific scope of work authorized by Agrium; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by Agrium and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

This document sets forth the results of certain services performed by Brown and Caldwell with respect to the property or facilities described therein (the Property). Agrium recognizes and acknowledges that these services were designed and performed within various limitations, including budget and time constraints. These services were not designed or intended to determine the existence and nature of all possible environmental risks (which term shall include the presence or suspected or potential presence of any hazardous waste or hazardous substance, as defined under any applicable law or regulation, or any other actual or potential environmental problems or liabilities) affecting the Property. The nature of environmental risks is such that no amount of additional inspection and testing could determine as a matter of certainty that all environmental risks affecting the Property had been identified. Accordingly, THIS DOCUMENT DOES NOT PURPORT TO DESCRIBE ALL ENVIRONMENTAL RISKS AFFECTING THE PROPERTY, NOR WILL ANY ADDITIONAL TESTING OR INSPECTION RECOMMENDED OR OTHERWISE REFERRED TO IN THIS DOCUMENT NECESSARILY IDENTIFY ALL ENVIRONMENTAL RISKS AFFECTING THE PROPERTY.

Further, Brown and Caldwell makes no warranties, express or implied, with respect to this document, except for those, if any, contained in the agreement pursuant to which the document was prepared. All data, drawings, documents, or information contained this report have been prepared exclusively for the person or entity to whom it was addressed and may not be relied upon by any other person or entity without the prior written consent of Brown and Caldwell unless otherwise provided by the Agreement pursuant to which these services were provided.

Section 9

References

AECOM, 2012. Final Soil Survey Report, Rasmussen Valley Mine Project Baseline Study. Prepared for Agrium, March.

-----, 2014. Final Supplemental Soil Survey Report, Rasmussen Valley Mine Project Baseline Study. Prepared for Agrium, October.

Bureau of Land Management, 2015. Draft Environmental Impact Statement Rasmussen Valley Mine, November.

Brown and Caldwell, 2015. Rasmussen Valley Mine Project Cap and Cover Alternatives Analysis Report. Prepared for Agrium, August.

Appendix A: Example Form for Daily Field Notes

DAILY FIELD NOTES

Date: ______________________

Weather conditions (circle): sunny clouds overcast temperature: __________
wind rain snow

Summary of day's activities: ____
____
____
____

Material salvaged? Y N
If yes, source location: ____
estimated volume (include units): ____

Material placed? Y N
If yes, placed location: ____
estimated volume (include units): ____

QA/QC tests performed (check):

_____ particle size distribution
No. tests _____
location __________________________
No. deficiencies _____

_____ Atterberg limits
No. tests _____
location __________________________
No. deficiencies _____

_____ moisture content
No. tests _____
location __________________________
No. deficiencies _____

_____ density
No. tests _____
location __________________________
No. deficiencies _____

Resolutions to any deficiencies noted, above: ____
____
____
____

Meetings held:____
____

Decisions made (work acceptance, paths to resolution, etc.): ____
____
____
____

Actions taken:____
____

DAILY FIELD NOTES

Date: ______________________

Personnel, including visitors:

Equipment used:

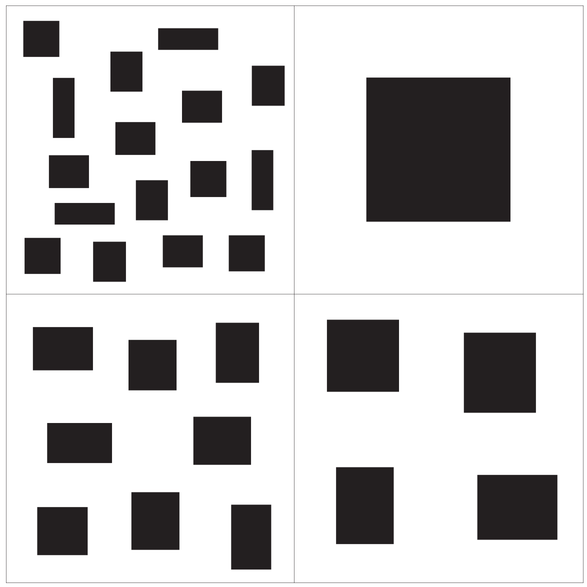
large equipment	test equipment	calibrated? (attach forms)
		Y N
		Y N
		Y N
		Y N
		Y N
		Y N

Photo log:

No.	Subject	No.	Subject

Other notes of interest:____

Appendix B: Referenced Test Methods and Standards



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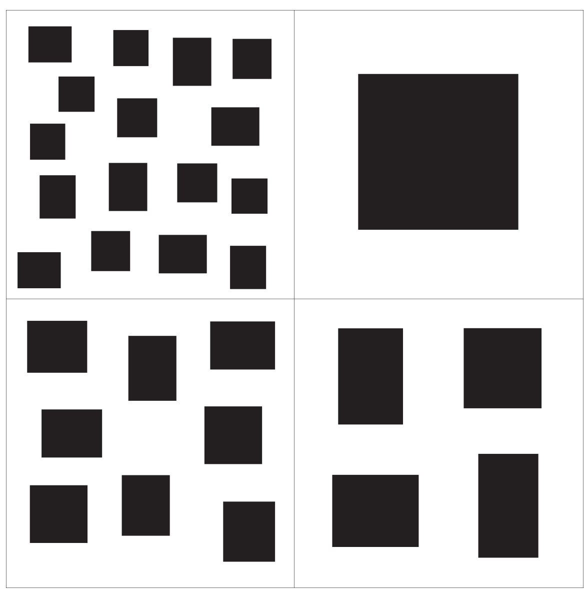

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Additional Appendices: Quality Assurance Project Plans and Media-specific Field Sampling Plans
(to be developed for Final EMP)

APPENDIX C

SURFACE WATER MANAGEMENT PLAN

Surface Water Management Plan for Rasmussen Valley Mine Preferred Alternative

Prepared for

Agrium Conda Phosphate Operations

3010 Conda Road

Soda Springs, Idaho 83276

August 2016

Federal Phosphate Lease I-05975

Surface Water Management Plan for Rasmussen Valley Mine
Preferred Alternative

Prepared for

Agrium Conda Phosphate Operations

3010 Conda Road

Soda Springs, Idaho 83276

August 2016

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List of Abbreviations

ac	acre
ac-ft	acre foot
Agrium	Agrium Conda Phosphate Operations
BC	Brown and Caldwell
BMP	best management practice
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMP	corrugated metal pipe
CN	curve number
COPC	constituent of potential concern
cu ft	cubic foot
D_{50}	mean rock size
EIS	Environmental Impact Statement
EOR	end of reclamation
°F	degree Fahrenheit
FHWA	Federal Highway Administration
fps	feet per second
ft/ft	foot per foot
GIS	geographic information system
GM	growth media
HDPE	high-density polyethylene
HEC-HMS	Hydrologic Engineering Center-Hydrologic Modeling System
HEC-15	Hydrologic Engineering Circular No. 15
HR-5	Haul Road Alternative 5
H:V	horizontal to vertical
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IDL	Idaho Department of Lands
IMASC	Idaho Mining Association Selenium Committee
in	inch
lbs	pound
LCM	Lanes Creek Mine
NA	not applicable
NAIP	National Agriculture Imagery Program
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
psf	pound per square foot
RCA	Rasmussen collaborative Alternative
RME	Rocky Mountain Environmental Associates
ROD	Record of Decision
RVM	Rasmussen Valley Mine
SCS	Soil Conservation Service
Site	RVM lease area
sq ft	square foot
sq mi	square mile
SRM	South Rasmussen Mine
SWE	snow water equivalent
SWMP	Surface Water Management Plan
SWPPP	Stormwater Pollution Prevention Plan
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
Whetstone	Whetstone Associates, Inc.

Section 1

Introduction

Nu-West Industries Inc., doing business as Agrium Conda Phosphate Operations (Agrium), proposes open-pit mining of phosphate on Federal Phosphate Lease I-05975, also known as Rasmussen Valley Mine (RVM). Through the National Environmental Policy Act (NEPA) process Agrium has developed an alternative to the proposed Mine and Reclamation Plan (Mine Plan) for the RVM. This alternative is referred to as the Rasmussen Collaborative Alternative (RCA) in various NEPA documents and has been selected as the Preferred Alternative by the agencies in the Environmental Impact Statement (EIS). This document is for the future RVM and has been created under the assumption that the Preferred Alternative will be selected in the Record of Decision (ROD). A key component of the RVM plan is this Surface Water Management Plan (SWMP), which describes how Agrium will design and implement best management practices (BMPs) at the RVM (i.e., Site) for controlling surface water runoff and minimizing erosion, sedimentation, and selenium impacts to receiving waters.

1.1 Purpose and Objectives

The RVM plan and SWMP have been prepared to meet the requirements of Title 43 Code of Federal Regulations (CFR) Part 3592 and the Idaho Administrative Procedures Act (IDAPA) Title 03, Chapter 02. This SWMP, in particular, has been developed to address CFR §3592.1(c), IDAPA 20.03.02.69.05(a), and IDAPA 20.03.02.69.05(f), which are cited in Table 1-1.

Table 1-1. Applicable Regulations for SWMP
Code of Federal Regulations
TITLE 43 - PUBLIC LANDS: INTERIOR
PART 3590—SOLID MINERALS (OTHER THAN COAL) EXPLORATION AND MINING OPERATIONS
Subpart 3592—Plans and Maps, §3592.1 Operating plans
(c) (8) (ii) A design for the necessary impoundment, treatment or control of all runoff water and drainage from workings to reduce soil erosion and sedimentation and to prevent the pollution of receiving waters
Idaho Administrative Procedures Act
IDAPA 20, TITLE 03, CHAPTER 02
20.03.02 RULES GOVERNING EXPLORATION, SURFACE MINING, AND CLOSURE OF CYANIDATION FACILITIES
069. Application Procedure and Requirements for Quarries, Decorative Stone, Building Stone, and Aggregate Materials Including Sand, Gravel and Crushed Rock.
05. Reclamation Plan Requirements. Reclamation plans must be submitted in map and narrative form and include the following:
a. Where surface waters are likely to be impacted and when requested by the director, documents identifying and assessing foreseeable, site-specific nonpoint sources of water quality impacts upon adjacent surface waters and the BMPs the operator will use to control such impacts during surface mining and reclamation; (3-30-06)
f. A drainage control map which identifies the location of BMPs that will be implemented to control erosion and such nonpoint source water quality impacts during surface mining and reclamation activities. (3-30-06)

The purpose of this SWMP is to provide a conceptual approach to managing surface water at the Site during mining and post-mine reclamation. BMPs are identified and designed on a conceptual basis. Additional design and analyses may need to be completed to accommodate changes in mining operations or to account for new site-specific information obtained through operations.

To fulfill the stated purpose, this SWMP will achieve the following specific objectives:

- Map and describe proposed surface water management feature BMPs for the Site.
- Estimate sizing requirements for surface water management features to meet specific design criteria.
- Describe the implementation of surface water management BMPs and provide guidance regarding the configuration of typical surface water management features.

1.2 Document Structure

Section 1 **Introduction**: Describes the purpose and objectives for this SWMP, referring specifically to relevant CFR and IDAPA codes.

Section 2 **Background**: Provides a general description of the proposed mining operations, discusses the local climate and hydrologic setting, and specifies the design objectives and approach.

Section 3 **Computational Methods**: Describes the analytical methodologies used to develop conceptual designs for surface water management, including discussions of hydrology, hydraulics, and riprap stability.

Section 4 **Design and Construction:** Presents the proposed surface water management features by mining phase and describes how surface water management BMPs will be implemented, including typical details and potential tabulated sizes/design dimensions.

Section 5 **References**: Lists references cited in the SWMP.

Exhibits Maps of proposed surface water management features by mining phase.

Attachments Supporting design documentation and input/output data from hydrologic modeling analyses.

Section 2

Background

This section provides general background related to this SWMP, including a description of the proposed mining operations and the local climate and hydrologic setting. In addition, the last section in this section defines the design objectives with brief descriptions of the analytical approach used to check that the design objectives are met.

2.1 Proposed Mining Operations

Several types of mine structures and facilities are required to recover phosphate ore and reclaim each respective lease area within the project. These structures include the following:

- pits
- haul roads and access ramps
- growth media (GM) stockpile areas
- borrow and storage areas
- pit backfill areas
- staging areas
- surface water management features

The RVM will be mined as an open pit. Pit design constraints include economic annual strip ratios, access requirements, slope stability assumptions and requirements, geometrical restrictions for the ultimate pit design, and balancing pit phase volumes with available backfill volumes.

2.1.1 Mining Activities

The RVM will be mined in nine phases over approximately 2.4 miles. The open pit will be mined to an average width of approximately 600 feet. Each phase is designed to be between 1,000 to 2,600 feet in length. The length will vary as required to maintain access. The development of the pit phases will disturb a total of approximately 213.6 acres. However, because of progressive open pit backfilling and concurrent reclamation, the maximum unreclaimed pit disturbance at any point in time will be minimized to the extent practical. A 20-foot pit crest offset will be used to clear potential fall risks from the pit crest area.

Table 2-1 describes the mining phases for the RVM and the main features are graphically represented on the map exhibits for each phase.

Table 2-1. Mining Activities by Phase	
Phase	
1	• The mining sequence is initiated by constructing temporary Haul Road 5 (HR-5) from the existing P4 South Rasmussen Mine (SRM) Pit to the north end of the Site where it will tie into the temporary West Side Haul Road, which will be constructed during this phase to the North Main Borrow and Storage Area and southernmost extent of the RVM Phase 2 pit. • The North-North and North Main Borrow and Storage Areas will be prepared by stripping and stockpiling the GM and alluvium needed for the backfill cap and cover system. • GM and alluvium extracted from Phase 1 prior to mining will be stockpiled between the pit and West Side Haul Road or hauled to the North-North and North Main Borrow and Storage Areas where it will be stored for use in future reclamation. • Meade Peak waste mined from Phase 1 will be transported to the P4 SRM pit for backfill. • Non-Meade Peak waste mined from Phase 1 may be used to help construct the haul roads. • Ore from Phase 1 will be hauled via the West Side Haul Road and HR-5 to the Wooley Valley Tipple. • During the Phase 1 mining activities, the Phase 2 area will be pre-stripped, and the salvaged GM and alluvium will be stockpiled between the pit and West Side Haul Road or hauled to the North-North and North Main Borrow and Storage Areas where it will be stored for use in future reclamation.
2	• Phase 2 advances mining south from Phase 1. Phase 2 will be accessed from the West Side Haul Road via the temporary access ramp and haul road constructed during Phase 1. As mining in Phase 2 progresses, a new temporary access ramp will be constructed to access the lower portion of Phase 2. • GM and alluvium extracted from Phase 2 prior to mining will be stockpiled between the pit and West Side Haul Road or hauled to the North-North and North Main Borrow and Storage Areas where it will be stored for use in future reclamation. • Meade Peak waste mined from Phase 2 will be placed as backfill in Phase 1, in Overfill Pile 1, or hauled to the P4 SRM pit for backfill. • Non-Meade Peak waste mined from Phase 2 may be used to help construct the haul roads. • Ore from Phase 2 will be hauled via the West Side Haul Road and HR-5 to the Wooley Valley Tipple. • During the Phase 2 mining activities, the Phase 3 area will be pre-stripped, and the salvaged GM and alluvium will be used in concurrent reclamation of Phase 1, stockpiled between the pit and West Side Haul Road, or hauled to the North-North and North Main Borrow and Storage Areas for use in future reclamation.
3	• Phase 3 advances mining south from Phase 2. Phase 3 will be accessed from the West Side Haul Road via the temporary access ramp constructed during Phase 2. As mining in Phase 3 progresses, a new temporary access ramp will be constructed to access the southern portion of Phase 3. • Piping for sediment basin pumping in later phases (Phase 5 prior to excavation of Pit 5) will be constructed under the access ramp between culverts C7 and C8 during this phase. See more discussion under Section .4.2.2.3. • GM and alluvium extracted from Phase 3 prior to mining will be directly placed during concurrent reclamation of earlier phases, stockpiled between the pit and West Side Haul Road, or hauled to the North-North and North Main Borrow and Storage Areas where it will be stored for use in future reclamation. • Meade Peak waste mined from Phase 3 will be placed as backfill in Phase 2, in Overfill Pile 2, or hauled to the P4 SRM pit for backfill. • Ore from Phase 3 will be hauled via the West Side Haul Road and HR-5 to the Wooley Valley Tipple. • During the Phase 3 mining activities, the Phase 4 area will be pre-stripped, and the salvaged GM and alluvium will be used in concurrent reclamation of Phase 2, stockpiled between the pit and West Side Haul Road, or hauled to the North-North and North Main Borrow Storage Areas for use in future reclamation.
4	• Phase 4 advances mining south from Phase 3. Phase 4 will be accessed from the West Side Haul Road via the temporary access ramp constructed during Phase 3. • A Staging Area will be established across the West Side Haul Road from the North Main Borrow and Storage Area. • GM and alluvium extracted from Phase 4 prior to mining will be directly placed during concurrent reclamation of earlier phases, stockpiled between the pit and West Side Haul Road, or hauled to the North-North and North Main Borrow and Storage Areas where it will be stored for use in future reclamation. • Meade Peak waste mined from Phase 4 will be placed as backfill in Phase 3, in Overfill Pile 2, or hauled to the P4 SRM pit for backfill. • Ore from Phase 4 will be hauled via the West Side Haul Road and HR-5 to the Wooley Valley Tipple. • During the Phase 4 mining activities, the Phase 5 area will be pre-stripped, and the salvaged GM and alluvium will be used for concurrent reclamation of Phase 3, stockpiled between the pit and West Side Haul Road, or hauled to the North-North and North Main Borrow and Storage Areas for use in future reclamation.

Table 2-1. Mining Activities by Phase	
Phase	Description
5	• Phase 5 advances mining south from Phase 4. Phase 5 will be accessed from the West Side Haul Road via the temporary access ramp constructed during Phase 4. • The South Main Borrow and Storage Area will be prepared by stripping and stockpiling the GM and alluvium needed for the backfill cap and cover system. • GM and alluvium extracted from Phase 5 prior to mining will be directly placed during concurrent reclamation of earlier phases, stockpiled between the pit and West Side Haul Road, or hauled to the North-North, North Main, or South Main Borrow and Storage Areas where it will be stored for use in future reclamation. • Meade Peak waste mined from Phase 5 will be placed as backfill in Phases 3 and 4, in Overfill Pile 3, or the Central Temporary Overburden Pile. • Ore from Phase 5 will be hauled via the West Side Haul Road and HR-5 to the Wooley Valley Tipple. • During the Phase 5 mining activities, the Phase 6 area will be pre-stripped, and the salvaged GM and alluvium will be used for concurrent reclamation of Phase 4, stockpiled between the pit and West Side Haul Road, or hauled to the North-North, North Main, or South Main Borrow and Storage Areas for use in future reclamation.
6	• Phase 6 skips over the large draw immediately south of Phase 5 to maintain a conveyance for stormwater flow as long as possible. Phase 6 will be accessed from the West Side Haul Road via the temporary access ramps constructed during Phase 5. • GM and alluvium extracted from Phase 6 prior to mining will be directly placed during concurrent reclamation of earlier phases, stockpiled between the pit and West Side Haul Road, or hauled to the North-North, North Main, or South Main Borrow and Storage Areas where it will be stored for use in future reclamation. • Meade Peak waste mined from Phase 6 will be placed as backfill in Phase 5 or the Central Temporary Overburden Pile. • Ore from Phase 6 will be hauled via the West Side Haul Road and HR-5 to the Wooley Valley Tipple. • During the Phase 6 mining activities, the Phase 7 area will be pre-stripped, and the salvaged GM and alluvium will be used for concurrent reclamation of Phase 5, stockpiled between the pit and West Side Haul Road, or hauled to the North-North, North Main, or South Main Borrow and Storage Areas for use in future reclamation.
7	• Phase 7 mines the area between Phases 5 and 6. This phase will interrupt the draw that drains stormwater from a large basin upslope of the pit. Phase 7 will be accessed from the West Side Haul Road via the temporary access ramps constructed during Phases 5 and 6. • GM and alluvium extracted from Phase 7 prior to mining will be directly placed during concurrent reclamation of earlier phases, stockpiled between the pit and West Side Haul Road, or hauled to the North-North, North Main, or South Main Borrow and Storage Areas where it will be stored for use in future reclamation. • Meade Peak waste mined from Phase 7 will be placed as backfill in Phases 5 or 6 or in the South Temporary Overburden Pile. • Ore from Phase 7 will be hauled via the West Side Haul Road and HR-5 to the Wooley Valley Tipple. • During the Phase 7 mining activities, the Phase 8 area will be pre-stripped, and the salvaged GM and alluvium will be used for concurrent reclamation of Phase 6, stockpiled between the pit and West Side Haul Road, or hauled to the North-North, North Main, or South Main Borrow and Storage Areas for use in future reclamation.
8	• Phase 8 advances mining south from Phase 6. Phase 8 will be accessed from the West Side Haul Road via the temporary access ramps constructed during Phase 7. As mining in Phase 8 progresses, a new temporary access ramp will be constructed to access the southern portion of Phase 8. • GM and alluvium extracted from Phase 8 prior to mining will be directly placed during concurrent reclamation of earlier phases, stockpiled between the pit and West Side Haul Road, or hauled to the North-North, North Main, or South Main Borrow and Storage Areas where it will be stored for use in future reclamation. • Meade Peak waste mined from Phase 8 will be placed as backfill in Phases 6 or 7. • Ore from Phase 8 will be hauled via the West Side Haul Road and HR-5 to the Wooley Valley Tipple. • During the Phase 8 mining activities, the Phase 9 area will be pre-stripped, and the salvaged GM and alluvium will be used for concurrent reclamation of Phase 7, stockpiled between the pit and West Side Haul Road, or hauled to the North-North, North Main, or South Main Borrow and Storage Areas for use in future reclamation.

Table 2-1. Mining Activities by Phase	
Phase	Description
9	• Phase 9 advances mining south from Phase 8. Phase 9 will be accessed from the West Side Haul Road via the temporary access ramps constructed during Phase 8. • GM and alluvium extracted from Phase 9 prior to mining will be directly placed during concurrent reclamation of earlier phases, stockpiled between the pit and West Side Haul Road, or hauled to the North-North, North Main, or South Main Borrow and Storage Areas where it will be stored for use in reclamation. • Meade Peak waste mined from Phase 9 will be placed as backfill in Phases 7 or 8. • Ore from Phase 9 will be hauled via the West Side Haul Road and HR-5 to the Wooley Valley Tipple.
End of Reclamation	• At the conclusion of mining, Phases 8 and 9 will have an open pit. Overburden from the Central and South Temporary Overburden Piles will be rehandled and placed as backfill in the Phase 8 and 9 pits. • The West Side Haul Road and HR-5 will be reclaimed and the material will be rehandled as backfill into the Phase 8 and 9 pits. • GM and alluvium will be hauled from the GM stockpile areas and the borrow and storage areas to the Phase 8 and 9 pits and the overburden pile areas for final cover construction. GM will also be used to reclaim the haul road areas and Staging Area. • The GM stockpile areas and the borrow and storage areas will be reclaimed by blending to distribute any surplus material, grading to promote drainage and blend with the surrounding topography, covering with 12 inches of GM, and seeding. • Water management structures such as sediment basins for contact water and runoff collection ditches will be cleaned of any potentially Meade Peak waste-containing sediment and filled in with the materials originally excavated from the structure. These structures would only be reclaimed after the associated mine features have successfully been reclaimed and vegetative cover established. Upslope run-on diversion ditches will be abandoned and left to naturally degrade.

2.2 Meade Peak and Non-Meade Peak Containing Materials

Overburden that does not include Meade Peak strata or specific Rex Chert material is referred to as “low-seleniferous” or low-SeW in various permitting documents. In the EIS and this document, these materials are referred to as “non-Meade Peak” material or “non-Meade Peak overburden.” Overburden that may contain Meade Peak or specific Rex Chert material, which is referred to as “seleniferous waste” or SeW in various permitting documents, is designated in the EIS and this document as “Meade Peak” material or “Meade Peak overburden.” See Section 2 in the EIS for the detailed discussion on the use of these terms.

2.3 Local Climate and Hydrologic Setting

The Site is located approximately 18 miles northeast of Soda Springs, Idaho, in the Blackfoot River basin, upstream of the Blackfoot Reservoir. Much of the Site drains west to Angus Creek, which eventually discharges to the Blackfoot River. The southern portion of the Site drains south to the Blackfoot River. The GM stockpile areas and the borrow and storage areas are all located in the Angus Creek watershed.

The climate in the RVM area is semi-arid, and patterns of local wind, precipitation, and temperature are influenced by prominent geographic features including the Blackfoot Reservoir and the Wooley Mountain Range (Whetstone Associates, Inc. [Whetstone], 2003). The RVM area experiences wide annual and diurnal variations in temperature and precipitation. May is the wettest month of the year, while July and August are typically the driest months. Annual precipitation averages 23.41 inches at the Site. In 2013, average monthly air temperature was greatest in July and August (64 degrees Fahrenheit [°F]), and lowest in December and January (18°F), with extreme temperatures ranging from -7°F in January to 71°F in July (Natural Resources Conservation Service [NRCS], 2014a-c). In general, frost or freezing conditions can occur in all months except July and August, and a majority of the annual precipitation typically falls as snow (Brown and Caldwell [BC], 2015).

2.4 Surface Water Design Objectives and Approach

Surface water management features were designed to achieve two general goals: (1) minimize erosion and sedimentation impacts and (2) reduce or prevent pollution to receiving waters. With respect to the latter, the mobilization and migration of selenium is of particular concern to phosphate mining in southeast Idaho. Exposure of phosphatic shales of sediments containing selenium to the atmosphere initiates oxidation of the selenium (in various chemical forms) to selenite, and the more oxidized selenate, a highly soluble form of selenium. Selenate, and to a slightly lesser degree selenite, once dissolved are highly mobile and move with the water through the environment.

In cooperation with regulatory agencies, the mining industry has identified BMPs that can be implemented to reduce and control erosion, sedimentation, and transportation of pollutants to receiving waters. General BMPs developed for surface, dredge, and placer mining operations in Idaho were developed by the Idaho Department of State Lands (IDL, 1992) and include the following:

- soil stabilization
- seeding and revegetation
- stream and undisturbed area surface runoff diversion
- sediment collection
- topsoil salvage
- pit backfill

In recent years, several additional BMPs have been identified that are designed specifically to address the mobilization and transport of selenium. In general, these BMPs are designed to minimize contact of precipitation, snowmelt, and runoff with mine disturbance areas that contain Meade Peak material. BMPs that are routinely applied at phosphate mining operations were developed by the Idaho Mining Association Selenium Committee (IMASC, 2000) and include the following:

- Use of low-selenium concentration (non-Meade Peak) material for earthen construction
- Encapsulation of seleniferous (Meade Peak material) middle shales in middle to lower regions of overburden piles where external disposal of seleniferous waste rock (Meade Peak overburden) cannot be avoided
- Selective handling (i.e., minimizing the presence of Meade Peak material in external overburden piles)
- Placement of (Meade Peak material and non-Meade Peak material*) overburden piles to avoid surface water, springs, and wetlands (*added to incorporate RVM terminology into IMASC, 2000 intent)

Agrium will design and implement appropriate BMPs for erosion, sedimentation, selenium and other COPCs control at the RVM to protect surface waters in and around the Site. Agrium will limit the quantity of Meade Peak material that will be exposed throughout the life of the mine through direct backfilling and ensuring that a minimum cap thickness is placed over backfilled Meade Peak material (see Mine Plan for details).

In general, this SWMP identifies two “types” of water; “contact water” and “non-contact water.” Contact water is defined as any water that comes into contact with the mine pit, haul roads, or storage piles containing Meade Peak materials. Non-contact water is defined as any other water, i.e., run-on water from upslope of the pit, runoff water collected from the GM and alluvium stockpiles, and any water collected that only contacts Non-Meade Peak containing materials. The design goal of this SWMP is to sequester the contact water from the non-contact water.

This SWMP describes two types of ditches that will be used to manage surface water run-on and runoff: run-on diversion ditches and runoff collection ditches. Run-on diversion ditches will intercept and divert non-contact water run-on from upslope of the pit and the GM and alluvium stockpiles around the features and into natural drainages. Culverts will be installed under haul roads where needed to convey non-contact surface water from undisturbed areas or GM stockpiles between the mine pit and haul road and maintain drainage. The run-on diversion ditches will be constructed in sequence with the mining phases to minimize stormwater run-on into the pit and excessive precipitation contact with exposed shales.

Runoff collection ditches will collect and convey non-contact water runoff from the GM and alluvium stockpiles to non-contact water sediment detention basins. These basins will collect and temporarily detain waters exposed to GM or alluvium stockpiles and borrow sites (i.e., non-contact water). The runoff collection ditches will also collect and convey contact water runoff from the pre-stripping areas, haul roads, and temporary overburden stockpiles to contact water sediment retention basins. These basins will collect and retain waters exposed to mining disturbances or Meade Peak materials (i.e., contact water). Table 2-2 outlines specific design objectives for this SWMP as they pertain to the overarching goals. The table also lists corresponding BMPs that could be used to manage surface water and achieve the design objectives. The table describes design criteria for use in sizing and constructing BMPs, as well as the analytical/design approach used to determine the size of the conceptual features presented in this SWMP.

Not all of the BMPs listed in Table 2-2 have been explicitly incorporated into the site maps that are part of this SWMP. Some of these BMPs are discussed in this SWMP while others may be considered during later planning stages or during construction as understanding of site conditions develop throughout mining. For example, a comprehensive stormwater pollution prevention plan will be required prior to final approval of the Mine Plan to accommodate the changing mining operations through the various construction phases.

2.4.1 Risk-Based Approach to Design

Design criteria for the BMPs in Table 2-2 were developed using a risk-based approach that accounts for the lifespan of the BMP and the probability of design capacities being exceeded. Using a risk-based approach, a 50-year design storm has approximately a 10 percent chance of occurring over a 5-year period. In other words, if a 50-year, 24-hour design storm is selected for BMP sizing, there is roughly a 10 percent chance of exceedance over an anticipated 5-year lifespan. The anticipated lifespan for each phase was based on the latest mine phasing plan, outlined in Table 2-3.

For all stormwater facilities, additional runoff from snowmelt was included in the model analysis and sizing calculations, conservatively assuming the rainfall design storm occurs during a snowmelt period (see Section 3.1). This “rain-on-snow” scenario is referred to as the Design Event. Each stormwater facility was designed to either the 100-year 24-hour or the 50-year 24-hour Design Event. The 100-year 24-hour Design Event is the 100-year 24-hour storm plus snow melt. The 50-year 24-hour Design Event is the 50-year 24-hour storm plus snow melt. Snowmelt assumptions are constant for both Design Events. Section 3.1 describes the Design Event in detail.

A 50-year, 24-hour Design Event was selected for most facilities based on a risk criterion of a 10 percent or less probability of the Design Event occurrence within the lifespan of the facility. However, a 100-year, 24-hour Design Event was used to size the re-established drainage channels and culverts draining large areas to provide an additional factor of safety. The Design Event selection for the haul road culverts—the furthest downstream facilities—was also applied to all connected upstream run-on diversion ditches and erosion control structures.

One exception to the risk-based design approach was the capacity of the sediment basins, which were universally sized for the 100-year, 24-hour rainfall design storm plus volume for the design snowmelt event, as described in Section 4.2.2.2.

Table 2-2. Surface Water Management Design Objectives and Criteria

Regulation	Design Objective	Surface Water BMPs	Design Criteria	Analytical/Design Approach
43 CFR 3592.1(c)(8)(ii): "…reduce soil erosion and sedimentation…" (See Table 1-1 for complete text)	Minimize soil erosion on disturbed areas (e.g., surface sediment mobilization and/or the formation of rills and gullies).	Revegetate disturbed surfaces.	Recommend standard stormwater management practices; specific design parameters not developed for this SWMP.	General BMPs described; specific features were not analyzed/designed
		Implement temporary erosion control practices: straw bales, silt fences, etc.	Recommend standard stormwater management practices; specific design parameters not developed for this SWMP.	General BMPs described; specific features were not analyzed/designed
		Plant vegetative buffer zones along slope contours.	Recommend standard stormwater management practices; specific design parameters not developed for this SWMP.	General BMPs described; specific features were not analyzed/designed
		Construct slope breaks/terraces on overburden where practical to do so.	Recommend standard stormwater management practices; specific design parameters not developed for this SWMP.	General BMPs described; specific features were not analyzed/designed
		Construct roads to shed water to roadside ditches; collect roadway runoff using roadside ditches and convey to sediment basins.	Recommend standard stormwater management practices; specific design parameters not developed for this SWMP.	General BMPs described; specific features were not analyzed/designed
		Construct run-on diversion ditches to collect and route concentrated runoff to stable channels or to locations where it can be dispersed.	Channel capacity should be sufficient to convey the peak discharge from the selected design event[a] plus 6 inches of freeboard.	SCS method[b] (hydrology), Manning's equation[c] (hydraulics)
		Re-establish drainage ways and major water courses over disturbed areas.	Channel capacity should be sufficient to convey the peak discharge from the selected design event[a] plus 6 inches of freeboard.	SCS method[b] (hydrology), Manning's equation[c] (hydraulics)
	Minimize the risk for newly constructed or re-established drainage channels to erode or degrade.	Minimize the slopes of channels and drainage channels to the extent practical; isolate steeper sections to the extent possible.	Use maximum of 1% grade for interceptor channels that contour the upland slope.	Consider slopes when aligning channels
		Line shallow to slightly steep channels with stable materials such as resilient vegetation or geomembranes.	Lining to be stable under peak flow conditions from the selected design event[a]. Stability criteria will vary depending on the lining type.	SCS method[b] (hydrology), FHWA et al.[d] (hydraulic design)
		Line slightly steep to moderately steep channels with stable materials such as riprap or cellular confinement blocks.	Lining to be stable under peak flow conditions from the selected design event[a]. Stability criteria will vary depending on the lining type.	SCS method[b] (hydrology), FHWA et al.[d] (hydraulic design)
		Line steep to highly steep channels with stable materials such as riprap; where necessary, construct grade control structures such as rock check dams.	Lining to be stable under peak flow conditions from the selected design event[a]. Stability criteria will vary depending on the lining type.	SCS method[b] (hydrology), FHWA et al.[d] (hydraulic design)
		Where necessary, construct energy dissipators to control highly turbulent flows and prevent local scour.	Size energy dissipators to pass discharge and remain stable under peak flow conditions from the selected design event[a].	SCS method[b] (hydrology), FHWA et al.[d] (hydraulic design)
		Construct stable crossings (e.g., culverts, low-water crossings) where roads cross runoff conveyance channels.	Size crossings to pass discharge and remain stable under peak flow conditions from the selected design event[a].	SCS method[b] (hydrology), FHWA et al.[d] (hydraulic design)
	Minimize the risk for destabilizing nearby streams or downstream receiving waters.	Construct energy dissipation/flow spreader structures at outfalls.	Size energy dissipators/flow spreaders to pass discharge and remain stable under peak flow conditions from the selected design event[a].	SCS method[b] (hydrology), FHWA et al.[d] (hydraulic design)
		Construct stable stream crossings (culverts, low-water crossings, etc.) where roads cross natural watercourses.	Size crossings to pass discharge and remain stable under peak flow conditions from the selected design event[a].	SCS method[b] (hydrology), FHWA et al.[d] (hydraulic design)
	Reduce or prevent discharge of sediment-laden runoff to receiving waters.	Construct sediment basins to capture and settle sediments from areas with potentially high sediment loads (e.g., roads, external waste dumps, and growth media stockpiles).	Size sediment basins to capture runoff volume produced by the design event[a].	SCS method[b] (hydrology),
43 CFR 3592.1(c)(8)(ii): "…prevent the pollution of receiving waters…" (See Table 1-1 for complete text)	Reduce or prevent surface water runoff from contacting Meade Peak materials or from commingling with contact water.	Construct run-on diversion ditches to capture and convey runoff (i.e., potential run-on) before it reaches active pits, open shales, and temporary overburden piles containing Meade Peak materials.	Channel capacity should be sufficient to convey the peak discharge from the selected design event[a] plus 6 inches of freeboard.	SCS method[b] (hydrology), Manning's equation[c] (hydraulics)
	Minimize run-on and infiltration into Meade Peak backfill areas.	Construct run-on diversion ditches to capture and convey runoff (i.e., potential run-on) before it reaches open pits and uncapped backfill areas containing Meade Peak materials.	Channel capacity should be sufficient to convey the peak discharge from the selected design event[a] plus 6 inches of freeboard.	SCS method[b] (hydrology), Manning's equation[c] (hydraulics)
		Construct runoff retention sediment basins in native soils that are down gradient from backfill areas containing Meade Peak materials.	No specific criterion.	Consider extent of Meade Peak materials when locating sediment basins.
		Plan for snow removal and avoid disposing of snow on surfaces containing Meade Peak material; snow will not be placed into backfill, onto backfill, on temporary overburden piles, or allowed to melt directly into surface water or leave the Site. Construct sediment basins adequately sized to accept plowed snow in addition to capturing runoff.	No specific criterion.	Consider extent of Meade Peak materials when planning snow removal.
	Capture and retain runoff from mining facilities that may contain pollutants. Captured water to be infiltrated, evaporated, or transported to be handled with pit water.	Construct runoff retention sediment basins to capture and retain potentially polluted runoff.	Size sediment basins to capture runoff volume produced by the design event[a].	SCS method[b] (hydrology)

Table 2-2 Notes:

[a]Design events for runoff conveyance structures were selected based on the anticipated life of the structure and risk-based approach discussed in Section 2.4.1.

[b]The SCS (Soil Conservation Service) Method—also known as the NRCS Method—is commonly used for event-based hydrologic analyses in rural watersheds; see Section 3.1.1.

[c]Channels were designed assuming uniform flow conditions. Channel capacity, flow depth, and flow velocity were calculated using Manning's equation; see Section 3.2.1.

[d]In general, hydraulic design calculations were performed based on guidance documents published by the Federal Highway Administration (FHWA). However, for special conditions (e.g., highly steep slopes) other methods were used; see Section 3.2.3.

Abbreviations:

BMP = best management practice.

CFR = Code of Federal Regulation.

FHWA = Federal Highway Administration.

SCS = Soil Conservation Service.

SWMP = Surface Water Management Plan.

Table 2-3. Timing and Duration of Mining Phases				
Phase	Mine Schedule by Month[a,b]	Duration of Mining (months)	Duration of Backfill (months)	Total Duration of Phase (months)[c]
1	13–17	3	2	5
2	13–24	8	4	12
3	19–35	7	10	17
4	25–39	6	9	15
5	29–50	13	9	22
6	40–56	10	7	17
7	48–65	8	10	18
8	55–69	10	5	15
9	63–72	7	3	10
EOR	~73–84	NA	NA	~12

Notes:

[a]Pre-mining infrastructure development occur from month 1 to 12.

[b]Based on revised 3H:1V Material Balance dated 01/29/15; HRC file RV_Mine_Schedule_1_29_2015_Option_RCA_3_1.xlsx.

[c]Final duration of phase is subject to change based on site conditions and operational requirements at the time of implementation.

Abbreviations:

EOR = end of reclamation; includes post-mining reclamation so duration of mining and backfill are not applicable.

NA = not applicable.

Section 3

Computational Methods

The hydrologic and hydraulic modeling analyses performed for this study can be divided into the development of peak design discharges (Section 3.1) and hydraulic design calculations (Section 3.2).

3.1 Design Event

Uncontrolled or unplanned release of captured water to surface waters is to be avoided. In the case of the RVM, the receiving surface water bodies are Angus Creek and subsequently the Blackfoot River, both of which are 303d listed by the Idaho Department of Environmental Quality (IDEQ) as impaired (IDEQ, 2014). Therefore, a conservative Design Event was selected as the design criteria upon which conveyance capacities were calculated. This Design Event anticipates a rainfall design storm occurring during spring snowmelt, a “rain-on-snow” event.

3.1.1 Design Event Peak Discharges

A precipitation-runoff model was developed to estimate discharge frequency based on precipitation frequency data. The model was developed using event-based hydrologic methods developed by the NRCS, formerly known as the Soil Conservation Service (SCS). These methods are collectively referred to as the SCS method, or the SCS-curve number method. Guidance for SCS methods is provided in the National Engineering Handbook (U.S. Department of Agriculture [USDA], 2010). A key assumption in such an analysis is that precipitation frequency is directly related to discharge frequency. This is not always true, but in the case of small drainage basins like those in this study, it is considered a reasonable assumption.

Computations for the precipitation-runoff model were performed using the Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS) Version 4.0, which was developed by the U.S. Army Corps of Engineers (USACE, 2013). In general, HEC-HMS requires two types of input: (1) a meteorological model and (2) a basin model. The meteorological model represents climatic conditions (i.e., precipitation) occurring over a basin. The basin model represents the physical characteristics of a drainage basin.

3.1.1.1 Meteorological Model

Historical climate information for the Site was investigated based on long-term records available from three meteorological stations of the National Oceanic and Atmospheric Administration’s (NOAA) National Weather Service (NWS). Table 3-1 lists the stations that were reviewed because of their proximity to the Site.

Table 3-1. NWS Stations Considered for Historical Climate Information					
Station Name	COOP ID	Elevation (ft amsl)	Latitude	Longitude	Period of Record
Conda	102071	6,204	42°43'N	111°33'W	1/1/1939 to 4/30/1978
Grace	103732	5,550	42°35'N	111°44'W	1/1/1907 to 1/20/2015
Soda Springs Airport	108535	5,842	42°39'N	111°35'W	6/1/1978 to 10/26/2012

Abbreviations:

ft amsl = feet above mean sea level.

NWS = National Weather Service.

With approximately 34 years of record, the station at Soda Springs Airport (COOP ID# 108535) is closest to the Site based on proximity. Table 3-2 summarizes the monthly and annual average precipitation, temperature, and snow levels for the Soda Springs Airport station, which is relatively close to the Site and has 34 years of record. This data was only used for reference to understand average precipitation trends near the Site. The climate data used for the modeling and design are described below.

Table 3-2. Historical Climate Information for the Soda Springs Airport													
Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average total precipitation (in)[a]	1.21	1.09	1.33	1.39	2.20	1.41	1.07	1.22	1.16	1.26	1.17	1.11	15.62
Average max. temperature (°F)	30.3	32.8	42.0	54.3	63.8	74.0	84.7	83.1	72.6	58.7	41.9	31.4	55.8
Average min. temperature (°F)	8.6	10.1	19.0	26.5	33.7	39.6	45.0	43.9	35.7	26.7	18.8	9.5	26.4
Average total snowfall (in)	11.7	8.6	7.3	3.7	0.5	0.1	0	0	0	0.9	6.7	10.6	50.0
Average snow depth (in)	10	11	5	0	0	0	0	0	0	0	1	5	3

Source: Western Regional Climate Center, 2012.

Abbreviations:

°F = degree Fahrenheit.

in = inch.

Notes:

[a]Snow water equivalent during winter months.

Table 3-3 lists the monthly pan evaporation data from Blackfoot Dam (COOP ID# 100920), which is the nearest NWS station to the Site. The period record for these data is 1948–71.

Table 3-3. Monthly Average Pan Evaporation Data from Blackfoot Dam Station												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
–[a]	–[a]	–[a]	–[a]	–[a]	7.56	9.19	7.42	3.97	–[a]	–[a]	–[a]	28.14

Source: Western Regional Climate Center, Desert Research Institute.

Table 3-3 Notes:

Evaporation reported in inches.

[a]Denotes months for which pan evaporation measurements were not taken.

