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TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION, INC.
HEADQUARTERS: P.O. BOX 33695 DENVER, COLORADO 80233-0695 303-452-6111

January 20, 2021

Mr. Zach Trujillo
Environmental Protection Specialist
Colorado Division of Reclamation, Mining & Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, CO 80203

RE: Colowyo Coal Company L.P.
Permit No. C-1981-019
Technical Revision No. 145
Adequacy Response

Dear Mr. Trujillo,

Tri-State Generation and Transmission Association Inc. (Tri-State), is the parent company to Axial Basin Coal Company, which is the general partner to Colowyo Coal Company L.P. (Colowyo). Therefore, Tri-State on behalf of Colowyo is submitting this adequacy response for technical revision 145 (TR-145) to Permit No. C-1981-019.

Tri-State received an adequacy letter from the Division dated December 31, 2020, and Tri-State is providing the following responses to the Division's concerns:

1. *When reviewing all proposed List of Maps for each associated Colowyo PAP Volume, it is observed that Map 35A – Bond Calculation Map Worst Case Topography has not been included. Map 35A was last updated with Colowyo TR- 141 and has not be requested for removal. Please update the proposed List of Maps with the TR-145 revision application.*

   Response: Map 35A has been added back onto the List of Maps for all volumes where appropriate.

Volume 2D

2. *There appears to be a wording error on Exhibit 7, page 1. The text "the Colowyo's sedimentation" should be changed to "Colowyo's sedimentation."*

   Response: The word "the" has been removed as noted.

3. *When reviewing the Streeter Pond figures:*

   a. *Comparing the proposed Streeter Pond As-Built drawing (Figure Exh. 7-14SP-1) to the currently approved drawing (Exhibit 7-SP, Attachment 4), the stage/storage curve is the same but the table with Storage Volume Computations has changed significantly. Please explain this apparent discrepancy (the Division acknowledges that the graph and table match in*

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the proposed drawing).

Response: The currently approved version of the Streeter Pond As-built does not contain a storage volume computation table, so it is unclear on what the Division is reviewing. As stated by the Division, Figure Exh. 7-14SP-1 as submitted under TR-145, the stage storage curve and storage volume computations table do match; therefore, no explanation is necessary. Further, please see response to comment 4.e. below.

b. The as-built drawing (Figure Exh. 7-14SP-1) does not have a scale that functions with electronic copies (it only works for hard copies at proper scale). Please add a scale such as the one on Figure Exh. 7-14SP- 2.

Response: Tri-State has never scaled a drawing specifically for electronic copies, nor does it understand what that means. All maps, as-builts, etc., are scaled accordingly and submitted, and this has been occurring since the Division started the ePermitting process without any issues. No changes are being made to Figure Exh. 7-14SP-2 as it is scaled correctly.

4. When reviewing the Streeter Pond SEDCAD:

c. Please provide an explanation to why the stock ponds in the proposed SEDCAD model are modeled as empty prior to storm runoff. In the currently approved SEDCAD model for the Streeter Pond, the stock ponds are full of water before the runoff begins. Full stock ponds are consistent with the term "worst- case hydrologic conditions," which is used in the introductory text (page Exh. 7-14SP-1). This change potentially has significant consequences; for example, the 10-year flow into Streeter Pond decreases from 78 cfs (currently approved model) to 3 cfs (proposed model) in the respective SEDCAD pages.

Response: The term "full stock ponds" is never cited as a "worst case scenario" in Appendix Exh. 7-14SP, Page Exh. 7-14SP-1, as the Division cites. It should be noted this is a statement made by the Division, and is not language proposed on page Exh. 7-14SP-1 by Tri-State.

As for the stock ponds, given the experience gained from constructing and managing many post mine stock ponds at Colowyo to date, unless there is a constant flow to a stock pond they tend to dry out through evaporation and infiltration after spring runoff is complete. Tri-State believes the stock ponds in the Streeter Pond watershed will be dry or close to dry the majority of the time. However, since the Division seems to have an issue with the ponds being modeled as dry, all three stock ponds have been remodeled with a

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permanent pool elevation.

d. *In the structure network, it is unclear why Structure #17 flows directly into the channel below (Streeter Ditch) rather than into a null at the confluence. Within this model and other models for the Colowyo Mine, null structures are commonly used at the confluence of two channels. Please explain.*

Response: A null at the confluence is already in the model. Please refer to Structure #19.

e. *Please confirm that the stage/storage information in SEDCAD for the Streeter Pond is accurate. Note that the information on the as-built drawing for this pond may not be correct, as the topography does not appear to reflect the current conditions: the large amount of sediment below the fill is not shown and the peninsula near the gate is not shown. If the stage/storage relationship for the pond has changed, this should be reflected in the SEDCAD model.*

Response: The Division needs to be reminded that the Streeter Pond was dredged in 2019 as documented in the Division's partial and complete inspection reports, and Colowyo's quarterly and annual impoundment reports. Further, the Streeter Pond was resurveyed after the pond was dredged in 2019, and a revised as-built reflecting this current pond configuration has been provided. In addition, the SEDCAD™ for Streeter Pond and its corresponding watershed has been revised accordingly based on this updated information.

Volume 2E

5. *Please explain how the CN values were chosen for the post-mining conditions to model in SEDCAD. In Figure Exh. 7-14ET-2 the large majority of the drainage area has a CN of 62 (925 acres out of 1049 acres). Please explain why that is the worst-case hydrologic condition.*

Response: Curve numbers are selected in accordance with Table 1 in Exhibit 7 in Volume 2D in the approved permit as required, and the model methodology is further descried in Volume 2D, Exhibit 7 Methodologies and Assumptions for Sedimentation Pond Evaluations, Section 1.5.

The East Taylor Pond watershed in its current condition, a large portion of which the southern portion of the watershed is not reporting to the pond due mostly to the existence of the final cut of the West Pit, and other areas that have not been backfilled and graded to date. Therefore, a large volume of surface water flows are being contained within the final cut of the West Pit and other mining related disturbances in the southern portion of the

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watershed, and are not reporting to the East Taylor Pond. West Pit reclamation areas currently reporting to the East Taylor Pond are well established and the majority are Phase II released further indicating surface water flows from these reclamation parcels in the West Pit reclamation are being reduced by successful revegetation. Once the southern portion of the East Taylor watershed is reclaimed, the post mine condition, a much larger area that was not previously reporting to the pond will be contributing within the watershed to the East Taylor Pond that at this time is not due to the West Pit and other disturbed areas limiting flows.

6. *Please explain apparent discrepancies between the East Taylor Pond As-Built (Figure Exh. 7-14ET-1) and the SEDCAD model (page 18 of the 25-year model). On the topographical drawing the principal spillway is below elevation 6940, which does not agree with the model. The spillway perforations are at an elevation of 6944 on the Stage Storage Curve, but there is no discharge in the Detailed Discharge Table until the water reaches 6952. The principal spillway is at 6952 on the Stage Storage Curve but a foot lower in SEDCAD. Also, there are errors on the section for the principal spillway, such as the elevation for the top of the pipe (6872 is lower than pond bottom).*

Response: First, two typographical errors have been corrected. One for the primary spillway elevations in the SEDCAD™ models, and one for the primary spillway elevation on the embankment cross-section on Figure 7-14-ET-1. Second, the primary discharge and primary spillway labels within the topographical contours on Figure 7-14ET-1 are a reference in space on where these structures are located in the pond. The labels are not the "actual" elevation locations as cited by the Division. They remain on the as-built as shown as they provide a helpful spacial reference. Finally, Tri-State found an error in the SEDCAD™ model for the perforation elevations, which has been corrected. All the models for the East Taylor Pond have been corrected and resubmitted accordingly.

7. *In the East Taylor Pond SEDCAD model, the discharge from structure #17 is 0.012 cfs (see page 10 of the 10- year model). Per the introductory text for the East Taylor Pond, however, the flow should be 0.56 cfs. Please explain this apparent discrepancy.*

Response: The 10-year and 25-year East Taylor hydrology demonstrations have been corrected. The 0.56 cfs is now the outflow from the "dummy" reservoir.

8. *When reviewing the Section 16 Pond text (Appendix Exh. 7-14S):*

    a. *In the text that discusses the temporary ditches, the listed depths of 0.5 foot and 1 foot may be too small when compared to depths in the SEDCAD model. For example, the depth for Structure #3 in the 10-year model is 1.17 feet. Please revise as appropriate and also explain if freeboard is not necessary.*

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Response: First, the depths listed for the East and West Section 16 depths are the minimum depths already approved previously by the Division. Please see application and final decision for TR-132. Further, both ditches remain in their current configuration as approved prior to TR-132. The Division should refer to their own decision documents on this point. Second, the depths listed in Appendix Exh. 7-14S were not proposed to be changed under TR-145. The changes that occurred to Appendix Exh. 7-14S under TR-145, included a rerun of the hydrology in the upper reaches of the watershed due to changes with the proposed PMT, and the appendix was renumbered and reformatted for consistency. No changes were made to any of the structures within the Section 16 watershed under TR-145. Third, it is perplexing as to why the Division is now questioning items previously reviewed and approved. It is further concerning that the Division is questioning ditches that have been constructed larger than the minimum requirements noted in the permit. The ditches have been in place and inspected by the Division for nearly thirty years. Moreover, a very large portion of the watershed reporting to both ditches is Phase III released and the ditches have been stable for nearly thirty years. All that being said, Tri-State is not making any changes in response to this comment as noted by the facts presented above.

b. *In the text that discusses the temporary ditches, it appears that the words "West" and "East" are mixed up in three or more locations. Please revise as appropriate.*

Response: The narrative for the temporary ditches has been corrected as noted.

9. *Figure Exh. 7-14S-2 (Section 16 watersheds) appears to have an error with the stationing for East Section 16 Ditch. The label "13+15" should be revised to "23+15."*

Response: The ditch station for the East Section 16 Ditch has been corrected as noted.

10. *The scale on Figure Exh. 7-14S-2 is incorrect. Please edit this error.*

Response: This very minor scale issue has been corrected as noted.

11. *Please explain an apparent discrepancy between the Section 16 Pond As-Built (Figure Exh. 7-14S-1) and the associated SEDCAD model. The spillway perforations are at an elevation of 7746 on the Stage Storage Curve of the drawing, but there is no discharge in the Detailed Discharge Table in the model until the water reaches 7753.*

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Response: Tri-State found an error in the SEDCAD™ model for the perforation elevations, which has been corrected. All the models for the Section 16 Pond have been corrected and resubmitted accordingly.

Volume 7

12. *On Maps 12 and 19 (and other maps), please check the disturbance boundary symbol. This symbol is not clearly shown in some areas such as the Section 16 Fill Ditch and Prospect Pond.*

Response: The disturbance boundary as shown on Map 12 and 19 is visible for all mining and reclamation areas. At times, it is overlain with the temporary channels, but due to the size of the area shown on the maps it is impossible to show completely. No changes are being made in response to this comment as Colowyo has always shown the disturbance boundary in this manner, which the Division has approved on many maps previously.

13. *On Map 12, the ditch that crosses the West Pit Fill (the East Taylor Pond Ditch) is not shown. However, this ditch is still included in Appendix Exh 7-14F. Please address this apparent discrepancy.*

Response: A layer was turned off for the East Taylor Pond Ditch in AutoCAD, which has been restored.

Volume 13

14. *Within the Section 28 Pond watershed, it is highly recommended that Tri-State consider the construction of stock tanks below Trib D and the other disturbed areas near the ridge. (It appears that one stock tank already exists below Trib D.) This would reduce the velocity of the peak discharge in the Natural Channel, which is above 15 feet per second during the 25-year storm, per the SEDCAD printout (pages 6-7). Also on this printout, the limiting velocity of 6 feet per second is listed for shales and hardpans.*

Response: There is not any reason for a stock pond to be constructed on the ground below Trib D. The hydrology does not dictate it is necessary, and there has never been any erosional issues. Further, Colowyo would be forced by the Division to create additional ground disturbance and bond accordingly since it would outside of the approved disturbance boundary. A stock pond will not be considered below Trib D.

15. *The curve number for the "purple" areas on Figure Exh. 7-20A-2 is shown as 57 in the legend of the figure, but this should be changed to 47 per the SEDCAD pages. Please make this change to the figure (or update SEDCAD if appropriate).*

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Response: The typographical error on Figure Exh. 7-20A-2 has been corrected.

16. *When reviewing the West Taylor Pond text:*

a. *Please add to the text an explanation of how the CN values in the SEDCAD model were chosen for the worst-case hydrologic condition.*

Response: The second paragraph on Page Exh 7-20B-1 in Exhibit 7, Item 20, Part B already describes how curve numbers are assigned for the post mine condition.

b. *There appear to be errors in the text on page Exh. 7-20B-1. The references to figures in the first paragraph should likely say "7-20B" rather than "7-20C."*

Response: Typographical error has been corrected.

c. *The introductory text for the West Taylor Pond hydrology approach should include a discussion of the geomorphic reclamation techniques proposed by Tri-State with TR-145. With this discussion, anyone who looks at the hydrology approach and design will understand that this method is being used and why this method entails significant benefits compared to conventional designs.*

Response: Tri-State agrees that the geomorphic reclamation techniques that will be implemented in South Taylor reclamation areas should be discussed. Tri-State disagrees that a hydrology narrative is the appropriate location in the permit, as it is a larger part of the overall reclamation plan rather than just hydrology. That being said, a narrative is being added to Volume 1, Section 2.05.4 to discuss the geomorphic reclamation techniques that will be utilized in South Taylor. This addition was impacted by the recently proposed decision for TR-143; therefore, the TR-143 proposed decision materials have been incorporated into TR-145 in Volume 1, Section 2.05.4.

d. *Map 12 indicates that a portion of Trib 1 flows over the permanent fill, however this channel is designed for the 10-year storm (rather than the 100-year storm). Please explain this in the introductory text or revise the design to meet Rule 4.09.2(7).*

Response: Since the portion of Trib 1 that flows over the permanent fill edge is minimal, text was added into Exhibit 7, Item 20, Part B indicating how Trib 1 was modeled.

e. *In the SEDCAD model for East Fork Taylor Ditch, a roughness coefficient of*

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0.12 is shown (see page 10 of the 100-year model). Given that this is unusually high, a discussion of this factor is warranted in the introductory text. Perhaps it belongs in the text related to the geomorphic reclamation techniques. Perhaps it could be stated that this is a conservative factor in the analysis.

Response: First, the roughness coefficient, which the Division needs to be aware, *is a SEDCAD™ calculation and not a user input in the software*, are what the software calculates them to be based on all of the factors in the hydrology model for a particular channel. Second, the Division is incorrect stating that the roughness coefficient cited is "unusually high". In other models, including other vegetative channels in the West Taylor Pond model, there are higher roughness coefficients for other channels modeled, so it does not make any sense why the Division chose this particular roughness coefficient as "unusually high" as it is not. Third, according to the authors of the SEDCAD™ software, **"***A higher roughness coefficient yields a higher depth for flow and a lower velocity*". (SEDCAD™ 4 User's Manual Schwab and Warner, 1998), page 100). As the roughness coefficient increases in a channel the velocity decreases as there is more resistance to flow. Limiting and/or lowering flow velocities is always targeted when modeling channels to mitigate erosional forces and ensure long-term stability of a channel. Given the fact that the modeled channel velocity for this segment of the East Fork Taylor Ditch is 3.85 fps, the limiting velocity is 7.0 fps, there is adequate freeboard in the channel; the roughness coefficient is going to be higher than a channel with a shallower depth and higher flow velocities. When the flows from a modeled channel are less than the limiting velocities erosion is being mitigated and it demonstrates channels will be stable long-term. Given the above statements, no changes are being made in response to this comment.

17. *When reviewing the West Taylor Pond figures:*

    a. *The watershed boundaries map (Figure Exh. 7-20B-2) contains three shades of green indicating different CN values, but the map legend only shows two shades of green. Please revise the map or explain this apparent discrepancy.*

    Response: The legend on Figure Exh. 7-2B-2 has three shades of green as is shown on the map. There is not any apparent discrepancy as the Division indicates. No changes have been made, as the map legend as submitted is correct.

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Volume 14

18. *With the changes to post-mining topography as part of the proposed Colowyo TR-145, please provide an updated Map 35A - Bond Calculation Map Worst Case Topography. With the updated Map 35A, please provide the Division updated volumes associated with each reclamation polygon to allow the Division to accurately calculate the reclamation cost estimate with the TR-145 proposed changes per Rule 3.02.2.*

Response: Map 35A has been updated and provided as requested. Further, the volumes associate with Map 35A are being provided under this cover letter, but are not part of the permit application package, and are provided or the Division to calculate the reclamation cots estimate only. Also, when the Division reviews Map 35A, each spoil grading area has been defined with a unique number, and the number corresponds directly to the attached spreadsheet and volumes. Further, on Map 35A, if a specific area doesn't not have a centroid to centroid haul distance the entire area balances within the specified polygon.

If you should have any additional questions or concerns, please feel free to contact Tony Tennyson at (970) 824-1232 at your convenience.

Sincerely,

DocuSigned by:
Daniel Casiraro
B70D69F114324DE...