Precipitation (i.e. Rainfall) Depths. The Precipitation-Frequency Atlas of the Western United States, developed by NOAA, is a standard reference for estimating rainfall depths for various durations and frequencies (Miller et al., 1973); Volume V specifically applies to the Idaho region. Point precipitation depths for the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year return period, 24-hour duration rainfall design storms were estimated using the geographic coordinates for the Site (42°50'20"N, 111°20'09"W). Table 3-4 shows the rainfall depths and frequencies for the Site.

Table 3-4. Site Precipitation-Frequency Data

Frequency	Precipitation (inches)
2-year	1.39
5-year	1.80
10-year	2.10
25-year	2.40
50-year	2.75
100-year	2.96

The rainfall depths obtained using the NOAA Atlas are point values (i.e., the probability of the rainfall depth accumulating over the specified duration is associated with a single point within a storm). Average rainfall intensity tends to decrease as the area of the storm increases; therefore, adjustment factors are typically used when applying rainfall depths over a drainage area. For the purposes of this SWMP the individual subbasins were analyzed as discrete drainage areas, not the cumulative area of the Site as a whole (Exhibits A-J). Therefore, the drainage areas at the Site are relatively small (less than 2 square miles). Areal reduction factors are considered negligible at this scale.

Hypothetical rainfall design storms were created by temporally distributing the estimated precipitation depths over the associated event duration (i.e., 24 hours) to form rainfall hyetographs. NRCS has developed four synthetic rainfall distributions for small watersheds (USDA, 1986) applicable to different regions of the United States. The Type II distribution, which applies to Idaho, has a high peak intensity that applies to areas where extreme events are typically characterized as thunderstorms.

Snowmelt Discharge. Historical snowpack information for the Site was investigated in order to develop the snowmelt component of the meteorological model based on long-term records available from NRCS SNOTEL stations. Table 3-5 lists the stations that were considered because of their proximity to the Site.

Table 3-5. NRCS SNOTEL Stations Considered for Historical Snowpack Information

Station Name	SNOTEL ID	Elevation (ft amsl)	Latitude	Longitude	Period of Record
Somsen Ranch	770	6,800	42°57'N	111°22'W	1981 to 2015
Giveout	493	6,930	42°25'N	111°10'W	1982 to 2015
Slug Creek Divide	761	7,225	42°34'N	111°18'W	1981 to 2015

Abbreviations:

ft amsl = feet above mean sea level.

NRCS = National Resources Conservation Service.

Although located farther from the Site than other stations, the Giveout station was selected for analysis of potential snowmelt because it is located on a west-facing slope and is most representative of anticipated snowmelt at the Site. Table 3-6 summarizes the average monthly snowpack data, in snow water equivalent (SWE), at the Giveout station.

Table 3-6. Monthly Snowpack Data for NRCS Giveout Station (1982–2015)[a]

Jan	Feb	Mar	Apr	May	Jun
4.1	6.6	8.9	8.6	2.2	0.0

Source: National Resources Conservation Service, 2016.

Notes:

[a]Snowpack represented as snow water equivalent (inches). Average of measurements collected at the beginning of each month.

Abbreviations:

NRCS = National Resources Conservation Service.

Based upon snowpack and climate data available for the Site, snowmelt could occur in tandem with the rainfall design storm, creating a rain-on-snow event. It is projected, considering the historical record, that such an event could occur in April or May. Therefore, daily SWE data for these months were analyzed over the period of record to determine the anticipated daily snowmelt (loss in SWE from one day to the next). Ninetieth (90th) percentile daily snowmelt values were calculated for the April/May period of each year, and then averaged over the period of record (1983 to 2015) to develop a conservative estimate of daily (24-hour) snowmelt that could occur in combination with the rainfall design storm. The design snowmelt was estimated to be 0.83 inches per day. A portion of the daily SWE loss will be due to evaporation, sublimation, and infiltration; however, in a rain-on-snow event these losses are likely to be minimal due to wet soils and cloudy conditions. Therefore, the total design snowmelt of 0.83 inches per day was conservatively included in the meteorological model.

Discharge from snowmelt was assumed to be at a steady state throughout the design snowmelt duration and was not converted to a unit hydrograph; rather, the design snowmelt was included in the meteorological model as a constant discharge (cubic feet per second), calculated as the daily snowmelt depth over the contributing drainage area in 24 hours. This is a conservative representation, as it compresses the snowmelt discharge into a 24-hour period. The snowmelt discharge was added cumulatively to the results of the rainfall design storm hydrograph for the meteorological model.

3.1.1.2 Basin Model

The SCS method uses a lumped-parameter approach to hydrologic modeling. Input data are developed for a set of sub-drainage areas, or subbasins. Each subbasin is assumed to have relatively uniform physical characteristics that can be represented by a single set of parameters. The spatial extents of the subbasins are represented by the delineated drainage areas. Losses within the subbasin (interception, depression storage, infiltration, etc.) are represented by a curve number (CN). And the rate at which excess precipitation (precipitation remaining after losses) is transformed to direct discharge at the subbasin outlet is represented by a synthetic unit hydrograph, which in turn is generated based on a basin lag time. The subbasins were delineated so that the direct discharge could be used to size the surface water management features. The methods used to develop the subbasins' parameters are described in the following sections.

3.1.1.2.1 Modeling Scenarios

Basin model input parameters were developed for both mining and reclaimed conditions. For the mining conditions, scenarios including the nine phases of mine development were modeled, as described in Table 2-1. Existing conditions were used to develop the model parameters as the surface water management features handle flows from undisturbed areas, with one exception. The proposed haul road land use was used in the existing condition model scenarios to account for runoff from the roadway surfaces. Each of the phases were simulated with the six rainfall design storms shown in Table 3-4 in addition to the constant snowmelt discharge (which is not dependent on a return period). These simulations cover the range of design criteria for the surface management features, as included on Table 2-2.

3.1.1.2.2 Subbasin Drainage Areas

Subbasins for the mining conditions scenarios (phases) were delineated using topographic survey data available for the Site. Subbasins for the reclaimed condition scenario were delineated using contours for the reclaimed topography. Subbasin boundaries were digitized using ArcGIS software[1], and subbasin areas were calculated using ArcGIS' intrinsic spatial tools. Subbasin boundaries are included in Exhibits A-J at the end of this document. Tables of subbasin areas are included in Attachment A.

3.1.1.3 Curve Numbers

The SCS method calculates runoff from a precipitation event, as shown in the Equation 1 from NRCS TR-55 (USDA, 1986):

$$P_e = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad \text{Equation 1}$$

where: P_e = excess precipitation/runoff (inches)
P = precipitation (inches)
I_a = initial abstraction (inches)
S = retention storage (inches)

The initial abstraction value, I_a, is the amount of water lost before any runoff is generated, primarily due to interception storage, depression storage, and infiltration. The retention storage value, S, is the potential maximum retention within the watershed after runoff begins. Both I_a and S are closely related to the vegetative cover and the soil type within the watershed, which can be represented through a CN. Equation 2 from NRCS TR-55 calculates the retention storage value, S:

$$S = \frac{1000}{CN} - 10 \qquad \text{Equation 2}$$

where: S = retention storage (inches)
CN = curve number (unitless)

The initial abstraction value (Equation 3), I_a, is often estimated as a fraction of S. That fraction, denoted λ, has often been assumed to be 0.2, based on empirical data for small agricultural watersheds (USDA, 1986). CNs have been tabulated and are selected based on land cover and soil type (USDA, 1986). These tabulated *CN* values are based on the $I_a=0.2S$ assumption.

$$I_a = \lambda \cdot S \qquad \text{Equation 3}$$

[1] ArcGIS is a geographic information system developed by ESRI: http://www.esri.com/software/arcgis/index.html.

Where: I_a = initial abstraction (inches)

$\lambda = 0.2$ (unitless)

S = retention storage (inches)

Vegetative Cover. Geographic information system (GIS) mapping of the existing conditions vegetative cover was reviewed to determine the aerial extent of the dataset. This dataset was originally prepared by Rocky Mountain Environmental Associates (RME) in 2009 (RME, 2009), and utilized by BC for the Rasmussen Valley 2012 Vegetative Baseline Report (BC, 2012). A large portion of the upper watershed was not included in the dataset; therefore, a combination of other land cover data, specified below, were used to digitize vegetative cover within the missing extent (Figure 3-1). The 2011 Natural Color 1-meter National Agriculture Imagery Program (NAIP) aerial photography was reviewed in combination with the normalized difference vegetation index data to determine the extent, type, and density of vegetation for the missing extent. Vegetation classifications included in the existing GIS dataset were assigned to the appended data based on the imagery inspection. The vegetative survey for the Site describes the existing land cover types within the delineated subbasins as aspen (mature, dry woodland, or potential old growth), high rangeland over 6,600 feet, mixed aspen and conifers, and sagebrush (big or silver). Vegetative cover for reclaimed conditions will be replanted with a grass/shrub mix and reestablished with a moderate ground cover. The vegetation types were correlated to the TR-55 land cover types and assigned a hydrologic condition based on the vegetative cover density (Table 3-7).

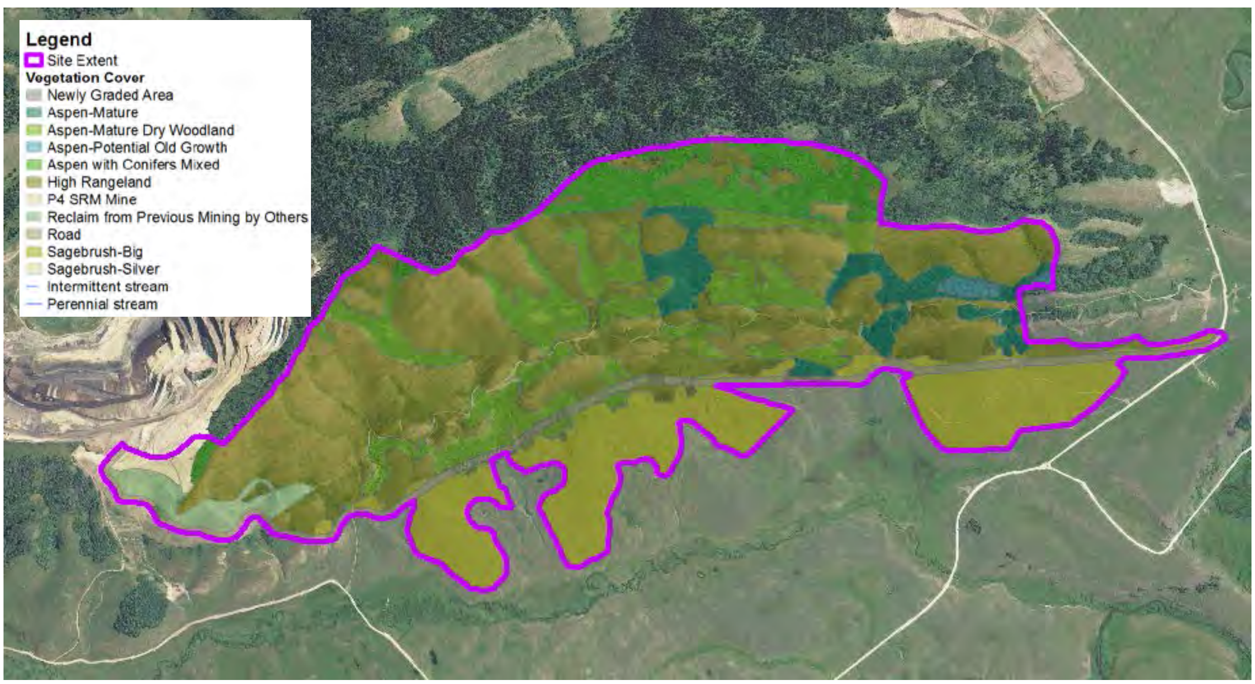

Figure 3-1. Existing Conditions Vegetative Cover
(2011 Natural Color 1-meter NAIP aerial photography with appended ARCADIS GIS mapped dataset overlay)

Table 3-7. Cover Type Cross Correlation between EIS Report and TR-55 Landcover Types		
EIS Vegetative Cover	TR-55 Cover Type and Condition	CN[b]
Aspen_Mature	Woods, Good Condition	55,70,77
Aspen_Mature Dry Woodland	Woods, Fair Condition	60,73,79
Aspen_Potential Old Growth	Woods, Good Condition	55,70,77
Aspen_with Conifers Mixed	Woods, Good Condition	55,70,77
Mixed Aspen And Conifer	Woods, Fair Condition	60,73,79
High_Rangeland over 6,600 ft	Pasture, grassland or range, Fair Condition	69,79,84
Sagebrush_Big	Brush, weed, grass mixture, Fair Condition	56,70,77
Sagebrush_Silver	Brush, weed, grass mixture, Fair Condition	56,70,77
Haul Road	Unpaved (including right-of-way)	91
Reclaimed Area	Brush, weed, grass mixture, Fair Condition	70

Notes:

[a]Hydrologic conditions were determined based on visual interpretation of vegetation density from NAIP imagery and comparison to ground cover percentage ranges for each cover type in Table 2-2c of the TR-55 document (USDA, 1986).

[b]Curve number values for B, C and D soils obtained from Table 2-2a and Table 2-2c of the TR-55 document (USDA, 1986).

Soils. For the purposes of selecting CN values, soils are classified by hydrologic soil group. Four classes are defined by the USDA (2010) as follows:

- **Group A** soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission (greater than 0.30 inch per hour).
- **Group B** soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15 to 0.30 inch per hour).
- **Group C** soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05 to 0.15 inch per hour).
- **Group D** soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0 to 0.05 inch per hour).

In collaboration with Agrium's EIS coordination efforts, AECOM completed an Order 2 soil survey of the Site (AECOM, 2012). AECOM then completed a supplemental survey in 2014 to increase the extent to the south (AECOM, 2014). A small extrapolation of the dataset was necessary to cover the entire Site based on visual inspection. Hydrologic soil groups A, B, C, or D were assigned to each soil type in the survey, included in Table 7 of the Soil Survey Report (AECOM, 2012).

CN Selection. CNs for the pre-mining conditions were selected from Table 2-2c of the TR-55 document (USDA, 1986) based on soil vegetative cover classification (Table 3-7) and hydrologic soil groups from the AECOM soil survey. Table 3-7 lists the CNs selected for each combination of land cover type, cover condition, and hydrologic soil group. All roadway surfaces were assigned a CN of 91, which correlates to unpaved roadways with open ditch right-of-ways in Table 2.2a of the TR-55 document (USDA, 1986). For the reclaimed areas, a standard CN of 70 was assigned based on a brush-weed-grass mixture land cover, moderate ground cover condition, and soil group C. The reclaimed area CN selection was based on the proposed reclamation seed mix and a conservative soil group selection, representative of the cover material properties.

Composite CNs for drainage subbasins were then calculated using an area-weighted average of the land cover conditions found within the delineated subbasin. To estimate the area-weighted CN, the land cover data were clipped by the subbasin areas using ArcGIS geospatial tools, and assigned a CN based on the assignments in Table 3-7 above. Each CN was then multiplied by its fraction of the total subbasin area, and summed to get the area-weighted CN. Composite CNs for each subbasin are included in Attachment A.

3.1.1.4 Basin Lag Time

The total runoff volume is equal to the volume of excess rainfall. Hydrologic models transform the volume of water from excess rainfall distributed over the basin to direct runoff at the basin outlet. This is often done using a unit hydrograph for the basin. If the basin is ungauged and no unit hydrograph has been developed, then a synthetic unit hydrograph can be created based on basin characteristics. NRCS developed a synthetic unit hydrograph known as the SCS Dimensionless Unit Hydrograph (USDA, 2010). Figure 3-2 shows a graph of the SCS Dimensionless Unit Hydrograph.

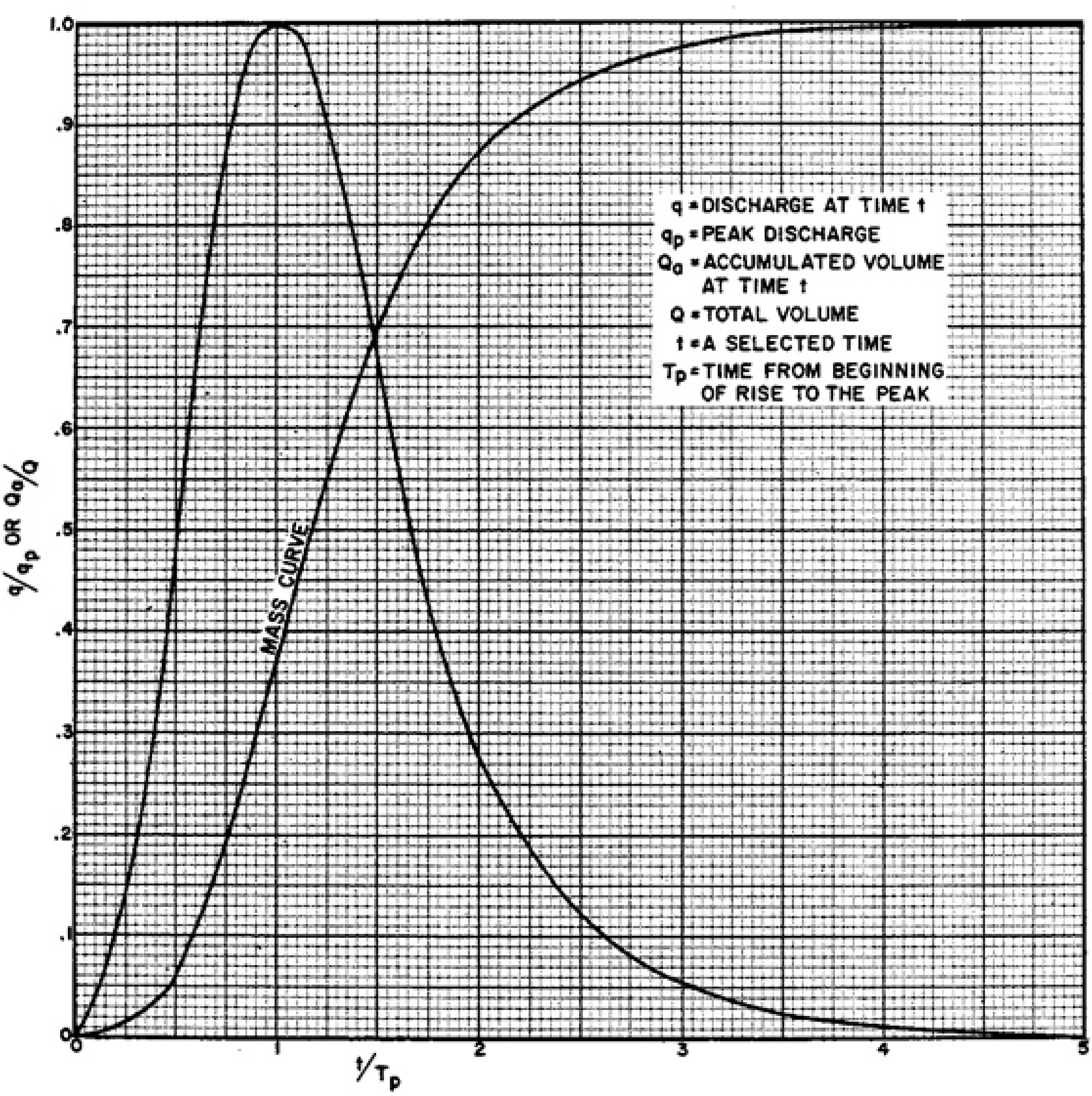

Figure 3-2. SCS Dimensionless Unit Hydrograph (USDA, 2010)

The SCS Dimensionless Unit Hydrograph is a parametric unit hydrograph mode. The ordinates of the unit hydrograph are calculated from two parameters representing the basin response: basin area (*A*) and basin lag time (*L*). The basin lag time is defined as the time difference between the center of mass of the excess rainfall and the peak of the unit hydrograph. The lag time for a basin can be estimated using a CN-based empirical relation from the USDA (2010):

$$L = \frac{l^{0.8}(S+1)^{0.7}}{1900\ Y^{0.5}} \qquad \text{Equation 4}$$

Where: L = basin lag time (hours)

l = length of the longest flow path in the watershed (feet)

Y = average land slope in the watershed (percent)

S = retention storage (inches), see Equation 2

The peak discharge of the unit hydrograph (q_p) (Equation 5) and the time-of-peak (T_p) (Equation 6) are related to the basin area and the basin lag time by the following equations from the USDA (2010):

$$q_p = \frac{CAQ}{T_p} \qquad \text{Equation 5}$$

$$T_p = \frac{\Delta D}{2} + L \qquad \text{Equation 6}$$

Where:

q_p = peak discharge of the unit hydrograph

C = a conversion constant = 484 for English units

A = basin area (square miles)

Q = total volume of runoff/excess precipitation (1 inch)

T_p = time to peak (hours)

L = basin lag time (hours)

ΔD = duration of excess precipitation (hours)

The basin slope (*Y*) parameter was estimated from slope raster data prepared by BC staff using Esri ArcGIS Zonal statistics tool. The longest flow path (*l*) for each subbasin was digitized in ArcGIS. Flow path velocity was calculated from the flow path and lag time (*L*) to check if the parameters were representative of common flow types. Velocities ranged from 1.5 feet per second (fps) representative of slow moving flow paths in flat subbasins, to 7 fps, common for longer fast moving steeper flow paths. Tables of subbasin lag times calculated using Equation 4 are included in Attachment A.

3.1.2 Channel Routing

Subbasin elements within the HEC-HMS model were connected to form a stream network. Channel routing was performed using the Muskingum-Cunge method. Lengths and slopes of the channels were estimated from topographic data for the Site. The channel geometry was assumed to be trapezoidal with a standard bottom width (4 feet for run-on diversion ditches and 6 feet for re-established drainage channels) and 2H:1V (horizontal:vertical) side slopes.

HEC-HMS model schematics showing the subbasins, routing reaches, and additional computational nodes (junctions) are provided in Attachment B.

3.2 Hydraulic Design

Peak discharges for the six 24-hour rainfall design storms (2-year, 5-year, 10-year, 25-year, 50-year, and 100-year) concurrent with the daily snowmelt were computed using HEC-HMS as described in the previous section (model output provided in Attachment C). The calculated discharges were then used to perform hydraulic calculations for designing surface water management features. Uniform flow calculations were performed to estimate flow depths, velocities, and shear stresses within channels and to verify that channel capacities are adequate to convey the design discharge without overtopping (Section 3.2.1). Roadway culverts were sized using the FHWA's HY-8 software (Section

3.2.2). Riprap sizing calculations were performed to estimate mean rock diameters for riprap channel and slope protection (see Section 3.2.3).

3.2.1 Uniform Flow Calculations for Channel Sizing

Uniform flow calculations were performed using Manning's equation as described in Chow et al. (1988) (Equation 7):

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2} \qquad \text{Equation 7}$$

Where:
- Q = design discharge (cfs)
- n = Manning's roughness coefficient
- A = cross-sectional area of flow (feet squared)
- R = hydraulic radius = A/P
- P = wetted perimeter of the cross-section (feet)
- S = energy slope, which is assumed equal to the bed slope of the channel

Channel Geometry. All channels are assumed to be trapezoidal with a standard bottom width of 4 or 6 feet (see Section 3.1.2) and side slopes of 2H:1V. The depth of the channel varies depending on the required capacity to convey the design discharge. The cross-sectional area (A) (Equation 8) and wetted perimeter (P) (Equation 9) for the channels are calculated using the following equations from Chow et al. (1988):

$$A = (b + zy)y \qquad \text{Equation 8}$$

$$P = b + 2y\sqrt{1 + z^2} \qquad \text{Equation 9}$$

Where:
- A = cross-sectional area (square feet)
- b = channel bottom width (feet)
- z = horizontal distance to 1 vertical for channel side slope
- y = flow depth (feet)
- P = wetted perimeter (feet)

Manning's Roughness. When modeling natural channels, Manning's roughness coefficient depends on a number of factors and is highly influenced by the size of the riprap relative to the flow depth. The FHWA Hydrologic Engineering Circular No. 15 (HEC-15) provides two empirical equations (Equation 10 and Equation 11) for calculating the Manning's roughness coefficient in riprap-lined channels (U.S. Department of Transportation [USDOT], 2005a). Blodgett (1986), as presented in HEC-15, provides a relationship for Manning's roughness coefficient as a function of flow depth and relative flow depth (expressed as a ratio of depth to mean rock diameter), shown in the following equation:

$$n = \frac{\propto\ d_a^{1/6}}{2.25 + 5.23 \log\left(\frac{d_a}{D_{50}}\right)}$$ **Equation 10**

Where: n = Manning's roughness coefficient (dimensionless)
$\propto$ = unit conversion constant = 0.262 in English units
d_a = average flow depth in the channel (feet)
D_{50} = mean riprap size (feet)

Equation 10 is applicable only for the range of conditions where $1.5 \leq d_a/D_{50} \leq 185$. As d_a/D_{50} approaches and falls below 1.5, individual rocks could begin to protrude above the water surface thereby affecting flow conditions and changing the roughness relationship. Bathurst (1991), as presented in HEC-15, provides a method for calculating Manning's roughness coefficient in a range: $0.3 < d_a/D_{50} < 8.0$; shown in the following equations:

$$n = \frac{\propto\ d_a^{1/6}}{\sqrt{g}\, f(Fr) f(REG) f(CG)}$$ **Equation 11**

$$f(Fr) = \left(\frac{0.28Fr}{b}\right)^{\log(0.755/b)}$$ **Equation 12**

$$f(REG) = 13.434 \left(\frac{T}{D_{50}}\right)^{0.492} b^{1.025(T/D_{50})^{0.118}}$$ **Equation 13**

$$f(CG) = \left(\frac{T}{d_a}\right)^{-b}$$ **Equation 14**

$$b = 1.14 \left(\frac{D_{50}}{T}\right)^{0.453} \left(\frac{d_a}{D_{50}}\right)^{0.814}$$ **Equation 15**

Where: $\propto$ = unit conversion constant= 1.49 in English units
d_a = average flow depth in channel (feet)
g = acceleration due to gravity = 32.2 feet per second squared
Fr = Froude number = $V/\sqrt{gd_a}$ (dimensionless)
V = flow velocity, feet per second
REG = roughness element geometry
CG = channel geometry
T = channel top width (feet)
b = parameter describing the effective roughness concentration
D_{50} = mean riprap size (feet)

Equation 10 was used to estimate Manning's roughness coefficient when d_a/D_{50} was greater than 1.5, and Equation 11 was used when d_a/D_{50} was less than 1.5. In the rare cases where d_a/D_{50} was less than 0.3, Equation 11 was used to approximate the Manning's roughness coefficient at d_a = $0.3D_{50}$. For both equations, the interdependency between the flow depth and Manning's roughness coefficient required an iterative solution.

3.2.2 Culvert Sizing

Culverts were sized using the HY-8 program (USDOT, 2009). The technical methods applied in the HY-8 program are based on the FHWA publication *Hydraulic Design Series 5: Hydraulic Design of Highway Culverts* (USDOT, 2005b).

An analysis window was opened for each proposed crossing (see Figure 3-3) and the appropriate design discharge (Section 3.1.1) was input. Various culvert diameters, barrel configurations, and materials were tested to provide Agrium with alternative design solutions that would convey the design discharge without exceeding the defined exceedance criterion. Because all mining roads are private, a culvert was assumed to exceed design only at overtopping conditions as per communication with Agrium on November 16, 2015 (Agrium teleconference communication November 16, 2015). For each culvert, design configurations of 1, 2, or 3 barrels with both corrugated metal pipe (CMP) and high density polyethylene (HDPE) materials were sized (Agrium teleconference communication November 16, 2015). For simplicity, Section 4.3 provides the preferred culvert design alternative for planning purposes. However, final selection of the culvert design will be based on material availability, operational requirements, and economics at the time of construction. Haul road culverts are considered non-permanent, unless requested by the U.S. Forest Service (USFS) to be left on USFS land. In that case, any permanent culverts must be CMP, as required by the USFS. Attachment D provides a summary of the culvert design alternatives that may be selected during implementation of mining operations.

The following assumptions were used in the analysis:

- The length of all culverts was assumed to be 120 feet (except HC6 which is 360 feet), which is equal to the approximate haul road width (100 feet) plus 10-foot buffers on either side of the roadway.
- The slope on all culverts was assumed to be 2 percent, which would equate to a 2.4-foot drop over the assumed 120-foot length (Agrium teleconference communication November 16, 2015).
- Road crest elevation was assumed to be 7 feet above the invert of the culvert pipe.

- Incorporating a measure of conservatism, culvert exceedance criterion of overtopping road did not account the presence of the road berm (see Figure 4-3).
- Culvert alternatives were developed for both CMP and smooth-wall, steel reinforced HDPE pipe.
- The downstream channel was assumed to be 2 percent slope for all culverts, which tended to limit tailwater effects. Thus, the culverts were assumed to be inlet controlled.
- The inlet type for all culverts was assumed to be “conventional” with a thin edge of pipe projecting from the embankment.

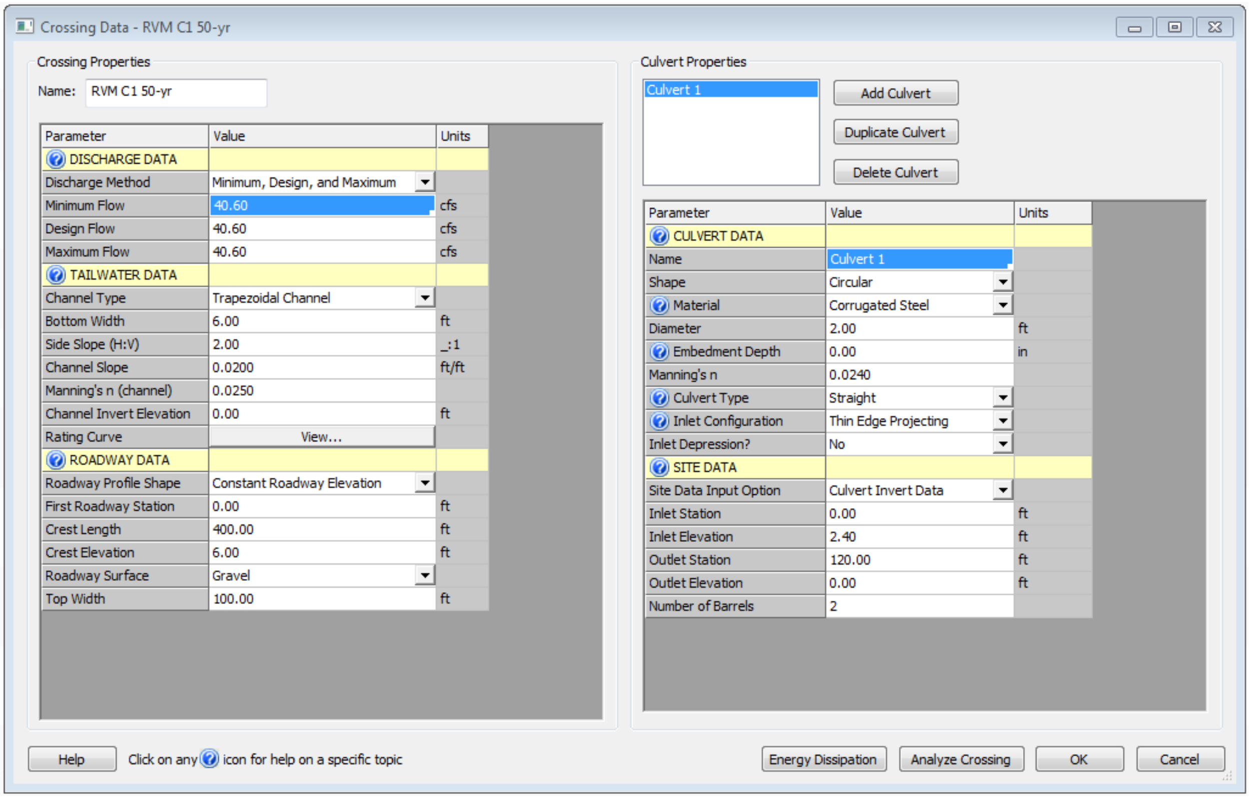

Figure 3-3. HY-8 Analysis Window

3.2.3 Riprap Sizing

Most riprap sizing equations are based on the stability of a characteristic particle size, often the mean rock diameter (D_{50}). The stability of a rock is a function of the size and density of the rock compared with the shear stress exerted on the submerged rock surface by flowing water. For this analysis, stable riprap was sized based on a calculated mean rock diameter. One of four calculation methods was used, depending on the steepness of the channel and whether the hydraulic conditions are assumed to be uniform flow or rapidly varied flow. Uniform flow can be assumed for designing channel lining along conveyance channels, while rapidly varied flow should be assumed at energy dissipating structures.

Gradation and filter design were not completed as part of this analysis; however, these should be addressed during detailed design work.

Uniform Flow: Shallow Slopes (less than 5 percent grade). FHWA’s HEC-15 manual provides a method for calculating stable riprap sizes in uniform prismatic channels with conditions requiring riprap sizes less than 22 inches in diameter (USDOT, 2005a). Sizing is based on permissible shear stress as follows (Equation 16):

$$\tau_p = F_* (\gamma_s - \gamma_w) D_{50}$$ **Equation 16**

Where: τ_p = permissible shear stress (pounds per square foot)
F_* = Shield's parameter (dimensionless)
γ_s = specific weight of the stone = 165 pounds per cubic foot
γ_w = specific weight of the water = 62.4 pounds per cubic foot
D_{50} = mean riprap size (feet)

Permissible shear stress is related to the shear stress at maximum flow depth (τ_d) using a safety factor (*SF*):

$$\tau_p \geq SF \tau_d$$ **Equation 17**

The shear stress at a given flow depth is calculated as follows:

$$\tau_d = \gamma_w d S_o$$ **Equation 18**

Where: τ_d = shear stress at maximum depth (pounds per square foot)
d = maximum channel depth (feet)
S_o = slope of the energy grade line, assumed equal to bed slope (feet/feet)
γ_w = specific weight of the water = 62.4 pounds per cubic foot

Using Equation 17 and Equation 18, Equation 16 can be rewritten as follows:

$$D_{50} \geq \frac{SF\ d\ S_o}{F_*(SG - 1)}$$ **Equation 19**

Where: D_{50} = mean riprap size (feet)
SG = specific gravity of rock = γ_s/γ (dimensionless)

The Shield's parameter in Equation 16 and Equation 19 varies with changes in skin friction and form drag, which have been shown to be related to particle Reynolds number as defined in the following equations (Equation 20 and Equation 21):

$$R_e = \frac{V_* D_{50}}{\nu} \qquad \text{Equation 20}$$

$$V_* = \sqrt{gdS} \qquad \text{Equation 21}$$

Where:

R_e = particle Reynolds number (dimensionless)

V_* = shear velocity (feet per second)

ν = kinematic viscosity = 1.217 x 10^{-5} square feet per second at 60° Fahrenheit

g = gravitational acceleration = 32.2 feet per second squared

d = maximum channel depth (feet)

S = channel slope (feet/feet)

The HEC-15 manual (USDOT, 2005a) recommends that the Shield's parameter in Equation 19 be estimated based on the Reynolds number as shown in Table 3-8. In addition, the safety factor in Equation 19 can be estimated based on the Reynolds number as shown in Table 3-8.

Table 3-8. Selection of Shield's Parameter and Safety Factor

Reynolds Number (*Re*)	Shield's Parameter (*F**)	Safety Factor (*SF*)
< $4x10^4$	0.047	1.0
$4x10^4 < R_e < 2x10^5$	Linear interpolation	Linear interpolation
> $2x10^5$	0.15	1.5

Uniform Flow: Moderately Steep Slopes (5 to 8 percent grade). For slopes at a grade between 5 and 8 percent, a modified version of Equation 19 is used (USDOT, 2005a) with an adjustment factor (Δ) that is a function of channel geometry and riprap size as shown in the following equations:

$$D_{50} \geq \frac{SF\ d\ S_o \Delta}{F_*(SG-1)} \qquad \text{Equation 22}$$

$$\Delta = \frac{K_1(1+sin(\alpha+\beta))\tan \emptyset}{2(cos\theta \tan \emptyset - SF'\ \sin\theta \cos\beta)} \qquad \text{Equation 23}$$

$$\beta = tan^{-1}\left(\frac{\cos\alpha}{\frac{2\sin\theta}{\eta \tan \emptyset} + \sin\alpha}\right) \qquad \text{Equation 24}$$

$$\eta = \frac{\tau_S}{F_*(\gamma_S - \gamma_w)D_{50}}$$ **Equation 25**

$$SF' = \frac{\cos(\theta)\tan(\phi)}{\eta'\tan(\phi) + \sin(\theta)\cos(\beta)}$$ **Equation 26**

$$\eta' = \eta\frac{1 + \sin(\alpha + \beta)}{2}$$ **Equation 27**

$$K_1 = \begin{cases} 0.77 & z \le 1.5 \\ 0.066z + 0.67 \quad for & 1.5 < z < 5 \\ 1.0 & 5 \le z \end{cases}$$ **Equation 28**

Where: D_{50} = mean riprap size (feet)

Δ = steep slope adjustment factor

α = angle of the channel bottom slope

β = angle between weight vector and the weight/drag resultant vector

θ = angle of the channel side slope

ϕ = angle of repose for the riprap

SF' = side slope safety factor

η = stability number

η' = side slope stability number

K_1 = ratio of channel side to bottom shear stress

τ_s = side shear stress (pounds per square foot) = $K_1 \tau_d$

z = horizontal distance to 1 vertical for channel side slope

Uniform Flow: Highly Steep Slopes (greater than 8 percent grade). Preliminary computations using Equation 22 found that calculated mean rock diameters for highly steep slopes exceeded the applicable riprap sizes for the HEC-15 method and were found to be unreasonable. Alternatively, a riprap sizing method developed specifically for highly steep flow conditions was used. Olivier (1967) as presented in Garcia (2008) developed an equation (Equation 29) for calculating mean rock size (D_{50}) on 8 to 45 percent slopes:

$$D_{50} = \frac{5.63q^{2/3}S^{7/9}}{(SG_{rr} - 1)^{10/9}g^{1/3}}$$ **Equation 29**

Where: D_{50} = mean riprap size (feet)

SG = specific gravity of rock = γ_S/γ (dimensionless)

q = unit discharge (cubic feet per second per foot)

S = slope (feet/feet)

SG_{rr} = specific gravity of riprap

g = gravitational acceleration = 32.2 feet per second squared

Rapidly Varied Flow (Energy Dissipators and Flow Spreaders). Riprap for energy dissipators and flow spreaders is sized differently than riprap for channel protection, mainly because the assumption of uniform flow does not hold true. The Isbash equation (Equation 30) as presented in Garcia (2008) and described by USACE (1992), can be used to size riprap for hydraulic structures such as energy dissipators and flow spreaders:

$$D_{50} = \frac{V_a^2}{C^2 2g\left(\frac{\gamma_s - \gamma_w}{\gamma_w}\right)} \qquad \text{Equation 30}$$

Where:

D_{50} = mean riprap size (feet)

V_a = average velocity

C = coefficient = 0.86 for high turbulence

g = acceleration due to gravity = 32.2 feet per second squared

γ_s = specific weight of the stone = 165.36 pounds per cubic foot

γ_w = specific weight of the water = 62.4 pounds per cubic foot

Section 4

Design and Construction

Surface water management design concepts were developed for each mining phase and the fully reclaimed phase at the Site. These design concepts are illustrated in a series of exhibits included at the end of this document (see Table 4-1 below).

Table 4-1. Surface Water Management Exhibits

Exhibit	Mining Phase
A	Phase 1
B	Phase 2
C	Phase 3
D	Phase 4
E	Phase 5
F	Phase 6
G	Phase 7
H	Phase 8
I	Phase 9
J	End of Reclamation

The design concepts shown in Exhibits A through J comprise BMPs designed to meet the specific surface water management objectives as described in Table 2-2. Surface water management BMPs are described below. Each section provides a general description of how the BMPs would be implemented at the Site. In some cases, figures are provided showing typical design details. Where appropriate, possible sizes and dimensions for specific features shown on Exhibits A through J are provided in tabular format. Each BMP was designed based on required capacity. As such the configurations presented are one possible configuration that will provide the required capacities. The dimensions and number of facilities are based on the volume of water that must be managed at each facility. These configurations do not represent the only configurations that may be constructed that will meet the design requirement. As an example, if one sediment basin complex is described as consisting of four basins of a particular dimension totaling a particular storage volume, the number and/or size of the basins will be decided during implementation. The ultimate requirement is that the installed basin capacity at each basin complex must meet or exceed the Total Storage Volume listed in Table 4-5 or Table 4-6.

The recommended BMPs presented in this SWMP are based on anticipated conditions during and at the end of mining operations. During implementation, site conditions will be evaluated to verify the appropriateness of each recommended BMP and make modifications as required to meet the intended design functionality.

4.1 Non-Contact Water

Non-contact water is defined as water (rain, snow, groundwater, etc.) that does not come into contact with Meade Peak material. As supported in the EIS analysis, non-contact water is not impacted by COPCs and therefore is managed for total dissolved solids (TDS) and suspended solids only. The thresholds for these will be defined in the Stormwater Pollution Prevention Plan (SWPPP). The sources of non-contact water on the RVM are the upslope drainage basins, the GM stockpile areas, and the borrow and storage areas. This surface water runoff will be managed separately from contact water (Section 4.2) and will not be allowed to comingle with contact water. An exception to this will be non-contact runoff from several reclaimed backfill and GM stockpile areas between the mine pit and haul, which will be allowed to combine with runoff from the haul road in the runoff collection ditch and will be treated as contact water. This is necessary because of the topography of the area. If non-contact water is inadvertently mingled with contact water, the resulting combined water will be treated as contact water.

4.1.1 Upslope Run-on Management

One of the most important methods for minimizing the risk of impacting surface waters is to intercept and divert runoff from upslope areas around the mine for release below the mine; this runoff water is commonly referred to as “run-on” because it has the potential to flow onto active areas of the mine. Runoff from upslope areas (i.e., run-on) will be intercepted and diverted around mining activities using run-on diversion ditches. Because of the steep slope above HR-5, run-on from areas upslope of HR-5 will not be diverted and will be allowed to combine with runoff from the haul road in the runoff collection ditch. The sediment basins along HR-5 are designed to contain the combined flow. Erosion control BMPs, such as straw wattles, will be installed (if needed) on the road cut slopes to minimize erosion.

Run-on diversion ditches were designed as follows:

- *Design discharge:* All run-on diversion ditches were designed based on the peak discharge from the 50-year, 24-hour storm event plus a 24-hr snowmelt depth of 0.83 in (i.e., the 50-year, 24-hour Design Event). Methods used to calculate the peak design discharges are described in Section 3.1.1. Channel subbasin areas were subdivided at grade breaks in the channels. Peak discharges from the subdivided basins were used when designing the erosion protection.
- *Channel design:* All run-on diversion ditches were designed to capture both overland flow and shallow subgrade flow. An overland ditch was sized to capture and convey overland flow from the entire design event. In addition, a subgrade cutoff trench below the center of the overland channel was included to capture subgrade groundwater. This resulted in a conservative design. Greater understanding of the site-specific hydrology gained as mining progresses will allow adjustment of this design.
- *Channel dimensions:* All run-on diversion ditches will have the following minimum dimensions:
  - Standard bottom width of 4 feet (Agrium teleconference communication November 16, 2015).
  - Side slopes with a minimum ratio of 2H:1V, which are assumed to remain stable for the wide range of soil conditions likely to be encountered onsite.
  - Minimum depth of 1 foot; however, some channels will be constructed with a greater depth to convey the peak design discharge while still maintaining a minimum freeboard depth of 6 inches. Conveyance capacities were evaluated assuming uniform flow conditions as described in Section 3.2.1. The diversion ditch depth does not include channel lining materials such as riprap. If riprap is required for channel protection, then the channel depth needed for flow conveyance must be above the top of the channel lining.
- *Erosion protection:* Where possible, run-on diversion ditches were aligned along contours that will allow the channels to be constructed with a low slope of approximately less than 5 percent.

However, several sections of channel must be constructed down moderate to steep slopes. Recommendations for erosion protection are as follows:

– Run-on diversion ditches with shallow slopes (less than 5 percent) and a permissible velocity of less than 3.5 feet per second (fps) have the option to be either: (1) vegetated with the grass species seed mix listed in Table 4-2, or (2) lined with riprap (USACE, 1994). For the purposes of this plan, the two run-on diversion ditches—INTP1Ea, and INTP7Ec—that meet the criteria for grass-lining were designed conservatively with riprap material.

– Run-on diversion ditches with moderate to steep slopes (greater than 5 percent) will be lined with rock riprap. Recommendations for the size and gradation of the riprap are based on stability calculations using peak flow conditions associated with the Design Event (see Section 3.2.3).

– Energy dissipators will be constructed at the downstream end of steep reaches to reduce flow velocities and control highly erosive turbulent flow regimes.

– Flow spreaders will be constructed at the downstream outfall of ditches if the outlet is a significant distance from a natural drainage way and there is no energy dissipator proposed. The purpose of the flow spreader is to distribute and dissipate energy prior to entering the downstream receiving channel. Flow spreaders were not placed at the outlet of culverts because a separate armoring specification is required for culverts.

Table 4-2. Seed Mix for Diversion Ditches

Scientific Name	Common Name	Seeds/lbs	Seeds/lbs /sq ft/ac	Recommended PLS (lbs/ac)	% of Seed Mix	PLS/sq ft	% of PLS/sq ft
Grasses:							
Bromus marginatus	Mountain Brome	64,080	1	12	31.6	17.6	26.9
Leymus cinereus	Great Basin Wildrye	130,000	3	8	21.1	23.8	38.4
Pascopyrum smithii	Western Wheatgrass	113,840	3	8	21.1	21.0	32.1
Triticum aestivum x Secale cereale	Quickguard	13,000	0	10	26.3	3.0	4.6
Recommended Overall Totals for Broadcast Seeding[a]				38	100.0	65.4	100.0

Notes:

[a]Reduce rate by 50 percent if drill seeding.

Abbreviations:

ac = acre.

lbs = pound.

PLS = pure live seed.

sq ft = square foot.

- *Subgrade cutoff trench*: In the diversion ditches to be located upslope of the pit, a subgrade cutoff trench will be incorporated below the diversion ditch invert to capture shallow subgrade flow. This BMP is an incorporation of the lessons learned through the Lanes Creek Mine (LCM) water management. At the LCM, run-on water was observed flowing both overland as well as simultaneously entering the subgrade and traveling at shallow depths with the topography and expressing farther down gradient. This BMP was implemented successfully at LCM to divert non-contact run-on water around the mining areas. The general topography and location of the mine toward the toe of the ridge at RVM is similar to that found at LCM; therefore, subgrade flow is also expected at RVM. While the Design Event has been conservatively calculated, the proportional amount and rate of flow between surface and shallow subgrade, as well as depth to bedrock are all unknowns; therefore, the following assumptions and criteria were applied:

– The run-on diversion ditch has been designed to accommodate the entire Design Event.
– Depth of trench will be uniform with the channel surface. Actual depth will be field determined.
– The pipe size of the cutoff trench drain is 12-inch-diameter, based on the range of typical and reasonable subsurface pipe sizes, not on a particular flow.
– The trench will be filled with drain rock starting from below the pipe up to the surface of the overland flow channel to allow for subsurface flow to daylight if the pipe reaches maximum capacity as well as to allow surface flow to enter the trench. Vertically interconnecting these two drainage systems, the ditch and the trench, increases the overall capacity.

Hydraulic estimates and design parameters for the run-on diversion ditches are provided in Table 4-3 and Table 4-4, respectively.

Table 4-3. Hydraulic Design Estimates for Proposed Run-On Diversion Ditches

Feature ID[a]	Lifespan (phases)	Design Discharge[b] (cfs)	Peak Flow Velocity[c] (fps)	Flow Depth[c] (feet)	Maximum Shear Stress[c] (psf)	Stable Rock Diameter[d] (inches)
INTP1Ea	1–9	3.8	2.0	0.40	0.9	2.3
INTP1Eb	1–EOR	12.0	5.6	0.44	3.1	4.6
INTP1Ec	1–9	90.4	4.4	2.35	1.7	6.2
INTP1Wa	1–9	1.2	2.5	0.11	1.6	1.6
INTP1Wb	1–4	62.2	4.5	1.81	2.3	7.0
INTP1Wc	1–9	64.8	9.9	1.07	10.4	16.7
INTP1Wd	1–2	70.6	8.4	1.28	4.9	8.9
INTP3Ea	3–9	66.2	4.9	1.79	2.6	7.6
INTP3Eb	3–EOR	82.6	4.8	2.09	3.4	8.6
INTP4Ea	4–EOR	88.7	3.8	2.56	0.9	3.6
INTP4Eb	4–EOR	90.7	6.6	1.81	7.5	11.7
INTP4Ec	4–7	93.7	4.4	2.40	1.3	5.4
INTP5Eb	5–EOR	60.4	8.2	1.16	5.2	8.8
INTP5Ec	5–9	66.2	3.5	2.22	0.9	3.3
INTP5Wa	5–9	30.3	5.2	0.99	4.0	5.6
INTP6Wa	6	18.2	4.9	0.69	2.5	3.9
INTP7Ec	7–EOR	58.6	3.5	2.07	0.9	3.4

Notes:

[a]Run-on diversion ditches were given IDs generally based on the following:

- *Feature type where INT = interceptor channel, also referred to as run-on diversion ditches.*
- *P# for the phase number in which the feature is constructed.*
- *Directional (e.g., E for east) when there was more than one channel constructed during a phase.*
- *Letter (e.g., a, b) when a channel was subdivided based on grade breaks. Features were labeled alphabetically starting at the upstream end.*

[b]Design discharge is estimated using the design event that includes the design storm plus snowmelt. The design event was selected using risk-based approach and anticipated life of structure. The 50-yr design storm was selected for all diversion ditches. The design storm

peak discharge was estimated using SCS methods as presented in Section 3.1.1. Snowmelt was estimated as discussed in Section 3.1.1.1.

[c]Hydraulic estimates are calculated assuming uniform flow conditions as described in Section 3.2.1.

[d]Stable rock diameter for riprap design is calculated using the method presented in Section 3.2.3.

Abbreviations:

EOR = end of reclamation.

cfs = cubic feet per second.

fps = feet per second.

psf = pound per square foot.

Table 4-4. Design Parameters for Proposed Run-On Diversion Ditches

Feature ID[a]	Lifespan (phases)	Channel Bed Slope[b] (ft/ft)	Channel Side Slopes[c] (H:V)	Total Depth of Channel[d] (feet)	Free-board[e] (feet)	Subgrade Cutoff Trench (Y/N)	Riprap Lining Type[f]	Riprap Optional (Y/N)[g]
INTP1Ea	1–9	0.04	2:1	1.0	0.6	Yes	Type H	Yes
INTP1Eb	1–EOR	0.14	2:1	1.0	0.6	No	Type H	No
INTP1Ec	1–9	0.06	2:1	3.0	0.7	No	Type I	No
INTP1Wa	1–9	0.24	2:1	1.0	0.9	Yes	Type H	No
INTP1Wb	1–4	0.03	2:1	2.5	0.7	Yes	Type I	No
INTP1Wc	1–9	0.22	2:1	2.0	0.9	Yes	Type K	No
INTP1Wd	1–2	0.09	2:1	2.0	0.7	No	Type J	No
INTP3Ea	3–9	0.04	2:1	2.5	0.7	Yes	Type I	No
INTP3Eb	3–EOR	0.04	2:1	3.0	0.9	Yes	Type J	No
INTP4Ea	4–EOR	0.01	2:1	3.5	0.9	Yes	Type H	No
INTP4Eb	4–EOR	0.11	2:1	2.5	0.7	Yes	Type J	No
INTP4Ec	4–7	0.01	2:1	3.0	0.6	Yes	Type H	No
INTP5Eb	7–EOR	0.10	2:1	2.0	0.8	Yes	Type J	No
INTP5Ec	5–9	0.01	2:1	3.0	0.8	No	Type H	No
INTP5Wa	5–9	0.09	2:1	1.5	0.5	No	Type H	No
INTP6Wa	6	0.08	2:1	1.5	0.8	Yes	Type H	No
INTP7Ec	7–EOR	0.01	2:1	3.0	0.9	Yes	Type H	Yes

Notes:

[a]Run-on diversion ditches were given IDs generally based on the following:

- *Feature type where INT = interceptor channel, also referred to as run-on diversion ditches.*
- *P# for the phase number in which the feature is constructed.*
- *Directional (e.g., E for east) when there was more than one channel constructed during a phase.*
- *Letter (e.g., a, b) when a channel was subdivided based on grade breaks. Features were labeled alphabetically starting at the upstream end.*

[b]Bed slope is estimated using site topography and proposed channel alignment.

[c]Channel side slopes are assumed to be 2H:1V for all run-on diversion ditches. Channel bottom width is assumed to be 4 feet for all run-on diversion ditches.

[d]Flow depth is calculated assuming uniform flow conditions as described in Section 3.2.1. Depth is rounded up to nearest half-foot increment (including a minimum of 6 inches of freeboard).

[e]A minimum of 6 inches of freeboard is assumed.

[f]Riprap lining type is selected such that the mean rock diameter (D_{50}) is greater than the calculated stable rock diameter. Riprap gradation by type is described in Table 4-9. To simplify for operations, the riprap size can be rounded up so that design Type H can be replaced by Type I, and design Type J can be replaced by Type K.

[g]Riprap lining is optional for ditches with a slope less than 5% and a scour velocity less than 3.5 fps. At a minimum, all ditches will be grass-lined.

Table 4-4 Abbreviations:

EOR = end of reclamation.

ft/ft = foot per foot.

H:V = horizontal to vertical.

4.1.2 Typical Run-on Diversion Ditch

Figure 4-1 is a cross-sectional drawing of a typical earthen or grass-lined run-on diversion ditch with a subgrade cutoff trench.

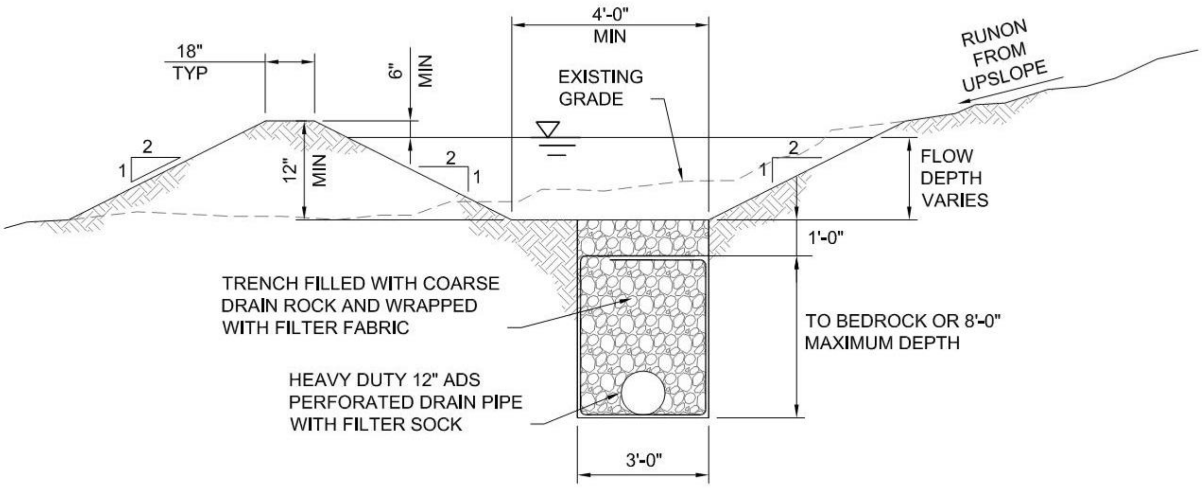

Figure 4-1. Cross-section for Typical Earthen or Grass-lined Run-on Diversion Ditch

Figure 4-2 is a cross-sectional drawing of a typical riprap lined run-on diversion ditch with a subgrade cutoff trench. The selection of an earthen channel versus a riprap lined channel is based on the design scour velocity. The scour velocity differs depending on the construction material of the channel. In the case of RVM, the earthen material is assumed to be silt/clay, providing a scour velocity of 3.5 fps (USACE, 1994). Riprap is proposed for all diversion ditches; however, channels with a velocity below the scour velocity can be grass-lined depending on the operational conditions at the time of construction. Table 4-4 lists the run-on diversion ditches that can be grass-lined.

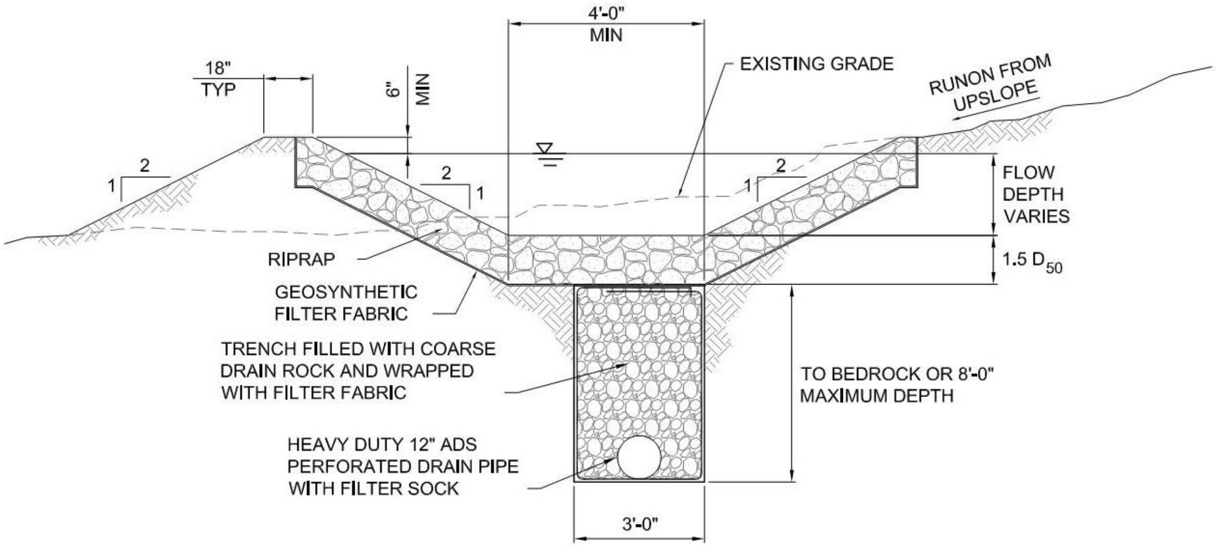

Figure 4-2. Cross-section for Typical Riprap-lined Run-on Diversion Ditch

4.1.3 Disturbed Surfaces and Slopes

Although most mining activities will occur within the mining pits, some disturbance will occur outside the pits. These disturbances could include cut/fill slopes on haul roads, staging areas, temporary overburden piles, GM stockpile areas, and the borrow and storage areas. IMASC (2000) describes numerous BMPs for controlling erosion and COPC transport on disturbed surfaces and slopes. A few general types of BMPs are described below:

- *Topsoil management and revegetation:* Reclamation of disturbed mining lands through revegetation can reduce infiltration and erosion by encouraging evapotranspiration of rainfall and retarding excess overland flows. Proper BMP selection with respect to site conditions can promote successful vegetation establishment and mitigate against selenium uptake and subsequent contamination of the wildlife food chain.
- *Snow management:* Snow removal is necessary for the continuation of mine operations during winter months. Proper management of snow can mitigate against unwanted impacts of excess surface and subsurface runoff from melting snow. Management will include the utilization of disposal sites for snow that will keep contact snow (i.e., contact water) segregated from non-contact snow (i.e., non-contact water).
- *Sediment management:* An abundance of BMPs are available for capturing sediment mobilized from disturbed slopes. Common examples include straw bale barriers, silt fencing, wattling, vegetated buffer zones, gravel filter berms, and sediment basins.

Runoff from the GM stockpile areas and the borrow and storage areas is considered non-contact water; therefore, complete retention of the 100-year Design Event volume is not necessary. Therefore, sediment basins for these areas may be designed as flow-through detention basins with an outlet control to provide attenuation of the peak discharge and adequate settling of sediment. In addition, infiltration of runoff is permissible for non-contact water; therefore, the sediment basins for non-contact water will be unlined, as there is no concern of selenium contamination from non-contact water. Table 4-5 provides minimum detention volume requirements (Total Storage Volume) and one possible configuration for each of the proposed non-contact water sediment basin complexes.

Table 4-5. Design Parameters for Proposed Non-Contact Water Sediment Basins								
Feature ID[a]	Downstream Culvert ID	Modeled Phase	Lifespan (Phases)	Estimated Runoff Volume (cu ft)[b]	Total Storage Volume (cu ft)[c,d]	Total Footprint (sq ft)	Number of Basins[d,e]	Unit Dimensions (LxWxH)[c,d,e]
SB-GM1	No culvert	1	1–9	94,624	62,000	28,900	3	166 x 58 x 7
SB-GM2	No culvert	1	1–9	52,632	34,000	16,900	2	146 x 40 x 7
SB-GM3	No culvert	1	1–9	41,992	26,800	14,600	2	126 x 58 x 7
SB-GM4	No culvert	1	1–9	117,763	75,900	36,200	4	156 x 58 x 7
SB-GM5	No culvert	1	1–9	104,265	65,500	32,700	4	141 x 43 x 7
SB-GM6	No culvert	1	1–9	61,274	38,000	18,100	2	156 x 58 x 7
SB-GM7	No culvert	5	5–9	119,691	82,000	38,500	4	166 x 58 x 7
SB-GM8	No culvert	5	5–9	81,056	51,500	25,400	3	146 x 40 x 7

Notes:

[a]Sediment basins were given IDs generally based on the following:

- *Feature type where SB = Sediment Basin.*
- *GM = growth medium.*
- *Numbers added sequentially moving from east to west following phased mine development.*

[b]Runoff volume is based on 100-year, 24-hour Design Event; losses are estimated using SCS method (see Section 3.1.1.).

[c]Borrow and storage area basins were sized as flow-through detention basins with a minimum spillway height of 6 feet. Assumed standard basin size: varying length (L), width (W) = 58 feet, storage depth = 6 feet, freeboard = 1 foot, total height (H) = 7 ft. Outlet control will be provided by a rectangular weir spillway at 6 feet, a low flow orifice with varying diameter (2.5 to 4.5 inches) and minimal infiltration out the bottom of the basin, based on a measured saturated hydraulic conductivity for the native soil of 3x10-6 centimeters per second.

[d]The number of basins required is equal to the runoff volume divided by the standard basin volume, rounded up to the nearest integer.

[e]The configurations presented are one possible configuration that will provide the required capacities and do not represent the only configurations that will meet the design requirement. The number and/or size of the basins will be decided during construction and will meet or exceed the required Total Storage Volume.

Abbreviations:

cu ft = cubic feet.

ft = feet.

sq ft = square feet.

4.2 Contact Water

Contact water is defined as water (rain, snow, groundwater, etc.) that comes into contact with Meade Peak waste. Contact water is considered to be transporting COPCs, and is managed for a variety of COPCs. The thresholds for these will be defined in the SWPPP. This assumption is supported by the geochemical baseline program performed under the NEPA process. Full details of this program and the results are available in the EIS for the RVM. The sources of contact water on the RVM are any water collected; down gradient of the run-on diversion ditches and up gradient of the haul road as well as directly off the haul road. This water will be managed separately from non-contact water and will not be allowed to intermingle with non-contact water. If contact water is inadvertently mingled with non-contact water, the resulting combined water will be treated as contact water.

4.2.1 Pit Water management

Throughout the course of the mining activities, water can pool in the bottom of the pit even when run-on diversion ditches are used to divert surface runoff away from the pit walls. Sources of pit water include direct rainfall, snowmelt, and groundwater exfiltration. As pit water accumulates, it may be necessary to dewater active pits to facilitate mine operations. Pit water is classified as contact water and therefore, discharge of pit water to open drainages outside the pit is not allowed unless the conditions for discharge as established in the SWPPP are met. Therefore, pit water will be transported to areas of un-reclaimed active backfill within the pit area. Release of pit water to backfill areas will allow for infiltration of pit water into the porous un-reclaimed media.

4.2.2 Roadway Runoff and Crossings

Proper roadway drainage and implementation of erosion control BMPs can reduce the mobilization and transportation of sediments from haul roads to nearby drainages. Runoff water from haul roads will be managed as contact water.

4.2.2.1 Runoff Collection Ditches

Haul roads may be constructed with sloped surfaces, allowing for positive drainage toward the inside of the roadway where runoff collection ditches can be constructed to capture and convey roadway runoff. Figure 4-3 shows typical roadway cross-sections for various cut-fill slope scenarios. Collection ditches will be routed to sediment basins that allow runoff to be captured.

When haul roads are constructed, culverts will be installed as shown in Exhibits A through J.

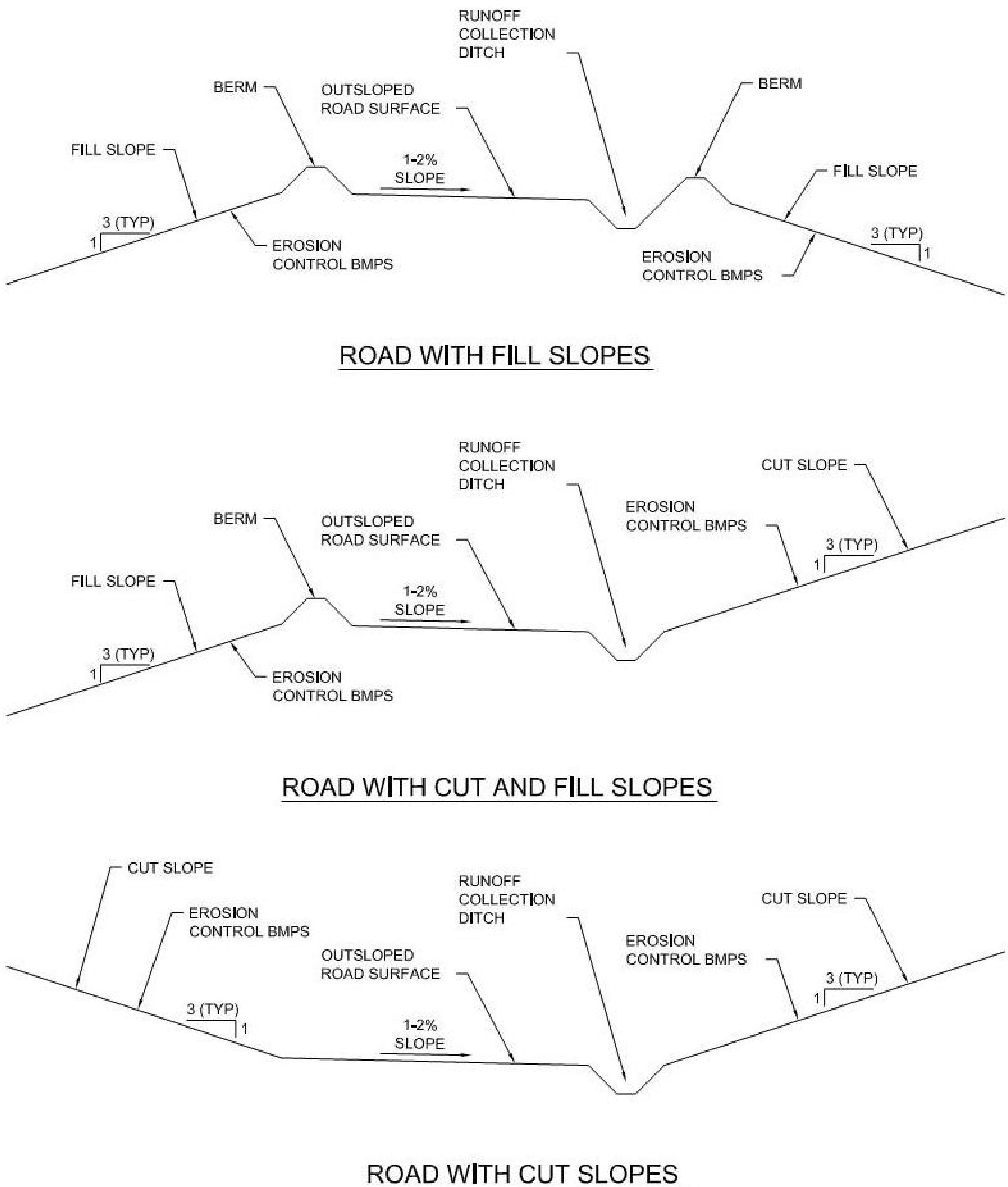

Figure 4-3. Typical Cross-sections Showing Sloping and Drainage for Roadways

4.2.2.2 Haul Road Runoff Basins

Roadway runoff is classified as contact water and complete retention of the 100-year Design Event volume is necessary. Therefore, sediment basins for the haul road and associated areas will be designed as retention basins. For all access ramps that do not directly drain into the pit, a series of sediment basins will be constructed to capture and retain runoff. Any of these contact-water sediment basins not within the pit footprint will be constructed to limit percolation into the alluvial aquifer using synthetic or compacted natural materials subject to BLM approval before construction. Water that accumulates in these sediment basins will be allowed to evaporate or be pumped onto unreclaimed backfill or into the mine pit where it will be combined with stormwater runoff within the pit and managed as pit water. If any sediment basin is found to be holding contact water for an extended period of time, the design and/or operation of the basin would be adapted in a manner that discourages use by wildlife. All sediment basins will be maintained, as needed, to provide sufficient capacity to accommodate the Design Event volume."

Contact-water sediment basins collect and store sediment from surface runoff by allowing particles to settle to the bottom of the basin while runoff is retained and evaporated/transported to other approved areas or flows over the emergency spillway. A sediment basin can be formed by excavation or retrofitting a natural ground surface depression to provide sufficient volume and retention time to allow sediment deposition during the Design Event flow. These temporary BMPs prevent heavy sediment loads caused by disturbed surface runoff from reaching natural drainages.

Sediment basins were designed as follows:

- *Design volume:* Sediment basins were designed to retain runoff from the 100-year, 24-hour Design Event. Sediment basin locations were determined based on the topography of the haul roads and the adjacent land. Methods used to calculate the peak design discharges are described in Section 3.1.
- *Standard basin size:* To determine the maximum footprint for each sediment basin for the purposes of this SWMP, a standard basin width and depth with varying length was developed. However, the length, width, and depth of the basins can be varied to fit within the constraints of the installation site as long as the total capacity of the basin complex is equal to or greater than the Total Storage Volume in Table 4-5. A typical basin size has been developed with dimensions as follows:
  - Sediment basins will have a 9-foot storage depth plus 1 foot of freeboard for a total depth of 10 feet.
  - Sediment basins will have side slopes with a ratio of 2H:1V.
  - The inlet to the sediment basin will have a maximum slope of 3H:1V.
  - Above-grade embankments will have side slopes with a ratio of 2H:1V.
  - The embankment on the downstream end of the basin will have an emergency spillway lined with riprap, which will allow water to discharge during an extreme event that exceeds the design event. The crest of the spillway should be 1 foot below the top of the basin.
  - Sediment basins will have a bottom width to the inlet channel width ratio of 3W:1W. The top width will range from 52 to 58 feet.
  - Sediment basins will have a varying length of 101 to 176 feet including a downstream embankment.
- *Number of sediment basins:* The standard dimensions described above provide storage ranging from approximately 15,000 to 43,500 cubic feet per basin. The design capacity of the basin

complex at each location was divided by the estimated storage capacity per basin to determine the number of sediment basins required at each location. Although the dimensions of individual basins may vary depending on site constraints, a series of smaller basins may be necessary to avoid basins that are excessively long or deep.

Figure 4-4 shows a typical sediment basin. Table 4-6 provides minimum retention volume (Estimated Runoff Volume) requirements and one possible configuration for each of the proposed contact water sediment basin complexes.

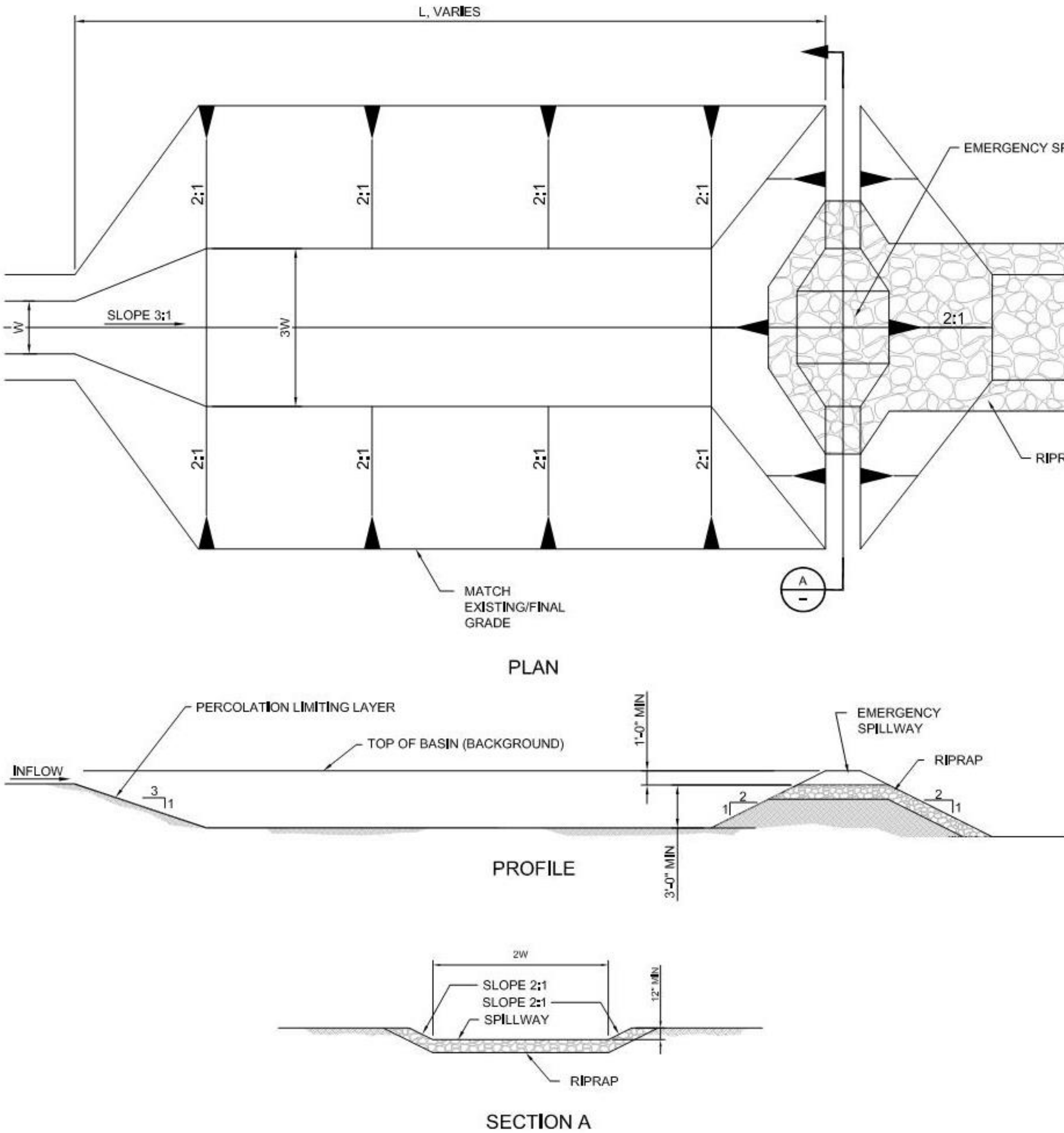

Figure 4-4. Typical Sediment Basin Configuration

Table 4-6. Design Parameters for Proposed Contact Water Sediment Basin Complexes								
Feature ID[a]	Downstream Culvert ID	Modeled Phase	Lifespan (phases)	Estimated Runoff Volume (cu ft)[b]	Total Storage Volume (cu ft)	Total Footprint (sq ft)	Number of Basins[c,e]	Unit Dimensions (LxWxH)[d,e]
SB-R1	C1	1	1–9	148,824	157,000	38,500	4	166 x 58 x 10
SB-R2	C2	1	1–9	53,631	55,000	17,600	3	101 x 58 x 10
SB-R3	C3	1	1–9	16,425	18,000	5,900	1	101 x 58 x 10
SB-R4	C4	3	3–9	84,553	94,000	24,500	3	141 x 58 x 10
SB-R5	C5	4	4–9	150,253	156,000	40,900	5	141 x 58 x 10
SB-R6	C5	5	5–9	84,053	94,000	24,500	3	141 x 58 x 10
SB-R7	C6	5	5–9	116,903	131,000	33,900	4	146 x 58 x 10
SB-R8	C6	3	3–9	143,469	148,000	36,900	4	159 x 58 x 10
SB-R9	C7	4	4–9	16,425	18,000	5,900	1	101 x 58 x 10
SB-R10	C7	4	4–9	14,497	15,000	5,900	1	101 x 52 x 10
SB-R11	C8	4	4–9	153,110	156,000	40,900	5	141 x 58 x 10
SB-R12	C8	4	4–9	30,422	31,000	11,900	2	103 x 52 x 10
SB-R13	C9	5	5–6	20,282	21,000	6,400	1	111 x 58 x 10
SB-R14	C9	5	5–9	162,821	170,000	40,800	4	176 x 58 x 10
SB-R15	C10	5	5–9	22,709	25,000	7,000	1	121 x 58 x 10
SB-R16	C10	5	5–9	71,984	74,000	18,400	2	159 x 58 x 10
SB-R17	HC4	7	5–7	62,773	64,000	19,300	3	111 x 58 x 10
SB-R18	C9	8	8–9	141,971	148,000	42,100	6	121 x 58 x 10
SB-R19	C11	8	8–9	45,419	49,000	14,000	2	121 x 58 x 10
SB-HC1	HC1/HC2/C8	4	4	27,995	29,000	7,800	1	134 x 58 x 10
SB-HC2	HC2/C8	4	4	145,328	148,000	36,900	4	159 x 58 x 10
SB-OB1	C6	5	5–9	179,676	185,000	46,100	5	159 x 58 x 10
SB-OB2	C8	6	6–9	180,606	185,000	46,100	5	159 x 58 x 10
SB-PS1	No culvert	7	7	139,113	148,000	36,900	4	159 x 58 x 10
SB-PSP5a	C10	5	5	79,198	84,000	22,800	3	131 x 58 x 10
SB-PSP5b	C10	5	5	30,422	31,000	8,200	1	141 x 58 x 10

Notes:

[a]Sediment basin complexes were given IDs generally based on the following:

- *SB = Sediment Basin.*
- *R = Roadway.*
- *HC = Temporary pit haul road culvert.*
- *OB = Overburden Pile.*
- *PS = Pre-stripping Area.*
- *Numbers generally added sequentially moving from east to west following phased mine development.*

[b]Runoff volume is based on 100-year Design Event; (see Section 3.1.1).

[c]The number of basins required is equal to the runoff volume divided by the standard basin volume, rounded up to the nearest integer. To be adjusted as basin complex site dictates.

[d]Assumed standard basin size: varying length (L), width (W) = 52 to 58 feet, storage depth = 9 feet, freeboard = 1 foot (total = H). To be adjusted as basin complex site dictates.

[e]The configurations presented are one possible configuration that will provide the required capacities and do not represent the only configurations that will meet the design requirement. The number and/or size of the basins will be decided during construction and will meet or exceed the required Estimated Runoff Volume.

Table 4-6 Abbreviations:

cu ft = cubic feet.

sq ft = square feet.

4.2.2.3 Excessive Runoff Management

For the phases in which sediment basins are not sized to store contact water from pre-stripping areas prior to excavation of the pit, pumping systems may be required. Specifically, in Phase 5 prior to excavation, there will be a large upslope pre-stripping area that drains to the haul road sediment basin complexes. If a large storm event occurs, pumping of the haul road sediment basins may be needed. Therefore, piping infrastructure will be placed within the same alignment as the haul road to create interconnected stormwater basin network to facilitate pumping for potential scenarios in which the sediment basins may exceed capacity. This piping infrastructure may be constructed concurrently with the construction of the haul road, i.e., incremental installation. The excess water will be transported onto unreclaimed backfill within the pit area. Release of excess water in sediment basins to backfill areas will allow for infiltration of excess runoff into the porous un-reclaimed media.

4.3 Culverts

Culverts are necessary to convey non-contact water under the haul roads. Run-on ditches upslope of the pit will intercept and divert non-contact run-on around the pit and into undisturbed drainages ahead of (i.e., east of) the active pit phase. As mining progresses and the pit phases are backfilled, re-established drainage channels will be constructed across the pit backfill to convey the upslope run-on into natural drainages. Where haul roads cross those drainages, culverts will be installed under the roads to maintain flow. The culverts will be removed during reclamation unless requested to be left in place by the USFS for long-term access. Specific culvert sizing design assumptions are discussed in Section 3.2.2.Culverts crossings were designed as follows:

- *Design discharge:* Most culverts were designed based on the peak discharge from the 50-year Design Event. Culverts C9 and HC3 were designed based on the 100-year, 24-hour Design Event due to the large contributing drainage area and the greater environmental impact potential should failure occur. Methods used to calculate the peak design discharges are described in Section 3.1.
- *Culvert sizes:* Methods for sizing culverts are described in Section 3.2.2. Alternative culvert sizes range from 12 to 48 inches, assuming single, double, and triple barrel configurations. Hydraulic estimates and design parameters for a single proposed culvert alternative are provided in Table 4-7and Table 4-8. Attachment D provides the complete list of culvert design alternatives that were analyzed and that may be selected during implementation of mining operations.
- *Culvert Material:* Culvert alternatives were developed for both CMP and smooth-wall, steel reinforced HDPE pipe. Table 4-7 and Table 4-8 assume CMP culverts are used. Alternative sizing scenarios for both CMP and HDPE culverts are presented in Table D-1 (Attachment D).
- *Erosion protection:* Each culvert location will require rock protection at the inlet and outlet to provide erosion protection.
  - *Inlet protection:* At some culvert locations, the upstream drainage is steep prior to any earth-disturbing activities. As the drainage approaches the culvert, energy dissipation will be necessary to protect the culvert inlet from erosion. Riprap just upstream of the culvert inlet and at the inlet will be sized based on site conditions.

– *Outlet protection:* Figure 4-7 shows typical rock protection at a culvert outlet. Stable rock diameter for the outlet protection was estimated based on the culvert exit velocity (see Section 3.2.3). Riprap lining type was selected such that the mean rock diameter (D_{50}) is greater than the calculated stable rock diameter. Riprap gradation by type is described in Section 3.2.3.

Table 4-7. Hydraulic Design Estimates for Proposed Culvert Crossings

Feature ID[a]	Lifespan (phases)	Design Event	Probability of Exceedance During Lifespan[b]	Design Discharge (cfs)	Headwater Depth[c] (feet)	Outlet Depth (feet)[d]	Exit Velocity[d] (fps)	Stable Rock Diameter[e] (inches)
C1	1–9	50-yr, 24-hr	10%	34.6	5.6	1.81	7.78	9.2
C2	1–9	50-yr, 24-hr	10%	15.9	4.5	1.22	5.96	5.4
C3	1–9	50-yr, 24-hr	10%	91.6	5.6	1.80	8.37	10.7
C4	1–9	50-yr, 24-hr	10%	18.1	5.4	1.53	7.02	7.5
C5	1–9	50-yr, 24-hr	10%	101.7	5.8	1.91	8.61	11.3
C6	1–9	50-yr, 24-hr	10%	93.8	5.6	1.82	8.41	10.8
C7	1–9	50-yr, 24-hr	10%	90.6	5.5	1.76	8.30	10.5
C8	4–9	50-yr, 24-hr	8%	41.3	5.3	1.69	8.16	10.2
C9	5–9	100-yr, 24-hr	4%	188.8	6.0	2.05	8.87	12.0
C10	5–9	50-yr, 24-hr	7%	66.4	5.5	1.76	7.71	9.1
C11	8–9	50-yr, 24-hr	3%	10.2	6.0	1.22	6.52	6.5
HC1	4	50-yr, 24-hr	2%	2.4	3.6	0.66	4.37	2.9
HC2	4	50-yr, 24-hr	2%	21.3	4.7	1.35	6.91	7.3
HC3	5–6	100-yr, 24-hr	2%	178.4	5.9	2.03	8.85	12.0
HC4	5–6	50-yr, 24-hr	5%	9.2	5.2	1.17	6.23	5.9
HC5	6	50-yr, 24-hr	3%	16.7	5.2	1.47	6.74	6.9
HC6	7	50-yr, 24-hr	3%	4.2	3.6	0.77	4.61	3.2
HC7	2	50-yr, 24-hr	2%	4.4	3.7	0.79	4.67	3.3
HC8	3	50-yr, 24-hr	3%	25.3	5.0	1.49	7.23	8.0
HC9	4	50-yr, 24-hr	2%	10.3	6.0	1.22	6.53	6.5

Notes:

[a]Culverts were given IDs generally based on the following:

- *C = Main access haul road culvert.*
- *HC = Temporary pit access ramp culvert.*
- *Numbered sequentially from east to west.*

[b]Probability of failure (Pn) was calculated as the sum of the probabilities of the design event (Tr) occurrence during each year of the structure's lifespan (n, years). Probability Equation: Pn = 1-[(Tr -1)/Tr]^n. See Table 2-3 for lifespan of each phase.

[c]Culverts were sized to the failure criterion of roadway overtopping, assuming a maximum headwater depth of 6 feet and a minimum freeboard of 1 foot.

[d]Culvert hydraulics were calculated using the HY8 modeling program as described in Section 3.2.2.

[e]Stable rock diameter is estimated based on culvert exit velocity (see Section 3.2.3).

Abbreviations:

cfs = cubic feet per second.

fps = feet per second.

Table 4-8. Design Parameters for Proposed Culvert Crossings								
Feature ID[a]	Modeled Phase	Lifespan (phases)	Culvert Length[b] (feet)	Slope on Culvert[c] (ft/ft)	Pipe Material[d]	Pipe Diameter[e] (inches)	Parallel Culvert Barrels[e]	Outlet Riprap Protection Type[f]
C1	1	1–9	120	0.02	CMP	36	1	Type J
C2	1	1–9	120	0.02	CMP	24	1	Type I
C3	1	1–9	120	0.02	CMP	48	2	Type K
C4	2	1–9	120	0.02	CMP	24	1	Type J
C5	5	1–9	120	0.02	CMP	48	2	Type K
C6	1	1–9	120	0.02	CMP	48	2	Type K
C7	7	1–9	120	0.02	CMP	48	2	Type K
C8	4	4–9	120	0.02	CMP	48	1	Type K
C9	5	5–9	120	0.02	HDPE	48	3	Type K
C10	7	5–9	120	0.02	CMP	36	2	Type J
C11	4	8–9	120	0.02	CMP	18	1	Type J
HC1	4	4	120	0.02	CMP	12	1	Type H
HC2	4	4	120	0.02	CMP	36	1	Type J
HC3	5	5–6	120	0.02	HDPE	48	3	Type K
HC4	5	5–6	120	0.02	CMP	18	1	Type I
HC5	6	6	120	0.02	CMP	24	1	Type J
HC6	7	7	360	0.02	CMP	18	1	Type H
HC7	2	2	120	0.02	CMP	18	1	Type H
HC8	3	3	120	0.02	CMP	36	1	Type J
HC9	4	4	120	0.02	CMP	18	1	Type J

Notes:

[a]Culverts were given IDs generally based on the following:

- *C = Main access haul road culvert.*
- *HC = Temporary pit access ramp culvert.*
- *Numbered sequentially from east to west.*

[b]All culverts (except HC6, which has an assumed length of 360 feet) are assumed to be 120 feet long: 100-foot roadway width plus an additional 20 feet.