Daniel J. Casiraro
Senior Manager
Environmental Services

DJC:TT:der

Enclosure

cc: Chris Gilbreath (via email)
Tony Tennyson (via email)
Angela Aalbers (via email)
File: C. F. 1.1.2.127 - G471-11.3(21)d

Map 35A Volumes

Volumes

Area	Cut	Fill
TS-1	3,797,770	3,889,055
TS-2	2,416,217	2,192,130
TS-3	1,056,234	1,443,519
TS-4	1,527,757	1,601,149
TS-5	455,009	447,785
TS-6	1,063,103	1,085,759
TS-7	2,558,894	2,512,532
TS-8	4,628,603	4,559,583
TS-9	4,408,828	4,516,894
TS-10	4,516,062	4,755,597
TS-11	3,900,843	4,226,798
TS-12	4,030,324	3,500,377
TS-13	3,986,133	3,550,963
TS-14	4,065,316	3,324,952
TS-15	4,033,424	3,605,898
TS-16	1,386,289	1,407,596
TS-17	1,200,585	1,206,901
TS-18	756,905	1,415,325
TS-19	239,096	232,976
TS-20	453,833	482,195
TS-21	556,913	555,556
TS-22	347,730	326,712

TOTAL	50,027,393	49,475,789

Centroid Haul Distances and Grades

Haul	Start Elev.	End Elev.	Elev. Change	Haul Distance	Overall Grade
TS-1	7,905	7,900	-5	5,876	-0.09%
TS-2	7,810	7,670	-140	1,580	-8.86%
TS-3	7,810	7,680	-130	1,430	-9.09%
TS-4	7,845	7,675	-170	1,101	-15.44%
TS-5	8,110	8,065	-45	910	-4.95%
TS-6	8,050	7,950	-100	1,172	-8.53%
TS-7	8,090	8,050	-40	5,853	-0.68%
TS-8	8,095	8,050	-45	5,509	-0.82%
TS-9	8,020	8,040	20	6,658	0.30%
TS-10	8,085	8,010	-75	6,762	-1.11%
TS-11	8,090	8,100	10	7,359	0.14%
TS-12	7,950	7,890	-60	1,135	-5.29%
TS-13	8,000	7,950	-50	2,742	-1.82%
TS-14	7,990	8,090	100	4,376	2.29%
TS-15	8,020	8,200	180	6,594	2.73%
TS-16	7,770	7,600	-170	1,711	-9.94%
TS-17	7,635	7,475	-160	1,973	-8.11%
TS-18	7,435	7,390	-45	815	-5.52%
TS-19	7,330	7,320	-10	436	-2.29%
TS-20	7,400	7,355	-45	2,507	-1.79%
TS-21	7,270	7,265	-5	1,399	-0.36%
TS-22	7,235	7,255	20	628	3.18%

CHANGE SHEET FOR PERMIT REVISIONS, TECHNICAL REVISION, AND MINOR REVISIONS

Mine Company Name: **Colowyo Coal Company**

Permit Number: **C-1981-019**

Date: **January 20, 2021**

Revision Description: **TR-145 West Pit and South Taylor PMT Revision**

Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
1	List of Maps Page x (1 page)	List of Maps Page x (1 page)	List of Maps has been updated.
1	Page 2.05-17 through 2.05-37 (21 pages)	Page 2.05-17 through 2.05-37 (21 pages)	Section 2.05.4 has been updated and TR-143 approval materials have been included which caused a pagination shift.
2A			No Change
2B			No Change
2C			No Change
2D	Exhibit 7 Pages 1 through 3 (3 pages)	Exhibit 7 Pages 1 through 3 (3 pages)	Typographical error has been corrected and text has been updated for clarity.
2D	Pages Exh. 7-14SP-1 and Exh. 7-14SP-2 (2 pages)	Pages Exh. 7-14SP-1 and Exh. 7-14SP-2 (2 pages)	Appendix Exh. 7-14SP has been updated.
2D	Figures Exh. 7-14SP-1 (1 page)	Figures Exh. 7-14SP-1 (1 page)	Streeter Pond As-Built has been updated.
2D	Streeter Pond Hydrology 10 year and 25 year storm events, and Streeter and Buckskin Ditches 100 year event (72 pages)	Streeter Pond Hydrology 10 year and 25 year storm events, and Streeter and Buckskin Ditches 100 year event (72 pages)	Streeter watershed models have been updated.
2E	Page Exh. 7-ET-3 (1 page)	Page Exh. 7-ET-3 (1 page)	Appendix Exh. 7-14ET has been updated.
2E	East Taylor Pond Hydrology 10 year and 25 year storm events, and Taylor Ditch 100 year event (72 pages)	East Taylor Pond Hydrology 10 year and 25 year storm events, and Taylor Ditch 100 year event (72 pages)	East Taylor watershed models have been updated.
2E	Figure Exh. 7-14ET-1 (1 page)	Figure Exh. 7-14ET-1 (1 page)	Figure Exh. 7-14ET-1 has been updated.
2E	Pages Exh. 7-14S-2 and Exh. 7-14S-3 (2 pages)	Pages Exh. 7-14S-2 and Exh. 7-14S-3 (2 pages)	Typographically error has been corrected.
2E	Figure Exh. 7-14S-2 (1 page)	Figure Exh. 7-14S-2 (1 page)	Figure Exh. 7-14S-2 has been updated.
2E	Section 16 10-year and 25-year storm event models (27 pages)	Section 16 10-year and 25-year storm event models (27 pages)	Section 16 pond models have been updated.
3			No Change

CHANGE SHEET FOR PERMIT REVISIONS, TECHNICAL REVISION, AND MINOR REVISIONS

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Volume Number	Page, Map or other Permit Entry to be REMOVED		Page, Map or other Permit Entry to be ADDED		Description of Change
4					No Change
4					No Change
5A					No Change
5B					No Change
6	List of Maps Page 2 (1 page)		List of Maps Page 2 (1 page)		List of Maps has been updated.
7	List of Maps Page 2 (1 page)		List of Maps Page 2 (1 page)		List of Maps has been updated.
7	Map 12		Map 12		Map 12 has been updated.
8	List of Maps Page 2 (1 page)		List of Maps Page 2 (1 page)		List of Maps has been updated.
9	List of Maps Page 2 (1 page)		List of Maps Page 2 (1 page)		List of Maps has been updated.
10	List of Maps Page 2 (1 page)		List of Maps Page 2 (1 page)		List of Maps has been updated.
12	South Taylor/Lower Wilson page ix (1 page)		South Taylor/Lower Wilson page ix (1 page)		List of Maps has been updated.
13	Page Exh. 7-20B-1 through Exh. 7-20B-3 (3 pages)		Page Exh. 7-20B-1 and Exh. 7-20B-3 (3 pages)		Typographical error has been corrected and new text has been inserted.
13	West Taylor 10-year and 25-year storm event models all pages (72 pages)		West Taylor 10-year and 25-year storm event models all pages (72 pages)		West Taylor model error has been corrected.
14	List of Maps Page 2 (1 page)		List of Maps Page 2 (1 page)		List of Maps has been updated.
14	Map 35A		Map 35A		Map 35A has been updated and provided.
15	List of Maps Page xii (1 page)		List of Maps Page xii (1 page)		List of Maps has been updated.
16					No Change
17					No Change
18A					No Change
18B					No Change
18C					No Change
18D					No Change
19					No Change

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Permit Number: **C-1981-019**

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Volume Number	Page, Map or other Permit Entry to be REMOVED		Page, Map or other Permit Entry to be ADDED		Description of Change
20					No Change
21	List of Maps Page 2 (1 page)		List of Maps Page 2 (1 page)		List of Maps has been updated.
22	List of Maps Page 2 (1 page)		List of Maps Page 2 (1 page)		List of Maps has been updated.

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the estbalishment of reclaimed plant communities that meet the designated post mining land use of rangeland, with the subcomponents of grazingland and wildlife habitat. Please see Section 2.05.5 for a detailed description of the post mine land uses at Colowyo.

Areas designated as grazingland for the post mining land use will aim to establish vegetation communities comprised of species primarily selected for palatability and production, with incidental wildlife habitat. The reclamation seed mixes utilized in grazingland targeted areas are designed to establish highly productive stands of native perrennial grasses to support grazing and forage, yet the mixes contain forbs and shrubs to also provide additional benefits for incidental wildlife use. Topsoil replacement depths in grazingland areas vary based on slope, which will encourage species diversity and mimic soil development processes in native soil systems.

Areas designated for wildlife habitat as the post mining land use will aim to establish a sagebrush steppe vegetation community. The reclamation seed mix utilized in sagebrush steppe targeted areas is designed to encourage sagebrush establishment by decreasing perennial grass competition through decreasing the number of grass species and seed numbers, and also incorporating only bunchgrasses (as opposed to sod-forming grasses), with a significant increase in the total amount and relative proportion of sagebrush seed. Reclamation techniques that will encourage the deposition and entrapment of blowing snow (to increase spring soil moisture) are also employed in sagebrush steppe targeted areas, to provide a competitive advantage to sagebrush over perennial grasses. These techniques include taking advantage of site-specific opportunities for the development of convex and concave surfaces along with the potential development of small berms along the contour and approximately perpendicular to prevailing winds. Topsoil replacement depths in sagebrush steppe targeted areas will be reduced relative to other areas, also to decrease competition from grasses.

The reclamation timetable and associated acreages for the various aspects of the mining operation are provided on Table 2.03-1.

In the South Taylor reclamation areas, geomorphic reclamation techniques will be implemented in the final PMT surface. Geomorphic reclamation techniques are used to design and construct a PMT, which beaks up long continuous slopes with smaller watersheds, adds sinuosity to the post mine permanent channels, and creates a landform that is erosionally stable. Part of the final configuration of the South Taylor geomorphic reclamation PMT surface specifically targets topography to harvest wind and snow for reestablishment of tall shrubs and aspens, which are required for the revegetation success of the South Taylor Pit.

Backfill and Grading Plan

As discussed in detail in Section 2.05.3, the mining method implemented by Colowyo is referred to as open-pit multiple seam/single seam dragline mining. The overburden material from the initial boxcut area was deposited in a permanent valley fill. As mining progresses, overburden material from each successive cut is backfilled into the previously mined out area. This cycle was repeated for the entire mining area. Because an open-pit mining technique is used, the regrading and backfilling of the spoil material is as contemporaneous as possible behind the mined-out area to facilitate proper leveling of the overburden material.

The backfilled mining areas are graded to establish the approximate original contour and to blend in with the undisturbed areas outside the mining limits. Additional information on the backfilling and regrading plan are discussed further in Section 2.05.3 and Section 4.14.

Final grading before topsoil placement will be conducted in a manner that minimizes erosion and provides a surface for the topsoil that minimizes slippage. If spoil compaction is a problem, the spoil will be ripped with a dozer to minimize compaction, assure stability, and minimize slippage after topsoil replacement. Where possible, development of concave landforms (to encourage snow entrapment) will be developed.

Where necessary, the overburden surface will be roughened by ripping or discing etc., to ensure a bond between the topsoil and spoil to reduce slippage. To date there is no evidence of topsoil slippage on reclaimed areas. A few small tension cracks resulting from settling of fill along tie in locations with highwall have occurred in a few areas. However these areas within a year or two after reclamation, soon stabilize and begin to fill in.

The final post mine surfaces are shown on Map 19, 19A, and 19B. Appropriate cross sections that show the anticipated final surface configuration of the reclaimed area, in conjunction with the existing pre-mining topography are shown Maps 20, 20A and 20B.

Topsoil Redistribution Plan

As discussed in Section 2.05.3, prior to any mining-related disturbances, all available topsoil will be removed from the site to be disturbed, and will be redistributed or stockpiled as necessary to satisfy the needs of the reclamation timetable described herein. The topsoil redistrubtion plan is also broken into three distinct timeframes which are pre-2005, 2005 to 2009, and post-2010. Each plan is described in more detail below.

Pre-2005 and 2005-2009 Topsoil Redistribution Plan

Prior to 2005, essentially all reclamation units were covered with an average of 18 inches of topsoil. From 2005 through 2009, reclamation areas received an approximate average of 8 inches of topsoil. Most of these reclamation areas have been Phase III released to date, and the remaining units on schedule for a near future Phase III bond release application.

Post-2010 Topsoil Redistribution Plan

Variable topsoil replacement depth has been utilized at Colowyo since 2010. Post-2010 topsoil replacement is directly tied to the post mine land uses presented in Section 2.05.5, targeting two rangeland components consisting of grazingland and wildlife habitiat (sagebrush steppe).

In grazingland targeted areas (areas with slopes greater than 10%), topsoil will be redistributed utilizing variable replacement depths. Thinner topsoil (approximately six inches) will be replaced on ridge tops, and topsoil replacement depth will gradually thicken moving down the slopes toward the drainage bottoms. This gradation in topsoil depth on slopes recreates native edaphic conditions and mimics soil development on local landforms. Lower-lying areas (relative to the surrounding landscape), such as natural swales, depressions, and subtle drainageways that tend to catch more

snow will also receive deeper topsoil replacement depths. These areas should store greater quantities of moisture, which will increase overall productivity, while providing enhanced opportunities for growth and development of the mountain shrub and snowberry communities (seed is a component of the grazingland seed mix). Even in areas where these shrub species do not initially germinate, the deeper soils systems with increased water holding capacity and altered hydrologic function of localized areas with increased snow capture will mimic the native conditions for mountain shrub and snowberry communities, setting the foundation for succession to progress in these areas over long-term time horizons.

In wildlife habitat (sagebrush steppe) targeted areas (flatter areas with less than 10% slopes), topsoil replacement depth will target an average of four inches, with a more uniform application depth to encourage proper seeding depth and conditions for sagebrush establishment. To encourage snow capture and increase spring soil moisture, reclamation techniques will attempt to take advantage of site-specific opportunities for the development of convex and concave surfaces along with the potential development of small berms along the contour and approximately perpendicular to prevailing winds.

General Topsoil Handling Procedures

Colowyo will ensure proper topsoil resource management through various quality assurance and control procedures. Procedures utilized to account for topsoil volumes include an annual analysis of the topsoil balance, accounting for volumes in stockpiles, current and following year's reclamation areas, the total disturbance area, and the results of topsoil stripping activities each year. Detailed soil maps for the permit area assist operations and guide management in preparation and scheduling for topsoil salvage activities. Topsoil resources are generally segregated by area (East Pit, West Pit, Section 16, South Taylor Area, facilities, Gossard Loadout, etc.), to ensure that these resources are reapplied to the general areas from which they came.

During topsoil removal in advancement of the mining operations, dozers will be utilized to pile up the topsoil so it can be loaded and hauled to stockpile or immediately to a reclamation area. Scrapers may also be employed for topsoil removal as deemed appropraiote. Topsoil salvage is guided by the existing soil maps and resources available to Colowyo personnel. Topsoil salvage is avoided during times of soil saturation, as a best management practice to avoid overly compacting the soil.

Topsoil stockpiles are revegetated as soon as is practicable to prevent losses from wind and water erosion. Stockpiles are seeded with a mix of native reclamation species to stabilize the stockpile. All stockpiles are properly labeled as topsoil to avoid mishandling, and detailed as-built information is collected to accurately calculate stockpile volumes as a quality control procedure. All topsoil stockpiles are protected with a ditch and berm around their perimeter to conserve the resource.

When topsoil is to be reapplied following stockpiling, topsoil is normally loaded from stockpile with loaders and trucks, and then hauled to the backfill reclamation areas, where it is dumped and graded for final placement. Topsoil hauled in trucks will be dumped strategically to minimize handling and disturbance, and then pushed out with dozers and/or scrapers until spread to the appropriate locations and depths. Reapplied topsoil will be graded in a manner that maintains

surface roughness to help minimize sheet flow and erosion while also creating microtopography to assist vegetative diversity on the reclamation. On steeper slopes (typically greater than 10% slope) Colowyo will also employ the use of contour furrows and cross ripping following topsoil laydown to create slope breaks and increase surface roughness on otherwise long and straight slopes.

At the discreation of Colowyo, native soil, collected from the local ecosystems, will be used to inoculate reclamation areas with beneficial mycorrhizae. Mycorrhizae are symbiotic relationships that form between fungi and plants. The fungi colonize the root system of a host plant, providing increased water and nutrient absorption capabilities while the plant provides the fungus with carbohydrates formed from photosynthesis.

Revegetation Plan

Following the topsoiling of an area, Colowyo will reseed the topsoiled area as soon as is practicable in accordance with the targeted post mining land use as described in Section 2.05.5. Seeding is targeted to occur during in the fall, prior to the first snowfall event (typically mid to late October).

Colowyo typically uses a rangeleand drill to complete seeding on both targeted post mine land uses. However, Colwoyo also has the ability to utilize a Truax (Trillon) drill if deemed necessary. At times, broadcast seeding may be required on steeper areas, wet areas, very rocky areas, or simply on areas that were missed by the other seeding equipment. If seeding cannot be completed prior to seasonal snowfall, broadcast seeding may occur in the spring as soon as ground conditions allow. Broadcast seeding of the sagebrush steppe areas may also be seeded directly into snowbanks if winter or spring conditions allow. When broadcasting is utilized and ground conditions allow, a very light tine harrow or similar equipment may be dragged behind the seeder to facilitate improved soil to seed contact.

Seed Mixes

Two seed mixes are utilized at Colowyo, with each mix designed to facilitate revegetation meeting the designated post mining land use of rangeland, subcomponents of grazingland and wildlife habitat (sagebrush steppe). The mixes have been adapted over time in response to changing regulatory requirements, and thorough evaluations of quantitative emergence and dominance data from reclaimed and released reclamation areas. The mixes represent the seasonal varieties and lifeforms present in the pre-mine area, and are comprised almost entirely of native species. The lone introduced taxon included in both seed mixes (cicer milkvetch), which provides excellent forage for wildlife and livestock, is very successful on Colowyo's existing reclamation, and is an excellent species for providing necessary habitat requisites for a variety of insects that in turn are especially important to other wildlife.

Grazingland Seed Mixture

The reclamation seed mixture for post mine areas targeting grazingland is presented on Table 2.05-7. The grazingland seed mixture contains sufficient diversity for ecological stability, erosion control for steeper slopes, and will meet the goals of the designated post mining land use. The seed mixture contains a variety of grasses, forbs and shrub species well adapted to the soil and moisture conditions found at Colowyo. The seed mixture includes species capable of occupying the anticipated micro-habitats encountered in the reclaimed areas. This seed mixture will be

quickly effective for erosion control in young reclamation, while also facilitating the desired post-mining vegetative community with the same seasonal varieties and lifeforms of the pre-mined area.

The species and seeding rates indicated on this grazingland mix have been adapted from an analyses of the success of past mixes, and the resulting emergence and dominance data within previously successful revegetated areas.

Wildlife Habitat Seed Mixture
The reclamation seed mixture for areas targeting wildlife habitate (sagebrush steppe) is presented in Table 2.05-8. The sagebrush steppe seed mixture also contains sufficient diversity for ecological stability. This mixture contains a variety of grasses, forbs and shrub species well adapted to the soil and moisture conditions found at Colowyo and should provide both the structural diversity and life form diversity necessary for the designated sagebrush steppe wildlife habitat. The seed mixture includes species capable of occupying the anticipated micro-habitats encountered in the reclaimed areas and contains sufficient sagebrush seed to hopefully encourage at least some emergence each year, and occasional substantial emergence when climatic conditions are favorable.

Similar to the seed mixture for grassland areas, the species and seeding rates indicated on this sagebrush steppe mix resulted from in-depth analyses of past mixes and the resulting emergence and dominance within successful revegetated areas at Colowyo. Furthermore, it is anticipated that the reduced competition from grasses, especially sod-forming species such as thickspike wheatgrass, will result in elevated diversity and better performance from slower growing species.

Although not yet identified as an issue on Colowyo's reclamation, because the amount of grasses (and all sod-formers) has been substantially reduced for this sagebrush steppe mix, it is possible that on occasion, grass emergence may not be satisfactory for erosion control or life form diversity. If this scenario occurs in the future, a supplemental inter-seeding with the grassland mix may be utilized to increase the grass and forb component of the specific area. This activity is allowed under Rule 4.15.7 (5)(g).

Contingency Seed Substitutions
Table 2.05-9 provide a list of contingency species for Table 2.05-7 and Table 2.05-8, should certain taxa be unavailable or unwarranted in any given year.

Fencing

Where Colowyo deems appropriate, smaller areas within a larger areas seeded to wildlife habitat may be fenced to encourage shrub development and to limit browsing by local wildlife.

Mulching Techniques

Mulching techniques are not currently employed at Colowyo, except in rare instances. During the initial permitting processes, Colowyo proposed that on slopes flatter than 4h:lv that rather than utilize a hay mulch, a stubble mulch or no mulch be used on reclaimed areas. The use of mulch on

these relatively flat slopes was demonstrated to be of no value towards reclamation at the Colowyo site. The application of mulch was identified to produced problems with delayed germination on the reclaimed areas, rather than solving an assumed erosion problem, which is addressed through other methods.

Mulches tend to shade the soil, thus slowing the rise in soil temperature needed for germination of seeds. At Colowyo, the higher elevation and typical late spring snows result in cooler spring temperatures and delayed soil thawing. By eliminating the use of mulch, the soil temperature is increased earlier in the spring, thus enabling the seeds to germinate earlier when soil moisture conditions are optimum, immediately following snowmelt. Earlier growth also results in further root development by the plants, aiding survival through the dry and hot summer months.

Without the use of a mulch, erosion control has been maintained with surface manipulation methods such as contour furrows, drainage benches and permanent drainage channels. The initial reclamation at Colowyo that began in 1978 is indisputable evidence that the methods used at Colowyo have proven highly successful in controlling erosion on slopes as steep as 3h:lv until vegetative cover has established. Where deemed necessary by Colowyo (e.g., sagebrush steppe targeted areas, south-facing slopes, high wind areas, etc.), mulching techniques (or other practices such as chisel plowing, or discing on the contour) will be reinstated as necessary.

Irrigation

No irrigation is planned for areas to be seeded.

Pest and Disease Control

Noxious plants, as defined in Section 1.04, will be managed in accordance with the following section – "Weed Management Plan". If insects become a problem to the point where they endanger the successful establishment of the seeded vegetation on the reclaimed area, they will also be controlled using methods suggested by the Colorado State University Extension Service. All herbicides and pesticides utilized will be those that are approved by the appropriate state and federal governmental agencies responsible for the approval and distribution of such agents.

Weed Management Plan

A listing of Colorado's noxious weeds (A, B, and C lists) as well as an indication of Rio Blanco and Moffat Counties' listed taxa are indicated on Table 2.05-10 along with an indication of those taxa that have been observed on or near the Colowyo mine. As indicated on this table, there are no "A" list taxa known from the area. "A" list taxa must be eradicated. To the contrary, there are seven (7) "B" list (must be managed) taxa known from the environs of the Colowyo Mine as well as three (3) "C" list (management may be required by local governments) species. Of these 10 species, common mullein and poison hemlock from the "C" list, and Russian olive from the "B" list are not overly problematic and will normally not require attention. In fact the Russian olive was purposefully planted in the reclamation. If "infestations" of common mullein or poison hemlock evolve, they will be treated in the same manner as the more problematic species.

The remaining seven species: hoary cress, musk thistle, Canada thistle, bull thistle, houndstongue, black henbane, and downy brome (cheatgrass) will be the primary focus of the program and will likely receive attention as appropriate at the Colowyo mine. In addition, continued monitoring of reclamation will focus on identification of any new noxious weeds.

For the most part, noxious weeds observed on or near Colowyo reclamation do not achieve "infestation" levels. By infestation, Colowyo means: 1) relative cover contribution of one noxious weed species or a combination of noxious weed species exceeding three percent in a revegetated stand; or 2) a "patch" of any listed species in which the noxious weed component exceeds 25% relative cover and occupies an area larger than 100 square feet on any disturbed area. Rather, noxious weeds tend to occur as scattered individuals or small pockets of individuals. This distribution suggests that spot control will be the only effective procedure that can be utilized.

To manage these seven noxious weed species populations, Colowyo will either perform itself, or contract out, annual weed control activities. Weed control will typically involve herbicide application at the appropriate rates and during the appropriate life stages (as possible) to effect control. Spot applications will be preferred over "blanket" applications to prevent loss of desirable reclaimed taxa such as seeded forbs and shrubs, however, blanket application may be necessary if any infestation areas are observed.

All Colowyo staff remain vigilant for pockets of noxious weeds in the reclamation. If larger concentrations are observed, they will be mapped, recorded with GPS, or other means of identification to facilitate control by weed spraying crews. Both the weed spraying crew and the revegetation monitoring crews will be especially important in this regard.

In addition to revegetated areas, vigilance will be maintained for other locations conducive to noxious weed populations. Such areas include: riparian areas, topsoil piles, major traffic areas, road cuts and fill slopes, ditches, pond embankments, non-use areas, etc.

Weed control measures may include mowing, discing (conventional cultivation), burning, grazing, or applying an approved herbicide. Weedy annual species (such as pennycress) with a single season life cycle provide initial site stabilization and moisture conservation in newly seeded reclamation sites; as such they will not be specifically targeted for control. Historically, seedings on reclaimed sites have greatly out competed annual weed infestations within three or four growing seasons.

Specific control measures will be selected by evaluating the location, growth characteristics and vulnerability of each weed. Management efforts will begin after proper planning and evaluation are performed. Proper use of chemicals applied during weed control is ensured by oversight of weed spraying activities by individual(s) certified by the State of Colorado to handle and apply herbicides.

Measures for Determining Success of Revegetation

Measures for determining successful revegetation are outlined in Section 4.15.

Soil Testing Plan

From conception to the mid-1990's, Colowyo tested for topsoil fertility. In order to assure that the reapplied topsoil would support the proposed post-mining land use of rangeland, a soil sampling program wase implemented. Soil samples were taken randomly over each retopsoiled area and were analyzed for nitrate-nitrogen, phosphorus, and potassium. Historical results indicated adequate nutrient value to support post-mining revegetation.

Colowyo has demonstrated through numerous years of monitoring that topsoil fertility is not a concern at the mine; this is mainly due to the nutrient rich soil that is commonly present throughout the region. As a result, Colowyo has suspended the soil testing program requirements, until such time as Colowyo determines that the soil fertility adversely affects the reclamation and/or the post-mining land use.

As needed, other soil amendments could be considered for addition to the reclaimed areas to support reclamation efforts.

Acid-Forming and Toxic-Forming Materials

No significant acid-forming materials exist within the overburden soil or coal seams to be mined. Therefore, Colowyo will not undertake special handling procedures as described in Section 2:05.3. A detailed description of the chemical characteristics of soils and overburden materials is presented under Sections 2.04.6 and 2.04.9.

For a detailed description of the special handling of spoil material and sampling programs, refer to the Production Methods and Equipment Segment of this section.

Flammable liquids, such as oil and fuel, will be protected from spilling into other areas by earthen, concrete or HDPE lined structures surrounding each storage facility. A spill containment control plan has been developed to protect against spills.

All major equipment on the mine site will be equipped with portable fire extinguishers or automatic fire suppression systems. The water truck used for dust suppression at the mine site could also be used to control most fires.

Sealing of Exploration and Mine Holes

Exploration and mine holes which remain open for use as a water supply well or for use as a groundwater monitoring well will be completed with casing or piezometers at sufficient height above the land surface to prevent drainage of surface water or entrance of foreign material into the well, and will be fitted with caps to prevent the introduction of objects other than monitoring and sampling equipment. When the groundwater monitoring wells are no longer needed or required for any purpose, each well will be eliminated by plugging with concrete to the surface and removal of the associated surface structure.

Plugging procedures utilized for exploration drill holes that will not be mined through during the

current Permit term are as follows:

1. Drill holes drilled deeper than the stripping limit (450-500 feet) will be plugged by pumping cement or heavy solids bentonite Plug Gel or chips through the drill stem from the bottom up to within 3 feet of the ground surface.
2. Drill holes shallower than stripping limits (450-500 feet) may be plugged with the ready-mix concrete method instead the method in #1 to within 3 feet of the ground surface.
3. Drill holes with no water or coal zones may be plugged by backfilling with cuttings, and placing a plug ten feet below the ground surface to support a cement plug or bentonite chips to within 3 feet of the ground surface.

For safety considerations, exploration drill holes that will eventually be mined through during normal mining activites need only be covered with wood, plastic or other such material or otherwise bermed to prevent access until mining operations mine through each hole.

Those holes completed in aquifers will be sealed entirely with cement or other suitable sealant to within 3 feet of the ground surface.

Where possible, the sealed holes will be marked. At times reclamation operations will cover up the sealed drill holes and marking of holes will not be possible.

Within 60 days of the abandonment of a drill hole, approved drilling program or when requested by the Division, the following information will be submitted:

a) Location of drill hole as plotted accurately on a topographic map.
b) Depth of drill hole.
c) Surface elevation of drill hole.
d) Intervals where water was encountered during drilling activities.
e) Diameter of drill hole
f) Type of amount of cement or other sealant used.
g) Name of drilling contractor and license number of rig.
h) How the hole was worked.

Exploration taking place inside and outside of the permit area will be handled through the Notice of Intent (NOI) procedures. See the appropriate NOI for details for each program.

Water and Air Quality Control Techniques

Steps to be taken to comply with the Clean Water Act and other applicable water quality laws and regulations and health and safety standards include a comprehensive drainage and sediment control plan described in Section 2.05.3 and Sections 4.05.1 through 4.05.18. With respect to compliance with the Clean Water Act, Colowyo has a discharge permit from the Colorado State Department of Health under the National Pollutant and Discharge Elimination System (NPDES). Compliance with this permit will serve to effect compliance with the Clean Water Act and the Colorado Water Quality Control Act. A copy of this submittal is presented in Exhibit 7, Hydrology Information.

Colowyo, likewise, operates under several emission permits from the Colorado Department of Health, Air Pollution Control Division. Fugitive dust control measures will be employed as an integral part of the mining and reclamation operations.

Colowyo conducts air quality monitoring at the site in accordance with the requirements of emission permits approved by the Colorado Air Pollution Control Division. A copy of all applicable emission permits has been included in Exhibit 8 of the application.

Details of pollution control measures are discussed in section 2.05.6.

2.05.5 Post-mining Land Uses

The implementation of the reclamation plan as described in Section 2.05.4 will restore the disturbed land to the pre-mining use of rangeland, with two targeted subcomponents of grazingland and wildlife habitat (sagebrush steppe). Replacement of grazingland will be facilitated by targeting revegetation efforts toward primarily grassland communities. Because grasslands are effective for erosion control, this post mine land use will be implemented on those lands with slopes greater than 10%. Replacement of wildlife habitat will be facilitated by targeting revegetation efforts toward the re-establishment of a sagebrush steppe community. Because early-seral sagebrush steppe is less able to preclude erosion, it will be limited to those lands with slopes less than 10%.

The post mining land use of rangeland for the reclaimed area has been designed to match the pre-mining land uses found in the area. Specifically, Colowyo will reclaim the mined areas to a rangeland condition capable of supporting both domestic livestock and wildlife. One of the objectives of the reclamation plan will be to provide grazing for livestock, and the other objective will be to restore and improve habitats for deer, elk, and sage grouse.

Comments from the Bureau of Land Management and the State of Colorado approving the post mining land use are provided in Exhibit 1, Documents and Leases.

The observation of hundreds of deer and elk consistently utilizing reclaimed areas at Colowyo confirm success in meeting these goals. It is generally recognized that the herbaceous communities of grasses and forbs found on older reclaimed mining areas and other similar areas in northwest Colorado have in fact attracted these important wildlife species from surrounding native rangelands. Therefore, even though the grassland targeted areas are designed for livestock grazing, they exhibit a considerable component of wildlife habitat benefits as well.

Shrubs will also be replaced through seeding techniques to meet applicable regulatory requirements as described in Section 4.15.8. The post-mining land use is graphically shown on the Post-mining Topography Map (Map 19).

To support the proposed post-mining land use, small water impoundments (stock ponds) will be constructed to encourage an even distribution of grazing animals over the reclaimed site and to enhance the areas for wildlife. These small structures will also replace the existing water rights associated with the stock ponds that existed pre-mining. If necessary, Colowyo will submit

designs for these small impoundments to the Division prior to their construction.

Also, to provide access in the area for ranching purposes, the access road from Highway 13 will be left in place after mining is complete, and a number of "ranch roads" will be provided on the reclaimed area to approximate the roads that were in the area before mining. The access road will be narrowed from 26 to 12 feet, the asphalt removed, sideslopes reduced to 4:1 and the sides revegetated.

The consideration of rangeland as a post-mining land use is identical to the discussion in Section 2.04.3. The limitations on changing to an alternative land use are fully discussed in that Section.

2.05.6 Mitigation of Surface Mining Operation Impacts

Air Pollution Control Plan

Colowyo maintains fugitive dust control measures as an integral part of all mining and reclamation activities. Presently, Colowyo operates under numerous Emission Permits issued from the Colorado Department of Health, Air Pollution Control Division, as more particularly described in Section 2.03.10. Copies of all applicable emission permits issued by the Colorado Department of Health are available onsite and can be reviewed by request. Colowyo conducts air quality monitoring at the site in accordance with the requirements of the emission permits.

The principal fugitive dust control practices employed by Colowyo are as follows:

Roads

Colowyo employs a dust suppression program for in pit roads and other unpaved roads which primarily involves periodic watering. Mine water trucks run periodically as needed over the roads wetting down any dusty conditions. During the dryer months of the year, the water trucks will wet down the roads which are being utilized a minimum of two or three times per shift. If determined to be necessary as an addition to periodic watering, a chemical dust suppression agent may be used during the dry months on the primary in pit roads. To this date, however, chemical stabilization of the unpaved in pit roads has not been successful for more than a short period of time due to changing weather conditions and the use of heavy haulage trucks.

Colowyo has surfaced “in-pit” roads with gravel or crushed rock; however, no roads in the pit area will be paved with asphalt. Asphalt could not sustain the enormous weights of the haulage equipment currently in use. Likewise, crawler equipment would rip the asphalt surface causing an extremely hazardous condition for all equipment and personnel. All roads in the mining operation will be constantly maintained by a motor grader, scraper, or rubber tired dozer to remove any coal, rock, or any other debris. Smooth and clean road surfaces are essential for not only minimizing dust, but also for allowing efficient, safe and economic use of haulage equipment.

The haul roads have been paved with asphalt to provide for emission control. The paved roads include approximately five miles of road from State Highway 13to the main office building, the road from the main office building to the Gossard coal loadout, and the road from the shop facility

to the Gossard coal loadout.