[c]All culverts are assumed to be constructed with a 2 percent slope. Assuming a culvert length of 120 feet, the total drop on the culvert from inlet to outlet would be 2.4 feet.

[d]All culverts are assumed to be CMP.

[e]Culverts were sized to the failure criterion of overtopping, with a maximum headwater depth of 6 feet and a minimum freeboard of 1 foot.

[f]Riprap lining type is selected such that the mean rock diameter (D_{50}) is greater than the calculated stable rock diameter. Riprap gradation by type is described in Section 3.2.3. To simplify for operations, the riprap size can be rounded up so that design Type H can be replaced by Type I, and design Type J can be replaced by Type K.

Abbreviations:

CMP = corrugated metal pipe.

ft/ft = foot per foot.

4.4 Turbulent Flow Armoring

The Site is located in steep, rugged terrain. Many of the channels described in the previous sections will have steep bed slopes and will carry high-energy, turbulent flows during large events. Structures will need to be installed at major grade breaks or at terminal points to dissipate energy, and in many cases, distribute the flow over a wider area. Two types of structures have been designed for this purpose: energy dissipators and flow spreaders.

Some culvert inlets and all culvert outlets will experience high velocity and turbulent flows. These structures will require armoring against scouring. Riprap aprons have been designed to a minimum mean riprap diameter and dimensions for these structures.

4.4.1 Riprap

Table 4-9 summarizes the riprap design parameters based on the methodology described in Section 3.2.3. As noted, the prescribed riprap sizing can be rounded up to simplify operations.

Table 4-9. Design Parameters for Riprap

Parameter		Type H	Type I[a]	Type J	Type K[a]	Type L
Gradation[b] by Rock Diameter (inches)	D_{max}	12	16	18	24	30
	D_{50}	6	8	12	18	24
	D_{15}	3	4	6	9	12
Thickness[c] (inches)		9	12	18	27	36
Filter Layer[d]		Geo. fabric	Geo. fabric	Geo. fabric	Geo. fabric	Geo. fabric

Notes:

[a] *To simplify for operations, the riprap size can be rounded up so that design Type H can be replaced by Type I, and design Type J can be replaced by Type K. Type L is used for a few re-established channels, which require a larger diameter riprap than Type K can provide.*

[b] *Gradation is based on recommendations from U.S. Department of the Interior (USDOI, 1982).*

[c] *Riprap layer thickness should be equal to 1.5 times D_{50}.*

[d] *Use of a geosynthetic filter fabric is recommended for all applications; however, a gravel-rock filter blanket could also be used. Design of the filter layer should be revisited during final design.*

4.4.2 Energy Dissipators

Energy dissipators should be constructed at the bottoms of steep slopes where there is a significant reduction in gradient. The entire structure is riprap-lined. The general configuration consists of four sections moving from upstream to downstream as follows:

- *Inlet transition:* the geometry at the upstream end of the energy dissipator should match that of the incoming channel. The sides of the channel should then expand out at a rate of 3 (longitudinal) to 1 (lateral) until reaching a bottom width that is approximately 3 times the initial inlet channel bottom width (3W). Through this transition, the bed elevation should drop approximately 24 inches.
- *Stilling basin:* After the inlet transition, the bottom of the energy dissipator should become flat for a length of approximately 3 times the initial inlet channel bottom width (3W). At the downstream end of the flat section the bottom should begin to rise back up at a 2H:1V slope for 4 feet. The 24-inch drop in elevation through the inlet transition and this 24-inch rise create a pool to dissipate energy. Often a hydraulic jump will occur within this section.
- *Apron:* Another flat bottom section of riprap continues downstream from the stilling basin for approximately 2 times the initial inlet channel bottom width (2W).

- *Outlet transition:* Downstream of the apron the structure should transition back to match the downstream channel geometry. The outlet transition can be more rapid than the inlet transition: e.g., 2 (longitudinal) to 1 (lateral).

Figure 4-5 is a conceptual sketch of an energy dissipator structure. Table 4-10 and Table 4-11 list the energy dissipators identified for this SWMP. Note that the feature IDs contain the name of the channel they will be constructed on, indicating the feature is an in-line energy dissipator located at the downstream end of that channel section. Table 4-10 provides hydraulic design estimates for the proposed energy dissipators. Table 4-11 provides dimensions and design parameters for the proposed energy dissipators.

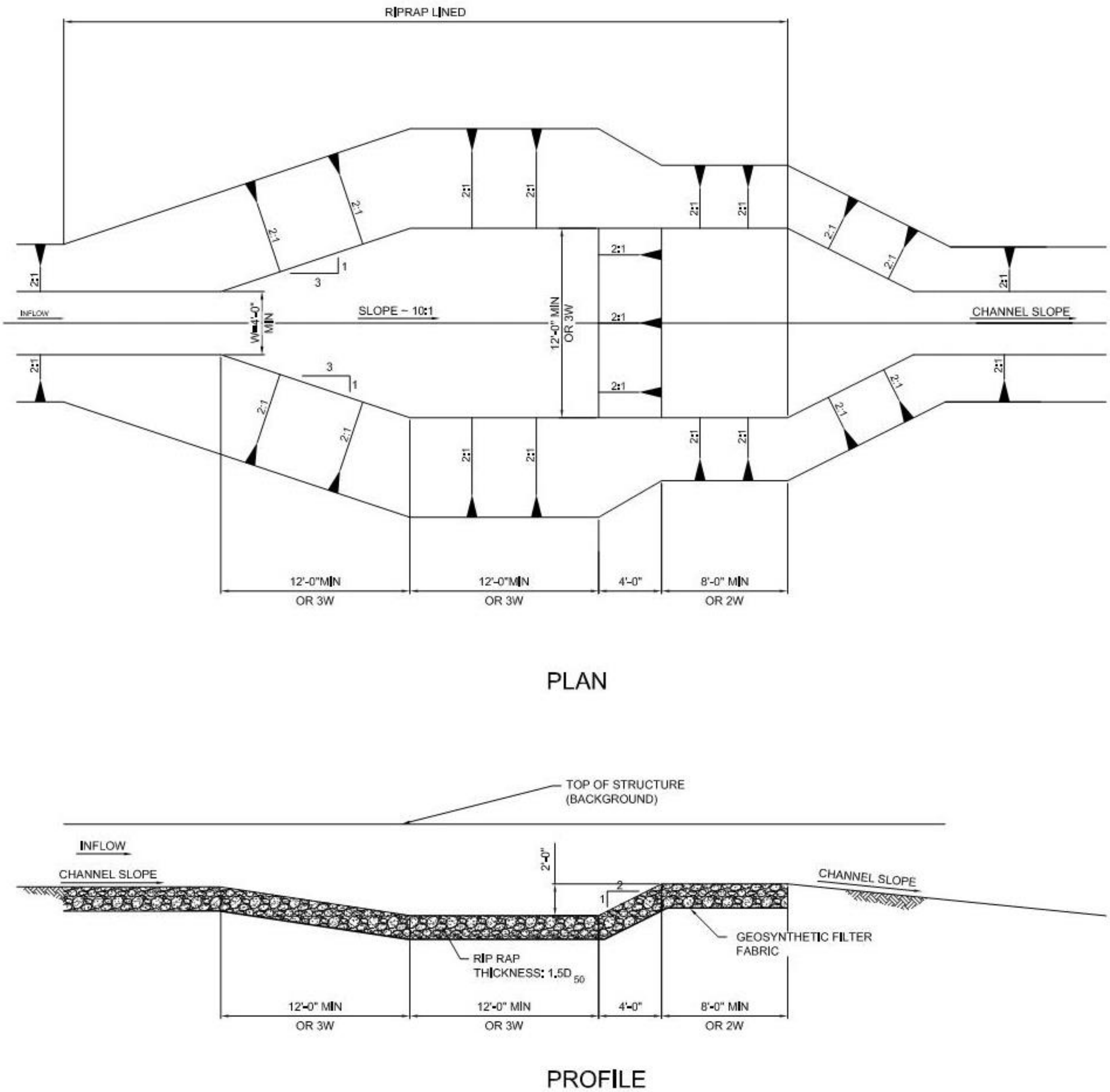

Figure 4-5. Typical Energy Dissipator

Table 4-10. Hydraulic Design Estimates for Proposed Energy Dissipators					
Feature ID[a]	Lifespan (phases)	Design Event	Design Discharge[b] (cfs)	Inflow Velocity[c] (fps)	Estimated Stable Rock Diameter[d] (inches)
ED-1Wc	1–9	50-yr	64.8	9.9	18.0
ED-1Wa	1–9	50-yr	1.2	2.5	1.2
ED-4Eb	4–9	50-yr	90.7	6.6	7.9
ED-5Eb	5–9	50-yr	60.4	8.2	12.4

Notes:

[a]Energy dissipators were given IDs generally based on the following:

- *ED = energy dissipator.*
- *Second portion of the ID indicates the run-on diversion ditch for which each energy dissipator is associated.*

[b]Peak design discharge is estimated using SCS methods as presented in Section 3.1.

[c]Hydraulic estimates are calculated assuming uniform flow conditions as described in Section 3.2.1.

[d]Stable rock diameter for riprap design is calculated using the method presented in Section 3.2.3.

Abbreviations:

cfs = cubic feet per second.

fps = feet per second.

Table 4-11. Design Parameters for Proposed Energy Dissipators							
Feature ID[a]	Lifespan (phases)	Stilling Basin Width[b] (feet)	Stilling Basin Length[c] (feet)	Stilling Basin Depth[d] (feet)	Apron Width[e] (feet)	Apron Length[f] (feet)	Riprap Lining Type[g]
ED-1Wc	1–9	12	12	1	12	8	Type K
ED-1Wa	1–9	12	12	1	12	8	Type H
ED-4Eb	4–9	12	12	1	12	8	Type I
ED-5Eb	5–9	12	12	1	12	8	Type K

Notes:

[a]Energy dissipators were given IDs generally based on the following:

- *ED = energy dissipator.*
- *Second portion of the ID indicates the run-on diversion for which each energy dissipator is associated.*

[b]Stilling basin width is based on 3 times the inflow channel bottom width (4 feet).

[c]Stilling basin length is based on 3 times the inflow channel bottom width (4 feet).

[d]Stilling basin depth is assumed to be 12 inches for all energy dissipators.

[e]Apron width is based on 3 times the inflow channel bottom width (4 feet).

[f]Apron basin length is based on 2 times the inflow channel bottom width (4 feet).

[g]Riprap lining type is selected such that the mean rock diameter (D_{50}) is greater than the calculated stable rock diameter. Riprap gradation by type is described in Table 4-9.

4.4.3 Flow Spreaders

Flow spreaders serve much of the same purpose as energy dissipators but with the added purpose of spreading the flow out over a wide area. Distributed shallow flow is much less erosive than concentrated flow, so flow spreader structures can be used at downstream outfalls where water is discharged to the natural drainage way.

The flow spreader structure recommended in this SWMP was adapted from the conceptual design presented by Agrium et al. (2005). The entire structure is riprap lined and has a trapezoidal cross-section. The upstream inlet to the structure should match the geometry of the inflow channel. The bottom width should then expand out at a rate of 4 (longitudinal) to 1 (lateral) for a length of approximately 60 feet. The bottom width of the structure will be approximately 34 feet at the end of the transition (assuming a 4-foot bottom width for the inflow channel).

Figure 4-6 is a conceptual sketch of a flow spreader. Table 4-12 provides hydraulic design estimates for the proposed flow spreaders. Table 4-13 provides dimensions and design parameters for the proposed flow spreaders.

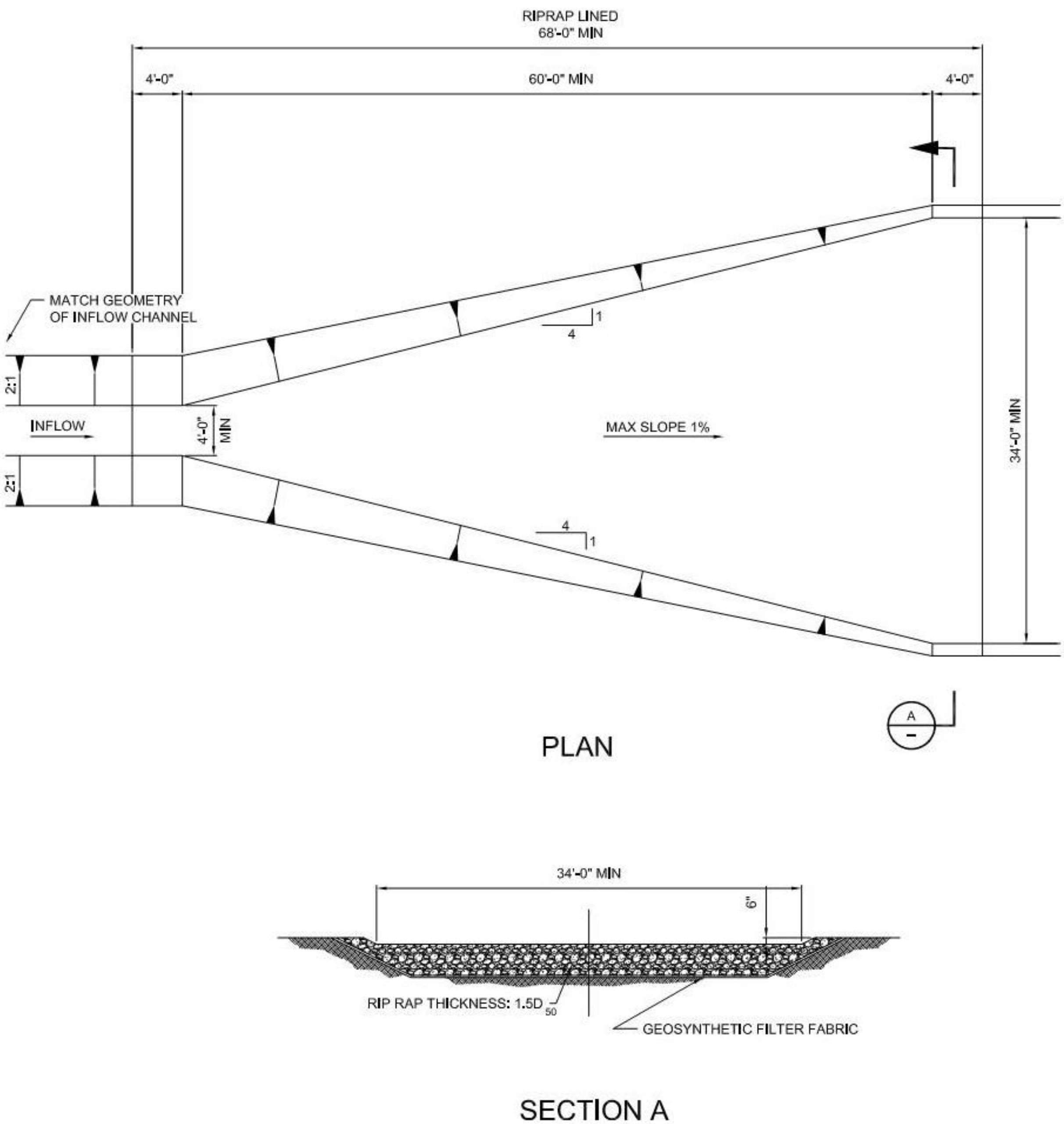

Figure 4-6. Typical Flow Spreader

Table 4-12. Hydraulic Design Estimates for Proposed Flow Spreaders					
Feature ID	Lifespan (phases)	Design Event	Design Discharge[a] (cfs)	Inflow Velocity[b] (fps)	Estimated Stable Rock Diameter[c] (inches)
FS-1	1–9	50-yr, 24-hr	90.4	4.4	3.7
FS-2	5–9	50-yr, 24-hr	66.2	3.5	2.4

Notes:

[a]Peak design discharge is estimated using SCS methods as presented in Section 3.1.

[b]Hydraulic estimates are calculated assuming uniform flow conditions as described in Section 3.2.1.

[c]Stable rock diameter for riprap design is calculated using the method presented in Section 3.2.3.

Abbreviations:

cfs = cubic feet per second.

fps = feet per second.

Table 4-13. Design Parameters for Proposed Flow Spreaders					
Feature ID	Lifespan (phases)	Inlet Bottom Width[a] (feet)	Transition Length[b] (feet)	Outlet Bottom Width[c] (feet)	Riprap Lining Type[d]
FS-1	5–9	4	60	34	Type H
FS-2	5–9	4	60	34	Type H

Notes:

[a]Based on an assumed inflow channel bottom width of 4 feet.

[b]A transition length of 60 for all flow spreaders is assumed.

[c]Based on an inflow channel bottom width of 4 feet plus an assumed expansion transition rate of 4 longitudinal to 1 lateral (per side) over a length of 60 feet.

[d]Riprap lining type is selected such that the mean rock diameter (D_{50}) is greater than the calculated stable rock diameter. Riprap gradation by type is described in Section 3.2.3.

4.4.4 Culvert Inlet Armoring

At some culvert locations, the upstream drainage is steep prior to any earth-disturbing activities. As the drainage approaches the culvert, energy dissipation will be necessary to protect the culvert inlet from erosion. Riprap is proposed just upstream of the culvert inlet, directly at the inlet, and on the bank around and above the inlet for protection. The inlet riprap can be the same as the designed riprap sizing for the culvert outlet (See Section 4.4.5).

4.4.5 Culvert Outlet Armoring

Figure 4-7 shows typical rock protection at a culvert outlet. Stable rock diameter for the outlet protection was estimated based on the culvert exit velocity (see Section 3.2.2). Riprap lining type was selected such that the mean rock diameter (D_{50}) is greater than the calculated stable rock diameter. Riprap gradation by type is described in Section 3.2.3.

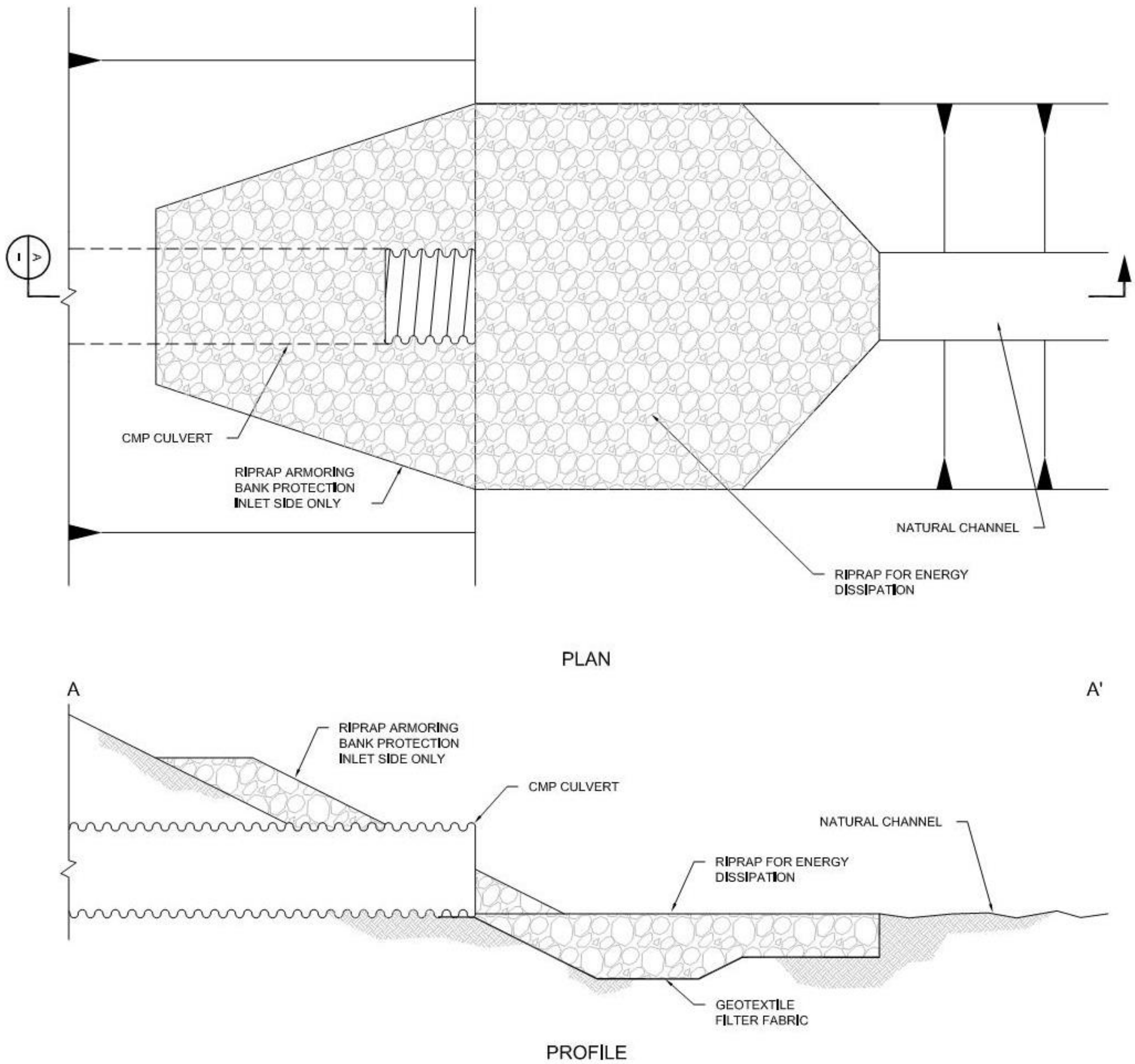

Figure 4-7. Typical Culvert Outlet Riprap Protection

4.5 Re-Established Drainage Channels

Excavation of the proposed pit will temporarily disrupt surface drainage networks. Therefore, the drainage channels will need to be re-established over the backfilled pit as part of reclamation. In general, the permanent re-established drainage channels are designed to reproduce the same hydrologic and geomorphic characteristics as the pre-existing drainage network. However, the designs also consider long-term channel stability and minimizing the potential for infiltration into the backfill. Where applicable, the re-established channels will be extended downslope of the backfilled pit through reclaimed areas and discharge into undisturbed natural drainages.

The Site is located high in the watersheds; however, minimal intermittent drainages are observed north of the proposed haul road. The proposed re-established drainage channels will have similar characteristics. Furthermore, the number and locations of the proposed re-established drainage channels were designed to reproduce roughly the same drainage patterns as the existing topography.

Figure 4-8 is a cross-section of a typical re-established drainage channel over the backfilled pit. Note that the drainage channel is integrated into the cap design to avoid increased infiltration into pit backfill. The channel also includes riprap channel lining for stability and a layer of compacted alluvium or GM as recommended by Agrium et al. (2005).

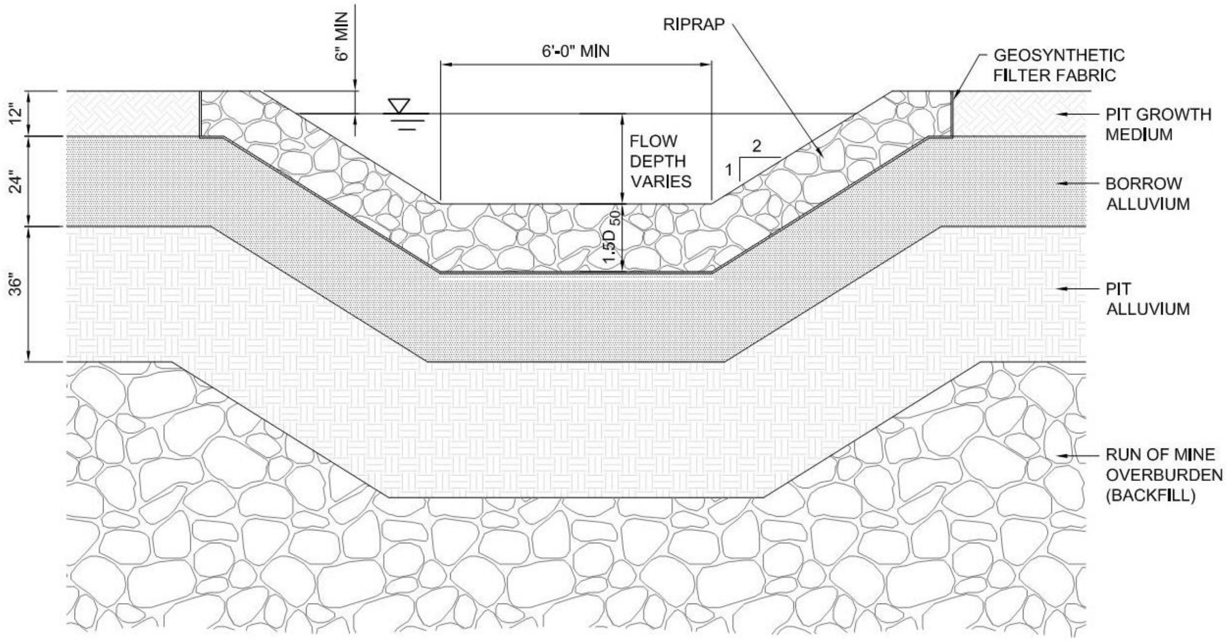

Figure 4-8. Typical Cross-section for Re-established Drainage Channel over Pit Backfill

Figure 4-9 is a cross-section of a typical re-established drainage channel over a reclaimed area. The channel includes riprap channel lining for stability.

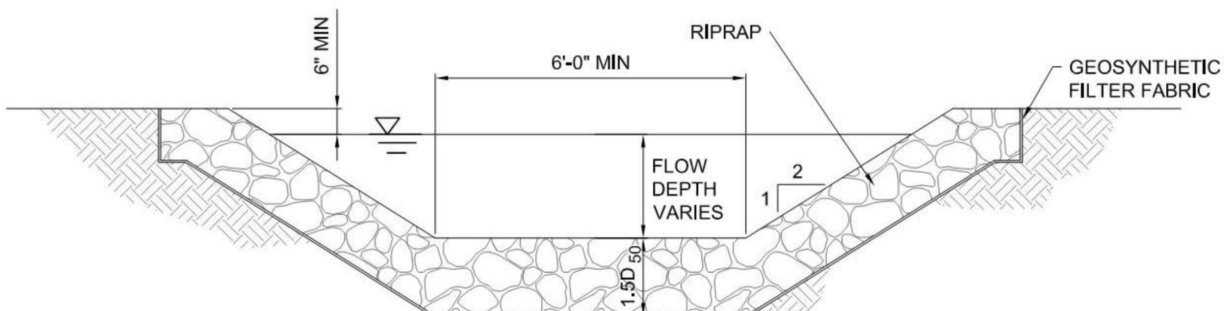

Figure 4-9. Typical Cross-section for Re-established Drainage Channel over non-Pit Backfill Reclaimed Areas

All re-established drainage channels will have a bottom width of 6 feet and minimum 2H:1V side slopes. Because they are considered permanent structures, re-established drainage channels will be designed with a depth sufficient to convey the peak discharge from the 100-year, 24-hour Design Event, plus an additional 6 inches of freeboard. Table 4-14 lists the proposed re-established drainage channels for the Site, along with the results from the hydraulic design calculations. Table 4-15 provides the design parameters for each permanent drainage channel.

Table 4-14. Hydraulic Design Estimates for Proposed Re-Established Drainage Channels

Feature ID[a]	Lifespan (phases)	Design Event	Design Discharge[b] (cfs)	Peak Flow Velocity[c] (fps)	Flow Depth[c] (feet)	Max Shear Stress[c] (psf)	Stable Rock Diameter[d] (inches)
RDP5-1a	5–EOR	100-yr, 24-hr	81.1	10.1	1.01	12.9	19.0
RDP7-1a	7–EOR	100-yr, 24-hr	105.1	9.8	1.26	9.4	14.2
RDP7-2a	7–EOR	100-yr, 24-hr	77.6	8.3	1.13	6.2	9.6
RDP8-1a	8–EOR	100-yr, 24-hr	84.1	8.8	1.15	6.1	10.0
RDEOR-1a	EOR	100-yr, 24-hr	11.4	3.8	0.43	2.0	2.5
RDEOR-2a	EOR	100-yr, 24-hr	95.2	10.1	1.14	9.2	15.1

Notes:

[a]Re-established drainage channels were given IDs generally based on the following:

- *RD = re-established permanent drainage channel, with number or EOR to denote mining phases when drainage channel established.*
- *Numbered sequentially moving north to south when multiple channels created per phase.*

[b]Peak design discharge is estimated using SCS methods as presented in Section 3.1.

[c]Hydraulic estimates are calculated assuming uniform flow conditions as described in Section 3.2.1.

[d]Stable rock diameter for riprap design is calculated using the method presented in Section 3.2.3.

Abbreviations:

EOR = end of reclamation.

cfs = cubic feet per second.

fps = feet per second.

psf = pound per square foot.

Table 4-15. Design Parameters for Proposed Re-Established Drainage Channels

Feature ID[a]	Lifespan (phases)	Channel Bed Slope[b] (ft/ft)	Channel Bottom Width[c] (feet)	Channel Side Slopes[d] (H:V)	Total Depth of Channel[e] (feet)	Free-board[f] (feet)	Riprap Lining Type[g]
RDP5-1a	5–EOR	0.27	6	2:1	2.0	1.0	Type L
RDP7-1a	7–EOR	0.16	6	2:1	2.0	1.0	Type K
RDP7-2a	7–EOR	0.12	6	2:1	2.0	1.0	Type J
RDP8-1a	8–EOR	0.12	6	2:1	2.0	1.0	Type J
RDEOR-1a	EOR	0.08	6	2:1	1.5	0.5	Type H
RDEOR-2a	EOR	0.17	6	2:1	2.0	1.0	Type K

Notes:

[a]Re-established drainage channels were given IDs generally based on the following:

- *RD = re-established drainage channel, with number or EOR to denote mining phases when drainage channel established.*
- *Numbered sequentially moving north to south when multiple channels created per phase.*

[b]Bed slope is estimated using site topography and proposed channel alignment.

[c]Channel bottom width is assumed to be 6 feet for all re-established drainage channels.

[d]Channel side slopes are assumed to be 2H:1V for all re-established drainage channels.

[e]Channel depth is calculated assuming uniform flow conditions as described in Section 3.2.1.

[f]A minimum of 6 inches of freeboard is assumed.

[g]Riprap lining type is selected such that the mean rock diameter (D_{50}) is greater than the calculated stable rock diameter. Riprap gradation by type is described in Section 3.2.3. To simplify operations, the riprap size can be rounded up so that design Type H can be replaced by Type I, and design Type J can be replaced by Type K.

Table 4-15 Abbreviations:

EOR = end of reclamation.

ft/ft = foot per foot.

H:V = horizontal to vertical.

Section 5

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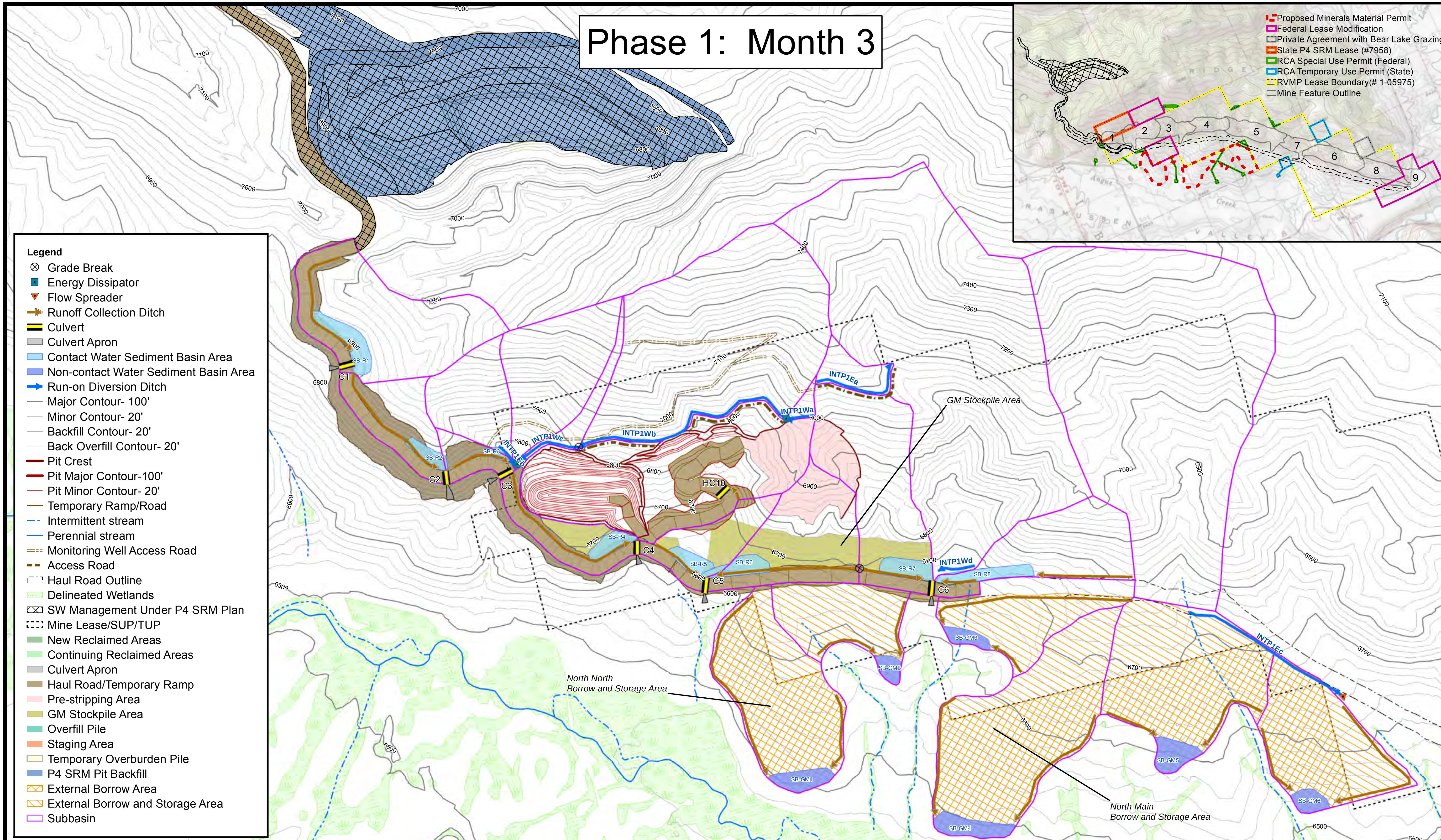
Exhibits



Brown AND Caldwell	Date: 7/21/2016 Project No: 148744 Client: Agrium	Map Coordinate System: NAD 1983 UTM Zone 12N Notes: Mine and impact scheduling shown is for the end-of mining, before backfilling is completed. Final scheduling is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading.All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.	Exhibit A Phase 1 Surface Water Facilities Layout Surface Water Management Plan Rasmussen Valley Mine

Feet 0 500 1,000

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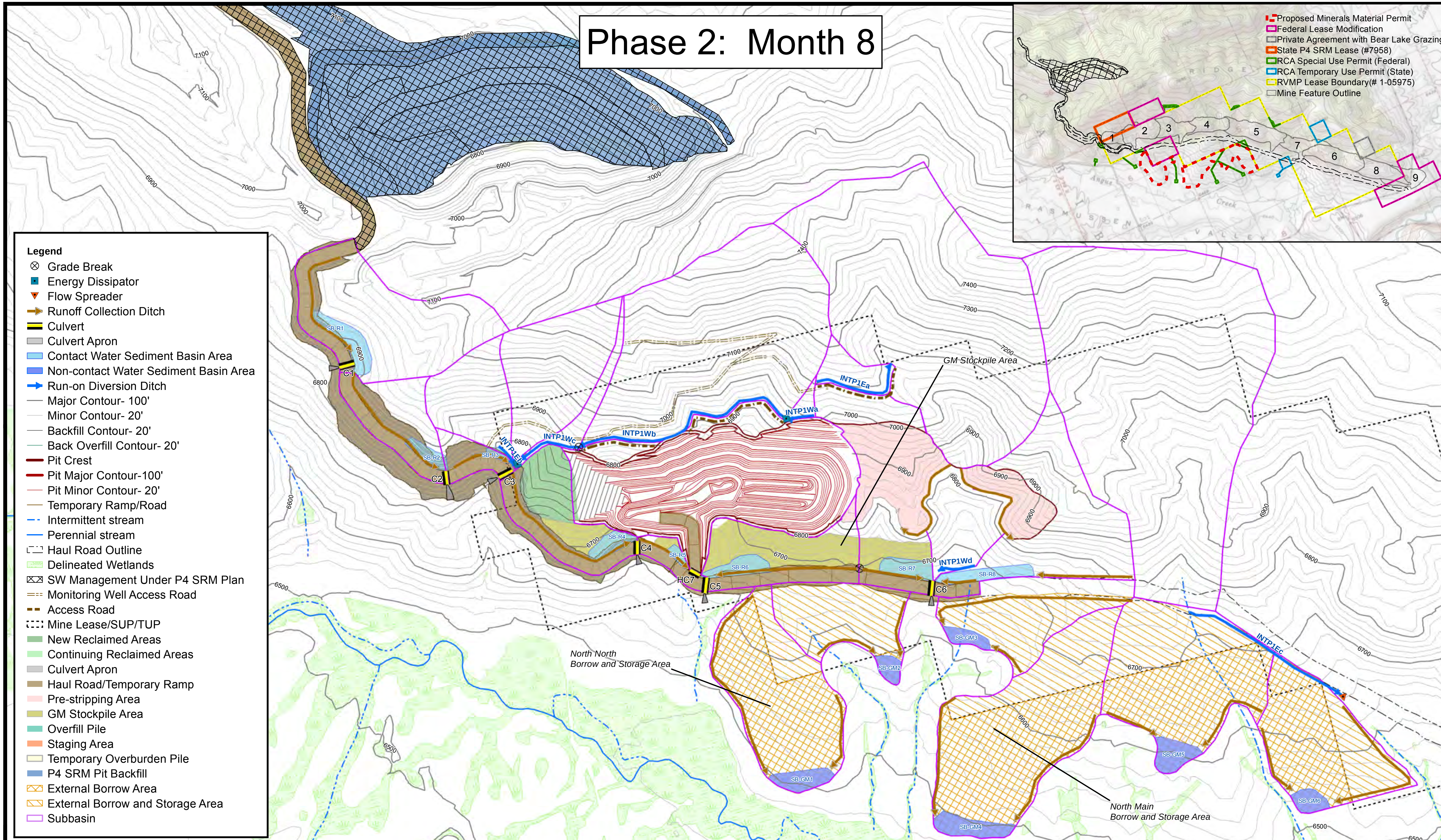

Brown AND Caldwell

Date: 7/21/2016

Project No: 148744

Client: Agrium

Map Coordinate System: NAD 1983 UTM Zone 12N
Notes: Mine and impact scheduling shown is for the end-of mining, before backfilling is completed. Final scheduling is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading.All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.

0 500 1,000 Feet

Exhibit B
Phase 2 Surface Water Facilities Layout
Surface Water Management Plan
Rasmussen Valley Mine

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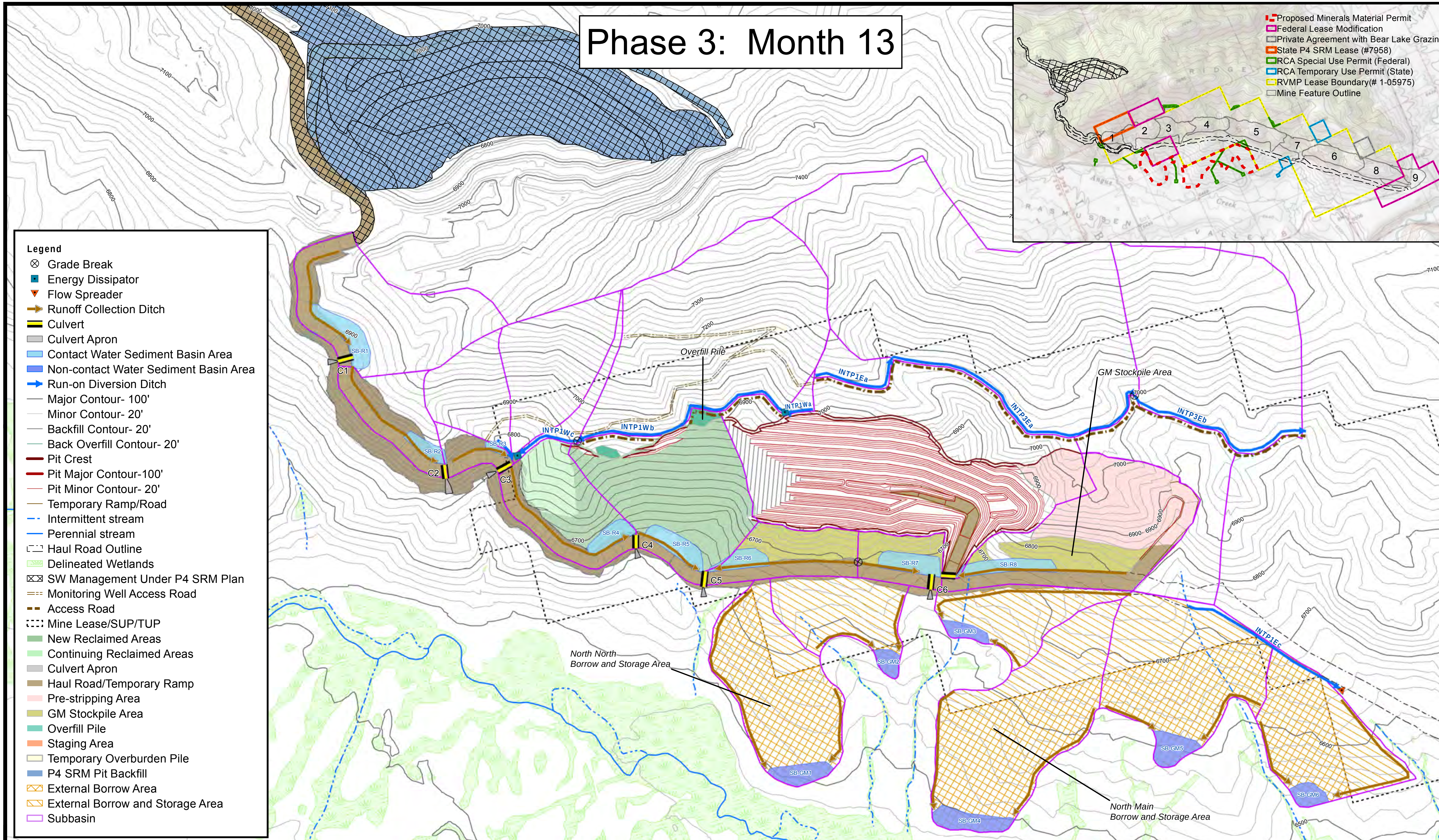

Brown AND Caldwell

Date: 7/21/2016

Project No: 148744

Client: Agrium

Map Coordinate System: NAD 1983 UTM Zone 12N
Notes: Mine and impact scheduling shown is for the end-of mining, before backfilling is completed. Final scheduling is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading.All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.