A strict speed control will be implemented for all roads to control dust and to provide for safe operation of the equipment.

Most haul road embankment slopes and adjacent areas have been mechanically stabilized and seeded with a mixture shown in Table 7, Reclamation Seed Mixture. Mechanical stabilization has consisted of furrowing, chiseling, "cat tracking" and mulch, depending on accessibility to the slopes.

No travel of unauthorized vehicles will be allowed on anything other than established roads. All overburden haulage equipment will be restricted only to appropriate roads.

Colowyo does not plan to cover any of the haul trucks because the roundtrip between the coal crushing facility and the active mining area will be relatively short, and the loaded trucks will be moving slowly. Also, care will be taken by the front-end loader or shovel operators not to overfill any of the haul trucks so as to cause excessive fugitive dust.

Coal Crushing Facility

Coal will be hauled from the various mining areas in haulage trucks to the primary crusher facility as shown on the Existing Structures - South Map (Map 22). Following primary crushing, the coal is hauled to the Gossard Loadout facility, as shown on the Existing Structures - North Map (Map 21).

The coal crushing and conveying operations at the primary crusher and the Gossard Loadout have been equipped with a water spraying system at all coal transfer points. A four-sided enclosure-bas-been installed on the truck dump at the primary crusher to prevent excessive dust emissions. The secondary crusher at the Gossard Loadout has a bag house to control coal dust emissions. A stacking tube with metal doors is also used to minimize coal dust emissions at the 100,000 ton crushed coal stockpile. The air quality control measures at the coal crushing handling and loadout facilities have been approved by the Colorado Department of Health, Air Pollution Control Division.

Colowyo maintains several areas for coal storage near the shop facilities and also near the Gossard Loadout. Inactive storage piles have been sloped and compacted to prevent wind erosion and spontaneous combustion. If coal dust becomes troublesome in the active coal storage piles, a mobile water truck with a high pressure pump and nozzle is available for dust suppression.
No thermal dryers are used in the coal crushing and handling facilities.

Disturbance

Colowyo, in as much as practical, minimizes the area of land disturbed at any one time. Topsoil is removed only to the extent necessary to accommodate the mining operations. Through the mine plan, the rehandling of both topsoil and overburden is kept to a minimum. Reclamation of disturbed areas will commence as contemporaneously as possible.

As necessary, mobile water truck will be assigned to work in topsoil or overburden removal operations to keep any dusty conditions under control. Planting of special windbreak vegetation in the permit area is not planned.

Blasting

Sequential blasting is utilized as a standard practice to reduce the amount of unconfined particulate matter produced.

Complete blasting information is set forth in Section 2.05.3 and Sections 4.08.1 through 4.08.6.

Fish and Wildlife Plan

Prior to and during the early years of mining, Colowyo implemented wildlife management and range management programs to offset the potential impacts of mining on wildlife and to improve the rangeland in surrounding areas which had deteriorated after years of overgrazing. Other protection measures were also implemented to minimize any possible effects of the increased mining activity.

Also, during the early stages of pre-planning for the mining operation, Colowyo adopted a policy to return the land to a condition capable of supporting the diverse wildlife populations that the area currently supports. The assumption in the late 1970s was that shrub reestablishment would play a key role in wildlife habitat mitigation. These early efforts were unique in that revegetation with shrub species, especially native shrub species, had never been an integral part of pre-mine planning in the West. Virtually no information was available and very little was known about the growth requirements of native species. To reach these early objectives, Colowyo implemented revegetation and wildlife habitat use studies designed to determine the feasibility and techniques of revegetating disturbed areas with native shrub vegetation adapted to northwest Colorado. However, after decades of experience, it has become obvious that reestablishment of shrubs on the reclaimed area is not critical to encourage wildlife use such as by elk.

For example, in recent years it has been observed that elk herds of between 200 and 400 animals utilize the reclaimed grasslands of the mine as foraging habitat. These numbers increase to between 2000 and 4000 animals during the hunting season and then slowly drop off as the snow depths increase and the elk herds migrate to lower elevations. The animals return in the Spring for the early green-up. This occurs for at least three reasons: 1) elk are primarily grazers (grass consumers) by nature, 2) there is abundant, high quality grass on the reclaimed areas especially in comparison to surrounding country which exhibits very little if any grassland acreage and relatively low grass production in shrublands, and 3) elk have learned that harassments (such as hunting) are minimized on mining areas (refuge effect) which allows them to forage in relative peace. Likewise, mule deer populations have been observed on reclaimed grasslands at elevated densities (40-60 animals on a daily basis during the Spring, Summer, and Fall periods). Similarly, 15-20 pronghorn utilize the reclamation on a daily basis during the Spring and early Summer periods.

Following the winter, it has been observed in early spring that forage utilization on the reclamation often ranges between 70 and 90 percent, especially near water sources. In fact, utilization is often so elevated that both elk and mule deer turn to the few unfenced shrubs that have been established about the reclaimed area and cause extensive hedging damage. Over the years it has been observed that such hedging eventually leads to the death of most of these over-utilized shrubs.

Because of the dependence on these areas, and the shrub populations, efforts by Colowyo (as indicated in the previous portions of Section 2.05) have continued to improve reclamation techniques. As discussed in this revision, new and significant strides are being taken to re-establish sagebrush steppe communities as well as grassland areas. Many of these new measures will benefit not only the large game animal segment of the wildlife community, but also other components such as sage grouse and sharp-tailed grouse populations that are dependent on sagebrush and other woody species for forage and cover.

Impacts of Mining Operations on Wildlife Resources Within the Mine Plan Area

Several short term negative impacts to wildlife are to be expected in the permit area. Removal of vegetation communities and habitats will be the most direct impact, resulting in a reduction of forage and cover. Non-mobile species will be destroyed in localized areas as vegetation and topsoil are removed. Mobile species will be temporarily displaced until mined areas are reclaimed. As the mine progresses, some changes in topography will occur through the removing of vegetation, rock outcroppings, draws, etc. which form natural shelters.

Disturbance of soils will affect soil profiles, micro-climate, and other soil properties.

The backfilling and grading as required in Section 4.14.2 will assure that topographic features and drainage patterns will be returned to approximate original contour.

Wildlife species inhabiting the permit area that have the most potential for being affected include deer, elk, sage grouse, and raptors. However, experience to date has shown that all of these species have adapted to the presence of the Colowyo operation, resulting in minimal direct impact. Most of the mitigation measures, protection measures, and habitat improvement techniques are directed toward this wildlife group.

Range and Wildlife Management Programs

Data collected during pre-mine studies during 1974 - 1976 indicated overuse by cattle, deer, and elk. A majority of the browse species (serviceberry, oak, snowberry, bitterbrush, sage, chokecherry) showed overutilization to varying degrees. (It has been evident both past and present that many of the shrubs are in a decadent condition.)

The results of past poor range management practices and heavy browse use have been a reduction in growth with less available forage. In addition, species such as oak and serviceberry have grown taller, with palatable growth being limited to a height which can be reached only by the largest animals.

As oak and serviceberry have grown taller, large windbreaks have been created. In the winter, these areas hold the snow, which becomes deep enough to limit all access by deer and elk. Thirty years of observations on the permit area have shown that winter use of the mountain shrub type by elk and deer is highly dependent on snow depth and severity of winter weather conditions. The use of serviceberry has been limited to shrubs near the edges of the stands where less snow buildup occurs. Depending on snow depth, elk and deer populations tend to concentrate on south facing hill slope areas where snow depth is minimal.

Colowyo began fencing the boundaries of the Federal lease during the fall of 1976. The fencing was completed during the summer of 1977. At this time all cattle were removed from the lease area. The fencing was completed as part of an overall grazing management program to improve the rangeland after several years of over-grazing. In 1991, Colowyo constructed a similar fence to provide a boundary for the areas added to the Permit and to exclude grazing in this area.

Disturbed Areas

Disturbed acreage has been kept to a minimum in the permit area by proper planning for the location of mine support facilities, haul roads, and pit advance. The mining methods, as discussed in Section 2.05.3, allow for a minimum amount of disturbance on an annual basis (less than 100 acres per pit), when compared to strictly one or two seam mines with similar production levels which disturb several hundred acres annually per pit. Topsoil and vegetation are removed during the summer and fall months to allow for only enough disturbance to facilitate mining advance through June of the following year.

Habitat Improvement Program

Prior to start-up of mining, Colowyo initiated a big game habitat improvement program in January 1976. The purpose of this on-going program was to increase range carrying capacity by increasing available browse and increased access to herbaceous species. Another objective of the program was to provide increased forage on selected undisturbed areas on and adjacent to the mine site to draw wildlife away from newly reclaimed areas until the vegetation became established. A third benefit was to improve enough habitat prior to and during mining in order to offset the temporary loss of habitat from mining.

The technique for habitat improvement involved using a rubber tired or tracked dozer during the winter months, preferably when there was minimal snow cover and the ground was frozen, to shear off the dormant shrubs a few inches above ground level.

The shrubs tended to shear or break off easily when the ground was frozen leaving the root systems undisturbed. During the following spring, vigorous new growth from root sprouting occurred, and easy access was provided for deer and elk. This technique has had the additional effect of allowing grasses and forbs to establish stands that will compete with the shrubs, thus prolonging heights useable by wildlife. Approximately 30 acres of overmature decadent shrubs, i.e., serviceberry, oak, and chokecherry was “brushed” on an annual basis through 1986.

Although no specific data has been collected on these areas, general observations have shown that

the areas are heavily utilized by both deer and elk. On all of the areas, any new shrub sprouting is kept down to a height of only a few inches. The one-acre plot that was cleared of vegetation and fenced in 1977 for testing by the Meeker Environmental Plant Center can be used as a good comparison of the differences between browsed and unbrowsed areas that have had similar treatments. Several of the unbrowsed shrubs that have grown up from root sprouting in the Plant Center plot have attained heights of up to four feet in just a few years. Over a five-year period, we feel the cumulative effects of improving 50-75 acres per year for deer and elk use has been increasingly successful in meeting the objectives of increasing available forage and drawing wildlife away from reclaimed areas.

This wildlife mitigation program is considered a success and was discontinued at permit renewal as reclaimed areas are now attracting a large population of local wildlife populations. Also, suitable areas within the permit for this mitigation had been increasingly difficult to find. Much of the habitat suitable for improvement had already received treatment.

Sagegrouse Mitigation

In a preliminary findings document dated December 11, 1981, the Division requested additional information on sagegrouse use of the Colowyo permit area and a description of habitat mitigation measures. Colowyo submitted the following response, dated May 25, 1982, which satisfied the remaining concerns of the Division.

Sagegrouse Mitigation

I. Ongoing Mitigation Offsetting Current Loss of Sagegrouse Habitat Due to Mining.

Prior to 1976 due to the prior landowners' grazing practices, the rangeland both within the permit area and surrounding areas was in an overgrazed condition.

After 1976 the following changes in the management of the land, then owned by Colowyo, took place which indirectly increased the sagegrouse nesting and brood rearing capacity of the overall area. This increased carrying capacity of the sagegrouse habitat provides the mitigation for any displaced sagegrouse population during mining.

1. From 1976 until 1979 all livestock grazing was stopped in order to allow the range to rest and to return to a more productive state. The immediate benefit to sagegrouse was the increased production of herbaceous vegetation which, along with insects, is an important component to the sagegrouse brood population diet. A secondary benefit was the end of any nest trampling and end of disturbance and heavy grazing around watering areas due to livestock grazing.

2. During 1976 a fence was constructed around the Federal coal lease which eliminated all further livestock grazing in this area. Since 1976 to the present, sagegrouse have continued to benefit as described as #1 above.

3. All other areas outside of the lease fence (approximately 6,000 acres) have been grazed since 1979 at 60% of carrying capacity. This rate would allow for an increased sagegrouse brood population over that which the area supported in an overgrazed condition.

4. Since 1976, numerous areas of thick, decadent stands of the mountain shrub vegetation within and adjacent to the lease area have been cleared of brush as part of the big game mitigation program. As a result of the brushing, the production of succulent herbaceous vegetation has increased, offering more forage for the sage grouse brood population.

   The above changes in Management practices of the rangeland around the Colowyo mining area contribute to the increased capability of supporting any displaced sage grouse nesting and brooding population. No additional treatments to mitigate for a displaced sage grouse population are in effect, nor would other methods likely be as effective.

II. Post-mining Mitigation for Sagegrouse

As stated in the Permit Application, sage grouse use of the area to be mined is for nesting and brood rearing purposes.

According to information contained within the Bureau of Land Management Technical Note #330, "Habitat Requirements and Management Recommendations for Sage Grouse," the most important factor for nesting habitat in the sagebrush vegetation type is sagebrush. Within this vegetative community, the majority of sage grouse nests occur under sagebrush. It is assumed that within the mountain shrub vegetative community, sage grouse nest would be found under the mountain shrub components as well as sagebrush.

The most important factor for brooding habitat is the availability of the appropriate foods for the chicks. Also, during the later summer months of brood rearing, the availability of water becomes important.

Within the pre-mine vegetative community, the nesting cover component is assumed to be sagebrush as well as other elements of the mountain shrub community.

Within the post-mining vegetative community, seeded shrubs will supply the necessary requirements for nesting cover.

Within the literature no specific location of nests seem to be indicated other than a preference for less dense and shorter shrubs which seem to indicate a need for quick escape should the hen be flushed unexpectedly. The density and structures of the shrub component within the post-mine community should provide the diversity of cover and density suited to sagegrouse nesting.

Within the pre-mine vegetative community, insects and succulent vegetation provide

the majority of the food for the developing chicks. As these food sources mature and dry, the grouse will move to areas still supporting succulent vegetation. These sites include springs, seeps, drainage bottoms and water impoundments. During the late summer and fall months, the important food plants dry up on the upland slopes and the grouse will tend to remain closer to available watering areas where some succulent vegetation is still available. Many of the grouse are then observed in the alfalfa and irrigated meadowlands on areas around the mining area.

Within the post-mine vegetative community, the food component for brood rearing will be provided by insects and succulent vegetation on reclaimed areas early in chick development. Later into the summer months, as food sources dry up on the upland slopes, food will be available near water impoundments and drainage bottoms being returned to the post-mining topography. The literature indicates no optimum distance between nesting sites and food sources. Evidently, the location of nesting sites are independent of food sources, rather, the nesting locations are based on available cover, and the grouse movements are tied to the availability of succulent vegetation.

For the most part, the mitigation measures indicated above had the desired impact of improving conditions for sage grouse on undisturbed areas under Colowyo control. To the contrary, original reclamation plan measures did not result in a sagebrush component consistent with the original projections in many areas of the mine, especially the old reclaimed units that were revegetated with "introduced" pasture grasses. Beginning in the late 1990s and as evident in revegetated units that have been seeded since then, the sagebrush component of reclamation has improved substantially, but is still not up to original expectations. Therefore, substantial changes to the reclamation plan have been introduced in this submittal to hopefully, make another quantum leap forward in the ability to establish sagebrush steppe communities. Many changes in techniques have been proffered including variable topsoil depths, significantly increased amounts of the appropriate sagebrush seed, proper planting techniques to encourage sagebrush, etc. Given success of these techniques elsewhere in the mining industry, the potential is strong that the original projections for sagebrush establishment at Colowyo will be realized from this point forward.

Additional Mitigation Measures

The pre-planning for a minimum amount of annual disturbance, the establishment of herbaceous species, the replacement of native shrub species, and habitat improvement techniques are the most important areas for minimizing impacts to wildlife, several other protection measures are in effect.

Electric power lines located in the permit area will be constructed in accordance with the requirements of Section 4.18 to minimize potential electrical hazards to large raptors.

Vehicle use within the permit area is limited to the active mining area and the various support facilities. Off-road vehicle use is kept to a minimum and is usually only authorized for surveying, environmental data collection and monitoring, security, etc. Travel by foot, which causes much more disturbance to wildlife than vehicle traffic, is highly unlikely outside active mining areas.

Hunting with firearms inside Colowyo's permit boundary is allowed and is strictly managed by Colowyo.

Speed limits in the mine area are limited to reduce the likelihood of collisions between vehicles and wildlife. Colowyo employees are fully aware of the possibility of encountering wildlife on and -around the mine site and take special care to avoid these species.

In summary after several years of mining at Colowyo, the question is no longer whether coal mining at Colowyo has had an adverse impact on local wildlife populations. The population of deer and elk in the vicinity of Colowyo is reaching record levels. There is little doubt that wildlife populations are drawn to the reclaimed areas because of the availability of quality herbaceous vegetation. The immediate vicinity around Colowyo has become well known as a wildlife refuge, particularly during big game seasons.

The issue now is how can Colowyo assist CPW in efforts to control wildlife populations to a level that can be supported by adjacent ranges. To do so, in 1990 we have entered into a cooperative effort with the CPW to establish a "Ranching For Wildlife" area located south of Hayden. Colowyo has also cooperated with the CPW in allowing public hunters access to company properties in Axial Basin Ranch to increase harvest of local cow elk populations.

The concern for wildlife mitigation has clearly evolved from a concern for the impact of mining on the wildlife population to a concern for involving Colowyo in managing increasing populations especially for big game animals, particularly elk. As one of the large landowners in the region, Colowyo will continue to work with the CPW to assist where possible to manage local big game populations.