0 500 1,000 Feet

Exhibit C
Phase 3 Surface Water Facilities Layout
Surface Water Management Plan
Rasmussen Valley Mine

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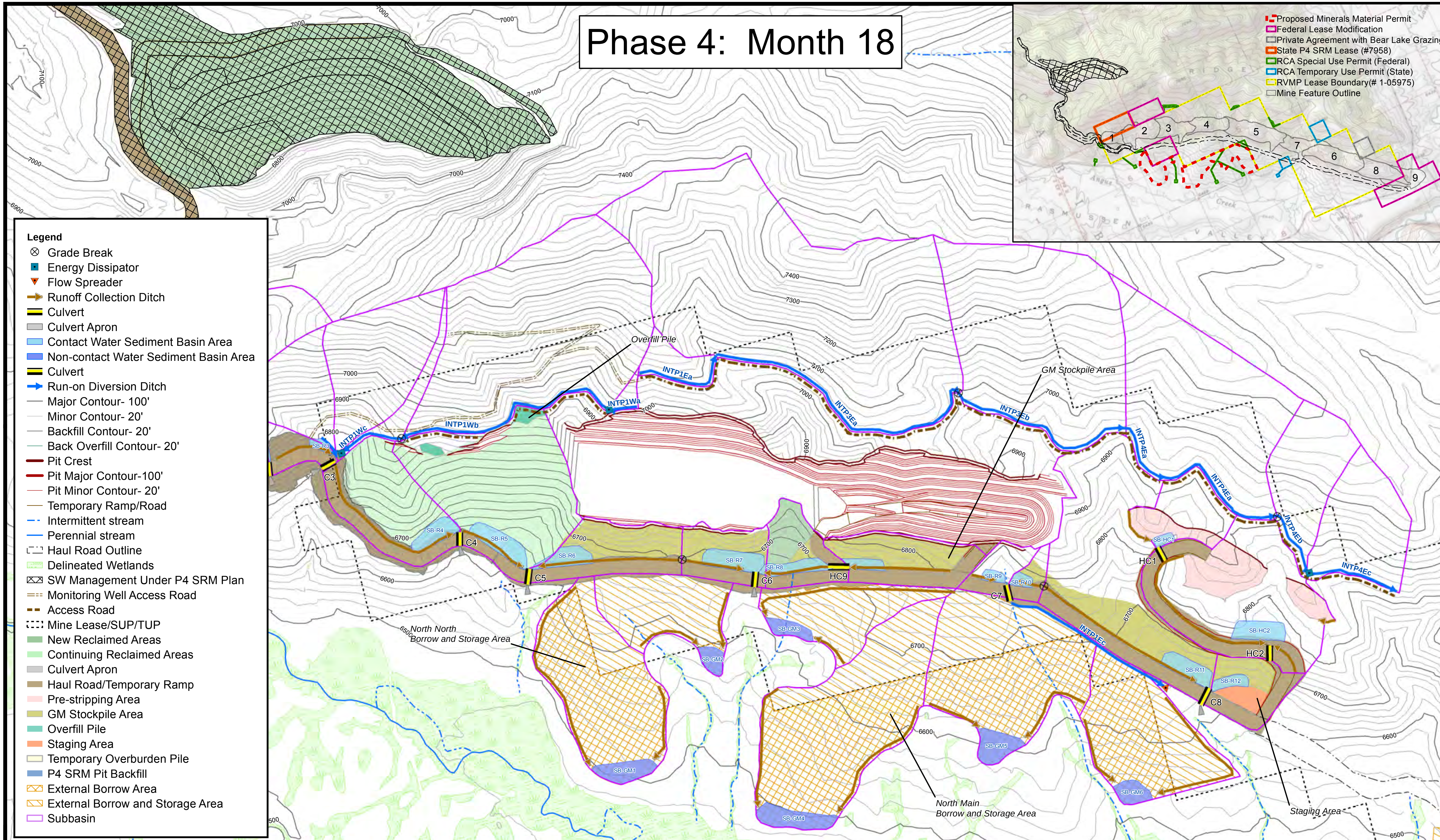

Brown AND Caldwell	Date: 7/21/2016 Project No: 148744 Client: Agrium

Map Coordinate System: NAD 1983 UTM Zone 12N
Notes: Mine and impact scheduling shown is for the end-of mining, before backfilling is completed. Final scheduling is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading. All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.

0 500 1,000 Feet

Exhibit D
Phase 4 Surface Water Facilities Layout
Surface Water Management Plan
Rasmussen Valley Mine

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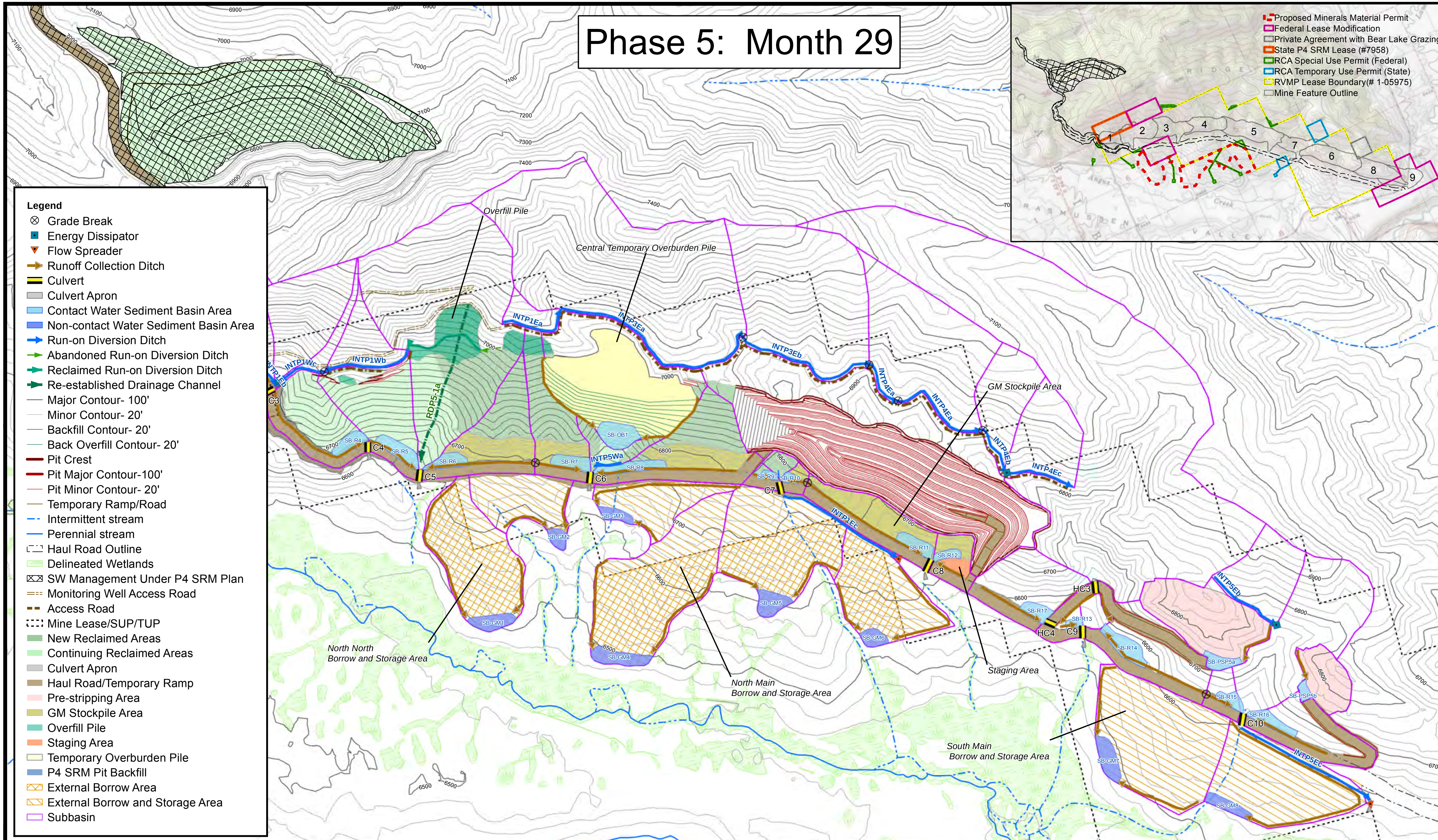

Brown AND Caldwell

Date: 7/21/2016

Project No: 148744

Client: Agrium

Map Coordinate System: NAD 1983 UTM Zone 12N
Notes: Mine and impact scheduling shown is for the end-of mining, before backfilling is completed. Final scheduling is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading.All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.

Feet
0 500 1,000

Exhibit E
Phase 5 Surface Water Facilities Layout
Surface Water Management Plan
Rasmussen Valley Mine

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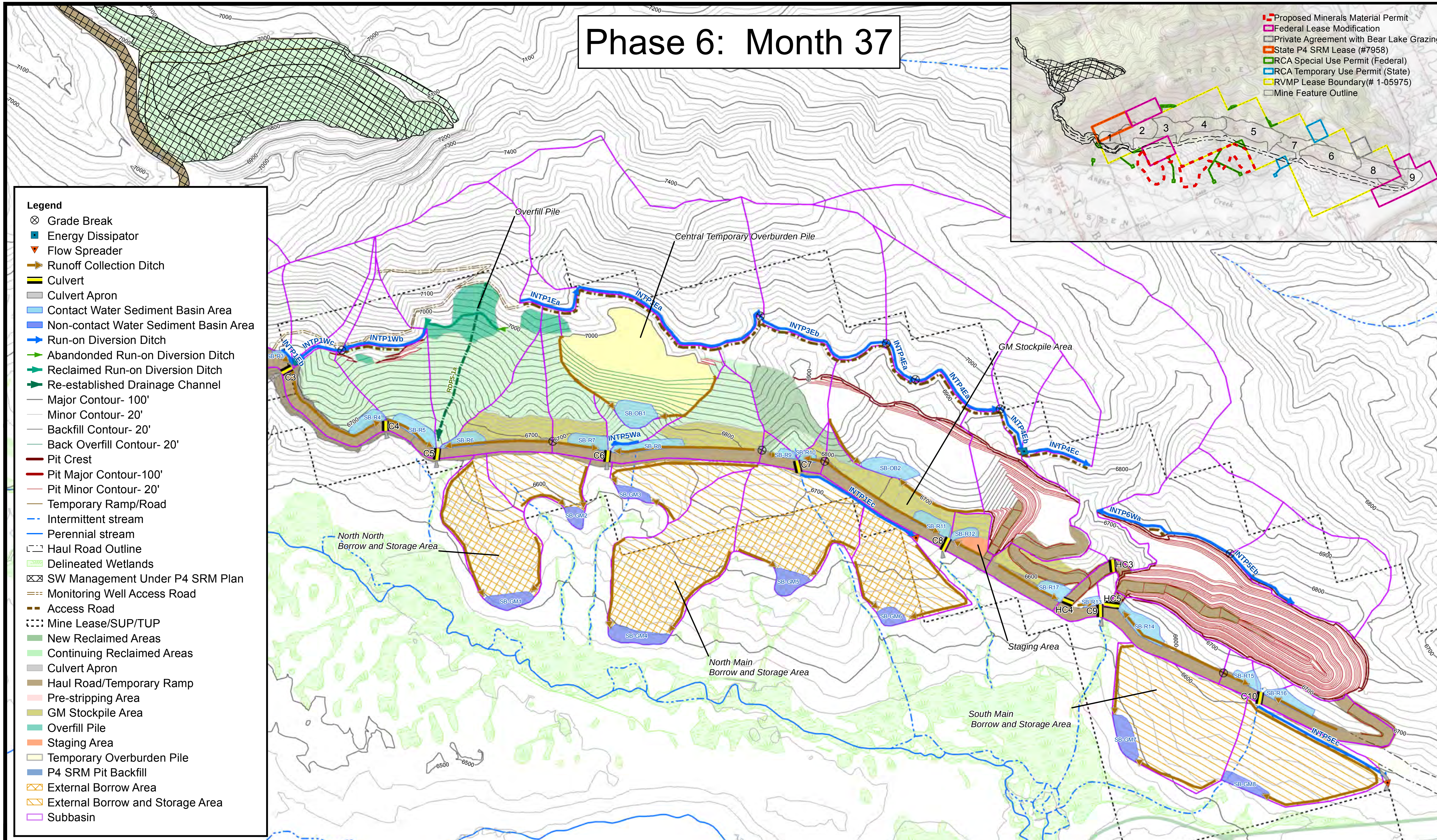

Brown AND Caldwell

Date: 7/21/2016

Project No: 148744

Client: Agrium

Map Coordinate System: NAD 1983 UTM Zone 12N
Notes: Mine and impact scheduling shown is for the end-of mining, before backfilling is completed. Final scheduling is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading.All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.

Feet
0 500 1,000

Exhibit F
Phase 6 Surface Water Facilities Layout
Surface Water Management Plan
Rasmussen Valley Mine

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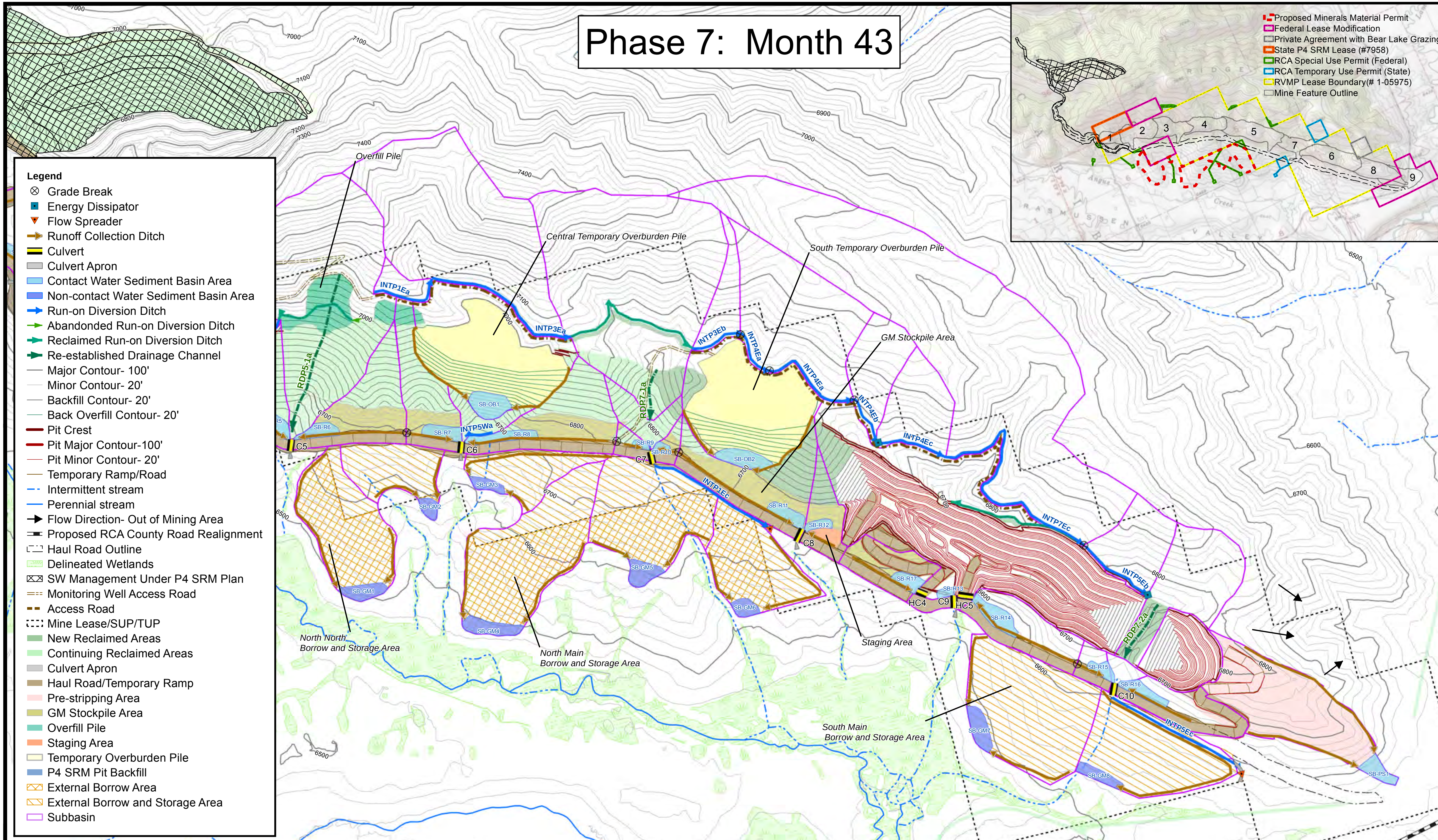


Brown AND Caldwell

Date: 7/21/2016

Project No: 148744

Client: Agrium

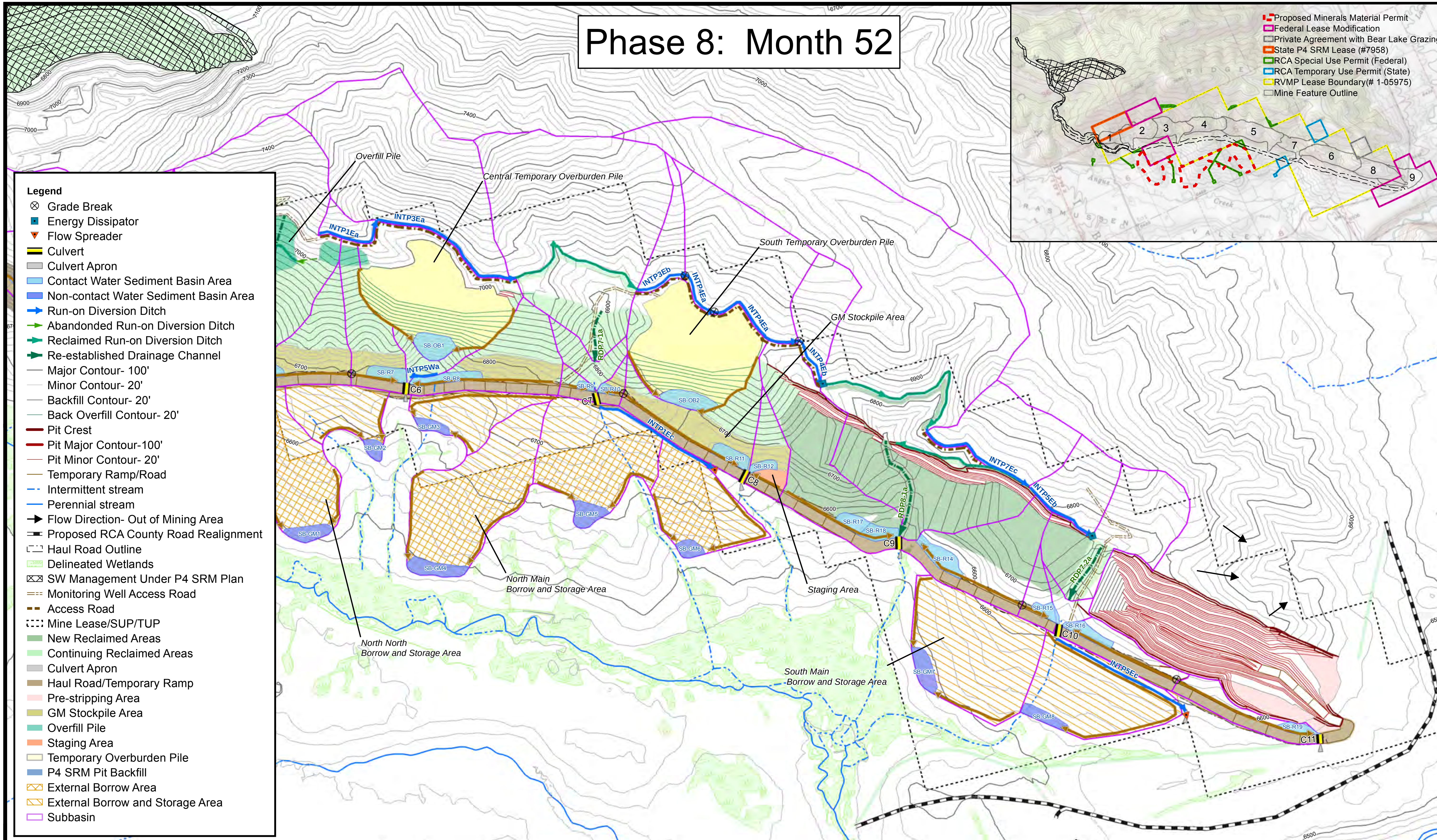
Map Coordinate System: NAD 1983 UTM Zone 12N
Notes: Mine and impact scheduling shown is for the end-of mining, before backfilling is completed. Final scheduling is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading.All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.

0 500 1,000 Feet

N

Exhibit G
Phase 7 Surface Water Facilities Layout
Surface Water Management Plan
Rasmussen Valley Mine

Path:Bcsea06\ P:\Agrium\147223 RVMP SWMP\GIS\MXD\Final_Exhibits_SWMP_20160408\ExhibitG_SWMP_Phase7_Map_NEPA.mxd



Brown AND Caldwell

Date: 7/21/2016

Project No: 148744

Client: Agrium

Map Coordinate System: NAD 1983 UTM Zone 12N
Notes: Mine and impact scheduling shown is for the end-of mining, before backfilling is completed. Final scheduling is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading.All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.

Feet
0 500 1,000

Exhibit H
Phase 8 Surface Water Facilities Layout
Surface Water Management Plan
Rasmussen Valley Mine

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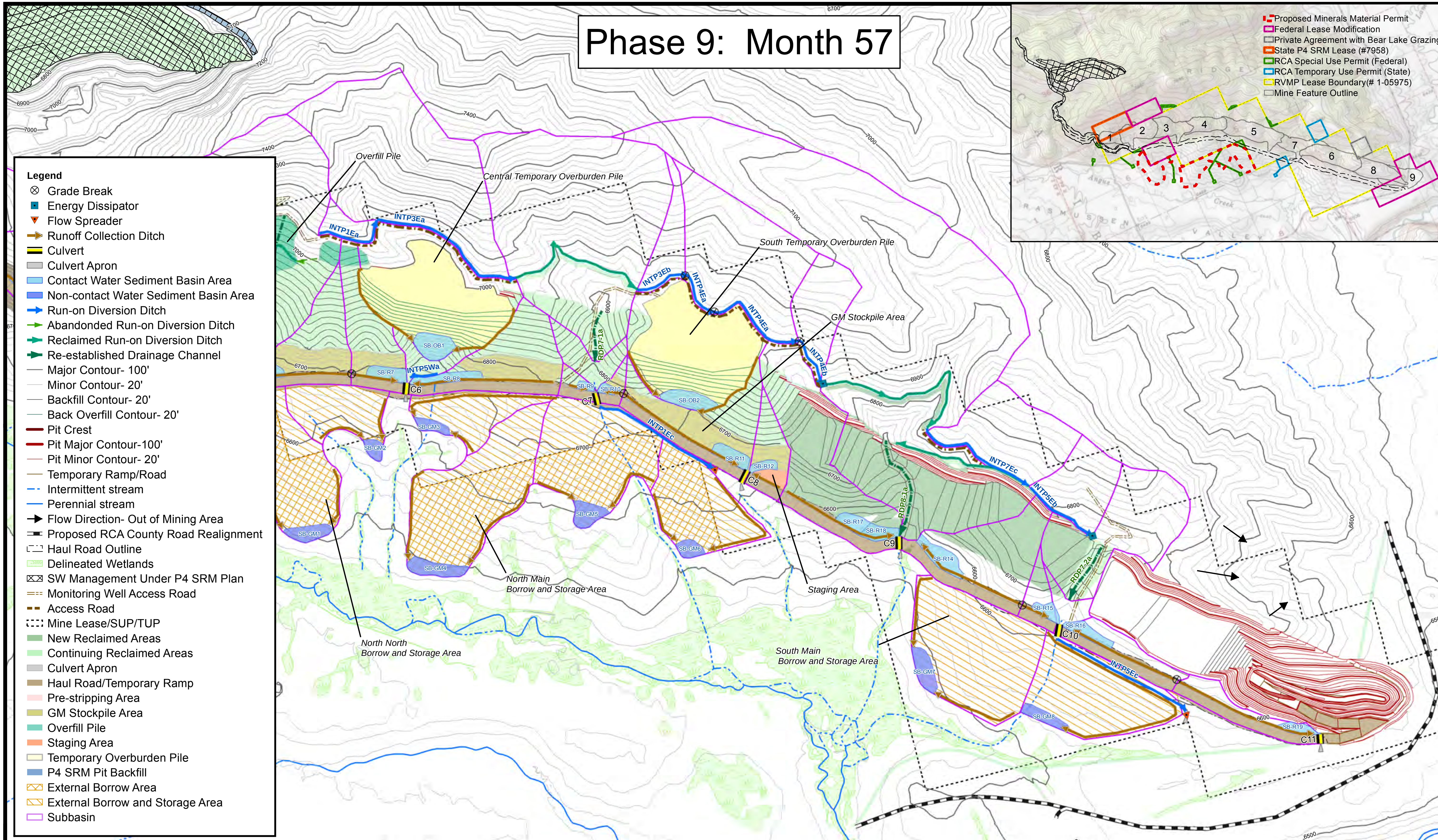
Phase 9: Month 57



Date: 7/21/2016

Project No: 148744

Client: Agrium

Map Coordinate System: NAD 1983 UTM Zone 12N
Notes: Mine and impact scheduling shown is for the end-of mining, before backfilling is completed. Final scheduling is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading.All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.

Feet 0 500 1,000

Exhibit I
Phase 9 Surface Water Facilities Layout
Surface Water Management Plan
Rasmussen Valley Mine

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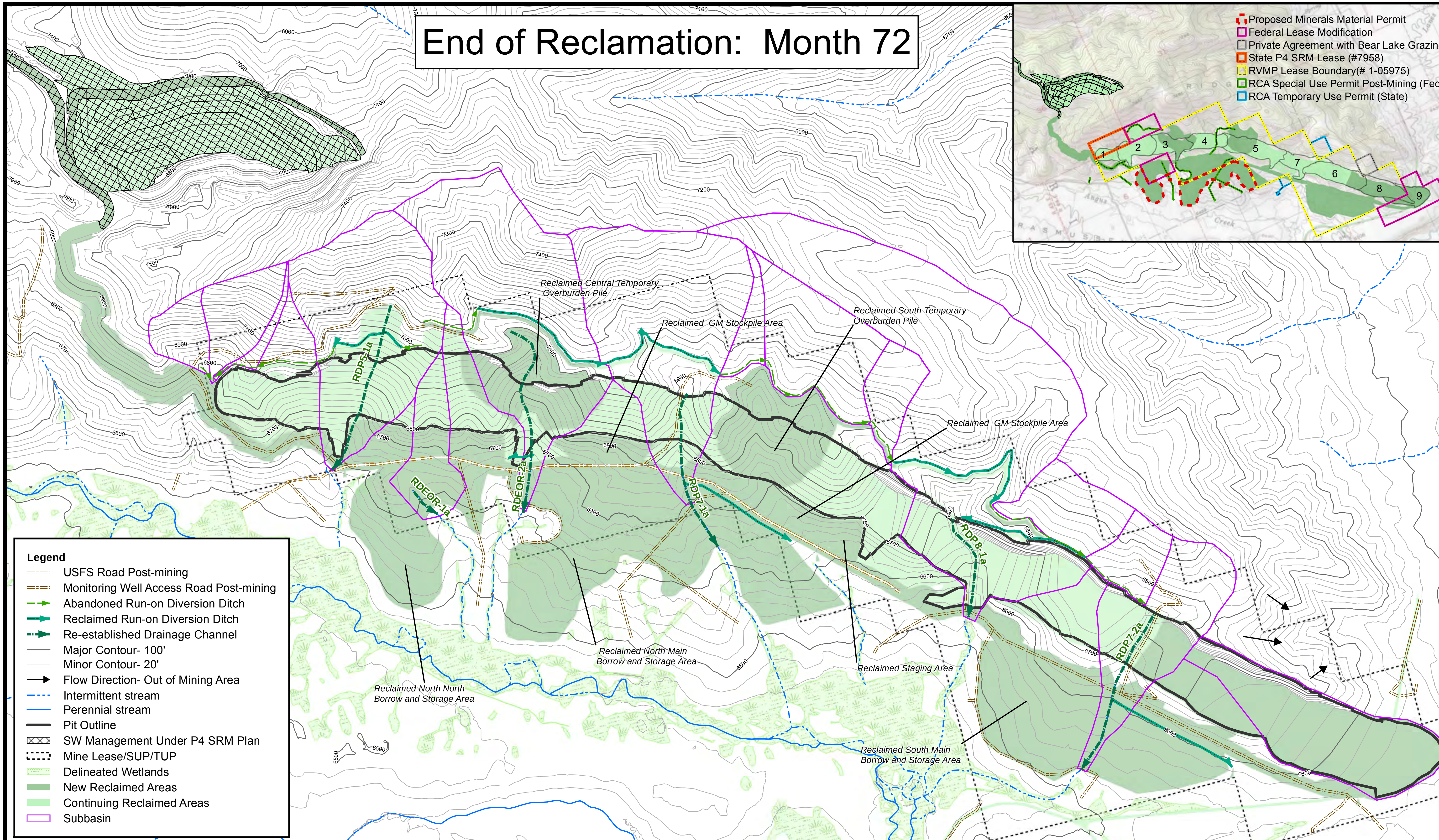


Brown AND Caldwell

Date: 7/21/2016

Project No: 148744

Client: Agrium

Map Coordinate System: NAD 1983 UTM Zone 12N

Notes: Mine and impact scheduling shown is subject to update according to operational requirements. Configuration of SW facilities is subject to change based on final grading. All proposed facilities will be constructed within Agrium's accepted permanent or temporary use lease boundary.

0 500 1,000 2,000 Feet

Exhibit J
End of Reclamation Surface Water Facilities Layout
Surface Water Management Plan
Rasmussen Valley Mine

Path:Bcsea06\ P:\Agrium\147223 RVMP SWMP\GIS\MXD\Final_Exhibits_SWMP_20160408\ExhibitJ_SWMP_EndofRehandle_Map.mxd

Attachment A: HEC-HMS Model Input

Table A-1. Subbasin Areas for Proposed Run-On Diversion Ditches			
Feature ID[a]	Description	Model Input Area (sq mi)	Total Tributary Area (sq mi)
INTP1Ea	Run-on diversion ditch constructed in phase 1	0.004	0.004
INTP1Eb	Run-on diversion ditch constructed in phase 1	0.013	0.013
INTP1Wa	Run-on diversion ditch constructed in phase 1	0.001	0.001
INTP1Wb	Run-on diversion ditch constructed in phase 1	0.064	0.065
INTP1Wc	Run-on diversion ditch constructed in phase 1	0.004	0.069
INTP1Wd	Run-on diversion ditch constructed in phase 1	0.117	0.117
INTP3Ea	Run-on diversion ditch constructed in phase 3	0.104	0.108
INTP3Eb	Run-on diversion ditch constructed in phase 3	0.057	0.165
INTP4Ea	Run-on diversion ditch constructed in phase 4	0.046	0.211
INTP4Eb	Run-on diversion ditch constructed in phase 4	0.016	0.227
INTP4Ec	Run-on diversion ditch constructed in phase 4	0.018	0.245
INTP5Eb	Run-on diversion ditch constructed in phase 5	0.016	0.266
INTP5Ec	Run-on diversion ditch constructed in phase 5	0.312	0.312
INTP5Wa	Run-on diversion ditch constructed in phase 5	0.005	0.053
INTP6Wa	Run-on diversion ditch constructed in phase 6	0.030	0.030
INTP7Ec	Run-on diversion ditch constructed in phase 7	0.161	0.25
INTP1Ea	Run-on diversion ditch constructed in phase 1	0.004	0.004

Notes:

[a]Run-on diversion ditches were given IDs generally based on the following:

- *Feature type where INT = interceptor ditch.*
- *P# for the phase number in which the feature is constructed.*
- *Directional (e.g., E for east) when there was more than one ditch constructed during a phase.*
- *Letter (e.g., a, b) when a channel was subdivided based on grade breaks. Features were labeled alphabetically starting at the upstream end.*
- *INTP1Ec and INTP5Ec are not included in this list because the ditches do not have a separate subbasin. These diversion ditches are located at the outlet of Culvert 7 and Culvert 10, respectively, to divert flow around a borrow and storage area.*

Abbreviations:

sq mi = square mile.

Table A-2. Subbasin Areas for Proposed Culverts			
Feature ID[a]	Description	Model Input Area (sq mi)	Total Tributary Area (sq mi)
C1	Temporary culvert under HR-5	0.032	0.032
C2	Temporary culvert under HR -5	0.012	0.012
C3	Temporary culvert under HR-5	0.108	0.108
C4	Temporary culvert under West Side Haul Road	0.019	0.019
C5	Temporary culvert under West Side Haul Road	0.128	0.128
C6	Temporary culvert under West Side Haul Road	0.155	0.155
C7	Temporary culvert under West Side Haul Road	0.191	0.191
C8	Temporary culvert under West Side Haul Road	0.096	0.096
C9	Temporary culvert under West Side Haul Road	0.507	0.507
C10	Temporary culvert under West Side Haul Road	0.312	0.312
C11	Temporary culvert under West Side Haul Road	0.010	0.01
HC1	Temporary culvert under pit access ramp	0.010	0.01

Table A-2. Subbasin Areas for Proposed Culverts			
Feature ID[a]	Description	Model Input Area (sq mi)	Total Tributary Area (sq mi)
HC2	Temporary culvert under pit access ramp	0.046	0.046
HC3	Temporary culvert under pit access ramp	0.443	0.443
HC4	Temporary culvert under pit access ramp	0.019	0.019
HC5	Temporary culvert under pit access ramp	0.018	0.018
HC6	Temporary culvert under pit access ramp	0.011	0.011
HC7	Temporary culvert under pit access ramp	0.003	0.003
HC8	Temporary culvert under pit access ramp	0.036	0.036
HC9	Temporary culvert under pit access ramp	0.012	0.012

Notes:

[a]Culverts were given IDs generally based on the following:

- *C = Culvert under West Side Haul road.*
- *HC = Culvert under pit access ramp.*
- *Numbered sequentially from east to west.*

Abbreviations:

sq mi = square mile.

Table A-3. Subbasin Areas for Proposed Re-established Drainage Channels			
Feature ID[a]	Description	Model Input Area (sq mi)	Total Tributary Area (sq mi)
RDP5-1a	Permanent drainage channel established in phase 5	0.085	0.085
RDP7-1a	Permanent drainage channel established in phase 7	0.178	0.178
RDP7-2a	Permanent drainage channel established in phase 7	0.292	0.292
RDP8-1a	Permanent drainage channel established in phase 8	0.280	0.280
RDEOR-1a	Permanent drainage channel established at end of mining operations	0.024	0.024
RDEOR-2a	Permanent drainage channel established at end of mining operations	0.124	0.124

Notes:

[a]Re-established drainage channels were given IDs generally based on the following:

- *RD = re-established drainage channel with number or EOR (end of reclamation) to denote mining phase when drainage channel established.*
- *Numbered sequentially moving east to west when multiple channels established per phase.*

Abbreviations:

sq mi = square mile.

Table A-4. Subbasin Curve Numbers and Initial Abstractions for Proposed Run-On Diversion Ditches				
Feature ID[a]	$CN_{0.2}$[b]	λ[c]	S (inches)[d]	Ia (inches)[e]
INTP1Ea	77	0.2	3.0	0.6
INTP1Eb	76	0.2	3.2	0.6
INTP1Wa	79	0.2	2.7	0.5
INTP1Wb	79	0.2	2.7	0.5
INTP1Wc	78	0.2	2.8	0.6
INTP1Wd	75	0.2	3.3	0.7

Table A-4. Subbasin Curve Numbers and Initial Abstractions for Proposed Run-On Diversion Ditches				
Feature ID[a]	$CN_{0.2}$[b]	λ[c]	S (inches)[d]	Ia (inches)[e]
INTP3Ea	74	0.2	3.5	0.7
INTP3Eb	66	0.2	5.2	1.0
INTP4Ea	62	0.2	6.1	1.2
INTP4Eb	65	0.2	5.4	1.1
INTP4Ec	75	0.2	3.3	0.7
INTP5Eb	72	0.2	3.9	0.8
INTP5Wa	64	0.2	5.6	1.1
INTP6Wa	73	0.2	3.7	0.7
INTP7Ec	72	0.2	3.9	0.8

Notes:

[a]INTP1Ec and INTP5Ec are not included in this list because the ditches do not have a separate subbasin. These diversion ditches are located at the outlet of Culvert 7 and Culvert 10, respectively, to divert flow around borrow and storage areas.

[b]CN0.2 = commonly tabulated curve number for use with Ia=0.2S.

[c]λ = fraction of retention storage used to estimate initial abstraction.

[d]S = retention storage (see Equation 2).

[e]Ia = initial abstraction.

Table A-5. Subbasin Curve Numbers and Initial Abstractions for Proposed Culverts				
Feature ID	$CN_{0.2}$[a]	λ[b]	S (inches)[c]	Ia (inches)[d]
C1	79	0.2	2.7	0.5
C2	78	0.2	2.8	0.6
C3	78	0.2	2.8	0.6
C4	78	0.2	2.8	0.6
C5	77	0.2	3.0	0.6
C6	75	0.2	3.3	0.7
C7	73	0.2	3.7	0.7
C8	72	0.2	3.9	0.8
C9	58	0.2	7.2	1.4
C10	56	0.2	7.9	1.6
C11	79	0.2	2.7	0.5
HC1	63	0.2	5.9	1.2
HC2	70	0.2	4.3	0.9
HC3	71	0.2	4.1	0.8
HC4	68	0.2	4.7	0.9
HC5	78	0.2	2.8	0.6
HC6	66	0.2	5.2	1.0
HC7	77	0.2	3.0	0.6
HC8	74	0.2	3.5	0.7
HC9	75	0.2	3.3	0.7

Notes:

[a]$CN_{0.2}$ = commonly tabulated curve number for use with Ia = 0.2S.

[b]λ = fraction of retention storage used to estimate initial abstraction.

[c]Ia = initial abstraction.

[d]S = retention storage (see Equation 2).

Table A-6. Subbasin Curve Numbers and Initial Abstractions for Proposed Re-Established Drainage Channels				
Feature ID	$CN_{0.2}$[a]	λ[b]	S (inches)[c]	Ia (inches)[d]
RDP5-1a	75	0.2	3.4	0.7
RDP7-1a	67	0.2	5.0	1.0
RDP7-2a	71	0.2	4.2	0.8
RDP8-1a	71	0.2	4.0	0.8
RDEOR-1a	70	0.2	4.3	0.9
RDEOR-2a	76	0.2	3.2	0.6

Notes:

[a]$CN_{0.2}$ = commonly tabulated curve number for use with Ia=0.2S.

[b]λ = fraction of retention storage used to estimate initial abstraction.

[c]Ia = initial abstraction.

[d]S = retention storage (see Equation 2).

Table A-7. Subbasin Lag Times for Proposed Run-On Diversion Ditches				
Feature ID[a]	$CN_{0.2}$[b]	Y (%)[c]	l (feet)[d]	L (min)[e]
INTP1Ea	77	36	960	3.4
INTP1Eb	76	46	996	3.2
INTP1Wa	79	41	434	1.6
INTP1Wb	79	46	2748	6.5
INTP1Wc	78	38	1519	4.6
INTP1Wd	75	38	3537	9.8
INTP3Ea	74	37	3689	10.7
INTP3Eb	66	30	2162	9.5
INTP4Ea	62	24	2378	12.8
INTP4Eb	65	23	1254	7.3
INTP4Ec	75	30	1310	5.1
INTP5Eb	72	25	984	4.8
INTP5Wa	64	36	721	3.8
INTP6Wa	73	23	1922	8.2
INTP7Ec	72	20	6731	24.7

Notes:

[a]INTP1Ec and INTP5Ec are not included in this list because the ditches do not have a separate subbasin. These diversion ditches are located at the outlet of Culvert 7 and Culvert 10, respectively, to divert flow around borrow and storage areas.

[b]$CN_{0.2}$ = commonly tabulated curve number for use with I_a=0.2S.

[c]Y = average land slope in the watershed.

[d]l = length of the longest flow path in the watershed.

[e]L = basin lag time (see Equation 4).

Abbreviations:

min = minute.

Table A-8. Subbasin Lag Times for Proposed Culverts				
Feature ID	$CN_{0.2}$[a]	Y (%)[b]	I (feet)[c]	L (min)[d]
C1	79	33	1110	3.7
C2	78	37	906	3.1
C3	78	47	1405	3.9
C4	78	34	1260	4.2
C5	77	42	2568	6.8
C6	75	38	3537	9.8
C7	73	34	857	3.5
C8	72	26	2982	11.3
C9	58	29	303	2.5
C10	56	22	290	2.9
C11	79	20	1208	5.2
HC1	63	23	697	4.8
HC2	70	30	905	4.3
HC3	71	23	6481	23.3
HC4	68	30	963	4.7
HC5	78	27	836	3.4
HC6	66	24	933	5.4
HC7	84	16	292	1.6
HC8	74	34	1655	5.9
HC9	75	34	444	2.0

Notes:

[a]$CN_{0.2}$ = commonly tabulated curve number for use with I_a=0.2S.

[b]Y = average land slope in the watershed.

[c]I = length of the longest flow path in the watershed.

[d]L = basin lag time (see Equation 4).

Abbreviations:

min = minute.

Table A-9. Subbasin Lag Times for Proposed Re-Established Drainage Channels				
Feature ID	$CN_{0.2}$[a]	Y (%)[b]	I (feet)[c]	L (min)[d]
RDP5-1a	75	41	2798	8
RDP7-1a	67	31	3300	13
RDP7-2a	71	22	2884	12
RDP8-1a	71	24	7037	24
RDEOR-1a	70	27	1811	8
RDEOR-2a	76	37	4034	11

Notes:

[a]$CN_{0.2}$ = commonly tabulated curve number for use with I_a=0.2S.

[b]Y = average land slope in the watershed.

[c]I = length of the longest flow path in the watershed.

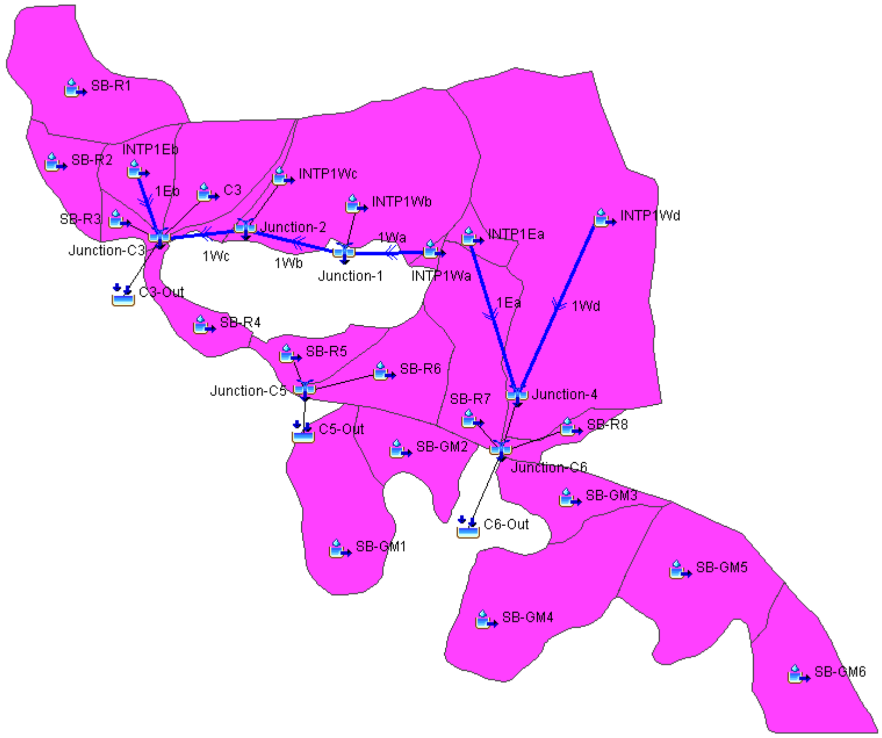
[d]L = basin lag time (see Equation 4).

Abbreviations:

min = minute.

Attachment B: HEC-HMS Model Schematics

Phase 1



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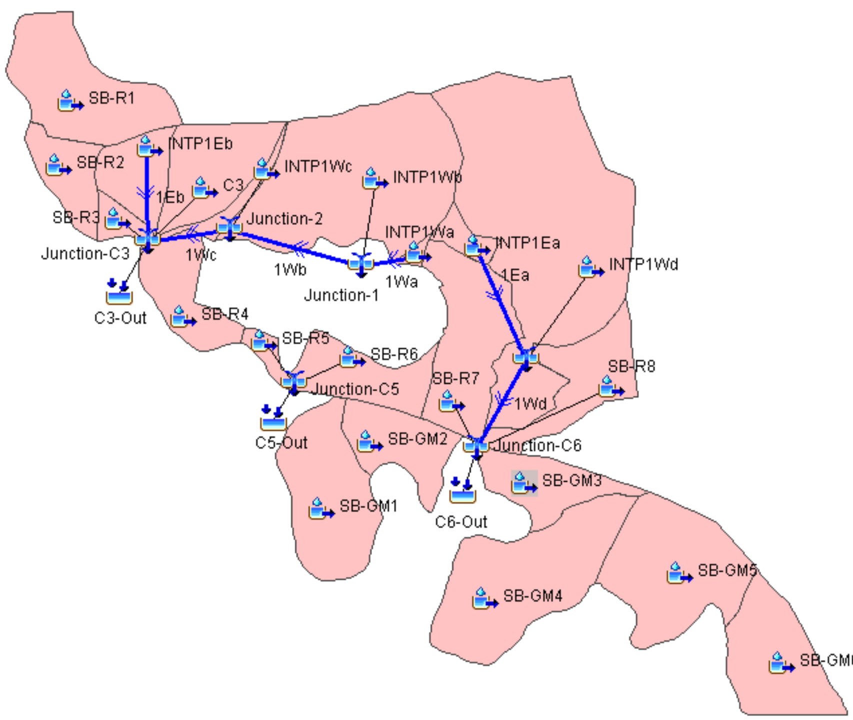
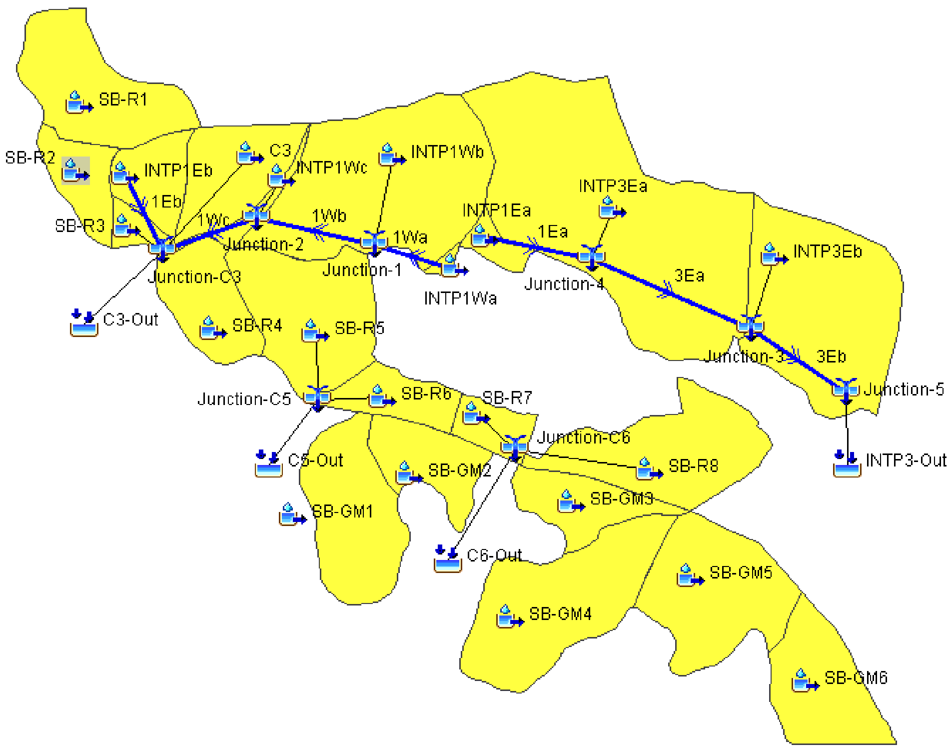


Phase 3

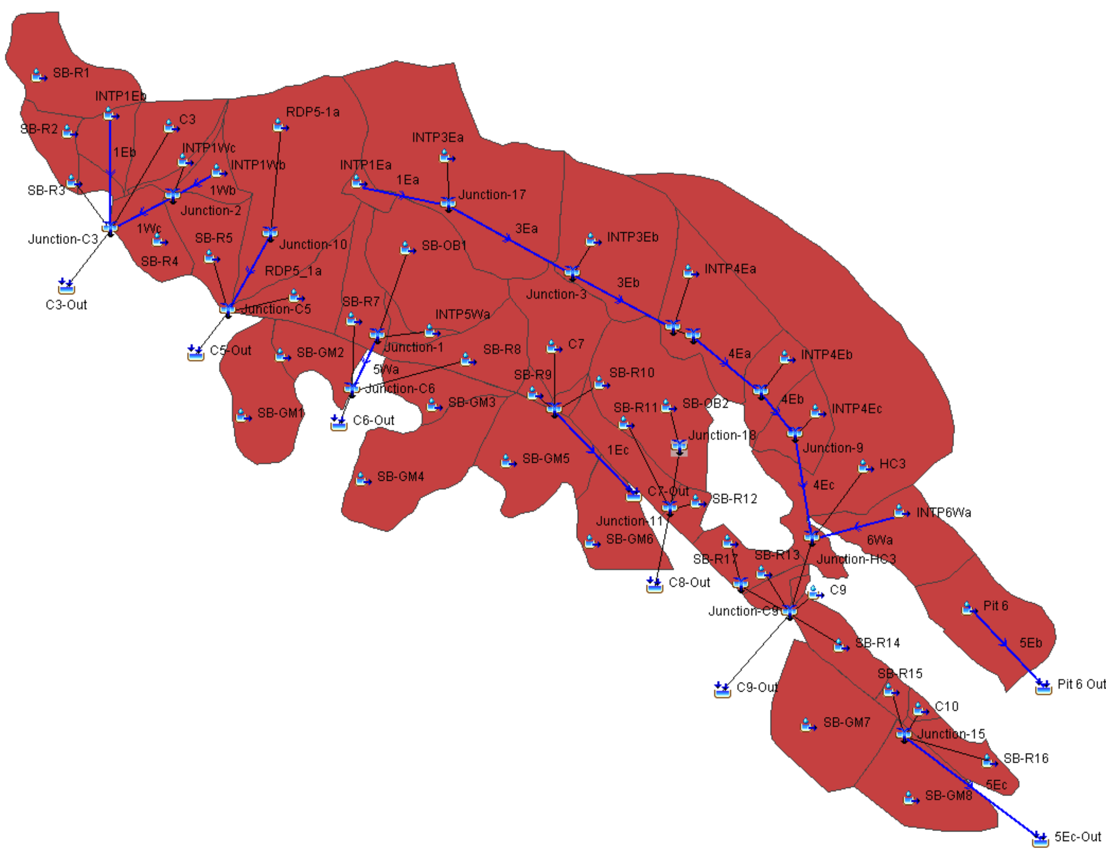


Phase 4

Brown AND Caldwell

Phase 5

Phase 6



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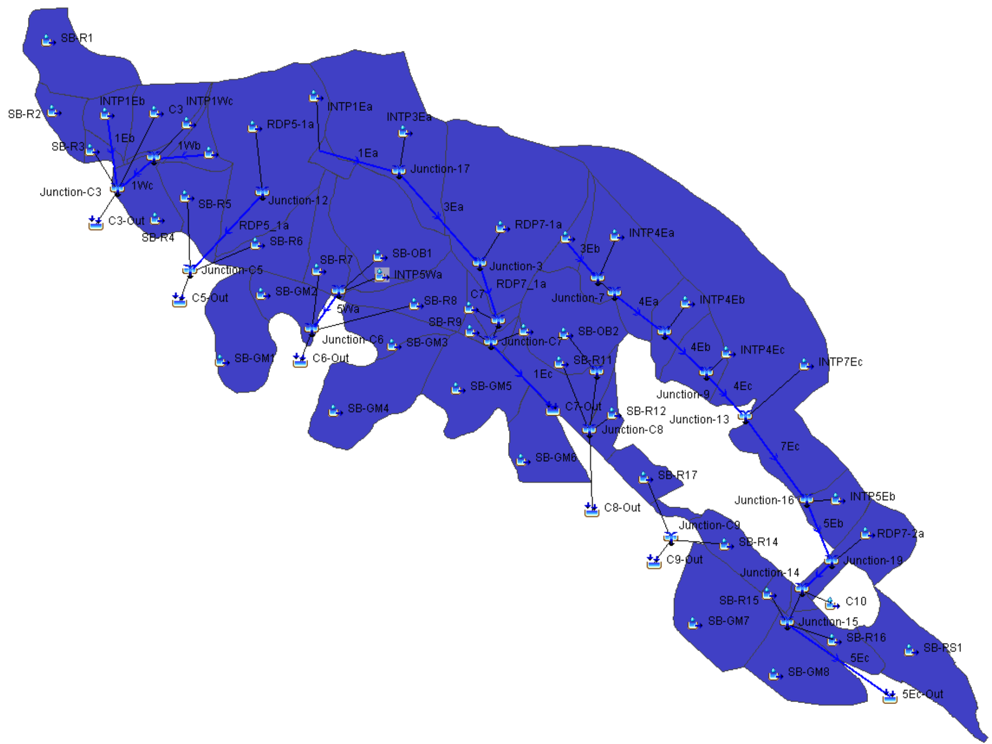
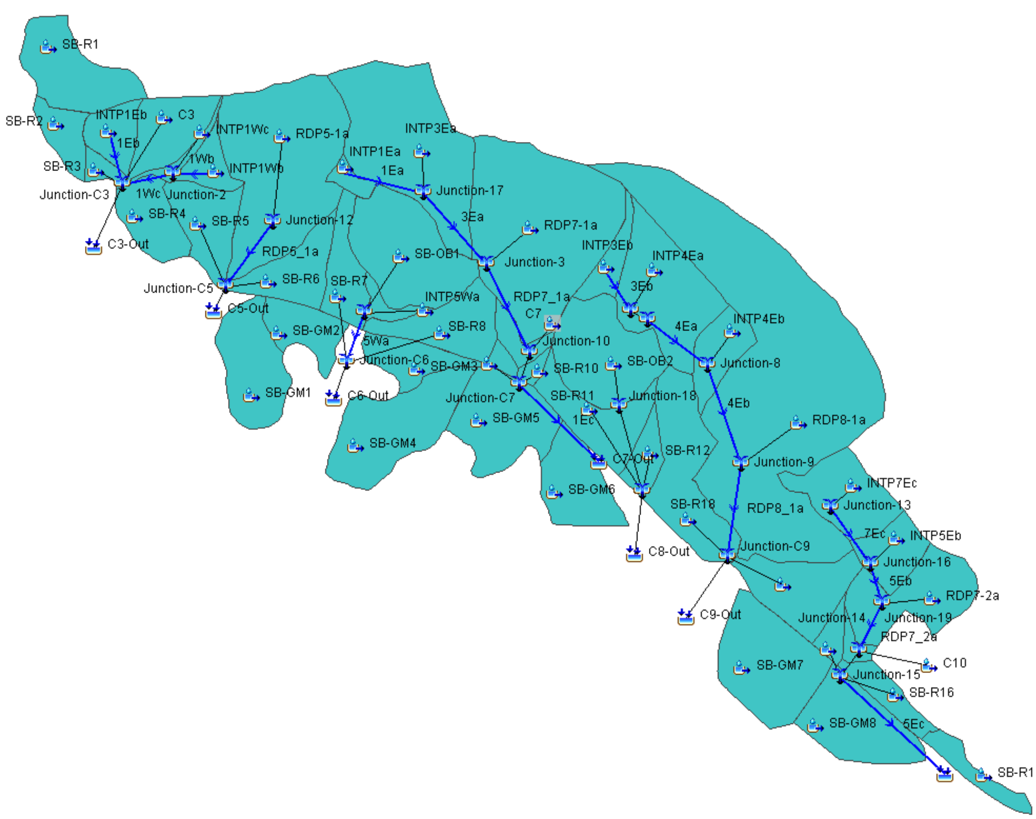
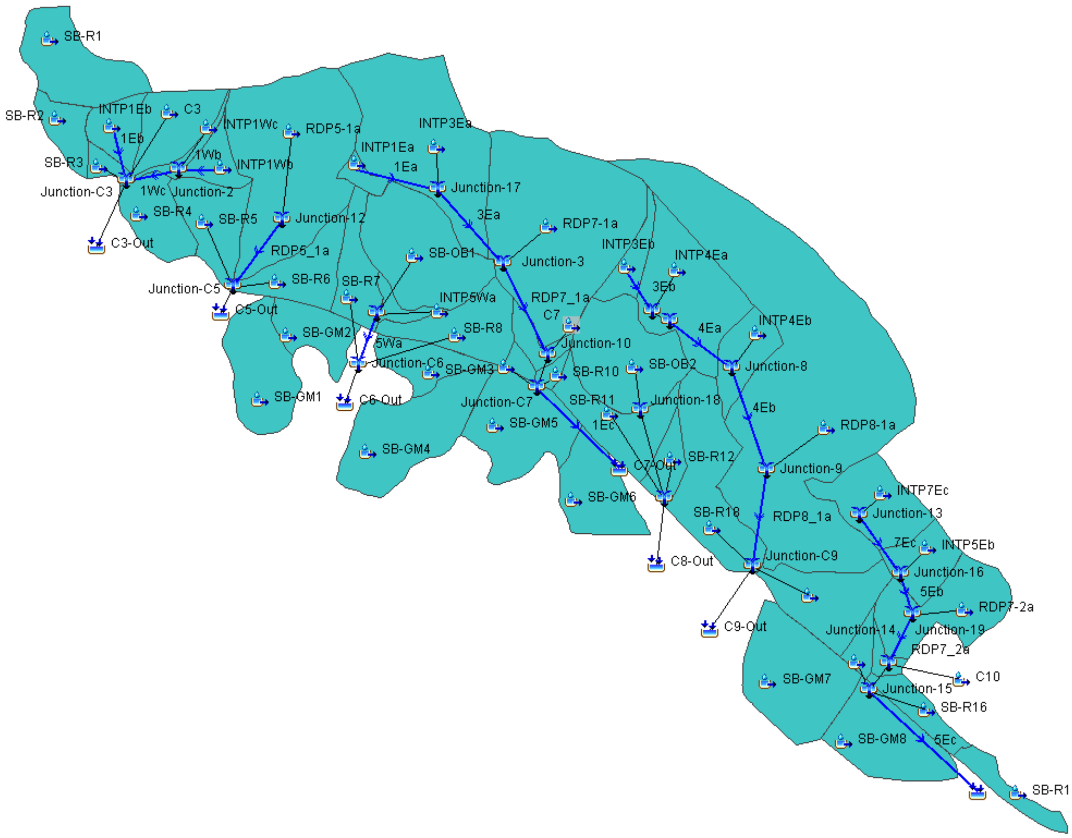


Phase 8



Phase 9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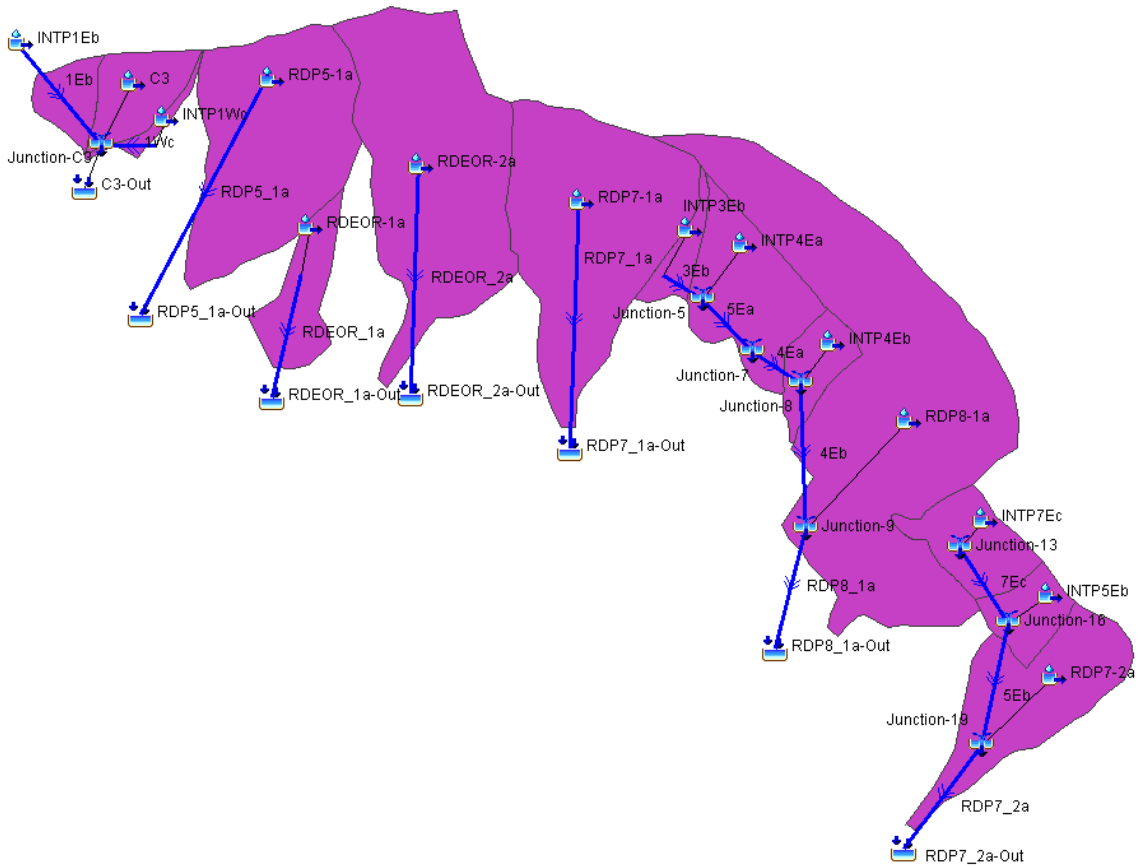
C3
INTP1Wc
RDP5-1a
INTP3Ea
1Eb
SB-R3
1Wb
INTP1Wb
INTP1Ea
1Ea
Junction-C3
1Wc
Junction-2
Junction-17
SB-R4
SB-R5
Junction-12
3Ea
RDP7-1a
C3-Out
RDP5_1a
SB-OB1
INTP3Eb
Junction-3
INTP4Ea
Junction-C5
SB-R6
SB-R7
3Eb
C5-Out
INTP5Wa
RDP7_1a
C7
4Ea
INTP4Eb
SB-GM2
SB-R8
5Wa
Junction-10
Junction-C6
SB-GM3
SB-R10
SB-OB2
Junction-8
SB-GM1
C6-Out
Junction-C7
SB-R11
Junction-18
4Eb
SB-GM5
1Ec
RDP8-1a
SB-GM4
C7-Out
SB-R12
Junction-9
SB-GM6
INTP7Ec
SB-R18
RDP8_1a
Junction-13
C8-Out
7Ec
INTP5Eb
Junction-C9
Junction-16
5Eb
RDP7-2a
C9-Out
Junction-14
Junction-19
RDP7_2a
C10
SB-GM7
Junction-15
SB-R16
SB-GM8
5Ec
SB-R19

End of Reclamation



Attachment C: HEC-HMS Model Output

Table C-1. Phase 1 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	24.7	19Oct2015, 11:58	1.3
C3-Out	0.108	105.5	19Oct2015, 12:01	6.5
C5-Out	0.032	30.7	19Oct2015, 11:58	1.6
C6-Out	0.155	111.1	19Oct2015, 12:03	7.5
INTP1Ea	0.004	4.4	19Oct2015, 11:57	0.2
INTP1Eb	0.013	14	19Oct2015, 11:57	0.7
INTP1Wa	0.001	1.3	19Oct2015, 11:55	0.1
INTP1Wb	0.064	70.6	19Oct2015, 12:00	4
INTP1Wc	0.004	4.4	19Oct2015, 11:59	0.2
INTP1Wd	0.117	83.9	19Oct2015, 12:04	5.7
Junction-C3	0.108	105.5	19Oct2015, 12:01	6.5
Junction-C5	0.032	30.7	19Oct2015, 11:58	1.6
Junction-C6	0.155	111.1	19Oct2015, 12:03	7.5
Junction-1	0.065	71.6	19Oct2015, 12:00	4.1
Junction-2	0.069	74.6	19Oct2015, 12:03	4.3
Junction-4	0.121	87.1	19Oct2015, 12:04	5.9
SB-GM1	0.031	8.7	19Oct2015, 12:07	0.8
SB-GM2	0.016	8.6	19Oct2015, 12:02	0.5
SB-GM3	0.015	4.1	19Oct2015, 12:04	0.3
SB-GM4	0.043	6.2	19Oct2015, 12:13	0.8
SB-GM5	0.036	8.6	19Oct2015, 12:06	0.8
SB-GM6	0.025	2.6	19Oct2015, 12:07	0.3
SB-R1	0.032	39.6	19Oct2015, 11:58	2
SB-R2	0.012	13.9	19Oct2015, 11:57	0.7
SB-R3	0.004	4.7	19Oct2015, 11:57	0.2
SB-R4	0.009	14	19Oct2015, 11:55	0.7
SB-R5	0.011	11.4	19Oct2015, 11:58	0.6
SB-R6	0.021	19.4	19Oct2015, 11:59	1
SB-R7	0.029	24.2	19Oct2015, 12:00	1.4
SB-R8	0.005	4.5	19Oct2015, 11:58	0.2
1Ea	0.004	4.4	19Oct2015, 12:00	0.2
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Wa	0.001	1.3	19Oct2015, 11:56	0.1
1Wb	0.065	71.3	19Oct2015, 12:04	4.1
1Wc	0.069	74.4	19Oct2015, 12:04	4.3
1Wd	0.117	83.6	19Oct2015, 12:04	5.7

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-2. Phase 1 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	21.3	19Oct2015, 11:58	1.1
C3-Out	0.108	91.1	19Oct2015, 12:02	5.7
C5-Out	0.032	26.2	19Oct2015, 11:59	1.4
C6-Out	0.155	93.8	19Oct2015, 12:03	6.4
INTP1Ea	0.004	3.8	19Oct2015, 11:58	0.2
INTP1Eb	0.013	12	19Oct2015, 11:57	0.6
INTP1Wa	0.001	1.2	19Oct2015, 11:55	0.1
INTP1Wb	0.064	61.6	19Oct2015, 12:01	3.5
INTP1Wc	0.004	3.8	19Oct2015, 11:59	0.2
INTP1Wd	0.117	70.8	19Oct2015, 12:04	4.9
Junction-C3	0.108	91.1	19Oct2015, 12:02	5.7
Junction-C5	0.032	26.2	19Oct2015, 11:59	1.4
Junction-C6	0.155	93.8	19Oct2015, 12:03	6.4
Junction-1	0.065	62.3	19Oct2015, 12:00	3.6
Junction-2	0.069	64.8	19Oct2015, 12:04	3.8
Junction-4	0.121	73.6	19Oct2015, 12:04	5.1
SB-GM1	0.031	6.7	19Oct2015, 12:07	0.6
SB-GM2	0.016	7	19Oct2015, 12:02	0.4
SB-GM3	0.015	3	19Oct2015, 12:04	0.3
SB-GM4	0.043	4.5	19Oct2015, 12:14	0.6
SB-GM5	0.036	6.3	19Oct2015, 12:07	0.6
SB-GM6	0.025	1.7	19Oct2015, 12:08	0.2
SB-R1	0.032	34.6	19Oct2015, 11:58	1.8
SB-R2	0.012	12	19Oct2015, 11:57	0.6
SB-R3	0.004	4.1	19Oct2015, 11:57	0.2
SB-R4	0.009	12.4	19Oct2015, 11:55	0.6
SB-R5	0.011	9.8	19Oct2015, 11:58	0.5
SB-R6	0.021	16.5	19Oct2015, 11:59	0.9
SB-R7	0.029	20.5	19Oct2015, 12:00	1.2
SB-R8	0.005	3.8	19Oct2015, 11:58	0.2
1Ea	0.004	3.8	19Oct2015, 12:00	0.2
1Eb	0.013	12	19Oct2015, 11:58	0.6
1Wa	0.001	1.2	19Oct2015, 11:56	0.1
1Wb	0.065	62.2	19Oct2015, 12:04	3.6
1Wc	0.069	64.8	19Oct2015, 12:04	3.8
1Wd	0.117	70.6	19Oct2015, 12:05	4.9

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-3. Phase 2 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	24.7	19Oct2015, 11:58	1.3
C3-Out	0.108	106.2	19Oct2015, 12:01	6.5
C5-Out	0.02	21.7	19Oct2015, 11:58	1.2
C6-Out	0.151	108.6	19Oct2015, 12:03	7.2
INTP1Ea	0.004	4.4	19Oct2015, 11:57	0.2
INTP1Eb	0.013	14	19Oct2015, 11:57	0.7
INTP1Wa	0.001	1.3	19Oct2015, 11:55	0.1
INTP1Wb	0.064	70.6	19Oct2015, 12:00	4
INTP1Wc	0.004	4.4	19Oct2015, 11:59	0.2
INTP1Wd	0.098	70.4	19Oct2015, 12:04	4.8
Junction-C3	0.108	106.2	19Oct2015, 12:01	6.5
Junction-C5	0.02	21.7	19Oct2015, 11:58	1.2
Junction-C6	0.151	108.6	19Oct2015, 12:03	7.2
Junction-1	0.065	71.6	19Oct2015, 12:00	4.1
Junction-2	0.069	74.5	19Oct2015, 12:03	4.3
Junction-4	0.102	73.9	19Oct2015, 12:04	5
SB-GM1	0.031	8.7	19Oct2015, 12:07	0.8
SB-GM2	0.016	8.6	19Oct2015, 12:02	0.5
SB-GM3	0.015	4.1	19Oct2015, 12:04	0.3
SB-GM4	0.043	6.2	19Oct2015, 12:13	0.8
SB-GM5	0.036	8.6	19Oct2015, 12:06	0.8
SB-GM6	0.025	2.6	19Oct2015, 12:07	0.3
SB-R1	0.032	39.6	19Oct2015, 11:58	2
SB-R2	0.012	13.9	19Oct2015, 11:56	0.7
SB-R3	0.004	6.3	19Oct2015, 11:56	0.2
SB-R4	0.016	19.6	19Oct2015, 11:58	1
SB-R5	0.003	5	19Oct2015, 11:55	0.2
SB-R6	0.017	17.7	19Oct2015, 11:59	0.9
SB-R7	0.029	25.6	19Oct2015, 12:00	1.4
SB-R8	0.02	13.9	19Oct2015, 12:01	0.8
1Ea	0.004	4.4	19Oct2015, 12:00	0.2
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Wa	0.001	1.3	19Oct2015, 11:56	0.1
1Wb	0.065	71.3	19Oct2015, 12:04	4.1
1Wc	0.069	74.4	19Oct2015, 12:04	4.3
1Wd	0.102	73.7	19Oct2015, 12:04	5

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-4. Phase 2 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	21.3	19Oct2015, 11:58	1.1
C3-Out	0.108	91.6	19Oct2015, 12:01	5.7
C5-Out	0.02	18.8	19Oct2015, 11:58	1
C6-Out	0.151	91.7	19Oct2015, 12:03	6.2
INTP1Ea	0.004	3.8	19Oct2015, 11:58	0.2
INTP1Eb	0.013	12	19Oct2015, 11:57	0.6
INTP1Wa	0.001	1.2	19Oct2015, 11:55	0.1
INTP1Wb	0.064	61.6	19Oct2015, 12:01	3.5
INTP1Wc	0.004	3.8	19Oct2015, 11:59	0.2
INTP1Wd	0.098	59.4	19Oct2015, 12:04	4.1
Junction-C3	0.108	91.6	19Oct2015, 12:01	5.7
Junction-C5	0.02	18.8	19Oct2015, 11:58	1
Junction-C6	0.151	91.7	19Oct2015, 12:03	6.2
Junction-1	0.065	62.3	19Oct2015, 12:00	3.6
Junction-2	0.069	64.8	19Oct2015, 12:04	3.8
Junction-4	0.102	62.5	19Oct2015, 12:04	4.3
SB-GM1	0.031	6.7	19Oct2015, 12:07	0.6
SB-GM2	0.016	7	19Oct2015, 12:02	0.4
SB-GM3	0.015	3	19Oct2015, 12:04	0.3
SB-GM4	0.043	4.5	19Oct2015, 12:14	0.6
SB-GM5	0.036	6.3	19Oct2015, 12:07	0.6
SB-GM6	0.025	1.7	19Oct2015, 12:08	0.2
SB-R1	0.032	34.6	19Oct2015, 11:58	1.8
SB-R2	0.012	12	19Oct2015, 11:56	0.6
SB-R3	0.004	5.6	19Oct2015, 11:56	0.2
SB-R4	0.016	17	19Oct2015, 11:58	0.9
SB-R5	0.003	4.4	19Oct2015, 11:55	0.2
SB-R6	0.017	15.2	19Oct2015, 11:59	0.8
SB-R7	0.029	21.7	19Oct2015, 12:00	1.2
SB-R8	0.02	11.5	19Oct2015, 12:01	0.7
1Ea	0.004	3.8	19Oct2015, 12:00	0.2
1Eb	0.013	12	19Oct2015, 11:58	0.6
1Wa	0.001	1.2	19Oct2015, 11:56	0.1
1Wb	0.065	62.2	19Oct2015, 12:04	3.6
1Wc	0.069	64.8	19Oct2015, 12:04	3.8
1Wd	0.102	62.3	19Oct2015, 12:04	4.3

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-5. Phase 3 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	24.7	19Oct2015, 11:58	1.3
C3-Out	0.108	106.2	19Oct2015, 12:01	6.5
C5-Out	0.047	49.7	19Oct2015, 11:58	2.6
C6-Out	0.044	34.8	19Oct2015, 12:00	2
INTP1Ea	0.004	4.4	19Oct2015, 11:57	0.2
INTP1Eb	0.013	14	19Oct2015, 11:57	0.7
INTP1Wa	0.001	1.3	19Oct2015, 11:55	0.1
INTP1Wb	0.064	70.6	19Oct2015, 12:00	4
INTP1Wc	0.004	4.4	19Oct2015, 11:59	0.2
INTP3Ea	0.102	68.2	19Oct2015, 12:05	4.8
INTP3Eb	0.057	21.9	19Oct2015, 12:05	1.6
INTP3-Out	0.163	90.9	19Oct2015, 12:10	6.7
Junction-C3	0.108	106.2	19Oct2015, 12:01	6.5
Junction-C5	0.047	49.7	19Oct2015, 11:58	2.6
Junction-C6	0.044	34.8	19Oct2015, 12:00	2
Junction-1	0.065	71.6	19Oct2015, 12:00	4.1
Junction-2	0.069	74.6	19Oct2015, 12:03	4.3
Junction-3	0.163	91	19Oct2015, 12:08	6.7
Junction-4	0.106	71.4	19Oct2015, 12:05	5
Junction-5	0.163	90.9	19Oct2015, 12:10	6.7
SB-GM1	0.031	8.1	19Oct2015, 12:07	0.8
SB-GM2	0.016	8.6	19Oct2015, 12:02	0.5
SB-GM3	0.015	4.1	19Oct2015, 12:04	0.3
SB-GM4	0.043	6.2	19Oct2015, 12:13	0.8
SB-GM5	0.036	4.3	19Oct2015, 12:08	0.5
SB-GM6	0.025	2.6	19Oct2015, 12:07	0.3
SB-R1	0.032	39.6	19Oct2015, 11:58	2
SB-R2	0.012	18	19Oct2015, 11:56	0.7
SB-R3	0.004	6.3	19Oct2015, 11:56	0.2
SB-R4	0.019	21	19Oct2015, 11:58	1.1
SB-R5	0.035	36.1	19Oct2015, 11:58	1.9
SB-R6	0.012	13.6	19Oct2015, 11:58	0.7
SB-R7	0.008	5.3	19Oct2015, 11:57	0.3
SB-R8	0.036	29.9	19Oct2015, 12:00	1.7
1Ea	0.004	4.4	19Oct2015, 12:00	0.2
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Wa	0.001	1.3	19Oct2015, 11:56	0.1

Table C-5. Phase 3 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
1Wb	0.065	71.3	19Oct2015, 12:04	4.1
1Wc	0.069	74.4	19Oct2015, 12:04	4.3
3Ea	0.106	71.2	19Oct2015, 12:08	5
3Eb	0.163	90.9	19Oct2015, 12:10	6.7

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-6. Phase 3 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	21.3	19Oct2015, 11:58	1.1
C3-Out	0.108	91.6	19Oct2015, 12:02	5.7
C5-Out	0.047	42.8	19Oct2015, 11:58	2.2
C6-Out	0.044	29.3	19Oct2015, 12:00	1.7
INTP1Ea	0.004	3.8	19Oct2015, 11:58	0.2
INTP1Eb	0.013	12	19Oct2015, 11:57	0.6
INTP1Wa	0.001	1.2	19Oct2015, 11:55	0.1
INTP1Wb	0.064	61.6	19Oct2015, 12:01	3.5
INTP1Wc	0.004	3.8	19Oct2015, 11:59	0.2
INTP3Ea	0.102	57.5	19Oct2015, 12:05	4.1
INTP3Eb	0.057	17.2	19Oct2015, 12:05	1.3
INTP3-Out	0.163	75.6	19Oct2015, 12:10	5.7
Junction-C3	0.108	91.6	19Oct2015, 12:02	5.7
Junction-C5	0.047	42.8	19Oct2015, 11:58	2.2
Junction-C6	0.044	29.3	19Oct2015, 12:00	1.7
Junction-1	0.065	62.3	19Oct2015, 12:00	3.6
Junction-2	0.069	64.8	19Oct2015, 12:04	3.8
Junction-3	0.163	75.8	19Oct2015, 12:08	5.7
Junction-4	0.106	60.3	19Oct2015, 12:05	4.3
Junction-5	0.163	75.6	19Oct2015, 12:10	5.7
SB-GM1	0.031	6	19Oct2015, 12:07	0.6
SB-GM2	0.016	7	19Oct2015, 12:02	0.4
SB-GM3	0.015	3	19Oct2015, 12:04	0.3
SB-GM4	0.043	4.5	19Oct2015, 12:14	0.6

Table C-6. Phase 3 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
SB-GM5	0.036	2.7	19Oct2015, 12:09	0.4
SB-GM6	0.025	1.7	19Oct2015, 12:08	0.2
SB-R1	0.032	34.6	19Oct2015, 11:58	1.8
SB-R2	0.012	15.9	19Oct2015, 11:56	0.6
SB-R3	0.004	5.6	19Oct2015, 11:56	0.2
SB-R4	0.019	18.1	19Oct2015, 11:58	0.9
SB-R5	0.035	31	19Oct2015, 11:58	1.6
SB-R6	0.012	11.7	19Oct2015, 11:58	0.6
SB-R7	0.008	4.4	19Oct2015, 11:58	0.2
SB-R8	0.036	25.3	19Oct2015, 12:01	1.5
1Ea	0.004	3.8	19Oct2015, 12:00	0.2
1Eb	0.013	12	19Oct2015, 11:58	0.6
1Wa	0.001	1.2	19Oct2015, 11:56	0.1
1Wb	0.065	62.2	19Oct2015, 12:04	3.6
1Wc	0.069	64.8	19Oct2015, 12:04	3.8
3Ea	0.106	60.1	19Oct2015, 12:09	4.3
3Eb	0.163	75.6	19Oct2015, 12:10	5.7

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-7. Phase 4 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	24.7	19Oct2015, 11:58	1.3
C3-Out	0.108	106.2	19Oct2015, 12:01	6.5
C5-Out	0.048	50.8	19Oct2015, 11:58	2.6
C6-Out	0.029	21.6	19Oct2015, 11:57	1.1
C7-Out	0.007	8.1	19Oct2015, 11:58	0.4
C8-Out	0.096	49.2	19Oct2015, 12:01	3.5
HC1	0.01	3.3	19Oct2015, 12:01	0.2
HC2	0.036	23.3	19Oct2015, 11:59	1.3
HC9	0.012	12.1	19Oct2015, 11:56	0.6
INTP1Ea	0.004	4.4	19Oct2015, 11:57	0.2
INTP1Eb	0.013	14.0	19Oct2015, 11:57	0.7

Table C-7. Phase 4 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
INTP1Wa	0.001	1.3	19Oct2015, 11:55	0.1
INTP1Wb	0.064	70.6	19Oct2015, 12:00	4.0
INTP1Wc	0.004	4.4	19Oct2015, 11:59	0.2
INTP3Ea	0.104	74.6	19Oct2015, 12:03	4.9
INTP3Eb	0.057	21.9	19Oct2015, 12:05	1.6
INTP4Ea	0.046	9.4	19Oct2015, 12:09	1.0
INTP4Eb	0.016	5.8	19Oct2015, 12:03	0.4
INTP4Ec	0.018	16.0	19Oct2015, 12:00	0.9
INTP4 Out	0.245	113.7	19Oct2015, 12:13	9.0
Junction-C3	0.108	106.2	19Oct2015, 12:01	6.5
Junction-C5	0.048	50.8	19Oct2015, 11:58	2.6
Junction-C6	0.029	21.6	19Oct2015, 11:57	1.1
Junction-C7	0.007	8.2	19Oct2015, 11:55	0.4
Junction-HC2	0.046	26.3	19Oct2015, 12:00	1.5
Junction-1	0.065	71.6	19Oct2015, 12:00	4.1
Junction-10	0.245	113.7	19Oct2015, 12:13	9.0
Junction-11	0.096	49.2	19Oct2015, 12:01	3.5
Junction-13	0.055	31.4	19Oct2015, 12:00	1.8
Junction-2	0.069	74.6	19Oct2015, 12:03	4.3
Junction-3	0.165	99.2	19Oct2015, 12:06	6.8
Junction-4	0.108	78.5	19Oct2015, 12:03	5.1
Junction-5	0.211	108.4	19Oct2015, 12:09	7.7
Junction-6	0.021	16.3	19Oct2015, 11:57	0.9
Junction-7	0.211	108.4	19Oct2015, 12:09	7.7
Junction-8	0.227	110.4	19Oct2015, 12:11	8.1
Junction-9	0.245	113.9	19Oct2015, 12:12	9.0
SB-R1	0.032	39.6	19Oct2015, 11:58	2.0
SB-R10	0.003	4.3	19Oct2015, 11:55	0.2
SB-R11	0.041	22.6	19Oct2015, 12:06	1.7
SB-R12	0.009	5.1	19Oct2015, 12:01	0.3
SB-R2	0.012	13.9	19Oct2015, 11:57	0.7
SB-R3	0.004	6.3	19Oct2015, 11:56	0.2
SB-R4	0.019	21.0	19Oct2015, 11:58	1.1
SB-R5	0.035	36.1	19Oct2015, 11:58	1.9
SB-R6	0.013	14.7	19Oct2015, 11:58	0.7
SB-R7	0.008	5.3	19Oct2015, 11:57	0.3
SB-R8	0.009	4.7	19Oct2015, 11:59	0.3

Table C-7. Phase 4 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
SB-R9	0.004	3.9	19Oct2015, 11:56	0.2
1Ea	0.004	4.4	19Oct2015, 12:00	0.2
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Ec	0.007	8.1	19Oct2015, 11:58	0.4
1Wa	0.001	1.3	19Oct2015, 11:56	0.1
1Wb	0.065	71.3	19Oct2015, 12:04	4.1
1Wc	0.069	74.4	19Oct2015, 12:04	4.3
3Ea	0.108	78.3	19Oct2015, 12:07	5.1
3Eb	0.165	99.0	19Oct2015, 12:09	6.8
4Ea	0.211	107.3	19Oct2015, 12:11	7.7
4Eb	0.227	110.1	19Oct2015, 12:12	8.1
4Ec	0.245	113.7	19Oct2015, 12:13	9.0
SB-GM1	0.031	8.1	19Oct2015, 12:07	0.8
SB-GM2	0.016	8.6	19Oct2015, 12:02	0.5
SB-GM3	0.015	4.1	19Oct2015, 12:04	0.3
SB-GM4	0.043	6.2	19Oct2015, 12:13	0.8
SB-GM5	0.036	4.3	19Oct2015, 12:08	0.5
SB-GM6	0.025	2.6	19Oct2015, 12:07	0.3
C3	0.022	24.7	19Oct2015, 11:58	1.3

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-8. Phase 4 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	21.3	19Oct2015, 11:58	1.1
C3-Out	0.108	91.6	19Oct2015, 12:02	5.7
C5-Out	0.048	43.7	19Oct2015, 11:58	2.3
C6-Out	0.029	17.9	19Oct2015, 11:57	1.0
C7-Out	0.007	7.0	19Oct2015, 11:59	0.3
C8-Out	0.096	40.0	19Oct2015, 12:02	2.9
HC1	0.01	2.4	19Oct2015, 12:01	0.2
HC2	0.036	18.9	19Oct2015, 12:00	1.1
HC9	0.012	10.3	19Oct2015, 11:56	0.5

Table C-8. Phase 4 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
INTP1Ea	0.004	3.8	19Oct2015, 11:58	0.2
INTP1Eb	0.013	12.0	19Oct2015, 11:57	0.6
INTP1Wa	0.001	1.2	19Oct2015, 11:55	0.1
INTP1Wb	0.064	61.6	19Oct2015, 12:01	3.5
INTP1Wc	0.004	3.8	19Oct2015, 11:59	0.2
INTP3Ea	0.104	63.1	19Oct2015, 12:04	4.2
INTP3Eb	0.057	17.2	19Oct2015, 12:05	1.3
INTP4Ea	0.046	7.0	19Oct2015, 12:10	0.8
INTP4Eb	0.016	4.4	19Oct2015, 12:03	0.3
INTP4Ec	0.018	13.6	19Oct2015, 12:00	0.7
INTP4 Out	0.245	93.7	19Oct2015, 12:14	7.6
Junction-C3	0.108	91.6	19Oct2015, 12:02	5.7
Junction-C5	0.048	43.7	19Oct2015, 11:58	2.3
Junction-C6	0.029	17.9	19Oct2015, 11:57	1.0
Junction-C7	0.007	7.0	19Oct2015, 11:55	0.3
Junction-HC2	0.046	21.3	19Oct2015, 12:00	1.2
Junction-1	0.065	62.3	19Oct2015, 12:00	3.6
Junction-10	0.245	93.7	19Oct2015, 12:14	7.6
Junction-11	0.096	40.0	19Oct2015, 12:02	2.9
Junction-13	0.055	25.4	19Oct2015, 12:00	1.5
Junction-2	0.069	64.8	19Oct2015, 12:04	3.8
Junction-3	0.165	82.8	19Oct2015, 12:07	5.7
Junction-4	0.108	66.3	19Oct2015, 12:03	4.4
Junction-5	0.211	89.6	19Oct2015, 12:09	6.5
Junction-6	0.021	13.5	19Oct2015, 11:57	0.7
Junction-7	0.211	89.6	19Oct2015, 12:09	6.5
Junction-8	0.227	90.9	19Oct2015, 12:12	6.8
Junction-9	0.245	94.0	19Oct2015, 12:12	7.6
SB-R1	0.032	34.6	19Oct2015, 11:58	1.8
SB-R10	0.003	3.8	19Oct2015, 11:55	0.2
SB-R11	0.041	18.7	19Oct2015, 12:06	1.4
SB-R12	0.009	4.1	19Oct2015, 12:01	0.3
SB-R2	0.012	12.0	19Oct2015, 11:57	0.6
SB-R3	0.004	5.6	19Oct2015, 11:56	0.2
SB-R4	0.019	18.1	19Oct2015, 11:58	0.9
SB-R5	0.035	31.0	19Oct2015, 11:58	1.6
SB-R6	0.013	12.7	19Oct2015, 11:58	0.6