With regard to sage grouse populations, Colowyo believes that the new revegetation metrics presented within this submittal will more completely address the concern for negative impacts to area populations and brooding habitat. As this new reclamation technology progresses and adapts into the future, it is anticipated that sage grouse use of reclaimed lands will return to pre-mining levels, or perhaps return to elevated levels as has been experienced at certain Wyoming mining operations.

Related to this mitigation and emphasis on wildlife populations, focus must be maintained on the fact that Colowyo is the landowner on the overwhelming majority of disturbed acreage. Were it not for the need for permitting of coal mining operations, and the desire to be a responsible steward of the land, the company could select to manage lands in a manner similar to other Western ranching operations that emphasize red meat production from livestock with little concern for the needs of wildlife.

Protection of Hydrologic Balance and Water Quality

Based on the data, other references available and reclamation plans previously presented in this section, the Colowyo Mine will not adversely affect the hydrologic balance or water quality of the adjacent areas.

The Colowyo Coal Company intends to use all practical methods to maintain the hydrologic balance and water quality in its present state and may improve the surface water characteristics as a result of reclamation procedures. The focus of this discussion will center on the permit area as it is the area of mining disturbance.

The hydrologic balance, previously discussed, will be protected through a number of procedures designed to mitigate any potential impact from mining. Temporary and permanent diversions will route runoff away from disturbed areas to minimize erosion and sediment loss. Temporary channels are designed to safely pass the runoff from a 10-year, 24-hour precipitation event and, where necessary, will be constructed using bank stabilization methods including energy dissipators, sediment traps, and dug outs or a combination of these methods. Drainage culverts will also use energy dissipators at the outlets if necessary so that runoff will not cause additional erosion and subsequently increased total suspended solids (TSS) levels. Detention ponds will be used to detain runoff water from the disturbed areas to allow the TSS to settle out and to attain acceptable concentrations for other parameters consistent with the requirements of the NPDES Permit. Any Small Area Exemptions (SAE's) employed will be designed to minimize contributions of TSS to the hydrologic balance.

Infiltration and percolation of precipitation in the mine area may be enhanced by the reclamation techniques of contour furrowing on hillsides and the continued excellent revegetation success at Colowyo. Infiltration rates for the pre-mined and post-mine condition of the land were presented earlier. Striffler and Rhodes (1981) showed through field measurements, using an intense rainfall simulation, that infiltration capacities of the mulched and revegetated areas were much greater than the pre-mine estimates. Runoff from the revegetated and contour-furrowed areas has been minor to date, as documented by Colowyo Mine personnel. Flows from Streeter Gulch will be moderated with the detention pond.

Moderated flows will continue to pass through the historic drainages. Recharge of the limited groundwater systems in the mine will not be inhibited and may be enhanced through the use of the above techniques.

Groundwater protection, per se, is not necessary in the permit area as essentially no continuous groundwater system exists. Perched aquifers of limited nature will be impacted only in the mine area property. This water will be evaporated. The quantity of groundwater is minimal as evidenced by the lack of water in test holes and the dry active pit.

Protection of water quality will also be maintained at the present variable limits through the use of the reclamation procedures listed above. Groundwater will not be affected as the supplies are minimal. Surface water will not be significantly impacted in the mine area. An ongoing monitoring program is maintained by the Colowyo Coal Company to verify the conclusions in the permit application. Sampling stations are maintained and samples collected in accordance with the water monitoring plan approved by the Division. Refer to the annual reclamation reports for results of the sampling program.

Flow volumes in the Goodspring Creek Alluvial Valley Floor may be impacted by the Colowyo

Mine through exercise of water rights. However, the impact is expected to be minimal as the water rights used are owned by the Colowyo Coal Company and are not an integral part of any ranching or farming operation. The Colowyo Augmentation Plan will mitigate the effects on any other water rights and will provide for flows downstream of the affected area. Quality of water in Good Spring Creek will not be affected by the exercise of the water rights.

As discussed under Hydrologic Balance-Permit Area, changes in flow volumes caused by mining and reclamation operations will be less than the accuracy range of present day flow measuring equipment.

In summary, the Colowyo Mine will not significantly affect the hydrologic balance or water quality of the general area or the permit area and the affect to the hydrologic balance within the permit area will be insignificant. Temporary increases in TDS and associated common ions are expected to affect quality in backfilled spoils within the permit area. Refer to annual reports for additional information regarding hydrologic monitoring.

Protection of Public Parks and Historical Places

No public parks are located within the permit or adjacent areas; therefore, no public parks will be affected by the proposed mining operations. Likewise, the proposed mining operations will not effect any places included on or eligible for listing in the National Register of Historical Places.

Because no public parks or historic places, included on or eligible for listing on the National Register of Historical Places, will be adversely affected, this Section of the regulations is not applicable to this permit application.

Surface Mining Near Underground Mining

No surface mining activities within the permit area will be conducted within 500 feet of an underground mine. Map 31, Red Wing Mine provides additional information.

Previous underground mining has taken place in the vicinity of the Colowyo operation; this previous mining is discussed in Sections 2.04.3 and 2.04.4

METHODOLOGIES AND ASSUMPTIONS FOR SEDIMENTATION POND EVALUATIONS

The hydrologic calculations used to model all of Colowyo's sedimentation ponds and the Taylor Pump Holding Pond, were performed using the SEDCAD^{TM}4 computer modeling program developed by Civil Software Design. The results of the SEDCAD^{TM}4 analyses are presented as attachments in each of the individual pond design sections.

The general procedures described herein will be used for all future hydrologic designs for ponds, ditches, and other facilities to be constructed at the Colowyo Mine.

1.0 HYDROLOGIC AND HYDRAULIC CALCULATIONS

SEDCAD^{TM}4 is a comprehensive, computer-based model used to evaluate storm water, erosion, and sediment control management techniques. The SEDCAD^{TM}4 model calculates run-off and peak flow via a numerical modeling technique based on user inputs of a design storm event (i.e., rainfall amount and duration, selection of rainfall distribution, and convolution increment). Hydrographs are developed on a sub-watershed basis with the input of area, time of concentration, SCS Curve Number, and the selection of 1 of 3 dimensionless double triangle unit hydrograph shapes. Routing of hydrographs is accomplished by Muskingum's Method.

Inputs to the hydrology component of the SEDCAD^{TM}4 computer model include:

- Precipitation Distribution
- Storm Duration
- Return Period/Precipitation
- Hydrograph Response Shape
- Drainage Basin Area
- Time of Concentration
- Muskingum Routing Parameters
- Curve Number
- Base Flow

Input values are shown on the SEDCAD^{TM}4 printouts included as attachments in each of the individual pond sections, and are explained in more detail below.

1.1 PRECIPITATION DISTRIBUTION

A precipitation distribution is input to model the run-off hydrograph. SEDCAD^{TM}4 allows the user to choose between the SCS Type I, Type IA, Type II, Type III, and user-defined storm unit mass curves. The Type II distribution is input as the most accurate reflection of area storm patterns.

1.2 STORM DURATION

A storm duration of 24 hours is used for the design and evaluation of the Colowyo ponds.

1.3 RETURN PERIOD/PRECIPITATION

A precipitation amount is required for the appropriate return period. The following return periods and precipitation events are used for the Colowyo Mine:

10-year, 24-hour storm event	1.8 in
25-year, 24-hour storm event	2.3 in
100-year, 24-hour storm event	2.7 in

1.4 HYDROGRAPH RESPONSE SHAPE

A unit hydrograph is chosen for each drainage area or sub-area modeled to predict the run-off response. The hydrograph responses available in the SEDCAD^{TM}4 model are slow, medium, and fast. A slow response corresponds to a forested area or an area with a number of obstructions. A fast response corresponds to an un-vegetated or poorly protected area. Medium and fast hydrograph responses are considered as most representative for mine areas.

The internal convolution increment is 0.05 hours, and values are saved at the user-specified interval of 0.1 hours or greater. A convolution increment of 0.1 is specified. It should be noted that a time of concentration less than 0.125 hours bypasses the unit hydrograph technique and instantaneous run-off is assumed. As explained in the SEDCAD^{TM}4 User's Manual (Schwab and Warner, 1998), the time of concentration restriction of 0.125 hours is dictated by a combination of array size restrictions, minimum internal convolution interval, and the user-specified time increment for saving convolution values.

1.5 DRAINAGE BASIN AREA

Drainage basin areas are determined for each pond from scaled topographic drawings. In many cases determination of the highest surface water flows with respect to volume of runoff has to be determined by examining several stages of the mining operation. The final post-mining topography would usually be expected to produce the largest volume or runoff as the entire watershed is contributing to the runoff by this stage, and is always evaluated but may not control the design. Watershed (or sub-watershed) areas are delineated consistent with four general categories representing various stages of reclamation and disturbance. The watershed or sub-watershed delineations reflect anticipated disturbance/reclamation status based on Colowyo's current mining and reclamation plans.

1.6 TIME OF CONCENTRATION, T_C

The time of concentration is calculated using the SCS upland method (Soil Conservation Service, 1986) as incorporated into the SEDCAD^{TM}4 software. The hydraulic lengths, drainage heights and associated slopes are determined from topographic drawings. The values calculated for each structure are shown on a sub-watershed basis in the SEDCAD^{TM}4 printouts.

1.7 MUSKINGUM ROUTING PARAMETERS, K, X

The Muskingum Routing Parameters are also calculated using the SCS upland method. The hydraulic lengths, drainage heights and associated slopes are determined from topographic drawings. The values calculated between each structure and/or sub-watershed are shown in the SEDCAD^{TM}4 printouts.

1.8 CURVE NUMBER, CN

The runoff curve number is a factor relating the amount of rainfall to the amount of runoff for a given area. Curve numbers were jointly developed and agreed upon by the Division and Colowyo.

The curve number for the undisturbed lands is selected as Hydrologic Soil Group (HSG) "C" based on the pre-mining mapped soils in the county SCS soil maps.

For disturbed lands the use of mapped SCS soil groups is not appropriate. Instead, Section 630.0702 "Disturbed Soils" in Chapter 7 of Part 630 of the NRCS National Engineering Handbook (NEH) recommends that onsite investigations should be made to determine the HSG, including on-site infiltration tests, grain size characteristics and lab permeability tests. A program meeting these requirements was carried out and reported in Striffler and Rhodes (1981), and it included tests performed at the Colowyo mine, as well as ten other Colorado coal mines.

All of the infiltration tests performed at the Colowyo Mine reported in Table C-5 of that study indicated infiltration rates well in excess of a "C" soil, and in all cases except one reflected rates that would be associated with a HSG "A" soil. That exceptional case indicated infiltration rate between HSG "A" and HSG B" soils. The selection of HSG"B" for the disturbed lands is therefore a conservative assumption, more likely to overestimate than to underestimate runoff rates.

With the HSG determined as described above for undisturbed and disturbed land, the CN is then dermined based on the land cover condition as described in numerous hydrologic references, all ultimately based on NEH cover and condition tables.

The resulting hydrologic curve numbers (CN) for use in SEDCAD^{TM}4 for the various categories of land at the mine are presented below in Table 1. Table 7 provides a scanned image of published curve numbers typical for disturbed areas; these values will not be used directly but are only provided to support to Table 1. Table 8 provides a similar listing from the National Engineering Handbook (NEH-4) (USDA-SCS, 1985); these values are included within the drop down menus of the SEDCAD^{TM}4 model. Of the several tables included here as Table 8, the last table presented here in Table 8 is applies to Range lands in arid and semi-arid areas, and is the most appropriate set of Curve Numbers for the Colowyo Mine applications. Values in Table 8 will not be used directly but are provided to support the values presented below in Table 1.

Appendix Exh. 7-14SP
Streeter Pond and Permanent Channels

The location of the Streeter Pond is presented on Map 12. The profiles of the associated permanent channels associated with the Streeter Pond watershed are presented on Map 33. These channels consist of the Streeter and Buckskin Ditches, and their design information is presented in this appendix. The as-built configuration for the Streeter Pond is presented on Figure Exh. 7-14SP-1, and Figure Exh. 7-14SP-2 provides the breakdown of drainage areas and hydrologic conditions for this sediment pond.

Exhibit 7, Item 14 in Volume 2D describes the hydrologic methodology used in sediment pond and post mine channel assumptions. Runoff curve numbers assigned to the undisturbed and reclaimed lands in various stages of reclamation have been selected in accordance with Table 1 in the Introductory Text for Exhibit 7 in Volume 2D. For channels protected by a riprap liner, selection of minimum riprap size is done using the Simons/OSM method in SEDCAD^{TM}. For channels to be protected by a vegetative liner, the permissible velocities are also determined using SEDCAD^{TM} routines.

Streeter Pond

The following pages present the results of the SEDCAD^{TM} models for the post mining condition. At this stage the oldest reclamation is on the northern extent of the reclaimed West Pit, and the younger (topsoil and seeded) reclamation is the southern reaches of the Streeter Pond watershed near the convergence of the West and South Taylor Pits.

The SEDCAD^{TM} model herein provides the results of the 10 year 24 hour design storm and demonstrates the Streeter Pond will meet the applicable settleable solids standard under this modeled storm event. The second SEDCAD^{TM} model demonstrates that the East Taylor Pond emergency spillway elevation is capable of containing the 25 year 24 hour storm.

The final post mining topographic surface and the final locations of the permanent drainage channels as presented on Map 12 were used to model the watershed for the post-mining condition. Three in-stream stock ponds (SD-1, SD-2, and SD-3) are included in the permanent channels to decrease peak flows from the modeled storm event, and to provide a water source to support the post-mining land use. A typical design for these stock ponds is presented on Figure 2.05-6 in Volume 1; however, each stock pond will ultimately be design and constructed to account for local ground conditions present in the post mine topography at the time of construction.

In summary, for the post mining case at the Streeter Pond, the 10 year 24 hour storm produces 2.60 acre feet of runoff, and the peak settleable solids concentration is 0.00 ml/l. The 25 year 24 hour storm event peaks at the 6,587.9 elevation, which is below the emergency spillway elevation of 6,588.0’

Streeter Permanent Post Mine Channels

The Streeter Pond watershed is comprised of two post-mining channels. The main channel is the Streeter Ditch, which will convey post mining surface water flows to the Streeter Pond. Buckskin Ditch is a tributary to the Streeter Ditch. The locations of both channels are presented on Map 12 and Figure Exh. 7-14SP-2, and the channel profiles are presented on Map 33.

The assumed hydrologic condition for both channels is the post mine condition when the entire Streeter watershed is reclaimed and reporting to the Streeter Pond.

The upper segments of the Streeter Ditch and the entirety of Buckskin Ditch have a contributing area of less than one square mile. They could be designed in accordance with Rule 4.05.3. However, for ease since the lower segments of Streeter Ditch meet the requirements of Rule 4.05.4, both ditches have been designed for the 100-year, 24-hour storm event.

A SEDCAD™ model has been included which evaluates the peak flow and total runoff volume for each of the channel segments for the 100 year, 24-hour storm event. The channel configurations for the 100 year, 24 hour storm for the Streeter and Buckskin Ditches are summarized below.

Streeter Ditch

Station	Peak Flow (CFS)	Average Slope (%)	Channel Type	Side Slopes	Erosion Protection
Station 0+00 to 10+00	7.93	28.3	Trapezoidal 6’ bottom	2H:1V	Riprap, D50 = 12”
Station 10+00 to 25+00	62.6	10.9	Trapezoidal 6’ bottom	2H:1V	Riprap, D50 = 12”
Station 25+00 to 45+00	62.6	2.0	Trapezoidal 12’ bottom	3H:1V	Riprap, D50 = 6”
Station 45+00 to 80+00	62.4	1.9	Trapezoidal 12’ bottom	3H:1V	Vegetation
Station 80+00 to 91+00	98.11	3.8	Trapezoidal 15’ bottom	3H:1V	Vegetation
Station 91+00 to 111+00	110.56	2.8	Trapezoidal 15’ bottom	3H:1V	Vegetation
Station 111+00 to 125+00	127.95	2.6	Trapezoidal 15’ bottom	3H:1V	Vegetation
Station 125+00 to 187+00	81.91	5.0	Trapezoidal 12’ bottom	3H:1V	Vegetation

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Streeter Pond
10 Year 24 Hour Storm Event

Effluent Demonstration

Post-Mining Condition

Tony Tennyson

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1100 West 116th Avenue
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General Information

Storm Information:

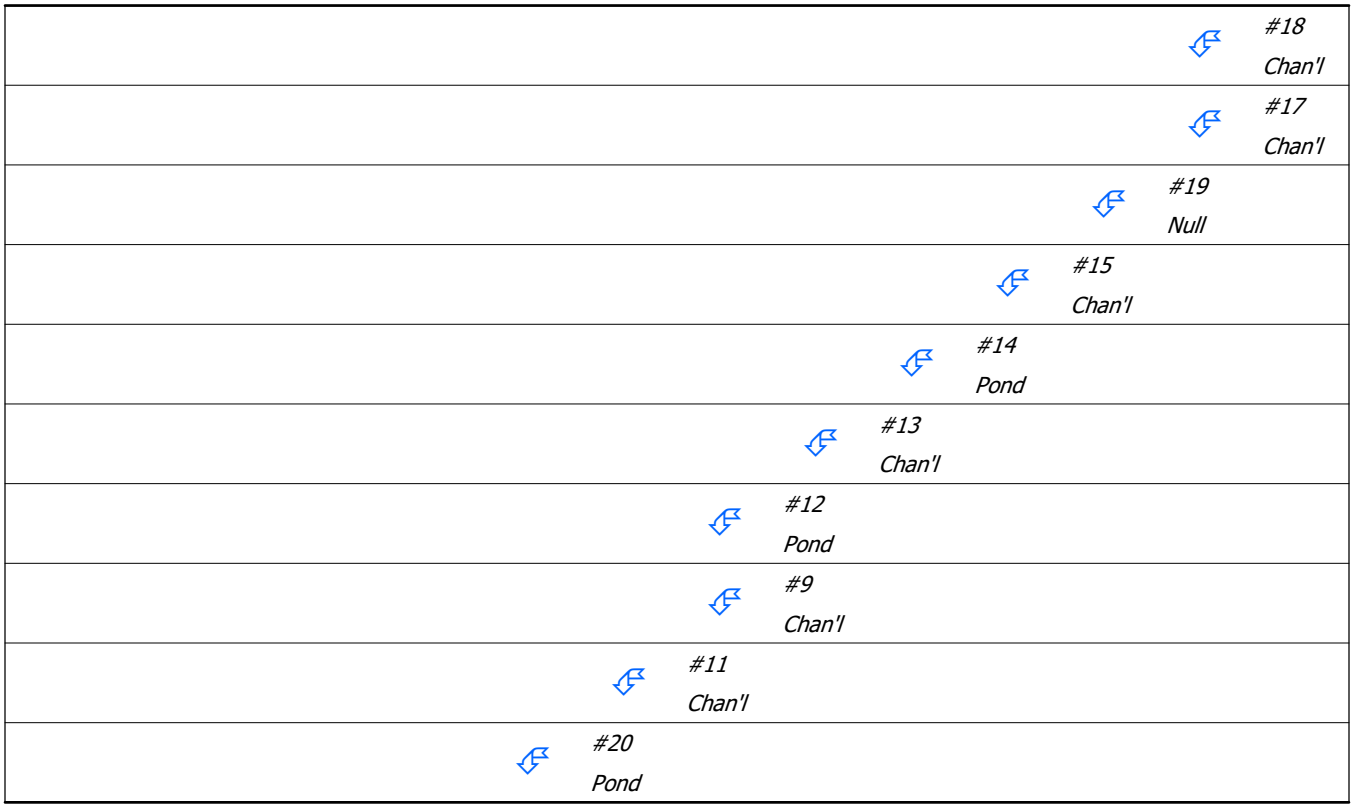
Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.800 inches

Particle Size Distribution:

Size (mm)	Colowyo Particle Size
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below Streeter Pond
Pond	#2	==>	#1	0.000	0.000	Streeter Pond
Null	#3	==>	#2	0.000	0.000	Null Above Streeter Pond
Null	#4	==>	#3	0.000	0.000	Streeter Ditch 0+00 to 10+00
Channel	#5	==>	#4	0.000	0.000	Streeter South Side Ditch
Channel	#6	==>	#3	0.000	0.000	Streeter Ditch 10+00 to 25+00
Channel	#7	==>	#6	0.000	0.000	Streeter Ditch 25+00 to 45+00 Streeter Ditch 25+00 to 45+00
Channel	#9	==>	#11	0.000	0.000	Stoker Ditch
Channel	#10	==>	#7	0.000	0.000	Streeter Ditch 45+00 to 80+00
Channel	#11	==>	#20	0.000	0.000	Streeter Ditch 80+00 to 91+00
Pond	#12	==>	#11	0.000	0.000	SD-2 Stockpond
Channel	#13	==>	#12	0.000	0.000	Streeter Ditch 91+00 to 111+00
Pond	#14	==>	#13	0.000	0.000	SD-3 Stockpond
Channel	#15	==>	#14	0.000	0.000	Streeter Ditch 111+00 to 125+00
Channel	#17	==>	#19	0.000	0.000	Buckskin Ditch
Channel	#18	==>	#19	0.000	0.000	Streeter Ditch 125+00 to 187+00
Null	#19	==>	#15	0.011	0.370	Null at Confluence Buckskin/Streeter
Pond	#20	==>	#10	0.000	0.000	SD-1 Stockpond



									#10 *Chan'l*
								#7 *Chan'l*	
							#6 *Chan'l*		
						#5 *Chan'l*			
					#4 *Null*				
				#3 *Null*					
			#2 *Pond*						
#1 *Null*									

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#19	8. Large gullies, diversions, and low flowing streams	2.60	5.20	200.00	4.83	0.011
#19	**Muskingum K:**					**0.011**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#18		316.200	316.200	21.73	4.99	87.9	300,083	168.65	6.80
#17		135.700	135.700	16.85	1.54	71.9	91,138	51.94	19.06
#19		0.000	451.900	25.50	6.53	159.8	138,263	78.20	9.83
#15		143.100	595.000	42.68	7.96	370.2	176,971	100.53	18.60
#14	In	0.000	595.000	42.68	7.96	370.2	176,971	100.53	18.60
	Out			11.71	5.00	0.0	5	0.00	0.00
#13		99.000	694.000	21.13	6.52	230.4	220,429	125.64	14.44
#12	In	0.000	694.000	21.13	6.52	230.4	220,429	125.64	14.44
	Out			6.80	3.56	0.0	1	0.00	0.00
#9		19.600	19.600	8.04	0.59	30.6	81,675	46.55	21.14
#11		71.400	785.000	24.37	5.32	201.0	170,377	97.11	15.93
#20	In	0.000	785.000	24.37	5.32	201.0	170,377	97.11	15.93
	Out			5.32	2.36	0.0	0	0.00	0.00
#10		160.900	945.900	5.32	2.38	0.1	6,414	3.65	1.92
#7		142.400	1,088.300	5.33	2.38	0.1	6,414	3.64	1.91
#6		58.100	1,146.400	5.33	2.38	0.1	6,414	3.64	1.91
#5		164.800	164.800	0.04	0.01	0.0	5,242	2.54	1.99
#4		9.500	174.300	2.84	0.22	217.0	1,075,732	613.11	301.85
#3		0.000	1,320.700	5.42	2.60	217.0	1,013,139	577.43	26.00
#2	In	21.200	1,341.900	5.42	2.60	217.0	1,013,139	577.43	26.00
	Out			1.52	2.29	36.0	16,765	0.00	0.00
#1		0.000	1,341.900	1.52	2.29	36.0	16,759	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #18 (Streeter Ditch 125+00 to 187+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	74.067%
0.0400	34.141%
0.0010	20.691%

Structure #17 (Buckskin Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.028%
0.0400	33.013%
0.0010	20.008%

Structure #19 (Null at Confluence Buckskin/Streeter):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.599%
0.0400	33.633%
0.0010	20.384%

Structure #15 (Streeter Ditch 111+00 to 125+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.260%
0.0400	33.274%
0.0010	20.166%

Structure #14 (SD-3 Stockpond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	73.260%	100.000%
0.0400	33.274%	100.000%
0.0010	20.166%	100.000%

Structure #13 (Streeter Ditch 91+00 to 111+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.001%
0.0010	20.001%

Structure #12 (SD-2 Stockpond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	73.000%	100.000%
0.0400	33.001%	100.000%
0.0010	20.001%	100.000%

Structure #9 (Stoker Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #11 (Streeter Ditch 80+00 to 91+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #20 (SD-1 Stockpond):

Size (mm)	In	Out
4.7500	100.000%	100.000%

Size (mm)	In	Out
0.0750	73.000%	100.000%
0.0400	33.000%	100.000%
0.0010	20.000%	100.000%

Structure #10 (Streeter Ditch 45+00 to 80+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.054%
0.0400	33.134%
0.0010	20.160%

Structure #7 (Streeter Ditch 25+00 to 45+00 Streeter Ditch 25+00 to 45+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.664%
0.0400	33.406%
0.0010	20.322%

Structure #6 (Streeter Ditch 10+00 to 25+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.664%
0.0400	33.406%
0.0010	20.322%

Structure #5 (Streeter South Side Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	100.000%
0.0400	45.193%
0.0010	27.390%

Structure #4 (Streeter Ditch 0+00 to 10+00):

Size (mm)	In/Out
4.7500	100.000%

Size (mm)	In/Out
0.0750	73.006%
0.0400	33.003%
0.0010	20.002%

Structure #3 (Null Above Streeter Pond):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.006%
0.0400	33.003%
0.0010	20.002%

Structure #2 (Streeter Pond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	73.006%	100.000%
0.0400	33.003%	100.000%
0.0010	20.002%	100.000%

Structure #1:

Size (mm)	In/Out
4.7500	100.000%
0.0750	100.000%
0.0400	100.000%
0.0010	100.000%

Structure Detail:

Structure #18 (Vegetated Channel)

Streeter Ditch 125+00 to 187+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	2.6	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	21.73 cfs		21.73 cfs	
Depth:	0.51 ft		0.90 ft	
Top Width:	18.05 ft		20.39 ft	
Velocity:	2.59 fps		1.37 fps	
X-Section Area:	8.39 sq ft		15.89 sq ft	
Hydraulic Radius:	0.461 ft		0.768 ft	
Froude Number:	0.67		0.27	
Roughness Coefficient:	0.0552		0.1473	

Structure #17 (Vegetated Channel)

Buckskin Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	4.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	16.85 cfs		16.85 cfs	
Depth:	0.44 ft		0.79 ft	
Top Width:	14.65 ft		16.72 ft	
Velocity:	2.87 fps		1.49 fps	
X-Section Area:	5.88 sq ft		11.29 sq ft	
Hydraulic Radius:	0.397 ft		0.665 ft	
Froude Number:	0.80		0.32	
Roughness Coefficient:	0.0560		0.1517	

Structure #19 (Null)

Null at Confluence Buckskin/Streeter

Structure #15 (Vegetated Channel)

Streeter Ditch 111+00 to 125+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	2.6	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	42.68 cfs		42.68 cfs	
Depth:	0.67 ft		1.10 ft	
Top Width:	19.05 ft		21.59 ft	
Velocity:	3.71 fps		2.12 fps	
X-Section Area:	11.49 sq ft		20.09 sq ft	
Hydraulic Radius:	0.596 ft		0.915 ft	
Froude Number:	0.84		0.39	
Roughness Coefficient:	0.0457		0.1065	

Structure #14 (Pond)

SD-3 Stockpond

Pond Inputs:

Initial Pool Elev:	97.00 ft
Initial Pool:	1.05 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
103.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	103.24 ft
H'graph Detention Time:	2.13 hrs
Pond Model:	CSTRS
Dewater Time:	0.54 days
Trap Efficiency:	100.00 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
90.01	0.050	0.001	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		
101.00	0.554	2.473	0.000		
102.00	0.761	3.127	0.000		
103.00	1.000	4.005	0.000		Spillway #1
103.24	0.916	4.248	11.713	12.95	Peak Stage
104.00	1.010	5.010	48.400		
105.00	1.020	6.025	167.398		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	0.000	0.000
102.00	0.000	0.000
103.00	0.000	0.000
104.00	48.400	48.400
105.00	167.398	167.398

Structure #13 (Vegetated Channel)

Streeter Ditch 91+00 to 111+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	3.2	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	21.13 cfs		21.13 cfs	
Depth:	0.47 ft		0.83 ft	
Top Width:	17.83 ft		20.01 ft	
Velocity:	2.73 fps		1.45 fps	
X-Section Area:	7.73 sq ft		14.62 sq ft	
Hydraulic Radius:	0.430 ft		0.721 ft	
Froude Number:	0.73		0.30	
Roughness Coefficient:	0.0555		0.1480	

Structure #12 (Pond)

SD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	97.00 ft
Initial Pool:	1.05 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
103.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	103.14 ft
H'graph Detention Time:	2.91 hrs
Pond Model:	CSTRS
Dewater Time:	0.44 days
Trap Efficiency:	100.00 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
90.01	0.050	0.001	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		
101.00	0.554	2.473	0.000		
102.00	0.761	3.127	0.000		
103.00	1.000	4.005	0.000		Spillway #1
103.14	0.909	4.147	6.797	10.60	Peak Stage

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
104.00	1.020	5.015	48.400	
105.00	1.040	6.045	167.398	

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	0.000	0.000
102.00	0.000	0.000
103.00	0.000	0.000
104.00	48.400	48.400
105.00	167.398	167.398

Structure #9 (Vegetated Channel)

Stoker Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.0:1	7.0:1	3.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	8.04 cfs		8.04 cfs	
Depth:	0.68 ft		1.14 ft	
Top Width:	7.42 ft		11.14 ft	
Velocity:	2.52 fps		1.07 fps	
X-Section Area:	3.19 sq ft		7.50 sq ft	
Hydraulic Radius:	0.420 ft		0.657 ft	
Froude Number:	0.68		0.23	
Roughness Coefficient:	0.0573		0.1818	

Structure #11 (Vegetated Channel)

Streeter Ditch 80+00 to 91+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	3.2	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	24.37 cfs		24.37 cfs	
Depth:	0.50 ft		0.87 ft	
Top Width:	18.00 ft		20.23 ft	
Velocity:	2.95 fps		1.59 fps	
X-Section Area:	8.25 sq ft		15.34 sq ft	
Hydraulic Radius:	0.454 ft		0.748 ft	
Froude Number:	0.77		0.32	
Roughness Coefficient:	0.0533		0.1381	

Structure #20 (Pond)

SD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	97.00 ft
Initial Pool:	1.05 ac-ft

*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
103.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	103.11 ft
H'graph Detention Time:	3.80 hrs
Pond Model:	CSTRS
Dewater Time:	0.33 days
Trap Efficiency:	100.00 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		
101.00	0.554	2.473	0.000		
102.00	0.761	3.127	0.000		
103.00	1.000	4.005	0.000		Spillway #1
103.11	0.899	4.116	5.317	8.00	Peak Stage
104.00	1.010	5.010	48.400		
105.00	1.020	6.025	167.398		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	0.000	0.000
102.00	0.000	0.000
103.00	0.000	0.000
104.00	48.400	48.400
105.00	167.398	167.398

Structure #10 (Vegetated Channel)

Streeter Ditch 45+00 to 80+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	2.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	5.32 cfs		5.32 cfs	
Depth:	0.33 ft		0.69 ft	
Top Width:	14.01 ft		16.16 ft	
Velocity:	1.22 fps		0.54 fps	
X-Section Area:	4.36 sq ft		9.76 sq ft	
Hydraulic Radius:	0.309 ft		0.596 ft	
Froude Number:	0.39		0.12	
Roughness Coefficient:	0.0786		0.2733	

Structure #7 (Riprap Channel)

Streeter Ditch 25+00 to 45+00

Streeter Ditch 25+00 to 45+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	2.0			

Riprap Channel Results:

Simons/OSM Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.33 cfs	
Depth:	0.22 ft	
Top Width:	13.30 ft	
Velocity:	1.95 fps	
X-Section Area:	2.74 sq ft	
Hydraulic Radius:	0.205 ft	
Froude Number:	0.76	
Manning's n:	0.0377	
Dmin:	2.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

Structure #6 (Riprap Channel)

Streeter Ditch 10+00 to 25+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	10.9			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.33 cfs	

	w/o Freeboard	w/ Freeboard
Depth:	0.11 ft	
Top Width:	6.42 ft	
Velocity*:		
X-Section Area:	0.66 sq ft	
Hydraulic Radius:	0.101 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Vegetated Channel)

Streeter South Side Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.0:1	7.0:1	3.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.04 cfs		0.04 cfs	
Depth:	0.08 ft		0.27 ft	
Top Width:	2.68 ft		4.16 ft	
Velocity:	0.22 fps		0.05 fps	
X-Section Area:	0.20 sq ft		0.83 sq ft	
Hydraulic Radius:	0.074 ft		0.197 ft	
Froude Number:	0.14		0.02	
Roughness Coefficient:	0.2068		1.6946	

Structure #4 (Null)

Streeter Ditch 0+00 to 10+00

Structure #3 (Null)

Null Above Streeter Pond

Structure #2 (Pond)

Streeter Pond

Pond Inputs:

Initial Pool Elev:	6,583.00 ft
Initial Pool:	1.41 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
12.00	3.00	18.00	87.00	4.50	0.0150	6,585.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,588.00	50.00	1.50:1	1.50:1	20.00

Pond Results:

Peak Elevation:	6,585.13 ft
H'graph Detention Time:	10.52 hrs
Pond Model:	CSTRS
Dewater Time:	1.06 days
Trap Efficiency:	83.41 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,579.00	0.045	0.000	0.000		Top of Sed. Storage
6,580.00	0.140	0.088	0.000		
6,581.00	0.356	0.328	0.000		
6,582.00	0.560	0.783	0.000		
6,583.00	0.692	1.407	0.000		Low hole SPW #1
6,584.00	0.873	2.188	0.840	11.24*	
6,585.00	1.159	3.201	1.188	12.20	Spillway #1
6,585.13	1.169	3.363	1.518	2.00	Peak Stage
6,586.00	1.398	4.478	3.782		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,587.00	1.876	6.109	5.348		
6,588.00	2.120	8.106	6.550		Spillway #2
6,589.00	2.324	10.328	45.017		
6,590.00	2.465	12.722	150.324		
6,591.00	2.607	15.258	302.542		