Table C-8. Phase 4 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
SB-R7	0.008	4.4	19Oct2015, 11:58	0.2
SB-R8	0.009	3.8	19Oct2015, 12:00	0.2
SB-R9	0.004	3.3	19Oct2015, 11:56	0.2
1Ea	0.004	3.8	19Oct2015, 12:00	0.2
1Eb	0.013	12.0	19Oct2015, 11:58	0.6
1Ec	0.007	7.0	19Oct2015, 11:59	0.3
1Wa	0.001	1.2	19Oct2015, 11:56	0.1
1Wb	0.065	62.2	19Oct2015, 12:04	3.6
1Wc	0.069	64.8	19Oct2015, 12:04	3.8
3Ea	0.108	66.2	19Oct2015, 12:07	4.4
3Eb	0.165	82.6	19Oct2015, 12:09	5.7
4Ea	0.211	88.7	19Oct2015, 12:12	6.5
4Eb	0.227	90.7	19Oct2015, 12:12	6.8
4Ec	0.245	93.7	19Oct2015, 12:14	7.6
SB-GM1	0.031	6	19Oct2015, 12:07	0.6
SB-GM2	0.016	7	19Oct2015, 12:02	0.4
SB-GM3	0.015	3	19Oct2015, 12:04	0.3
SB-GM4	0.043	4.5	19Oct2015, 12:14	0.6
SB-GM5	0.036	2.7	19Oct2015, 12:09	0.4
SB-GM6	0.025	1.7	19Oct2015, 12:08	0.2

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-9. Phase 5 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.035	17.2	19Oct2015, 12:04	1.2
C3	0.022	24.7	19Oct2015, 11:58	1.3
C3-Out	0.053	60.9	19Oct2015, 11:58	3.1
C5-Out	0.128	118.8	19Oct2015, 12:01	7.0
C6-Out	0.096	71.1	19Oct2015, 12:01	4.1
C7	0.002	1.2	19Oct2015, 11:59	0.1
C7-Out	0.006	6.7	19Oct2015, 11:59	0.3
C8-Out	0.022	18.7	19Oct2015, 12:01	1.1
C9	0.002	0.4	19Oct2015, 11:59	0.0

Table C-9. Phase 5 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C9-Out	0.507	188.8	19Oct2015, 12:14	19.8
HC3	0.198	67.6	19Oct2015, 12:18	7.9
INTP1Ea	0.004	4.4	19Oct2015, 11:57	0.2
INTP1Eb	0.013	14.0	19Oct2015, 11:57	0.7
INTP1Wb	0.01	12.7	19Oct2015, 11:57	0.6
INTP1Wc	0.004	4.4	19Oct2015, 11:59	0.2
INTP3Ea	0.104	74.6	19Oct2015, 12:03	4.9
INTP3Eb	0.057	21.9	19Oct2015, 12:05	1.6
INTP4Ea	0.046	9.4	19Oct2015, 12:09	1.0
INTP4Eb	0.016	5.8	19Oct2015, 12:03	0.4
INTP4Ec	0.018	16.0	19Oct2015, 12:00	0.9
INTP5Eb	0.016	12.0	19Oct2015, 11:59	0.7
INTP5Wa	0.005	2.1	19Oct2015, 11:59	0.1
Junction-C3	0.053	60.9	19Oct2015, 11:58	3.1
Junction-C5	0.128	118.8	19Oct2015, 12:01	7.0
Junction-C6	0.096	71.1	19Oct2015, 12:01	4.1
Junction-C7	0.006	6.7	19Oct2015, 11:55	0.3
Junction-C9	0.507	188.8	19Oct2015, 12:14	19.8
Junction-HC3	0.443	177.6	19Oct2015, 12:14	16.9
Junction-1	0.053	36.7	19Oct2015, 12:00	2.1
Junction-10	0.245	113.7	19Oct2015, 12:13	9.0
Junction-11	0.022	18.7	19Oct2015, 12:01	1.1
Junction-12	0.019	11.2	19Oct2015, 12:00	0.6
Junction-15	0.104	64.4	19Oct2015, 11:59	4.1
Junction-16	0.051	28.2	19Oct2015, 12:03	1.9
Junction-17	0.108	78.5	19Oct2015, 12:03	5.1
Junction-18	0.085	81.4	19Oct2015, 12:01	4.7
Junction-2	0.014	17.0	19Oct2015, 11:59	0.9
Junction-3	0.165	99.2	19Oct2015, 12:06	6.8
Junction-5	0.211	108.4	19Oct2015, 12:09	7.7
Junction-7	0.211	108.4	19Oct2015, 12:09	7.7
Junction-8	0.227	110.4	19Oct2015, 12:11	8.1
Junction-9	0.245	113.9	19Oct2015, 12:12	9.0
RDP5-1a	0.085	81.4	19Oct2015, 12:01	4.7
RDP5_1a	0.085	81.1	19Oct2015, 12:02	4.7
SB-GM7	0.044	8.1	19Oct2015, 12:06	0.8
SB-GM8	0.033	2.7	19Oct2015, 12:07	0.4
SB-OB1	0.048	34.6	19Oct2015, 12:00	2.0
SB-PSP5a	0.023	15.2	19Oct2015, 11:57	0.8
SB-PSP5b	0.009	5.1	19Oct2015, 12:00	0.3
SB-R1	0.032	39.6	19Oct2015, 11:58	2.0

Table C-9. Phase 5 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
SB-R10	0.002	3.2	19Oct2015, 11:54	0.1
SB-R11	0.016	15.1	19Oct2015, 12:00	0.9
SB-R12	0.006	3.6	19Oct2015, 12:01	0.2
SB-R13	0.006	3.8	19Oct2015, 11:59	0.2
SB-R14	0.037	38.8	19Oct2015, 11:59	2.1
SB-R15	0.004	4.6	19Oct2015, 11:55	0.2
SB-R16	0.017	18.5	19Oct2015, 11:57	0.9
SB-R17	0.019	11.2	19Oct2015, 12:00	0.6
SB-R2	0.012	13.9	19Oct2015, 11:56	0.7
SB-R3	0.004	6.5	19Oct2015, 11:56	0.2
SB-R4	0.019	21.0	19Oct2015, 12:29	1.1
SB-R5	0.022	23.6	19Oct2015, 11:58	1.2
SB-R6	0.021	17.7	19Oct2015, 12:01	1.0
SB-R7	0.017	13.6	19Oct2015, 12:00	0.8
SB-R8	0.026	21.1	19Oct2015, 12:00	1.2
SB-R9	0.002	2.7	19Oct2015, 11:55	0.1
1Ea	0.004	4.4	19Oct2015, 12:00	0.2
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Ec	0.006	6.7	19Oct2015, 11:59	0.3
1Wb	0.01	12.7	19Oct2015, 11:59	0.6
1Wc	0.014	16.9	19Oct2015, 12:00	0.9
3Ea	0.108	78.3	19Oct2015, 12:07	5.1
3Eb	0.165	99.0	19Oct2015, 12:09	6.8
4Ea	0.211	107.3	19Oct2015, 12:11	7.7
4Eb	0.227	110.1	19Oct2015, 12:12	8.1
4Ec	0.245	113.7	19Oct2015, 12:13	9.0
5Eb	0.016	12.0	19Oct2015, 12:01	0.7
5Ec	0.104	63.4	19Oct2015, 12:03	4.1
5Ec-Out	0.104	63.4	19Oct2015, 12:03	4.1
5Wa	0.053	36.5	19Oct2015, 12:01	2.1
SB-GM1	0.031	8.1	19Oct2015, 12:07	0.8
SB-GM2	0.016	8.6	19Oct2015, 12:02	0.5
SB-GM3	0.015	4.1	19Oct2015, 12:04	0.3
SB-GM4	0.043	6.2	19Oct2015, 12:13	0.8
SB-GM5	0.036	4.3	19Oct2015, 12:08	0.5
SB-GM6	0.025	2.6	19Oct2015, 12:07	0.3

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-10. Phase 5 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.035	13.9	19Oct2015, 12:04	1.0
C3	0.022	21.3	19Oct2015, 11:58	1.1
C3-Out	0.053	52.7	19Oct2015, 11:58	2.6
C5-Out	0.128	101.7	19Oct2015, 12:01	6.0
C6-Out	0.096	59.6	19Oct2015, 12:01	3.5
C7	0.002	1.0	19Oct2015, 12:00	0.1
C7-Out	0.006	5.8	19Oct2015, 11:59	0.3
C8-Out	0.022	15.9	19Oct2015, 12:01	0.9
C9	0.002	0.3	19Oct2015, 12:00	0.0
C9-Out	0.507	156.5	19Oct2015, 12:15	16.7
HC3	0.198	55.7	19Oct2015, 12:19	6.7
INTP1Ea	0.004	3.8	19Oct2015, 11:58	0.2
INTP1Eb	0.013	12.0	19Oct2015, 11:57	0.6
INTP1Wb	0.01	11.1	19Oct2015, 11:57	0.6
INTP1Wc	0.004	3.8	19Oct2015, 11:59	0.2
INTP3Ea	0.104	63.1	19Oct2015, 12:04	4.2
INTP3Eb	0.057	17.2	19Oct2015, 12:05	1.3
INTP4Ea	0.046	7.0	19Oct2015, 12:10	0.8
INTP4Eb	0.016	4.4	19Oct2015, 12:03	0.3
INTP4Ec	0.018	13.6	19Oct2015, 12:00	0.7
INTP5Eb	0.016	10.0	19Oct2015, 12:00	0.6
INTP5Wa	0.005	1.6	19Oct2015, 12:00	0.1
Junction-C3	0.053	52.7	19Oct2015, 11:58	2.6
Junction-C5	0.128	101.7	19Oct2015, 12:01	6.0
Junction-C6	0.096	59.6	19Oct2015, 12:01	3.5
Junction-C7	0.006	5.8	19Oct2015, 11:55	0.3
Junction-C9	0.507	156.5	19Oct2015, 12:15	16.7
Junction-HC3	0.443	146.7	19Oct2015, 12:15	14.2
Junction-1	0.053	30.3	19Oct2015, 12:00	1.8
Junction-10	0.245	93.7	19Oct2015, 12:14	7.6
Junction-11	0.022	15.9	19Oct2015, 12:01	0.9
Junction-12	0.019	9.2	19Oct2015, 12:00	0.5
Junction-15	0.104	53.3	19Oct2015, 11:59	3.4
Junction-16	0.051	23.1	19Oct2015, 12:03	1.6
Junction-17	0.108	66.3	19Oct2015, 12:03	4.4
Junction-18	0.085	70.0	19Oct2015, 12:01	4.1
Junction-2	0.014	14.8	19Oct2015, 11:59	0.7
Junction-3	0.165	82.8	19Oct2015, 12:07	5.7
Junction-5	0.211	89.6	19Oct2015, 12:09	6.5

Table C-10. Phase 5 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
Junction-7	0.211	89.6	19Oct2015, 12:09	6.5
Junction-8	0.227	90.9	19Oct2015, 12:12	6.8
Junction-9	0.245	94.0	19Oct2015, 12:12	7.6
RDP5-1a	0.085	70.0	19Oct2015, 12:01	4.1
RDP5_1a	0.085	69.6	19Oct2015, 12:02	4.1
SB-GM7	0.044	5.8	19Oct2015, 12:07	0.6
SB-GM8	0.033	1.6	19Oct2015, 12:08	0.3
SB-OB1	0.048	28.7	19Oct2015, 12:01	1.7
SB-PSP5a	0.023	12.5	19Oct2015, 11:57	0.6
SB-PSP5b	0.009	4.2	19Oct2015, 12:01	0.3
SB-R1	0.032	34.6	19Oct2015, 11:58	1.8
SB-R10	0.002	2.8	19Oct2015, 11:54	0.1
SB-R11	0.016	13.0	19Oct2015, 12:01	0.7
SB-R12	0.006	2.9	19Oct2015, 12:01	0.2
SB-R13	0.006	3.1	19Oct2015, 11:59	0.2
SB-R14	0.037	33.4	19Oct2015, 11:59	1.8
SB-R15	0.004	3.9	19Oct2015, 11:55	0.2
SB-R16	0.017	15.9	19Oct2015, 11:57	0.8
SB-R17	0.019	9.2	19Oct2015, 12:00	0.5
SB-R2	0.012	12.0	19Oct2015, 11:56	0.6
SB-R3	0.004	5.8	19Oct2015, 11:56	0.2
SB-R4	0.019	18.1	19Oct2015, 12:29	0.9
SB-R5	0.022	20.3	19Oct2015, 11:58	1.1
SB-R6	0.021	15.0	19Oct2015, 12:01	0.9
SB-R7	0.017	11.5	19Oct2015, 12:01	0.7
SB-R8	0.026	17.7	19Oct2015, 12:01	1.0
SB-R9	0.002	2.3	19Oct2015, 11:55	0.1
1Ea	0.004	3.8	19Oct2015, 12:00	0.2
1Eb	0.013	12.0	19Oct2015, 11:58	0.6
1Ec	0.006	5.8	19Oct2015, 11:59	0.3
1Wb	0.01	11.1	19Oct2015, 11:59	0.6
1Wc	0.014	14.8	19Oct2015, 12:00	0.7
3Ea	0.108	66.2	19Oct2015, 12:07	4.4
3Eb	0.165	82.6	19Oct2015, 12:09	5.7
4Ea	0.211	88.7	19Oct2015, 12:12	6.5
4Eb	0.227	90.7	19Oct2015, 12:12	6.8
4Ec	0.245	93.7	19Oct2015, 12:14	7.6
5Eb	0.016	10.0	19Oct2015, 12:01	0.6
5Ec	0.104	52.4	19Oct2015, 12:03	3.4

Table C-10. Phase 5 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
5Ec-Out	0.104	52.4	19Oct2015, 12:03	3.4
5Wa	0.053	30.3	19Oct2015, 12:01	1.8
SB-GM1	0.031	6	19Oct2015, 12:07	0.6
SB-GM2	0.016	7	19Oct2015, 12:02	0.4
SB-GM3	0.015	3	19Oct2015, 12:04	0.3
SB-GM4	0.043	4.5	19Oct2015, 12:14	0.6
SB-GM5	0.036	2.7	19Oct2015, 12:09	0.4
SB-GM6	0.025	1.7	19Oct2015, 12:08	0.2

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-11. Phase 6 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.002	0.2	19Oct2015, 12:01	0.0
C3	0.022	24.7	19Oct2015, 11:58	1.3
C3-Out	0.053	60.7	19Oct2015, 11:58	3.1
C5-Out	0.128	118.8	19Oct2015, 12:01	7.0
C6-Out	0.091	66.6	19Oct2015, 12:01	3.8
C7	0.03	15.2	19Oct2015, 12:03	1.0
C7-Out	0.036	19.4	19Oct2015, 12:03	1.4
C8-Out	0.076	49.8	19Oct2015, 12:01	3.0
C9	0.001	0.3	19Oct2015, 11:59	0.0
C9-Out	0.468	184.5	19Oct2015, 12:13	18.4
HC3	0.155	55.2	19Oct2015, 12:18	6.4
INTP1Ea	0.004	4.4	19Oct2015, 11:57	0.2
INTP1Eb	0.013	14.0	19Oct2015, 11:57	0.7
INTP1Wb	0.01	12.7	19Oct2015, 11:57	0.6
INTP1Wc	0.004	4.4	19Oct2015, 11:59	0.2
INTP3Ea	0.104	74.6	19Oct2015, 12:03	4.9
INTP3Eb	0.057	21.9	19Oct2015, 12:05	1.6
INTP4Ea	0.046	9.4	19Oct2015, 12:09	1.0
INTP4Eb	0.016	5.8	19Oct2015, 12:03	0.4
INTP4Ec	0.018	16.0	19Oct2015, 12:00	0.9
INTP5Wa	0.005	0.1	19Oct2015, 00:00	0.0

Table C-11. Phase 6 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
INTP6Wa	0.03	21.7	19Oct2015, 12:03	1.4
Junction-C3	0.053	60.7	19Oct2015, 11:58	3.1
Junction-C5	0.128	118.8	19Oct2015, 12:01	7.0
Junction-C6	0.091	66.6	19Oct2015, 12:01	3.8
Junction-C7	0.036	19.4	19Oct2015, 12:00	1.4
Junction-C9	0.468	184.5	19Oct2015, 12:13	18.4
Junction-HC3	0.43	178.4	19Oct2015, 12:13	16.8
Junction-1	0.051	33.3	19Oct2015, 12:00	1.9
Junction-10	0.085	81.4	19Oct2015, 12:01	4.7
Junction-11	0.076	49.8	19Oct2015, 12:01	3.0
Junction-12	0.014	7.3	19Oct2015, 11:59	0.4
Junction-15	0.02	23.7	19Oct2015, 11:56	1.2
Junction-17	0.108	78.5	19Oct2015, 12:03	5.1
Junction-18	0.053	30.8	19Oct2015, 12:01	1.8
Junction-2	0.014	17.0	19Oct2015, 11:59	0.9
Junction-3	0.165	99.2	19Oct2015, 12:06	6.8
Junction-5	0.211	108.4	19Oct2015, 12:09	7.7
Junction-7	0.211	108.4	19Oct2015, 12:09	7.7
Junction-8	0.227	110.4	19Oct2015, 12:11	8.1
Junction-9	0.245	113.9	19Oct2015, 12:12	9.0
Pit 6	0.037	31.2	19Oct2015, 11:59	1.7
Pit 6 Out	0.037	31.1	19Oct2015, 12:00	1.7
RDP5-1a	0.085	81.4	19Oct2015, 12:01	4.7
RDP5_1a	0.085	81.1	19Oct2015, 12:02	4.7
SB-OB1	0.046	33.2	19Oct2015, 12:00	1.9
SB-OB2	0.053	30.8	19Oct2015, 12:01	1.8
SB-R1	0.032	39.6	19Oct2015, 11:58	2.0
SB-R10	0.003	4.3	19Oct2015, 11:55	0.2
SB-R11	0.017	15.5	19Oct2015, 12:01	0.9
SB-R12	0.006	4.1	19Oct2015, 11:58	0.2
SB-R13	0.006	3.8	19Oct2015, 11:59	0.2
SB-R14	0.017	19.4	19Oct2015, 11:57	1.0
SB-R15	0.004	4.5	19Oct2015, 11:56	0.2
SB-R16	0.014	19.2	19Oct2015, 11:57	0.9
SB-R17	0.014	7.3	19Oct2015, 11:59	0.4
SB-R2	0.012	13.9	19Oct2015, 11:56	0.6
SB-R3	0.004	6.3	19Oct2015, 11:56	0.2

Table C-11. Phase 6 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
SB-R4	0.019	21.0	19Oct2015, 11:58	1.1
SB-R5	0.022	23.6	19Oct2015, 11:58	1.2
SB-R6	0.021	17.7	19Oct2015, 12:01	1.0
SB-R7	0.017	13.6	19Oct2015, 12:00	0.8
SB-R8	0.023	20.0	19Oct2015, 12:00	1.1
SB-R9	0.003	3.5	19Oct2015, 11:56	0.2
1Ea	0.004	4.4	19Oct2015, 12:00	0.2
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Ec	0.036	19.4	19Oct2015, 12:03	1.4
1Wb	0.01	12.7	19Oct2015, 11:59	0.6
1Wc	0.014	16.9	19Oct2015, 12:00	0.9
3Ea	0.108	78.3	19Oct2015, 12:07	5.1
3Eb	0.165	99.0	19Oct2015, 12:09	6.8
4Ea	0.211	107.3	19Oct2015, 12:11	7.7
4Eb	0.227	110.1	19Oct2015, 12:12	8.1
4Ec	0.245	113.7	19Oct2015, 12:13	9.0
5Eb	0.037	31.1	19Oct2015, 12:00	1.7
5Ec	0.02	23.3	19Oct2015, 12:02	1.2
5Ec-Out	0.02	23.3	19Oct2015, 12:02	1.2
5Wa	0.051	33.2	19Oct2015, 12:01	1.9
6Wa	0.03	21.7	19Oct2015, 12:05	1.4
SB-GM1	0.031	8.1	19Oct2015, 12:07	0.8
SB-GM2	0.016	8.6	19Oct2015, 12:02	0.5
SB-GM3	0.015	4.1	19Oct2015, 12:04	0.3
SB-GM4	0.043	6.2	19Oct2015, 12:13	0.8
SB-GM5	0.036	4.3	19Oct2015, 12:08	0.5
SB-GM6	0.025	2.6	19Oct2015, 12:07	0.3
SB-GM7	0.044	8.1	19Oct2015, 12:06	0.8
SB-GM8	0.033	2.7	19Oct2015, 12:07	0.4

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-12. Phase 6 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.002	0.1	19Oct2015, 12:02	0.0
C3	0.022	21.3	19Oct2015, 11:58	1.1
C3-Out	0.053	52.5	19Oct2015, 11:58	2.6
C5-Out	0.128	101.7	19Oct2015, 12:01	6.0
C6-Out	0.091	56.1	19Oct2015, 12:01	3.2
C7	0.03	12.3	19Oct2015, 12:03	0.8
C7-Out	0.036	15.9	19Oct2015, 12:03	1.2
C8-Out	0.076	41.3	19Oct2015, 12:01	2.5
C9	0.001	0.2	19Oct2015, 12:00	0.0
C9-Out	0.468	152.7	19Oct2015, 12:14	15.5
HC3	0.155	45.6	19Oct2015, 12:18	5.4
INTP1Ea	0.004	3.8	19Oct2015, 11:58	0.2
INTP1Eb	0.013	12.0	19Oct2015, 11:57	0.6
INTP1Wb	0.01	11.1	19Oct2015, 11:57	0.6
INTP1Wc	0.004	3.8	19Oct2015, 11:59	0.2
INTP3Ea	0.104	63.1	19Oct2015, 12:04	4.2
INTP3Eb	0.057	17.2	19Oct2015, 12:05	1.3
INTP4Ea	0.046	7.0	19Oct2015, 12:10	0.8
INTP4Eb	0.016	4.4	19Oct2015, 12:03	0.3
INTP4Ec	0.018	13.6	19Oct2015, 12:00	0.7
INTP5Wa	0.005	0.1	19Oct2015, 00:00	0.0
INTP6Wa	0.03	18.3	19Oct2015, 12:03	1.2
Junction-C3	0.053	52.5	19Oct2015, 11:58	2.6
Junction-C5	0.128	101.7	19Oct2015, 12:01	6.0
Junction-C6	0.091	56.1	19Oct2015, 12:01	3.2
Junction-C7	0.036	15.9	19Oct2015, 12:00	1.2
Junction-C9	0.468	152.7	19Oct2015, 12:14	15.5
Junction-HC3	0.43	147.3	19Oct2015, 12:14	14.1
Junction-1	0.051	27.7	19Oct2015, 12:01	1.6
Junction-10	0.085	70.0	19Oct2015, 12:01	4.1
Junction-11	0.076	41.3	19Oct2015, 12:01	2.5
Junction-12	0.014	5.8	19Oct2015, 11:59	0.3
Junction-15	0.02	20.6	19Oct2015, 11:57	1.0
Junction-17	0.108	66.3	19Oct2015, 12:03	4.4
Junction-18	0.053	25.1	19Oct2015, 12:01	1.5
Junction-2	0.014	14.8	19Oct2015, 11:59	0.7
Junction-3	0.165	82.8	19Oct2015, 12:07	5.7

Table C-12. Phase 6 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
Junction-5	0.211	89.5	19Oct2015, 12:09	6.5
Junction-7	0.211	89.5	19Oct2015, 12:09	6.5
Junction-8	0.227	90.9	19Oct2015, 12:12	6.8
Junction-9	0.245	94.0	19Oct2015, 12:12	7.6
Pit 6	0.037	26.4	19Oct2015, 11:59	1.4
Pit 6 Out	0.037	26.3	19Oct2015, 12:01	1.4
RDP5-1a	0.085	70.0	19Oct2015, 12:01	4.1
RDP5_1a	0.085	69.6	19Oct2015, 12:02	4.1
SB-OB1	0.046	27.6	19Oct2015, 12:01	1.6
SB-OB2	0.053	25.1	19Oct2015, 12:01	1.5
SB-R1	0.032	34.6	19Oct2015, 11:58	1.8
SB-R10	0.003	3.7	19Oct2015, 11:55	0.2
SB-R11	0.017	13.3	19Oct2015, 12:01	0.8
SB-R12	0.006	3.4	19Oct2015, 11:58	0.2
SB-R13	0.006	3.1	19Oct2015, 11:59	0.2
SB-R14	0.017	16.7	19Oct2015, 11:58	0.8
SB-R15	0.004	3.8	19Oct2015, 11:56	0.2
SB-R16	0.014	16.8	19Oct2015, 11:57	0.8
SB-R17	0.014	5.8	19Oct2015, 11:59	0.3
SB-R2	0.012	12.0	19Oct2015, 11:56	0.6
SB-R3	0.004	5.6	19Oct2015, 11:56	0.2
SB-R4	0.019	18.1	19Oct2015, 11:58	0.9
SB-R5	0.022	20.3	19Oct2015, 11:58	1.1
SB-R6	0.021	15.0	19Oct2015, 12:01	0.9
SB-R7	0.017	11.5	19Oct2015, 12:01	0.7
SB-R8	0.023	16.9	19Oct2015, 12:00	1.0
SB-R9	0.003	3.0	19Oct2015, 11:56	0.1
1Ea	0.004	3.8	19Oct2015, 12:00	0.2
1Eb	0.013	12.0	19Oct2015, 11:58	0.6
1Ec	0.036	15.9	19Oct2015, 12:03	1.2
1Wb	0.01	11.1	19Oct2015, 11:59	0.6
1Wc	0.014	14.8	19Oct2015, 12:00	0.7
3Ea	0.108	66.2	19Oct2015, 12:07	4.4
3Eb	0.165	82.6	19Oct2015, 12:09	5.7
4Ea	0.211	88.7	19Oct2015, 12:12	6.5
4Eb	0.227	90.7	19Oct2015, 12:12	6.8
4Ec	0.245	93.7	19Oct2015, 12:14	7.6

Table C-12. Phase 6 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
5Eb	0.037	26.3	19Oct2015, 12:01	1.4
5Ec	0.02	20.3	19Oct2015, 12:02	1.0
5Ec-Out	0.02	20.3	19Oct2015, 12:02	1.0
5Wa	0.051	27.7	19Oct2015, 12:01	1.6
6Wa	0.03	18.2	19Oct2015, 12:05	1.2
SB-GM1	0.031	6	19Oct2015, 12:07	0.6
SB-GM2	0.016	7	19Oct2015, 12:02	0.4
SB-GM3	0.015	3	19Oct2015, 12:04	0.3
SB-GM4	0.043	4.5	19Oct2015, 12:14	0.6
SB-GM5	0.036	2.7	19Oct2015, 12:09	0.4
SB-GM6	0.025	1.7	19Oct2015, 12:08	0.2
SB-GM7	0.044	5.8	19Oct2015, 12:07	0.6
SB-GM8	0.033	1.6	19Oct2015, 12:08	0.3

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-13. Phase 7 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.002	0.2	19Oct2015, 12:01	0.0
C3	0.022	24.7	19Oct2015, 11:58	1.3
C3-Out	0.053	60.8	19Oct2015, 11:58	3.1
C5-Out	0.128	118.8	19Oct2015, 12:01	7.0
C6-Out	0.093	70.4	19Oct2015, 12:00	4.0
C7	0.007	6.2	19Oct2015, 11:58	0.3
C7-Out	0.191	108.3	19Oct2015, 12:07	7.9
C8-Out	0.075	52.1	19Oct2015, 12:01	3.1
C9-Out	0.027	22.9	19Oct2015, 11:58	1.2
INTP1Ea	0.004	4.4	19Oct2015, 11:57	0.2
INTP1Eb	0.013	14.0	19Oct2015, 11:57	0.7
INTP1Wb	0.01	12.7	19Oct2015, 11:57	0.6
INTP1Wc	0.004	4.4	19Oct2015, 11:59	0.2
INTP3Ea	0.074	66.1	19Oct2015, 12:02	4.1
INTP3Eb	0.009	4.2	19Oct2015, 12:01	0.3
INTP4Ea	0.046	9.4	19Oct2015, 12:09	1.0
INTP4Eb	0.016	5.8	19Oct2015, 12:03	0.4

Table C-13. Phase 7 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
INTP4Ec	0.018	16.0	19Oct2015, 12:00	0.9
INTP5Eb	0.016	11.9	19Oct2015, 12:00	0.7
INTP5Wa	0.005	2.1	19Oct2015, 12:00	0.1
INTP7Ec	0.161	54.7	19Oct2015, 12:20	6.6
Junction-C3	0.053	60.8	19Oct2015, 11:58	3.1
Junction-C5	0.128	118.8	19Oct2015, 12:01	7.0
Junction-C6	0.093	70.4	19Oct2015, 12:00	4.0
Junction-C7	0.191	108.4	19Oct2015, 12:06	7.9
Junction-C8	0.075	52.1	19Oct2015, 12:01	3.1
Junction-C9	0.027	22.9	19Oct2015, 11:58	1.2
Junction-1	0.051	35.3	19Oct2015, 12:00	2.0
Junction-10	0.185	107.3	19Oct2015, 12:06	7.5
Junction-12	0.085	81.4	19Oct2015, 12:01	4.7
Junction-13	0.25	71.9	19Oct2015, 12:17	9.1
Junction-14	0.294	77.7	19Oct2015, 12:25	10.8
Junction-15	0.312	80.7	19Oct2015, 12:25	12.0
Junction-16	0.266	73.8	19Oct2015, 12:24	9.8
Junction-17	0.078	70.3	19Oct2015, 12:02	4.3
Junction-18	0.041	22.6	19Oct2015, 12:01	1.4
Junction-19	0.292	77.7	19Oct2015, 12:25	10.8
Junction-2	0.014	17.1	19Oct2015, 11:59	0.9
Junction-3	0.178	105.2	19Oct2015, 12:06	7.2
Junction-5	0.055	12.6	19Oct2015, 12:07	1.2
Junction-7	0.055	12.6	19Oct2015, 12:07	1.2
Junction-8	0.071	15.7	19Oct2015, 12:10	1.6
Junction-9	0.089	23.0	19Oct2015, 12:03	2.5
RDP5-1a	0.085	81.4	19Oct2015, 12:01	4.7
RDP5_1a	0.085	81.1	19Oct2015, 12:02	4.7
RDP7-1a	0.1	35.5	19Oct2015, 12:06	2.9
RDP7-2a	0.026	16.2	19Oct2015, 12:03	1.0
RDP7_1a	0.178	105.1	19Oct2015, 12:06	7.2
RDP7_2a	0.292	77.6	19Oct2015, 12:25	10.8
SB-OB1	0.046	33.2	19Oct2015, 12:00	1.9
SB-OB2	0.041	22.6	19Oct2015, 12:01	1.4
SB-PS1	0.036	26.2	19Oct2015, 12:02	1.6
SB-R1	0.032	39.6	19Oct2015, 11:58	2.0
SB-R10	0.003	4.3	19Oct2015, 11:55	0.2
SB-R11	0.025	24.0	19Oct2015, 12:01	1.4
SB-R12	0.009	5.6	19Oct2015, 12:00	0.3
SB-R14	0.016	18.4	19Oct2015, 11:57	0.9
SB-R15	0.004	4.5	19Oct2015, 11:56	0.2

Table C-13. Phase 7 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
SB-R16	0.014	19.2	19Oct2015, 11:57	0.9
SB-R17	0.011	5.2	19Oct2015, 12:01	0.3
SB-R2	0.012	18.0	19Oct2015, 11:56	0.7
SB-R3	0.004	6.3	19Oct2015, 11:56	0.2
SB-R4	0.019	21.0	19Oct2015, 11:58	1.1
SB-R5	0.022	23.6	19Oct2015, 11:58	1.2
SB-R6	0.021	17.7	19Oct2015, 12:01	1.0
SB-R7	0.017	13.6	19Oct2015, 12:00	0.8
SB-R8	0.025	21.7	19Oct2015, 12:00	1.2
SB-R9	0.003	3.5	19Oct2015, 11:56	0.2
1Ea	0.004	4.4	19Oct2015, 12:00	0.2
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Ec	0.191	108.3	19Oct2015, 12:07	7.9
1Wb	0.01	12.7	19Oct2015, 11:59	0.6
1Wc	0.014	16.9	19Oct2015, 12:00	0.9
3Ea	0.078	69.9	19Oct2015, 12:05	4.3
3Eb	0.009	4.1	19Oct2015, 12:04	0.3
4Ea	0.055	12.5	19Oct2015, 12:12	1.2
4Eb	0.071	15.6	19Oct2015, 12:11	1.6
4Ec	0.089	23.0	19Oct2015, 12:06	2.5
5Eb	0.266	73.8	19Oct2015, 12:25	9.8
5Ec	0.312	80.6	19Oct2015, 12:29	12.0
5Ec-Out	0.312	80.6	19Oct2015, 12:29	12.0
5Wa	0.051	35.1	19Oct2015, 12:01	2.0
7Ec	0.25	71.7	19Oct2015, 12:24	9.1
SB-GM1	0.031	8.1	19Oct2015, 12:07	0.8
SB-GM2	0.016	8.6	19Oct2015, 12:02	0.5
SB-GM3	0.015	4.1	19Oct2015, 12:04	0.3
SB-GM4	0.043	6.2	19Oct2015, 12:13	0.8
SB-GM5	0.036	4.3	19Oct2015, 12:08	0.5
SB-GM6	0.025	2.6	19Oct2015, 12:07	0.3
SB-GM7	0.044	8.1	19Oct2015, 12:06	0.8
SB-GM8	0.033	2.7	19Oct2015, 12:07	0.4

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-14. Phase 7 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.002	0.1	19Oct2015, 12:02	0.0
C3	0.022	21.3	19Oct2015, 11:58	1.1
C3-Out	0.053	52.6	19Oct2015, 11:58	2.6
C5-Out	0.128	101.7	19Oct2015, 12:01	6.0
C6-Out	0.093	59.0	19Oct2015, 12:01	3.4
C7	0.007	5.3	19Oct2015, 11:58	0.3
C7-Out	0.191	90.4	19Oct2015, 12:08	6.7
C8-Out	0.075	43.6	19Oct2015, 12:01	2.6
C9-Out	0.027	19.4	19Oct2015, 11:58	1.1
INTP1Ea	0.004	3.8	19Oct2015, 11:58	0.2
INTP1Eb	0.013	12.0	19Oct2015, 11:57	0.6
INTP1Wb	0.01	11.1	19Oct2015, 11:57	0.6
INTP1Wc	0.004	3.8	19Oct2015, 11:59	0.2
INTP3Ea	0.074	56.8	19Oct2015, 12:03	3.6
INTP3Eb	0.009	3.3	19Oct2015, 12:02	0.2
INTP4Ea	0.046	6.9	19Oct2015, 12:10	0.8
INTP4Eb	0.016	4.4	19Oct2015, 12:03	0.3
INTP4Ec	0.018	13.6	19Oct2015, 12:00	0.7
INTP5Eb	0.016	10.0	19Oct2015, 12:00	0.6
INTP5Wa	0.005	1.6	19Oct2015, 12:00	0.1
INTP7Ec	0.161	45.2	19Oct2015, 12:20	5.6
Junction-C3	0.053	52.6	19Oct2015, 11:58	2.6
Junction-C5	0.128	101.7	19Oct2015, 12:01	6.0
Junction-C6	0.093	59.0	19Oct2015, 12:01	3.4
Junction-C7	0.191	90.6	19Oct2015, 12:06	6.7
Junction-C8	0.075	43.6	19Oct2015, 12:01	2.6
Junction-C9	0.027	19.4	19Oct2015, 11:58	1.1
Junction-1	0.051	29.2	19Oct2015, 12:00	1.7
Junction-10	0.185	89.6	19Oct2015, 12:06	6.4
Junction-12	0.085	70.0	19Oct2015, 12:01	4.1
Junction-13	0.25	58.8	19Oct2015, 12:18	7.7
Junction-14	0.294	63.8	19Oct2015, 12:27	9.1
Junction-15	0.312	66.4	19Oct2015, 12:26	10.1
Junction-16	0.266	60.4	19Oct2015, 12:25	8.2
Junction-17	0.078	60.4	19Oct2015, 12:02	3.7
Junction-18	0.041	18.3	19Oct2015, 12:01	1.1
Junction-19	0.292	63.7	19Oct2015, 12:26	9.1

Table C-14. Phase 7 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
Junction-2	0.014	14.8	19Oct2015, 11:59	0.7
Junction-3	0.178	88.0	19Oct2015, 12:06	6.1
Junction-5	0.055	9.5	19Oct2015, 12:07	1.0
Junction-7	0.055	9.5	19Oct2015, 12:07	1.0
Junction-8	0.071	11.8	19Oct2015, 12:10	1.3
Junction-9	0.089	18.5	19Oct2015, 12:01	2.1
RDP5-1a	0.085	70.0	19Oct2015, 12:01	4.1
RDP5_1a	0.085	69.6	19Oct2015, 12:02	4.1
RDP7-1a	0.1	27.9	19Oct2015, 12:07	2.4
RDP7-2a	0.026	13.4	19Oct2015, 12:03	0.9
RDP7_1a	0.178	87.7	19Oct2015, 12:06	6.1
RDP7_2a	0.292	63.7	19Oct2015, 12:27	9.1
SB-OB1	0.046	27.6	19Oct2015, 12:01	1.6
SB-OB2	0.041	18.3	19Oct2015, 12:01	1.1
SB-PS1	0.036	22.1	19Oct2015, 12:03	1.4
SB-R1	0.032	34.6	19Oct2015, 11:58	1.8
SB-R10	0.003	3.7	19Oct2015, 11:55	0.2
SB-R11	0.025	20.8	19Oct2015, 12:01	1.2
SB-R12	0.009	4.5	19Oct2015, 12:00	0.3
SB-R14	0.016	15.8	19Oct2015, 11:57	0.8
SB-R15	0.004	3.8	19Oct2015, 11:56	0.2
SB-R16	0.014	16.8	19Oct2015, 11:57	0.8
SB-R17	0.011	4.2	19Oct2015, 12:01	0.3
SB-R2	0.012	15.9	19Oct2015, 11:56	0.6
SB-R3	0.004	5.6	19Oct2015, 11:56	0.2
SB-R4	0.019	18.1	19Oct2015, 11:58	0.9
SB-R5	0.022	20.3	19Oct2015, 11:58	1.1
SB-R6	0.021	15.0	19Oct2015, 12:01	0.9
SB-R7	0.017	11.5	19Oct2015, 12:01	0.7
SB-R8	0.025	18.4	19Oct2015, 12:00	1.0
SB-R9	0.003	3.0	19Oct2015, 11:56	0.1
1Ea	0.004	3.8	19Oct2015, 12:00	0.2
1Eb	0.013	12.0	19Oct2015, 11:58	0.6
1Ec	0.191	90.4	19Oct2015, 12:08	6.7
1Wb	0.01	11.1	19Oct2015, 11:59	0.6
1Wc	0.014	14.8	19Oct2015, 12:00	0.7
3Ea	0.078	60.1	19Oct2015, 12:06	3.7

Table C-14. Phase 7 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
3Eb	0.009	3.3	19Oct2015, 12:04	0.2
4Ea	0.055	9.4	19Oct2015, 12:12	1.0
4Eb	0.071	11.8	19Oct2015, 12:11	1.3
4Ec	0.089	18.4	19Oct2015, 12:04	2.1
5Eb	0.266	60.4	19Oct2015, 12:26	8.2
5Ec	0.312	66.2	19Oct2015, 12:30	10.1
5Ec-Out	0.312	66.2	19Oct2015, 12:30	10.1
5Wa	0.051	29.2	19Oct2015, 12:01	1.7
7Ec	0.25	58.6	19Oct2015, 12:26	7.7
SB-GM1	0.031	6	19Oct2015, 12:07	0.6
SB-GM2	0.016	7	19Oct2015, 12:02	0.4
SB-GM3	0.015	3	19Oct2015, 12:04	0.3
SB-GM4	0.043	4.5	19Oct2015, 12:14	0.6
SB-GM5	0.036	2.7	19Oct2015, 12:09	0.4
SB-GM6	0.025	1.7	19Oct2015, 12:08	0.2
SB-GM7	0.044	5.8	19Oct2015, 12:07	0.6
SB-GM8	0.033	1.6	19Oct2015, 12:08	0.3

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-15. Phase 8 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.004	1.0	19Oct2015, 12:01	0.1
C3	0.022	24.7	19Oct2015, 11:58	1.3
C3-Out	0.053	61.3	19Oct2015, 11:58	3.1
C5-Out	0.128	118.8	19Oct2015, 12:01	7.0
C6-Out	0.093	70.4	19Oct2015, 12:00	4.0
C7	0.007	6.2	19Oct2015, 11:58	0.3
C7-Out	0.19	107.0	19Oct2015, 12:07	7.8
C8-Out	0.061	37.6	19Oct2015, 12:01	2.2
C9-Out	0.351	97.6	19Oct2015, 12:16	12.8
INTP1Ea	0.004	4.4	19Oct2015, 11:57	0.2
INTP1Eb	0.013	14.0	19Oct2015, 11:57	0.7
INTP1Wb	0.01	12.7	19Oct2015, 11:57	0.6

Table C-15. Phase 8 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
INTP1Wc	0.004	4.8	19Oct2015, 11:58	0.3
INTP3Ea	0.073	64.9	19Oct2015, 12:03	4.1
INTP3Eb	0.009	4.1	19Oct2015, 12:02	0.3
INTP4Ea	0.046	9.4	19Oct2015, 12:09	1.0
INTP4Eb	0.016	5.8	19Oct2015, 12:03	0.4
INTP5Eb	0.016	11.9	19Oct2015, 12:00	0.7
INTP5Wa	0.005	2.1	19Oct2015, 11:59	0.1
INTP7Ec	0.027	20.7	19Oct2015, 12:01	1.2
Junction-C3	0.053	61.3	19Oct2015, 11:58	3.1
Junction-C5	0.128	118.8	19Oct2015, 12:01	7.0
Junction-C6	0.093	70.4	19Oct2015, 12:00	4.0
Junction-C7	0.19	107.2	19Oct2015, 12:06	7.8
Junction-C8	0.061	37.6	19Oct2015, 12:01	2.2
Junction-C9	0.351	97.6	19Oct2015, 12:16	12.8
Junction-1	0.051	35.3	19Oct2015, 12:00	2.0
Junction-10	0.184	106.2	19Oct2015, 12:06	7.5
Junction-12	0.085	81.4	19Oct2015, 12:01	4.7
Junction-13	0.027	20.7	19Oct2015, 12:01	1.2
Junction-14	0.081	46.9	19Oct2015, 12:05	3.1
Junction-15	0.097	57.6	19Oct2015, 12:02	4.2
Junction-16	0.043	29.0	19Oct2015, 12:03	1.9
Junction-17	0.077	69.1	19Oct2015, 12:02	4.3
Junction-18	0.041	22.6	19Oct2015, 12:01	1.4
Junction-19	0.077	46.2	19Oct2015, 12:04	3.1
Junction-2	0.014	17.5	19Oct2015, 11:59	0.9
Junction-3	0.177	104.1	19Oct2015, 12:06	7.2
Junction-5	0.055	12.7	19Oct2015, 12:07	1.2
Junction-7	0.055	12.7	19Oct2015, 12:07	1.2
Junction-8	0.071	15.7	19Oct2015, 12:10	1.6
Junction-9	0.28	83.1	19Oct2015, 12:17	10.0
RDP5-1a	0.085	81.4	19Oct2015, 12:01	4.7
RDP5_1a	0.085	81.1	19Oct2015, 12:02	4.7
RDP7-1a	0.1	35.5	19Oct2015, 12:06	2.9
RDP7-2a	0.034	17.4	19Oct2015, 12:03	1.2
RDP7_1a	0.177	103.9	19Oct2015, 12:06	7.2
RDP7_2a	0.077	46.1	19Oct2015, 12:05	3.1
RDP8-1a	0.209	70.1	19Oct2015, 12:19	8.3