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,579.00	0.000	0.000	0.000
6,580.00	0.000	0.000	0.000
6,581.00	0.000	0.000	0.000
6,582.00	0.000	0.000	0.000
6,583.00	4.00>0.000	0.000	0.000
6,584.00	0.840	0.000	0.840
6,585.00	1.188	0.000	1.188
6,586.00	3.782	0.000	3.782
6,587.00	5.348	0.000	5.348
6,588.00	6.550	0.000	6.550
6,589.00	7.563	37.453	45.017
6,590.00	8.456	141.868	150.324
6,591.00	9.263	293.279	302.542

Structure #1 (Null)

Null Below Streeter Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#18	1	8.500	0.050	0.000	0.000	80.000	F	4.38	0.315
	2	213.800	0.803	0.000	0.000	74.000	F	20.63	4.368
	3	10.200	0.035	0.000	0.000	62.000	M	0.08	0.042
	4	11.600	0.147	0.000	0.000	62.000	M	0.06	0.039
	5	55.100	0.125	0.000	0.000	62.000	M	0.27	0.184
	6	6.300	0.118	0.000	0.000	47.000	S	0.00	0.000
	7	10.700	0.070	0.000	0.000	62.000	M	0.08	0.044
	Σ	**316.200**						**21.73**	**4.990**
#17	1	31.200	0.122	0.000	0.000	80.000	F	16.08	1.155
	2	101.900	0.516	0.000	0.000	62.000	M	0.44	0.333
	3	2.600	0.021	0.000	0.000	74.000	F	0.78	0.056
	Σ	**135.700**						**16.85**	**1.544**
#19	**Σ**	**451.900**						**25.50**	**6.534**
#15	1	6.600	0.044	0.000	0.000	47.000	M	0.00	0.000
	2	83.200	0.301	0.000	0.000	47.000	S	0.00	0.000
	3	16.600	0.091	0.000	0.000	62.000	M	0.13	0.068
	4	36.700	0.087	0.000	0.000	80.000	F	18.91	1.358
	Σ	**595.000**						**42.68**	**7.961**
#14	**Σ**	**595.000**						**42.68**	**7.961**
#13	1	32.800	0.034	0.000	0.000	80.000	F	16.90	1.214
	2	6.900	0.055	0.000	0.000	47.000	S	0.00	0.000
	3	20.300	0.068	0.000	0.000	47.000	S	0.00	0.000
	4	8.200	0.025	0.000	0.000	80.000	F	4.23	0.303
	5	2.900	0.067	0.000	0.000	47.000	S	0.00	0.000
	6	27.900	0.196	0.000	0.000	47.000	S	0.00	0.000
	Σ	**694.000**						**21.13**	**6.518**
#12	**Σ**	**694.000**						**21.13**	**6.518**
#9	1	4.000	0.078	0.000	0.000	62.000	F	0.03	0.016
	2	15.600	0.073	0.000	0.000	80.000	F	8.04	0.577
	Σ	**19.600**						**8.04**	**0.594**
#11	1	17.700	0.075	0.000	0.000	80.000	F	9.12	0.655
	2	6.800	0.029	0.000	0.000	80.000	F	3.50	0.252
	3	27.900	0.205	0.000	0.000	47.000	S	0.00	0.000
	4	7.200	0.058	0.000	0.000	80.000	F	3.71	0.266
	5	11.800	0.178	0.000	0.000	47.000	S	0.00	0.000

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**785.000**						**24.37**	**5.323**
#20	**Σ**	**785.000**						**24.37**	**5.323**
#10	1	78.800	0.424	0.000	0.000	47.000	S	0.00	0.000
	2	65.200	0.120	0.000	0.000	47.000	S	0.00	0.000
	3	0.600	0.022	0.000	0.000	80.000	F	0.31	0.018
	4	16.300	0.141	0.000	0.000	47.000	S	0.00	0.000
	Σ	**945.900**						**5.32**	**2.380**
#7	1	130.200	0.381	0.000	0.000	47.000	S	0.00	0.000
	2	12.200	0.168	0.000	0.000	57.000	S	0.01	0.004
	Σ	**1,088.300**						**5.33**	**2.384**
#6	1	22.400	0.072	0.000	0.000	47.000	S	0.00	0.000
	2	35.700	0.131	0.000	0.000	47.000	S	0.00	0.000
	Σ	**1,146.400**						**5.33**	**2.384**
#5	1	9.200	0.016	0.000	0.000	47.000	S	0.00	0.000
	2	155.600	0.375	0.000	0.000	54.000	S	0.04	0.009
	Σ	**164.800**						**0.04**	**0.009**
#4	1	9.500	0.058	0.000	0.000	74.000	F	2.84	0.206
	Σ	**174.300**						**2.84**	**0.215**
#3	**Σ**	**1,320.700**						**5.42**	**2.600**
#2	1	16.600	0.056	0.000	0.000	47.000	S	0.00	0.000
	2	4.600	0.048	0.000	0.000	57.000	S	0.00	0.000
	Σ	**1,341.900**						**5.42**	**2.600**
#1	**Σ**	**1,341.900**						**1.52**	**2.292**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#18	1	0.300	200.00	14.20	0.8000	0.9000	1	84.3	364,575	207.80	101.24
	2	0.300	400.00	9.30	0.0100	0.3800	1	3.4	1,005	0.37	0.21
	3	0.300	100.00	8.50	0.0700	0.3800	1	0.0	756	0.43	0.33
	4	0.030	100.00	1.50	0.0700	0.3800	1	0.0	12	0.01	0.01
	5	0.300	400.00	10.60	0.0100	0.3800	1	0.1	382	0.19	0.16
	6	0.300	400.00	9.50	0.0310	0.9000	1	0.0	1	0.00	0.00
	7	0.300	200.00	8.50	0.0310	0.3800	1	0.0	476	0.27	0.21

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**87.9**	**300,083**	**168.65**	**6.80**
#17	1	0.300	400.00	6.60	0.8000	0.3800	1	71.6	95,041	54.17	25.34
	2	0.300	400.00	7.40	0.0100	0.3800	1	0.1	191	0.09	0.08
	3	0.300	100.00	11.80	0.0700	0.3800	1	0.2	7,426	4.23	1.73
	Σ							**71.9**	**91,138**	**51.94**	**19.06**
#19	Σ							**159.8**	**138,263**	**78.20**	**9.83**
#15	1	0.300	200.00	15.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	9.40	0.0310	0.9000	1	0.0	1	0.00	0.00
	3	0.300	400.00	11.30	0.0100	0.3800	1	0.0	414	0.24	0.18
	4	0.300	400.00	11.50	0.8000	0.3800	1	210.3	224,470	127.94	61.00
	Σ							**370.2**	**176,971**	**100.53**	**18.60**
#14	Σ							**370.2**	**176,971**	**100.53**	**18.60**
#13	1	0.300	200.00	18.60	0.8000	0.3800	1	224.4	263,388	150.12	72.00
	2	0.300	300.00	15.70	0.0310	0.9000	1	0.0	1	0.00	0.00
	3	0.300	300.00	15.80	0.0310	0.9000	1	0.0	1	0.00	0.00
	4	0.300	100.00	4.80	0.8000	0.3800	1	5.9	30,704	17.50	8.11
	5	0.300	200.00	5.50	0.0310	0.9000	1	0.0	1	0.00	0.00
	6	0.300	400.00	6.70	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**230.4**	**220,429**	**125.64**	**14.44**
#12	Σ							**230.4**	**220,429**	**125.64**	**14.44**
#9	1	0.300	200.00	5.00	0.0100	0.3800	1	0.0	79	0.05	0.03
	2	0.300	300.00	7.10	0.8000	0.3800	1	30.6	81,675	46.55	21.74
	Σ							**30.6**	**81,675**	**46.55**	**21.14**
#11	1	0.300	400.00	14.70	0.8000	0.3800	1	128.2	277,070	157.92	75.89
	2	0.300	200.00	16.90	0.8000	0.3800	1	34.4	200,127	114.07	54.19
	3	0.300	400.00	6.60	0.0310	0.9000	1	0.0	1	0.00	0.00
	4	0.300	200.00	5.20	0.8000	0.3800	1	7.8	45,831	26.12	12.14
	5	0.300	400.00	8.40	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**201.0**	**170,377**	**97.11**	**15.93**
#20	Σ							**201.0**	**170,377**	**97.11**	**15.93**
#10	1	0.300	400.00	4.70	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	12.70	0.0310	0.9000	1	0.0	1	0.00	0.00
	3	0.300	50.00	1.50	0.8000	0.3800	1	0.1	6,414	3.66	1.92
	4	0.300	400.00	9.80	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**0.1**	**6,414**	**3.65**	**1.92**
#7	1	0.300	400.00	8.60	0.3100	0.9000	1	0.0	1	0.00	0.00

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	2	0.300	300.00	3.00	0.0310	0.9000	1	0.0	499	0.25	0.23
	Σ							**0.1**	**6,414**	**3.64**	**1.91**
#6	1	0.300	400.00	25.90	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	14.10	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**0.1**	**6,414**	**3.64**	**1.91**
#5	1	0.300	100.00	22.20	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	11.60	0.0310	0.9000	1	0.0	5,242	2.54	1.99
	Σ							**0.0**	**5,242**	**2.54**	**1.99**
#4	1	0.300	400.00	34.90	0.8000	0.9000	1	216.9	1,075,732	613.13	314.33
	Σ							**217.0**	**1,075,732**	**613.11**	**301.85**
#3	Σ							**217.0**	**1,013,139**	**577.43**	**26.00**
#2	1	0.300	400.00	30.40	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	34.10	0.0800	0.9000	1	0.0	1	0.00	0.00
	Σ							**217.0**	**1,013,139**	**577.43**	**26.00**
#1	Σ							**36.0**	**16,759**	**0.00**	**0.00**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	30.40	270.56	890.00	4.410	0.056
#2	**1**	**Time of Concentration:**					**0.056**
#2	2	3. Short grass pasture	34.00	274.04	806.00	4.660	0.048
#2	**2**	**Time of Concentration:**					**0.048**
#4	1	3. Short grass pasture	35.00	351.05	1,003.00	4.730	0.058
#4	**1**	**Time of Concentration:**					**0.058**
#5	1	3. Short grass pasture	22.00	49.72	226.00	3.750	0.016
#5	**1**	**Time of Concentration:**					**0.016**
#5	2	3. Short grass pasture	11.60	426.64	3,677.93	2.720	0.375
#5	**2**	**Time of Concentration:**					**0.375**
#6	1	3. Short grass pasture	26.00	275.85	1,061.00	4.070	0.072
#6	**1**	**Time of Concentration:**					**0.072**
#6	2	3. Short grass pasture	14.00	198.66	1,419.00	2.990	0.131
#6	**2**	**Time of Concentration:**					**0.131**
#7	1	3. Short grass pasture	8.60	276.31	3,212.90	2.340	0.381
#7	**1**	**Time of Concentration:**					**0.381**
#7	2	3. Short grass pasture	3.00	25.05	835.00	1.380	0.168
#7	**2**	**Time of Concentration:**					**0.168**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	1	3. Short grass pasture	5.00	25.15	503.00	1.780	0.078
#9	**1**	**Time of Concentration:**					**0.078**
#9	2	5. Nearly bare and untilled, and alluvial valley fans	7.10	49.70	700.00	2.660	0.073
#9	**2**	**Time of Concentration:**					**0.073**
#10	1	3. Short grass pasture	4.70	124.36	2,646.00	1.730	0.424
#10	**1**	**Time of Concentration:**					**0.424**
#10	2	3. Short grass pasture	11.00	126.17	1,147.00	2.650	0.120
#10	**2**	**Time of Concentration:**					**0.120**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.50	1.50	100.00	1.220	0.022
#10	**3**	**Time of Concentration:**					**0.022**
#10	4	3. Short grass pasture	9.80	124.46	1,270.00	2.500	0.141
#10	**4**	**Time of Concentration:**					**0.141**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	14.00	143.22	1,023.00	3.740	0.075
#11	**1**	**Time of Concentration:**					**0.075**
#11	2	5. Nearly bare and untilled, and alluvial valley fans	17.00	75.48	444.00	4.120	0.029
#11	**2**	**Time of Concentration:**					**0.029**
#11	3	3. Short grass pasture	6.60	100.05	1,515.90	2.050	0.205
#11	**3**	**Time of Concentration:**					**0.205**
#11	4	5. Nearly bare and untilled, and alluvial valley fans	5.20	24.80	477.00	2.280	0.058
#11	**4**	**Time of Concentration:**					**0.058**
#11	5	3. Short grass pasture	8.40	124.48	1,482.00	2.310	0.178
#11	**5**	**Time of Concentration:**					**0.178**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	18.60	99.84	536.80	4.310	0.034
#13	**1**	**Time of Concentration:**					**0.034**
#13	2	3. Short grass pasture	16.00	101.75	636.00	3.200	0.055
#13	**2**	**Time of Concentration:**					**0.055**
#13	3	3. Short grass pasture	16.00	126.24	789.00	3.200	0.068
#13	**3**	**Time of Concentration:**					**0.068**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.12	202.40	2.230	0.025
#13	**4**	**Time of Concentration:**					**0.025**
#13	5	3. Short grass pasture	5.50	25.13	457.00	1.870	0.067
#13	**5**	**Time of Concentration:**					**0.067**
#13	6	3. Short grass pasture	7.00	104.72	1,496.00	2.110	0.196
#13	**6**	**Time of Concentration:**					**0.196**
#15	1	3. Short grass pasture	15.00	74.85	498.99	3.090	0.044
#15	**1**	**Time of Concentration:**					**0.044**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	11.50	125.46	1,091.00	3.390	0.089
#15	**2**	**Time of Concentration:**					**0.301**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#15	3	3. Short grass pasture	11.30	100.00	885.00	2.680	0.091
#15	**3**	**Time of Concentration:**					**0.091**
#15	4	5. Nearly bare and untilled, and alluvial valley fans	12.00	130.80	1,090.00	3.460	0.087
#15	**4**	**Time of Concentration:**					**0.087**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	6.60	74.58	1,130.00	2.560	0.122
#17	**1**	**Time of Concentration:**					**0.122**
#17	2	3. Short grass pasture	7.40	298.66	4,036.00	2.170	0.516
#17	**2**	**Time of Concentration:**					**0.516**
#17	3	3. Short grass pasture	11.80	24.89	211.00	2.740	0.021
#17	**3**	**Time of Concentration:**					**0.021**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	8.50	44.88	528.00	2.910	0.050
#18	**1**	**Time of Concentration:**					**0.050**
#18	2	3. Short grass pasture	9.30	653.32	7,025.00	2.430	0.803
#18	**2**	**Time of Concentration:**					**0.803**
#18	3	3. Short grass pasture	8.50	25.07	295.00	2.330	0.035
#18	**3**	**Time of Concentration:**					**0.035**
#18	4	3. Short grass pasture	1.50	7.74	516.00	0.970	0.147
#18	**4**	**Time of Concentration:**					**0.147**
#18	5	3. Short grass pasture	10.60	124.86	1,178.00	2.600	0.125
#18	**5**	**Time of Concentration:**					**0.125**
#18	6	3. Short grass pasture	9.50	99.84	1,051.00	2.460	0.118
#18	**6**	**Time of Concentration:**					**0.118**
#18	7	3. Short grass pasture	8.50	50.23	591.00	2.330	0.070
#18	**7**	**Time of Concentration:**					**0.070**

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Streeter Pond
25 Year 24 Hour Storm Event

Emergency Spillway Demonstration

Post-Mining Condition

Tony Tennyson

Tri-State Generation & Transmission Association, Inc.
1100 West 116th Avenue
Westminster, CO 80234