Table C-15. Phase 8 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
RDP8_1a	0.28	83.0	19Oct2015, 12:18	10.0
SB-OB1	0.046	33.2	19Oct2015, 12:00	1.9
SB-OB2	0.041	22.6	19Oct2015, 12:01	1.4
SB-R1	0.032	39.6	19Oct2015, 11:58	2.0
SB-R10	0.003	4.3	19Oct2015, 11:55	0.2
SB-R11	0.011	9.5	19Oct2015, 12:01	0.5
SB-R12	0.009	5.6	19Oct2015, 12:00	0.3
SB-R14	0.029	26.8	19Oct2015, 11:59	1.4
SB-R15	0.005	5.3	19Oct2015, 11:58	0.3
SB-R16	0.011	16.5	19Oct2015, 11:56	0.8
SB-R18	0.042	18.5	19Oct2015, 12:06	1.4
SB-R19	0.01	11.7	19Oct2015, 11:59	0.6
SB-R2	0.012	18.0	19Oct2015, 11:56	0.7
SB-R3	0.004	6.3	19Oct2015, 11:56	0.2
SB-R4	0.019	21.0	19Oct2015, 11:58	1.1
SB-R5	0.022	23.6	19Oct2015, 11:58	1.2
SB-R6	0.021	17.7	19Oct2015, 12:01	1.0
SB-R7	0.017	13.6	19Oct2015, 12:00	0.8
SB-R8	0.025	21.7	19Oct2015, 12:00	1.2
SB-R9	0.003	3.5	19Oct2015, 11:56	0.2
1Ea	0.004	4.4	19Oct2015, 12:00	0.2
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Ec	0.19	107.0	19Oct2015, 12:07	7.8
1Wb	0.01	12.7	19Oct2015, 11:59	0.6
1Wc	0.014	17.4	19Oct2015, 12:00	0.9
3Ea	0.077	68.7	19Oct2015, 12:05	4.3
3Eb	0.009	4.1	19Oct2015, 12:04	0.3
4Ea	0.055	12.5	19Oct2015, 12:12	1.2
4Eb	0.071	15.6	19Oct2015, 12:11	1.6
5Eb	0.043	28.9	19Oct2015, 12:05	1.9
5Ec	0.097	56.9	19Oct2015, 12:06	4.2
5Ec-Out	0.097	56.9	19Oct2015, 12:06	4.2
5Wa	0.051	35.1	19Oct2015, 12:01	2.0
7Ec	0.027	20.5	19Oct2015, 12:06	1.2
SB-GM1	0.031	8.1	19Oct2015, 12:07	0.8
SB-GM2	0.016	8.6	19Oct2015, 12:02	0.5
SB-GM3	0.015	4.1	19Oct2015, 12:04	0.3

Table C-15. Phase 8 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
SB-GM4	0.043	6.2	19Oct2015, 12:13	0.8
SB-GM5	0.036	4.3	19Oct2015, 12:08	0.5
SB-GM6	0.025	2.6	19Oct2015, 12:07	0.3
SB-GM7	0.044	8.1	19Oct2015, 12:06	0.8
SB-GM8	0.033	2.7	19Oct2015, 12:07	0.4

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-16. Phase 8 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.004	0.7	19Oct2015, 12:02	0.1
C3	0.022	21.3	19Oct2015, 11:58	1.1
C3-Out	0.053	53.0	19Oct2015, 11:58	2.7
C5-Out	0.128	101.7	19Oct2015, 12:01	6.0
C6-Out	0.093	59.0	19Oct2015, 12:01	3.4
C7	0.007	5.3	19Oct2015, 11:58	0.3
C7-Out	0.19	89.3	19Oct2015, 12:08	6.7
C8-Out	0.061	30.9	19Oct2015, 12:01	1.9
C9-Out	0.351	79.9	19Oct2015, 12:17	10.7
INTP1Ea	0.004	3.8	19Oct2015, 11:58	0.2
INTP1Eb	0.013	12.0	19Oct2015, 11:57	0.6
INTP1Wb	0.01	11.1	19Oct2015, 11:57	0.6
INTP1Wc	0.004	4.2	19Oct2015, 11:59	0.2
INTP3Ea	0.073	55.9	19Oct2015, 12:03	3.5
INTP3Eb	0.009	3.3	19Oct2015, 12:02	0.2
INTP4Ea	0.046	6.9	19Oct2015, 12:10	0.8
INTP4Eb	0.016	4.4	19Oct2015, 12:03	0.3
INTP5Eb	0.016	10.0	19Oct2015, 12:00	0.6
INTP5Wa	0.005	1.6	19Oct2015, 12:00	0.1
INTP7Ec	0.027	17.5	19Oct2015, 12:02	1.1
Junction-C3	0.053	53.0	19Oct2015, 11:58	2.7
Junction-C5	0.128	101.7	19Oct2015, 12:01	6.0
Junction-C6	0.093	59.0	19Oct2015, 12:01	3.4
Junction-C7	0.19	89.5	19Oct2015, 12:06	6.7

Table C-16. Phase 8 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
Junction-C8	0.061	30.9	19Oct2015, 12:01	1.9
Junction-C9	0.351	79.9	19Oct2015, 12:17	10.7
Junction-1	0.051	29.2	19Oct2015, 12:00	1.7
Junction-10	0.184	88.6	19Oct2015, 12:06	6.3
Junction-12	0.085	70.0	19Oct2015, 12:01	4.1
Junction-13	0.027	17.5	19Oct2015, 12:02	1.1
Junction-14	0.081	38.6	19Oct2015, 12:05	2.6
Junction-15	0.097	47.3	19Oct2015, 12:02	3.6
Junction-16	0.043	24.2	19Oct2015, 12:04	1.6
Junction-17	0.077	59.3	19Oct2015, 12:02	3.7
Junction-18	0.041	18.3	19Oct2015, 12:01	1.1
Junction-19	0.077	38.1	19Oct2015, 12:04	2.6
Junction-2	0.014	15.2	19Oct2015, 11:59	0.8
Junction-3	0.177	87.0	19Oct2015, 12:06	6.1
Junction-5	0.055	9.5	19Oct2015, 12:08	1.0
Junction-7	0.055	9.5	19Oct2015, 12:08	1.0
Junction-8	0.071	11.8	19Oct2015, 12:11	1.3
Junction-9	0.28	67.9	19Oct2015, 12:18	8.3
RDP5-1a	0.085	70.0	19Oct2015, 12:01	4.1
RDP5_1a	0.085	69.6	19Oct2015, 12:02	4.1
RDP7-1a	0.1	27.9	19Oct2015, 12:07	2.4
RDP7-2a	0.034	14.1	19Oct2015, 12:04	1.0
RDP7_1a	0.177	86.6	19Oct2015, 12:06	6.1
RDP7_2a	0.077	38.0	19Oct2015, 12:05	2.6
RDP8-1a	0.209	57.8	19Oct2015, 12:19	7.0
RDP8_1a	0.28	67.8	19Oct2015, 12:19	8.3
SB-OB1	0.046	27.6	19Oct2015, 12:01	1.6
SB-OB2	0.041	18.3	19Oct2015, 12:01	1.1
SB-R1	0.032	34.6	19Oct2015, 11:58	1.8
SB-R10	0.003	3.8	19Oct2015, 11:55	0.2
SB-R11	0.011	8.1	19Oct2015, 12:01	0.5
SB-R12	0.009	4.6	19Oct2015, 12:00	0.3
SB-R14	0.029	22.8	19Oct2015, 11:59	1.2
SB-R15	0.005	4.6	19Oct2015, 11:58	0.2
SB-R16	0.011	14.6	19Oct2015, 11:56	0.7
SB-R18	0.042	15.0	19Oct2015, 12:06	1.2
SB-R19	0.01	10.2	19Oct2015, 11:59	0.6

Table C-16. Phase 8 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
SB-R2	0.012	15.9	19Oct2015, 11:56	0.6
SB-R3	0.004	5.6	19Oct2015, 11:56	0.2
SB-R4	0.019	18.1	19Oct2015, 11:58	0.9
SB-R5	0.022	20.3	19Oct2015, 11:58	1.1
SB-R6	0.021	15.0	19Oct2015, 12:01	0.9
SB-R7	0.017	11.5	19Oct2015, 12:01	0.7
SB-R8	0.025	18.4	19Oct2015, 12:00	1.0
SB-R9	0.003	3.0	19Oct2015, 11:56	0.1
1Ea	0.004	3.8	19Oct2015, 12:00	0.2
1Eb	0.013	12.0	19Oct2015, 11:58	0.6
1Ec	0.19	89.3	19Oct2015, 12:08	6.7
1Wb	0.01	11.1	19Oct2015, 11:59	0.6
1Wc	0.014	15.2	19Oct2015, 12:00	0.8
3Ea	0.077	59.1	19Oct2015, 12:06	3.7
3Eb	0.009	3.2	19Oct2015, 12:04	0.2
4Ea	0.055	9.4	19Oct2015, 12:12	1.0
4Eb	0.071	11.8	19Oct2015, 12:12	1.3
5Eb	0.043	24.1	19Oct2015, 12:05	1.6
5Ec	0.097	46.9	19Oct2015, 12:07	3.6
5Ec-Out	0.097	46.9	19Oct2015, 12:07	3.6
5Wa	0.051	29.2	19Oct2015, 12:01	1.7
7Ec	0.027	17.3	19Oct2015, 12:06	1.1
SB-GM1	0.031	6	19Oct2015, 12:07	0.6
SB-GM2	0.016	7	19Oct2015, 12:02	0.4
SB-GM3	0.015	3	19Oct2015, 12:04	0.3
SB-GM4	0.043	4.5	19Oct2015, 12:14	0.6
SB-GM5	0.036	2.7	19Oct2015, 12:09	0.4
SB-GM6	0.025	1.7	19Oct2015, 12:08	0.2
SB-GM7	0.044	5.8	19Oct2015, 12:07	0.6
SB-GM8	0.033	1.6	19Oct2015, 12:08	0.3

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-17. Phase 9 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.004	1.0	19Oct2015, 12:01	0.1
C3	0.022	24.7	19Oct2015, 11:58	1.3
C3-Out	0.053	61.3	19Oct2015, 11:58	3.1
C5-Out	0.128	118.8	19Oct2015, 12:01	7.0
C6-Out	0.093	70.4	19Oct2015, 12:00	4.0
C7	0.007	6.2	19Oct2015, 11:58	0.3
C7-Out	0.19	107.0	19Oct2015, 12:07	7.8
C8-Out	0.061	37.6	19Oct2015, 12:01	2.2
C9-Out	0.351	97.6	19Oct2015, 12:16	12.8
INTP1Ea	0.004	4.4	19Oct2015, 11:57	0.2
INTP1Eb	0.013	14.0	19Oct2015, 11:57	0.7
INTP1Wb	0.01	12.7	19Oct2015, 11:57	0.6
INTP1Wc	0.004	4.8	19Oct2015, 11:58	0.3
INTP3Ea	0.073	64.9	19Oct2015, 12:03	4.1
INTP3Eb	0.009	4.1	19Oct2015, 12:02	0.3
INTP4Ea	0.046	9.4	19Oct2015, 12:09	1.0
INTP4Eb	0.016	5.8	19Oct2015, 12:03	0.4
INTP5Eb	0.016	11.9	19Oct2015, 12:00	0.7
INTP5Wa	0.005	2.1	19Oct2015, 11:59	0.1
INTP7Ec	0.027	20.7	19Oct2015, 12:01	1.2
Junction-C3	0.053	61.3	19Oct2015, 11:58	3.1
Junction-C5	0.128	118.8	19Oct2015, 12:01	7.0
Junction-C6	0.093	70.4	19Oct2015, 12:00	4.0
Junction-C7	0.19	107.2	19Oct2015, 12:06	7.8
Junction-C8	0.061	37.6	19Oct2015, 12:01	2.2
Junction-C9	0.351	97.6	19Oct2015, 12:16	12.8
Junction-1	0.051	35.3	19Oct2015, 12:00	2.0
Junction-10	0.184	106.2	19Oct2015, 12:06	7.5
Junction-12	0.085	81.4	19Oct2015, 12:01	4.7
Junction-13	0.027	20.7	19Oct2015, 12:01	1.2
Junction-14	0.081	46.9	19Oct2015, 12:05	3.1
Junction-15	0.097	57.6	19Oct2015, 12:02	4.2
Junction-16	0.043	29.0	19Oct2015, 12:03	1.9
Junction-17	0.077	69.1	19Oct2015, 12:02	4.3
Junction-18	0.041	22.6	19Oct2015, 12:01	1.4
Junction-19	0.077	46.2	19Oct2015, 12:04	3.1
Junction-2	0.014	17.5	19Oct2015, 11:59	0.9

Table C-17. Phase 9 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
Junction-3	0.177	104.1	19Oct2015, 12:06	7.2
Junction-5	0.055	12.7	19Oct2015, 12:07	1.2
Junction-7	0.055	12.7	19Oct2015, 12:07	1.2
Junction-8	0.071	15.7	19Oct2015, 12:10	1.6
Junction-9	0.28	83.1	19Oct2015, 12:17	10.0
RDP5-1a	0.085	81.4	19Oct2015, 12:01	4.7
RDP5_1a	0.085	81.1	19Oct2015, 12:02	4.7
RDP7-1a	0.1	35.5	19Oct2015, 12:06	2.9
RDP7-2a	0.034	17.4	19Oct2015, 12:03	1.2
RDP7_1a	0.177	103.9	19Oct2015, 12:06	7.2
RDP7_2a	0.077	46.1	19Oct2015, 12:05	3.1
RDP8-1a	0.209	70.1	19Oct2015, 12:19	8.3
RDP8_1a	0.28	83.0	19Oct2015, 12:18	10.0
SB-OB1	0.046	33.2	19Oct2015, 12:00	1.9
SB-OB2	0.041	22.6	19Oct2015, 12:01	1.4
SB-R1	0.032	39.6	19Oct2015, 11:58	2.0
SB-R10	0.003	4.3	19Oct2015, 11:55	0.2
SB-R11	0.011	9.5	19Oct2015, 12:01	0.5
SB-R12	0.009	5.6	19Oct2015, 12:00	0.3
SB-R14	0.029	26.8	19Oct2015, 11:59	1.4
SB-R15	0.005	5.3	19Oct2015, 11:58	0.3
SB-R16	0.011	16.5	19Oct2015, 11:56	0.8
SB-R18	0.042	18.5	19Oct2015, 12:06	1.4
SB-R19	0.01	11.7	19Oct2015, 11:59	0.6
SB-R2	0.012	18.0	19Oct2015, 11:56	0.7
SB-R3	0.004	6.3	19Oct2015, 11:56	0.2
SB-R4	0.019	21.0	19Oct2015, 11:58	1.1
SB-R5	0.022	23.6	19Oct2015, 11:58	1.2
SB-R6	0.021	17.7	19Oct2015, 12:01	1.0
SB-R7	0.017	13.6	19Oct2015, 12:00	0.8
SB-R8	0.025	21.7	19Oct2015, 12:00	1.2
SB-R9	0.003	3.5	19Oct2015, 11:56	0.2
1Ea	0.004	4.4	19Oct2015, 12:00	0.2
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Ec	0.19	107.0	19Oct2015, 12:07	7.8
1Wb	0.01	12.7	19Oct2015, 11:59	0.6
1Wc	0.014	17.4	19Oct2015, 12:00	0.9

Table C-17. Phase 9 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
3Ea	0.077	68.7	19Oct2015, 12:05	4.3
3Eb	0.009	4.1	19Oct2015, 12:04	0.3
4Ea	0.055	12.5	19Oct2015, 12:12	1.2
4Eb	0.071	15.6	19Oct2015, 12:11	1.6
5Eb	0.043	28.9	19Oct2015, 12:05	1.9
5Ec	0.097	56.9	19Oct2015, 12:06	4.2
5Ec-Out	0.097	56.9	19Oct2015, 12:06	4.2
5Wa	0.051	35.1	19Oct2015, 12:01	2.0
7Ec	0.027	20.5	19Oct2015, 12:06	1.2
SB-GM1	0.031	8.1	19Oct2015, 12:07	0.8
SB-GM2	0.016	8.6	19Oct2015, 12:02	0.5
SB-GM3	0.015	4.1	19Oct2015, 12:04	0.3
SB-GM4	0.043	6.2	19Oct2015, 12:13	0.8
SB-GM5	0.036	4.3	19Oct2015, 12:08	0.5
SB-GM6	0.025	2.6	19Oct2015, 12:07	0.3
SB-GM7	0.044	8.1	19Oct2015, 12:06	0.8
SB-GM8	0.033	2.7	19Oct2015, 12:07	0.4

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-18. Phase 9 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C10	0.004	0.7	19Oct2015, 12:02	0.1
C3	0.022	21.3	19Oct2015, 11:58	1.1
C3-Out	0.053	53.0	19Oct2015, 11:58	2.7
C5-Out	0.128	101.7	19Oct2015, 12:01	6.0
C6-Out	0.093	59.0	19Oct2015, 12:01	3.4
C7	0.007	5.3	19Oct2015, 11:58	0.3
C7-Out	0.19	89.3	19Oct2015, 12:08	6.7
C8-Out	0.061	30.9	19Oct2015, 12:01	1.9
C9-Out	0.351	79.9	19Oct2015, 12:17	10.7
INTP1Ea	0.004	3.8	19Oct2015, 11:58	0.2
INTP1Eb	0.013	12.0	19Oct2015, 11:57	0.6
INTP1Wb	0.01	11.1	19Oct2015, 11:57	0.6

Table C-18. Phase 9 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
INTP1Wc	0.004	4.2	19Oct2015, 11:59	0.2
INTP3Ea	0.073	55.9	19Oct2015, 12:03	3.5
INTP3Eb	0.009	3.3	19Oct2015, 12:02	0.2
INTP4Ea	0.046	6.9	19Oct2015, 12:10	0.8
INTP4Eb	0.016	4.4	19Oct2015, 12:03	0.3
INTP5Eb	0.016	10.0	19Oct2015, 12:00	0.6
INTP5Wa	0.005	1.6	19Oct2015, 12:00	0.1
INTP7Ec	0.027	17.5	19Oct2015, 12:02	1.1
Junction-C3	0.053	53.0	19Oct2015, 11:58	2.7
Junction-C5	0.128	101.7	19Oct2015, 12:01	6.0
Junction-C6	0.093	59.0	19Oct2015, 12:01	3.4
Junction-C7	0.19	89.5	19Oct2015, 12:06	6.7
Junction-C8	0.061	30.9	19Oct2015, 12:01	1.9
Junction-C9	0.351	79.9	19Oct2015, 12:17	10.7
Junction-1	0.051	29.2	19Oct2015, 12:00	1.7
Junction-10	0.184	88.6	19Oct2015, 12:06	6.3
Junction-12	0.085	70.0	19Oct2015, 12:01	4.1
Junction-13	0.027	17.5	19Oct2015, 12:02	1.1
Junction-14	0.081	38.6	19Oct2015, 12:05	2.6
Junction-15	0.097	47.3	19Oct2015, 12:02	3.6
Junction-16	0.043	24.2	19Oct2015, 12:04	1.6
Junction-17	0.077	59.3	19Oct2015, 12:02	3.7
Junction-18	0.041	18.3	19Oct2015, 12:01	1.1
Junction-19	0.077	38.1	19Oct2015, 12:04	2.6
Junction-2	0.014	15.2	19Oct2015, 11:59	0.8
Junction-3	0.177	87.0	19Oct2015, 12:06	6.1
Junction-5	0.055	9.5	19Oct2015, 12:08	1.0
Junction-7	0.055	9.5	19Oct2015, 12:08	1.0
Junction-8	0.071	11.8	19Oct2015, 12:11	1.3
Junction-9	0.28	67.9	19Oct2015, 12:18	8.3
RDP5-1a	0.085	70.0	19Oct2015, 12:01	4.1
RDP5_1a	0.085	69.6	19Oct2015, 12:02	4.1
RDP7-1a	0.1	27.9	19Oct2015, 12:07	2.4
RDP7-2a	0.034	14.1	19Oct2015, 12:04	1.0
RDP7_1a	0.177	86.6	19Oct2015, 12:06	6.1
RDP7_2a	0.077	38.0	19Oct2015, 12:05	2.6
RDP8-1a	0.209	57.8	19Oct2015, 12:19	7.0

Table C-18. Phase 9 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
RDP8_1a	0.28	67.8	19Oct2015, 12:19	8.3
SB-OB1	0.046	27.6	19Oct2015, 12:01	1.6
SB-OB2	0.041	18.3	19Oct2015, 12:01	1.1
SB-R1	0.032	34.6	19Oct2015, 11:58	1.8
SB-R10	0.003	3.8	19Oct2015, 11:55	0.2
SB-R11	0.011	8.1	19Oct2015, 12:01	0.5
SB-R12	0.009	4.6	19Oct2015, 12:00	0.3
SB-R14	0.029	22.8	19Oct2015, 11:59	1.2
SB-R15	0.005	4.6	19Oct2015, 11:58	0.2
SB-R16	0.011	14.6	19Oct2015, 11:56	0.7
SB-R18	0.042	15.0	19Oct2015, 12:06	1.2
SB-R19	0.01	10.2	19Oct2015, 11:59	0.6
SB-R2	0.012	15.9	19Oct2015, 11:56	0.6
SB-R3	0.004	5.6	19Oct2015, 11:56	0.2
SB-R4	0.019	18.1	19Oct2015, 11:58	0.9
SB-R5	0.022	20.3	19Oct2015, 11:58	1.1
SB-R6	0.021	15.0	19Oct2015, 12:01	0.9
SB-R7	0.017	11.5	19Oct2015, 12:01	0.7
SB-R8	0.025	18.4	19Oct2015, 12:00	1.0
SB-R9	0.003	3.0	19Oct2015, 11:56	0.1
1Ea	0.004	3.8	19Oct2015, 12:00	0.2
1Eb	0.013	12.0	19Oct2015, 11:58	0.6
1Ec	0.19	89.3	19Oct2015, 12:08	6.7
1Wb	0.01	11.1	19Oct2015, 11:59	0.6
1Wc	0.014	15.2	19Oct2015, 12:00	0.8
3Ea	0.077	59.1	19Oct2015, 12:06	3.7
3Eb	0.009	3.2	19Oct2015, 12:04	0.2
4Ea	0.055	9.4	19Oct2015, 12:12	1.0
4Eb	0.071	11.8	19Oct2015, 12:12	1.3
5Eb	0.043	24.1	19Oct2015, 12:05	1.6
5Ec	0.097	46.9	19Oct2015, 12:07	3.6
5Ec-Out	0.097	46.9	19Oct2015, 12:07	3.6
5Wa	0.051	29.2	19Oct2015, 12:01	1.7
7Ec	0.027	17.3	19Oct2015, 12:06	1.1
SB-GM1	0.031	6	19Oct2015, 12:07	0.6
SB-GM2	0.016	7	19Oct2015, 12:02	0.4
SB-GM3	0.015	3	19Oct2015, 12:04	0.3

Table C-18. Phase 9 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
SB-GM4	0.043	4.5	19Oct2015, 12:14	0.6
SB-GM5	0.036	2.7	19Oct2015, 12:09	0.4
SB-GM6	0.025	1.7	19Oct2015, 12:08	0.2
SB-GM7	0.044	5.8	19Oct2015, 12:07	0.6
SB-GM8	0.033	1.6	19Oct2015, 12:08	0.3

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-19. End-of-Reclamation 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	26.2	19Oct2015, 11:58	1.3
C3-Out	0.039	44.3	19Oct2015, 11:58	2.3
INTP1Eb	0.013	14.0	19Oct2015, 11:57	0.7
INTP1Wc	0.004	4.4	19Oct2015, 11:59	0.2
INTP3Eb	0.009	4.1	19Oct2015, 12:02	0.3
INTP4Ea	0.046	9.4	19Oct2015, 12:09	1.0
INTP4Eb	0.016	6.9	19Oct2015, 12:03	0.5
INTP5Eb	0.016	13.6	19Oct2015, 11:59	0.7
INTP7Ec	0.026	20.9	19Oct2015, 12:01	1.2
Junction-C3	0.039	44.3	19Oct2015, 11:58	2.3
Junction-13	0.026	20.9	19Oct2015, 12:01	1.2
Junction-16	0.042	30.3	19Oct2015, 12:03	2.0
Junction-19	0.098	51.0	19Oct2015, 12:05	3.9
Junction-5	0.055	12.7	19Oct2015, 12:07	1.2
Junction-7	0.055	12.7	19Oct2015, 12:07	1.2
Junction-8	0.071	16.1	19Oct2015, 12:10	1.7
Junction-9	0.282	84.2	19Oct2015, 12:17	10.1
RDEOR-1a	0.024	11.4	19Oct2015, 12:03	0.8
RDEOR-2a	0.124	95.4	19Oct2015, 12:05	6.7
RDEOR_1a	0.024	11.4	19Oct2015, 12:04	0.8
RDEOR_1a-Out	0.024	11.4	19Oct2015, 12:04	0.8
RDEOR_2a	0.124	95.2	19Oct2015, 12:07	6.7
RDEOR_2a-Out	0.124	95.2	19Oct2015, 12:07	6.7
RDP5-1a	0.097	76.3	19Oct2015, 12:02	4.7

Table C-19. End-of-Reclamation 100-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
RDP5_1a	0.097	76.2	19Oct2015, 12:04	4.7
RDP5_1a-Out	0.097	76.2	19Oct2015, 12:04	4.7
RDP7-1a	0.112	37.5	19Oct2015, 12:08	3.3
RDP7-2a	0.056	22.2	19Oct2015, 12:08	1.9
RDP7_1a	0.112	37.4	19Oct2015, 12:10	3.3
RDP7_1a-Out	0.112	37.4	19Oct2015, 12:10	3.3
RDP7_2a	0.098	50.9	19Oct2015, 12:08	3.9
RDP7_2a-Out	0.098	50.9	19Oct2015, 12:08	3.9
RDP8-1a	0.211	71.0	19Oct2015, 12:19	8.4
RDP8_1a	0.282	84.1	19Oct2015, 12:18	10.1
RDP8_1a-Out	0.282	84.1	19Oct2015, 12:18	10.1
1Eb	0.013	13.9	19Oct2015, 11:58	0.7
1Wc	0.004	4.4	19Oct2015, 11:59	0.2
3Eb	0.009	4.0	19Oct2015, 12:04	0.3
4Ea	0.055	12.6	19Oct2015, 12:12	1.2
4Eb	0.071	16.1	19Oct2015, 12:10	1.7
5Eb	0.042	30.3	19Oct2015, 12:04	2.0
7Ec	0.026	20.6	19Oct2015, 12:05	1.2

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Table C-20. End-of-Reclamation 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
C3	0.022	22.8	19Oct2015, 11:58	1.2
C3-Out	0.039	38.4	19Oct2015, 11:58	2.0
INTP1Eb	0.013	12.0	19Oct2015, 11:57	0.6
INTP1Wc	0.004	3.8	19Oct2015, 11:59	0.2
INTP3Eb	0.009	3.2	19Oct2015, 12:02	0.2
INTP4Ea	0.046	6.9	19Oct2015, 12:10	0.8
INTP4Eb	0.016	5.5	19Oct2015, 12:03	0.4
INTP5Eb	0.016	11.5	19Oct2015, 11:59	0.6
INTP7Ec	0.026	17.6	19Oct2015, 12:01	1.0
Junction-C3	0.039	38.4	19Oct2015, 11:58	2.0
Junction-13	0.026	17.6	19Oct2015, 12:01	1.0

Table C-20. End-of-Reclamation 50-Year, 24-Hour Design Event				
Hydrologic Element	Drainage Area (sq mi)	Peak Discharge (cfs)	Time of Peak	Volume (ac-ft)
Junction-16	0.042	25.4	19Oct2015, 12:03	1.7
Junction-19	0.098	41.7	19Oct2015, 12:06	3.2
Junction-5	0.055	9.5	19Oct2015, 12:08	1.0
Junction-7	0.055	9.5	19Oct2015, 12:08	1.0
Junction-8	0.071	12.1	19Oct2015, 12:10	1.4
Junction-9	0.282	68.9	19Oct2015, 12:18	8.5
RDEOR-1a	0.024	9.1	19Oct2015, 12:04	0.6
RDEOR-2a	0.124	81.8	19Oct2015, 12:05	5.8
RDEOR_1a	0.024	9.0	19Oct2015, 12:04	0.6
RDEOR_1a-Out	0.024	9.0	19Oct2015, 12:04	0.6
RDEOR_2a	0.124	81.6	19Oct2015, 12:07	5.8
RDEOR_2a-Out	0.124	81.6	19Oct2015, 12:07	5.8
RDP5-1a	0.097	64.5	19Oct2015, 12:02	4.0
RDP5_1a	0.097	64.5	19Oct2015, 12:04	4.0
RDP5_1a-Out	0.097	64.5	19Oct2015, 12:04	4.0
RDP7-1a	0.112	29.5	19Oct2015, 12:09	2.7
RDP7-2a	0.056	17.5	19Oct2015, 12:08	1.6
RDP7_1a	0.112	29.4	19Oct2015, 12:10	2.7
RDP7_1a-Out	0.112	29.4	19Oct2015, 12:10	2.7
RDP7_2a	0.098	41.6	19Oct2015, 12:08	3.2
RDP7_2a-Out	0.098	41.6	19Oct2015, 12:08	3.2
RDP8-1a	0.211	58.6	19Oct2015, 12:19	7.1
RDP8_1a	0.282	68.8	19Oct2015, 12:19	8.5
RDP8_1a-Out	0.282	68.8	19Oct2015, 12:19	8.5
1Eb	0.013	12.0	19Oct2015, 11:58	0.6
1Wc	0.004	3.8	19Oct2015, 12:00	0.2
3Eb	0.009	3.2	19Oct2015, 12:05	0.2
4Ea	0.055	9.5	19Oct2015, 12:12	1.0
4Eb	0.071	12.1	19Oct2015, 12:11	1.4
5Eb	0.042	25.3	19Oct2015, 12:04	1.7
7Ec	0.026	17.4	19Oct2015, 12:06	1.0

Abbreviations:

ac-ft = acre feet.

cfs = cubic feet per second.

sq mi = square mile.

Attachment D: Culvert Design Alternatives

Table D-1. Alternative Sizing Scenarios for Haul Road Culverts						
Culvert ID[a]	Culvert Alternative	Design Event[b]	Design Discharge (cfs)	Barrel Diameter (in)[c]	Headwater Depth (ft)[d]	Selected Alternative for Table 4-7
C1	CMP - 1 Barrel	50-yr, 24-hr	34.6	36	5.6	
	CMP - 2 Barrels	50-yr, 24-hr	34.6	24	5.3	Preferred
	CMP - 3 Barrels	50-yr, 24-hr	34.6	24	4.4	
	HDPE - 1 Barrel	50-yr, 24-hr	34.6	36	5.3	
	HDPE - 2 Barrels	50-yr, 24-hr	34.6	24	4.9	
	HDPE - 3 Barrels	50-yr, 24-hr	34.6	18	5.1	
C2	CMP - 1 Barrel	50-yr, 24-hr	12.0	24	4.5	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	12.0	18	4.1	
	CMP - 3 Barrels	50-yr, 24-hr	12.0	12	6.0	
	HDPE - 1 Barrel	50-yr, 24-hr	12.0	18	5.2	
	HDPE - 2 Barrels	50-yr, 24-hr	12.0	12	5.4	
	HDPE - 3 Barrels	50-yr, 24-hr	12.0	–	–	
C3	CMP - 1 Barrel	50-yr, 24-hr	91.6	–	–	
	CMP - 2 Barrels	50-yr, 24-hr	91.6	48	5.6	Preferred
	CMP - 3 Barrels	50-yr, 24-hr	91.6	36	5.3	
	HDPE - 1 Barrel	50-yr, 24-hr	91.6	–	–	
	HDPE - 2 Barrels	50-yr, 24-hr	91.6	48	5.4	
	HDPE - 3 Barrels	50-yr, 24-hr	91.6	36	5.1	
C4	CMP - 1 Barrel	50-yr, 24-hr	18.1	24	5.4	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	18.1	18	5.0	
	CMP - 3 Barrels	50-yr, 24-hr	18.1	18	4.1	
	HDPE - 1 Barrel	50-yr, 24-hr	18.1	24	5.0	
	HDPE - 2 Barrels	50-yr, 24-hr	18.1	18	4.4	
	HDPE - 3 Barrels	50-yr, 24-hr	18.1	12	5.4	
C5	CMP - 1 Barrel	50-yr, 24-hr	101.7	–	–	
	CMP - 2 Barrels	50-yr, 24-hr	101.7	48	5.8	Preferred
	CMP - 3 Barrels	50-yr, 24-hr	101.7	36	5.6	
	HDPE - 1 Barrel	50-yr, 24-hr	101.7	–	–	
	HDPE - 2 Barrels	50-yr, 24-hr	101.7	48	5.6	
	HDPE - 3 Barrels	50-yr, 24-hr	101.7	36	5.3	
C5[b]	CMP - 1 Barrel	100-yr, 24-hr	118.8	–	–	
	CMP - 2 Barrels	100-yr, 24-hr	118.8	–	–	
	CMP - 3 Barrels	100-yr, 24-hr	118.8	48	5.3	
	HDPE - 1 Barrel	100-yr, 24-hr	118.8	–	–	
	HDPE - 2 Barrels	100-yr, 24-hr	118.8	48	5.9	
	HDPE - 3 Barrels	100-yr, 24-hr	118.8	36	5.6	

Table D-1. Alternative Sizing Scenarios for Haul Road Culverts						
Culvert ID[a]	Culvert Alternative	Design Event[b]	Design Discharge (cfs)	Barrel Diameter (in)[c]	Headwater Depth (ft)[d]	Selected Alternative for Table 4-7
C6	CMP - 1 Barrel	50-yr, 24-hr	93.8	–	–	
	CMP - 2 Barrels	50-yr, 24-hr	93.8	48	5.6	Preferred
	CMP - 3 Barrels	50-yr, 24-hr	93.8	36	5.4	
	HDPE - 1 Barrel	50-yr, 24-hr	93.8	–	–	
	HDPE - 2 Barrels	50-yr, 24-hr	93.8	48	5.4	
	HDPE - 3 Barrels	50-yr, 24-hr	93.8	36	5.1	
C7	CMP - 1 Barrel	50-yr, 24-hr	88.4	–	–	
	CMP - 2 Barrels	50-yr, 24-hr	88.4	48	5.5	Preferred
	CMP - 3 Barrels	50-yr, 24-hr	88.4	36	5.2	
	HDPE - 1 Barrel	50-yr, 24-hr	88.4	–	–	
	HDPE - 2 Barrels	50-yr, 24-hr	88.4	36	6.0	
	HDPE - 3 Barrels	50-yr, 24-hr	88.4	36	5.0	
C8	CMP - 1 Barrel	50-yr, 24-hr	41.3	48	5.3	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	41.3	36	4.6	
	CMP - 3 Barrels	50-yr, 24-hr	41.3	24	4.8	
	HDPE - 1 Barrel	50-yr, 24-hr	41.3	36	5.8	
	HDPE - 2 Barrels	50-yr, 24-hr	41.3	24	5.4	
	HDPE - 3 Barrels	50-yr, 24-hr	41.3	18	5.8	
C9	CMP - 1 Barrel	100-yr, 24-hr	156.5	–	–	
	CMP - 2 Barrels	100-yr, 24-hr	156.5	–	–	
	CMP - 3 Barrels	100-yr, 24-hr	156.5	48	5.8	Preferred
	HDPE - 1 Barrel	100-yr, 24-hr	156.5	–	–	
	HDPE - 2 Barrels	100-yr, 24-hr	156.5	–	–	
	HDPE - 3 Barrels	100-yr, 24-hr	156.5	48	5.6	
C10	CMP - 1 Barrel	50-yr, 24-hr	66.4	–	–	
	CMP - 2 Barrels	50-yr, 24-hr	66.4	36	5.5	Preferred
	CMP - 3 Barrels	50-yr, 24-hr	66.4	36	4.8	
	HDPE - 1 Barrel	50-yr, 24-hr	66.4	–	–	
	HDPE - 2 Barrels	50-yr, 24-hr	66.4	36	5.2	
	HDPE - 3 Barrels	50-yr, 24-hr	66.4	36	4.6	
C10[b]	CMP - 1 Barrel	100-yr, 24-hr	80.7	–	–	
	CMP - 2 Barrels	100-yr, 24-hr	80.7	48	5.3	
	CMP - 3 Barrels	100-yr, 24-hr	80.7	36	5.1	
	HDPE - 1 Barrel	100-yr, 24-hr	80.7	–	–	
	HDPE - 2 Barrels	100-yr, 24-hr	80.7	36	5.7	
	HDPE - 3 Barrels	100-yr, 24-hr	80.7	36	4.9	

Table D-1. Alternative Sizing Scenarios for Haul Road Culverts						
Culvert ID[a]	Culvert Alternative	Design Event[b]	Design Discharge (cfs)	Barrel Diameter (in)[c]	Headwater Depth (ft)[d]	Selected Alternative for Table 4-7
C11	CMP - 1 Barrel	50-yr, 24-hr	10.2	18	6.0	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	10.2	18	4.0	
	CMP - 3 Barrels	50-yr, 24-hr	10.2	12	5.1	
	HDPE - 1 Barrel	50-yr, 24-hr	10.2	18	4.7	
	HDPE - 2 Barrels	50-yr, 24-hr	10.2	12	4.7	
	HDPE - 3 Barrels	50-yr, 24-hr	10.2	–	–	
HC1	CMP - 1 Barrel	50-yr, 24-hr	2.4	12	3.6	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	2.4	–	–	
	CMP - 3 Barrels	50-yr, 24-hr	2.4	–	–	
	HDPE - 1 Barrel	50-yr, 24-hr	2.4	12	3.4	
	HDPE - 2 Barrels	50-yr, 24-hr	2.4	–	–	
	HDPE - 3 Barrels	50-yr, 24-hr	2.4	–	–	
HC2	CMP - 1 Barrel	50-yr, 24-hr	21.3	36	4.7	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	21.3	24	4.3	
	CMP - 3 Barrels	50-yr, 24-hr	21.3	18	4.3	
	HDPE - 1 Barrel	50-yr, 24-hr	21.3	24	5.5	
	HDPE - 2 Barrels	50-yr, 24-hr	21.3	18	4.8	
	HDPE - 3 Barrels	50-yr, 24-hr	21.3	18	4.0	
HC3	CMP - 1 Barrel	100-yr, 24-hr	177.5	–	–	
	CMP - 2 Barrels	100-yr, 24-hr	178.4	–	–	
	CMP - 3 Barrels	100-yr, 24-hr	178.4	–	–	Preferred
	HDPE - 1 Barrel	100-yr, 24-hr	178.4	48	6.0	
	HDPE - 2 Barrels	100-yr, 24-hr	178.4	–	–	
	HDPE - 3 Barrels	100-yr, 24-hr	178.4	–	–	
HC4	CMP - 1 Barrel	50-yr, 24-hr	9.2	18	5.2	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	9.2	18	3.7	
	CMP - 3 Barrels	50-yr, 24-hr	9.2	12	4.2	
	HDPE - 1 Barrel	50-yr, 24-hr	9.2	18	4.5	
	HDPE - 2 Barrels	50-yr, 24-hr	9.2	12	4.4	
	HDPE - 3 Barrels	50-yr, 24-hr	9.2	–	–	
HC5	CMP - 1 Barrel	50-yr, 24-hr	16.7	24	5.2	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	16.7	18	4.6	
	CMP - 3 Barrels	50-yr, 24-hr	16.7	18	4.0	
	HDPE - 1 Barrel	50-yr, 24-hr	16.7	24	4.8	
	HDPE - 2 Barrels	50-yr, 24-hr	16.7	18	4.3	
	HDPE - 3 Barrels	50-yr, 24-hr	16.7	12	5.0	

Table D-1. Alternative Sizing Scenarios for Haul Road Culverts						
Culvert ID[a]	Culvert Alternative	Design Event[b]	Design Discharge (cfs)	Barrel Diameter (in)[c]	Headwater Depth (ft)[d]	Selected Alternative for Table 4-7
HC6	CMP - 1 Barrel	50-yr, 24-hr	4.2	18	3.6	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	4.2	12	3.5	
	CMP - 3 Barrels	50-yr, 24-hr	4.2	–	–	
	HDPE - 1 Barrel	50-yr, 24-hr	4.2	12	4.2	
	HDPE - 2 Barrels	50-yr, 24-hr	4.2	–	–	
	HDPE - 3 Barrels	50-yr, 24-hr	4.2	–	–	
HC7	CMP - 1 Barrel	50-yr, 24-hr	4.4	18	3.7	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	4.4	12	3.5	
	CMP - 3 Barrels	50-yr, 24-hr	4.4	–	–	
	HDPE - 1 Barrel	50-yr, 24-hr	4.4	12	4.3	
	HDPE - 2 Barrels	50-yr, 24-hr	4.4	–	–	
	HDPE - 3 Barrels	50-yr, 24-hr	4.4	–	–	
HC8	CMP - 1 Barrel	50-yr, 24-hr	25.3	36	5.0	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	25.3	24	4.6	
	CMP - 3 Barrels	50-yr, 24-hr	25.3	18	4.6	
	HDPE - 1 Barrel	50-yr, 24-hr	25.3	36	4.8	
	HDPE - 2 Barrels	50-yr, 24-hr	25.3	18	5.4	
	HDPE - 3 Barrels	50-yr, 24-hr	25.3	18	4.3	
HC9	CMP - 1 Barrel	50-yr, 24-hr	10.3	18	6.0	Preferred
	CMP - 2 Barrels	50-yr, 24-hr	10.3	18	4.0	
	CMP - 3 Barrels	50-yr, 24-hr	10.3	12	5.2	
	HDPE - 1 Barrel	50-yr, 24-hr	10.3	18	4.7	
	HDPE - 2 Barrels	50-yr, 24-hr	10.3	12	4.8	
	HDPE - 3 Barrels	50-yr, 24-hr	10.3	–	–	

Notes:

[a]Culverts were given IDs generally based on the following:

- *C = Main access haul road culvert.*
- *HC = Temporary pit access ramp culvert.*
- *Numbered sequentially from east to west.*

[b]The 50-year, 24-hour design event was selected for most culverts with a few exceptions:

- *Culverts C9 and HC3 were sized for the 100-year event because they both drain a significant area.*
- *Culverts C5 and C10 were sized for the 50-year event; however, sizing for the 100-year, 24-hour event is also provided for comparison. C5 and C10 have contributing drainage from re-established channels sized to pass the 100-year event, for a maximum of 18 months. The risk of a 100-year event occurrence within the 18-month duration was less than 5%; therefore, the 50-year event was selected for the preferred scenario.*

[c]Culvert hydraulics were calculated using the HY8 modeling program as described in Section 3.2.2.

[d]Culverts were sized to the failure criterion of roadway overtopping assuming a maximum headwater depth of 6 feet and a minimum freeboard of 1 foot.

Abbreviations:

cfs = cubic feet per second.

ft = feet.

in = inch.