Phone: (970) 326-3560
Email: ttennyson@tristategt.org

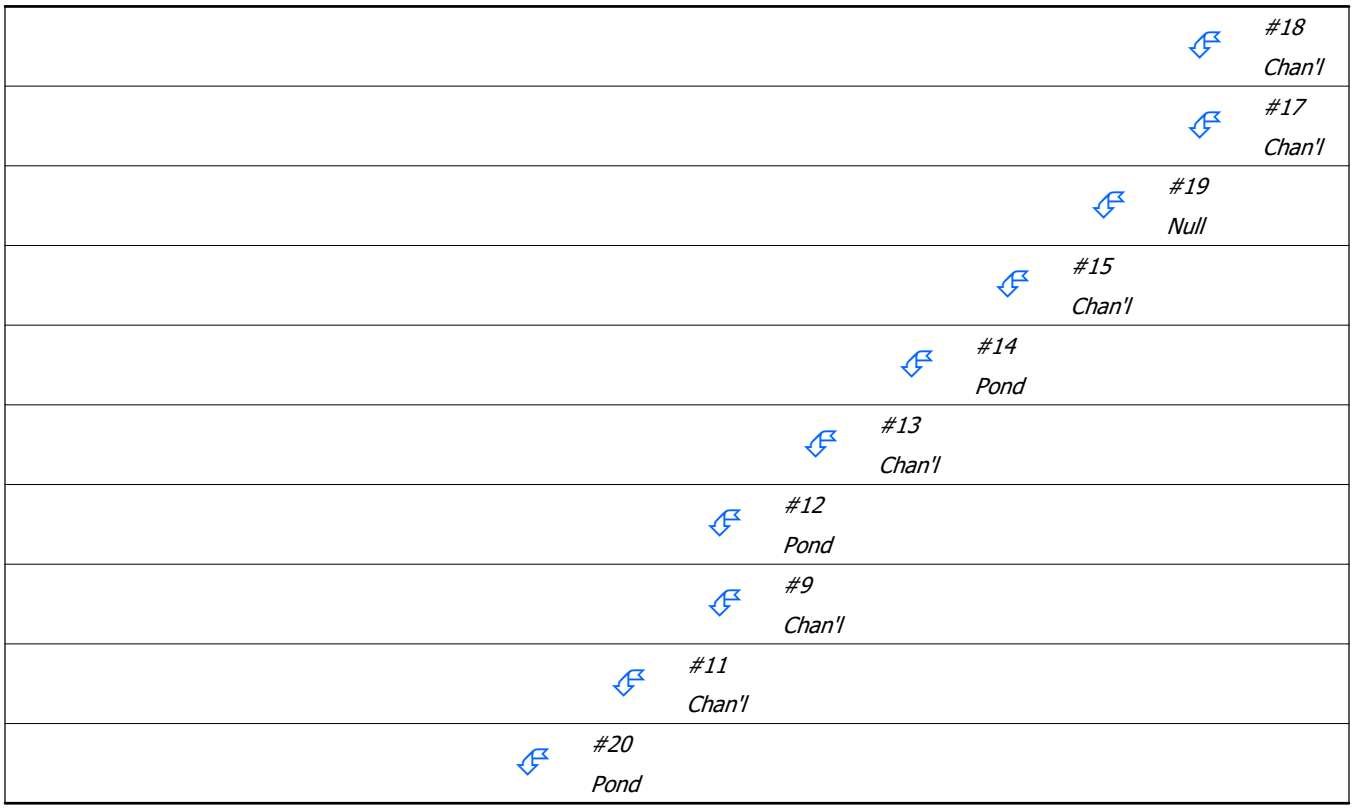
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below Streeter Pond
Pond	#2	==>	#1	0.000	0.000	Streeter Pond
Null	#3	==>	#2	0.000	0.000	Null Above Streeter Pond
Channel	#4	==>	#3	0.000	0.000	Streeter Ditch 0+00 to 10+00
Channel	#5	==>	#4	0.000	0.000	Streeter South Side Ditch
Channel	#6	==>	#3	0.000	0.000	Streeter Ditch 10+00 to 25+00
Channel	#7	==>	#6	0.000	0.000	Streeter Ditch 25+00 to 45+00 Streeter Ditch 25+00 to 45+00
Channel	#9	==>	#11	0.000	0.000	Stoker Ditch
Channel	#10	==>	#7	0.000	0.000	Streeter Ditch 45+00 to 80+00
Channel	#11	==>	#20	0.000	0.000	Streeter Ditch 80+00 to 91+00
Pond	#12	==>	#11	0.000	0.000	SD-2 Stockpond
Channel	#13	==>	#12	0.000	0.000	Streeter Ditch 91+00 to 111+00
Pond	#14	==>	#13	0.000	0.000	SD-3 Stockpond
Channel	#15	==>	#14	0.000	0.000	Streeter Ditch 111+00 to 125+00
Channel	#17	==>	#19	0.000	0.000	Buckskin Ditch
Channel	#18	==>	#19	0.000	0.000	Streeter Ditch 125+00 to 187+00
Null	#19	==>	#15	0.011	0.370	Null at Confluence Buckskin/Streeter
Pond	#20	==>	#10	0.000	0.000	SD-1 Stockpond



									#10 *Chan'l*
								#7 *Chan'l*	
							#6 *Chan'l*		
						#5 *Chan'l*			
					#4 *Chan'l*				
				#3 *Null*					
			#2 *Pond*						
#1 *Null*									

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#19	8. Large gullies, diversions, and low flowing streams	2.60	5.20	200.00	4.83	0.011
#19	**Muskingum K:**					**0.011**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#18		316.200	316.200	52.10	9.89
#17		135.700	135.700	28.31	3.15
#19		0.000	451.900	61.06	13.04
#15		143.100	595.000	83.09	15.56
#14	In	0.000	595.000	83.09	15.56
	Out			50.31	12.60
#13		99.000	694.000	54.18	15.17
#12	In	0.000	694.000	54.18	15.17
	Out			37.75	12.21
#9		19.600	19.600	13.86	1.03
#11		71.400	785.000	41.22	15.23
#20	In	0.000	785.000	41.22	15.23
	Out			25.38	10.76
#10		160.900	945.900	25.41	10.79
#7		142.400	1,088.300	25.48	10.85
#6		58.100	1,146.400	25.48	10.85
#5		164.800	164.800	0.42	0.34
#4		9.500	174.300	5.52	0.73
#3		0.000	1,320.700	26.17	11.58
#2	In	21.200	1,341.900	26.21	11.61
	Out			6.49	10.64
#1		0.000	1,341.900	6.49	10.64

Structure Detail:

Structure #18 (Vegetated Channel)

Streeter Ditch 125+00 to 187+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	2.6	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	52.10 cfs		52.10 cfs	
Depth:	0.73 ft		1.16 ft	
Top Width:	19.40 ft		21.99 ft	
Velocity:	4.13 fps		2.42 fps	
X-Section Area:	12.63 sq ft		21.55 sq ft	
Hydraulic Radius:	0.643 ft		0.963 ft	
Froude Number:	0.90		0.43	
Roughness Coefficient:	0.0433		0.0969	

Structure #17 (Vegetated Channel)

Buckskin Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	4.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	28.31 cfs		28.31 cfs	
Depth:	0.55 ft		0.92 ft	
Top Width:	15.29 ft		17.50 ft	
Velocity:	3.79 fps		2.09 fps	
X-Section Area:	7.48 sq ft		13.53 sq ft	
Hydraulic Radius:	0.483 ft		0.760 ft	
Froude Number:	0.95		0.42	
Roughness Coefficient:	0.0485		0.1184	

Structure #19 (Null)

Null at Confluence Buckskin/Streeter

Structure #15 (Vegetated Channel)

Streeter Ditch 111+00 to 125+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	2.6	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	83.09 cfs		83.09 cfs	
Depth:	0.89 ft		1.34 ft	
Top Width:	20.36 ft		23.03 ft	
Velocity:	5.26 fps		3.26 fps	
X-Section Area:	15.79 sq ft		25.46 sq ft	
Hydraulic Radius:	0.765 ft		1.085 ft	
Froude Number:	1.05		0.55	
Roughness Coefficient:	0.0381		0.0777	

Structure #14 (Pond)

SD-3 Stockpond

Pond Inputs:

Initial Pool Elev:	97.00 ft
Initial Pool:	1.05 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
103.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	104.02 ft
Dewater Time:	0.59 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
90.01	0.050	0.001	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		
101.00	0.554	2.473	0.000		
102.00	0.761	3.127	0.000		
103.00	1.000	4.005	0.000		Spillway #1
104.00	1.010	5.010	48.400	14.00	
104.02	1.010	5.026	50.307	0.05	Peak Stage
105.00	1.020	6.025	167.398		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	0.000	0.000
102.00	0.000	0.000
103.00	0.000	0.000
104.00	0.000	48.400
105.00	0.000	167.398

Structure #13 (Vegetated Channel)

Streeter Ditch 91+00 to 111+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	3.2	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	54.18 cfs		54.18 cfs	
Depth:	0.70 ft		1.10 ft	
Top Width:	19.20 ft		21.62 ft	
Velocity:	4.53 fps		2.68 fps	
X-Section Area:	11.97 sq ft		20.22 sq ft	
Hydraulic Radius:	0.616 ft		0.920 ft	
Froude Number:	1.01		0.49	
Roughness Coefficient:	0.0426		0.0940	

Structure #12 (Pond)

SD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	97.00 ft
Initial Pool:	1.05 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
103.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	103.78 ft
Dewater Time:	0.58 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
90.01	0.050	0.001	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		
101.00	0.554	2.473	0.000		
102.00	0.761	3.127	0.000		
103.00	1.000	4.005	0.000		Spillway #1
103.78	0.992	4.793	37.750	14.00	Peak Stage
104.00	1.020	5.015	48.400		
105.00	1.040	6.045	167.398		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	0.000	0.000
102.00	0.000	0.000
103.00	0.000	0.000
104.00	0.000	48.400
105.00	0.000	167.398

Structure #9 (Vegetated Channel)

Stoker Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.0:1	7.0:1	3.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	13.86 cfs		13.86 cfs	
Depth:	0.82 ft		1.31 ft	
Top Width:	8.58 ft		12.50 ft	
Velocity:	3.18 fps		1.46 fps	
X-Section Area:	4.36 sq ft		9.51 sq ft	
Hydraulic Radius:	0.496 ft		0.742 ft	
Froude Number:	0.79		0.29	
Roughness Coefficient:	0.0507		0.1451	

Structure #11 (Vegetated Channel)

Streeter Ditch 80+00 to 91+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	3.2	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	41.22 cfs		41.22 cfs	
Depth:	0.62 ft		1.02 ft	
Top Width:	18.74 ft		21.11 ft	
Velocity:	3.91 fps		2.24 fps	
X-Section Area:	10.53 sq ft		18.38 sq ft	
Hydraulic Radius:	0.556 ft		0.857 ft	
Froude Number:	0.92		0.42	
Roughness Coefficient:	0.0460		0.1072	

Structure #20 (Pond)

SD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	97.00 ft
Initial Pool:	1.05 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
103.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	103.52 ft
Dewater Time:	0.56 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		
101.00	0.554	2.473	0.000		
102.00	0.761	3.127	0.000		
103.00	1.000	4.005	0.000		Spillway #1
103.52	0.951	4.532	25.382	13.40	Peak Stage
104.00	1.010	5.010	48.400		
105.00	1.020	6.025	167.398		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	0.000	0.000
102.00	0.000	0.000
103.00	0.000	0.000
104.00	48.400	48.400
105.00	167.398	167.398

Structure #10 (Vegetated Channel)

Streeter Ditch 45+00 to 80+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	2.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	25.41 cfs		25.41 cfs	
Depth:	0.65 ft		1.10 ft	
Top Width:	15.88 ft		18.62 ft	
Velocity:	2.82 fps		1.50 fps	
X-Section Area:	9.00 sq ft		16.90 sq ft	
Hydraulic Radius:	0.560 ft		0.891 ft	
Froude Number:	0.66		0.28	
Roughness Coefficient:	0.0507		0.1297	

Structure #7 (Riprap Channel)

Streeter Ditch 25+00 to 45+00

Streeter Ditch 25+00 to 45+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	2.0			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	25.48 cfs	
Depth:	0.28 ft	
Top Width:	13.70 ft	
Velocity*:		
X-Section Area:	3.63 sq ft	
Hydraulic Radius:	0.264 ft	
Froude Number*:		

	w/o Freeboard	w/ Freeboard
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #6 (Riprap Channel)

Streeter Ditch 10+00 to 25+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	10.9			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	25.48 cfs	
Depth:	0.34 ft	
Top Width:	7.34 ft	
Velocity*:		
X-Section Area:	2.24 sq ft	
Hydraulic Radius:	0.299 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Vegetated Channel)

Streeter South Side Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.0:1	7.0:1	3.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.42 cfs		0.42 cfs	
Depth:	0.22 ft		0.52 ft	
Top Width:	3.74 ft		6.15 ft	
Velocity:	0.68 fps		0.20 fps	
X-Section Area:	0.62 sq ft		2.12 sq ft	
Hydraulic Radius:	0.164 ft		0.337 ft	
Froude Number:	0.29		0.06	
Roughness Coefficient:	0.1141		0.6270	

Structure #4 (Riprap Channel)

Streeter Ditch 0+00 to 10+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	28.3			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.52 cfs	
Depth:	0.01 ft	
Top Width:	6.04 ft	
Velocity*:		
X-Section Area:	0.06 sq ft	
Hydraulic Radius:	0.009 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Null)

Null Above Streeter Pond

Structure #2 (Pond)

Streeter Pond

Pond Inputs:

Initial Pool Elev:	6,583.00 ft
Initial Pool:	1.60 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
12.00	3.00	18.00	87.00	4.50	0.0150	6,585.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,588.00	50.00	1.50:1	1.50:1	20.00

Pond Results:

Peak Elevation:	6,587.95 ft
Dewater Time:	1.56 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,579.00	0.045	0.000	0.000		
6,580.00	0.140	0.088	0.000		
6,581.00	0.560	0.415	0.000		
6,582.00	0.560	0.975	0.000		
6,583.00	0.692	1.600	0.000		Low hole SPW #1
6,584.00	0.873	2.381	0.840	11.24*	
6,585.00	1.159	3.394	1.188	10.31*	Spillway #1
6,586.00	1.398	4.670	3.782	6.90	
6,587.00	1.876	6.302	5.348	4.35	
6,587.95	2.102	8.196	6.488	4.75	Peak Stage

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,588.00	2.120	8.299	6.550		Spillway #2
6,589.00	2.324	10.520	45.017		
6,590.00	2.465	12.915	150.324		
6,591.00	2.607	15.450	302.542		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,579.00	0.000	0.000	0.000
6,580.00	0.000	0.000	0.000
6,581.00	0.000	0.000	0.000
6,582.00	0.000	0.000	0.000
6,583.00	4.00>0.000	0.000	0.000
6,584.00	0.840	0.000	0.840
6,585.00	1.188	0.000	1.188
6,586.00	3.782	0.000	3.782
6,587.00	5.348	0.000	5.348
6,588.00	6.550	0.000	6.550
6,589.00	7.563	37.453	45.017
6,590.00	8.456	141.868	150.324
6,591.00	9.263	293.279	302.542

Structure #1 (Null)

Null Below Streeter Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#18	1	8.500	0.050	0.000	0.000	80.000	F	7.25	0.533
	2	213.800	0.803	0.000	0.000	74.000	F	47.43	8.351
	3	10.200	0.035	0.000	0.000	62.000	M	1.41	0.136
	4	11.600	0.147	0.000	0.000	62.000	M	0.62	0.126
	5	55.100	0.125	0.000	0.000	62.000	M	2.93	0.598
	6	6.300	0.118	0.000	0.000	47.000	S	0.00	0.000
	7	10.700	0.070	0.000	0.000	62.000	M	1.48	0.142
	Σ	**316.200**						**52.10**	**9.885**
#17	1	31.200	0.122	0.000	0.000	80.000	F	26.62	1.957
	2	101.900	0.516	0.000	0.000	62.000	M	3.04	1.085
	3	2.600	0.021	0.000	0.000	74.000	F	1.51	0.108
	Σ	**135.700**						**28.31**	**3.150**
#19	**Σ**	**451.900**						**61.06**	**13.035**
#15	1	6.600	0.044	0.000	0.000	47.000	M	0.00	0.000
	2	83.200	0.301	0.000	0.000	47.000	S	0.01	0.000
	3	16.600	0.091	0.000	0.000	62.000	M	2.29	0.221
	4	36.700	0.087	0.000	0.000	80.000	F	31.31	2.302
	Σ	**595.000**						**83.09**	**15.558**
#14	**Σ**	**595.000**						**83.09**	**15.558**
#13	1	32.800	0.034	0.000	0.000	80.000	F	27.98	2.057
	2	6.900	0.055	0.000	0.000	47.000	S	0.00	0.000
	3	20.300	0.068	0.000	0.000	47.000	S	0.00	0.000
	4	8.200	0.025	0.000	0.000	80.000	F	7.00	0.514
	5	2.900	0.067	0.000	0.000	47.000	S	0.00	0.000
	6	27.900	0.196	0.000	0.000	47.000	S	0.00	0.000
	Σ	**694.000**						**54.18**	**15.169**
#12	**Σ**	**694.000**						**54.18**	**15.169**
#9	1	4.000	0.078	0.000	0.000	62.000	F	0.55	0.053
	2	15.600	0.073	0.000	0.000	80.000	F	13.31	0.978
	Σ	**19.600**						**13.86**	**1.032**
#11	1	17.700	0.075	0.000	0.000	80.000	F	15.10	1.110
	2	6.800	0.029	0.000	0.000	80.000	F	5.80	0.426
	3	27.900	0.205	0.000	0.000	47.000	S	0.00	0.000
	4	7.200	0.058	0.000	0.000	80.000	F	6.14	0.452
	5	11.800	0.178	0.000	0.000	47.000	S	0.00	0.000

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	∑	**785.000**						**41.22**	**15.228**
#20	**∑**	**785.000**						**41.22**	**15.228**
#10	1	78.800	0.424	0.000	0.000	47.000	S	0.01	0.000
	2	65.200	0.120	0.000	0.000	47.000	S	0.01	0.000
	3	0.600	0.022	0.000	0.000	80.000	F	0.51	0.037
	4	16.300	0.141	0.000	0.000	47.000	S	0.00	0.000
	∑	**945.900**						**25.41**	**10.794**
#7	1	130.200	0.381	0.000	0.000	47.000	S	0.01	0.001
	2	12.200	0.168	0.000	0.000	57.000	S	0.08	0.051
	∑	**1,088.300**						**25.48**	**10.846**
#6	1	22.400	0.072	0.000	0.000	47.000	S	0.00	0.000
	2	35.700	0.131	0.000	0.000	47.000	S	0.00	0.000
	∑	**1,146.400**						**25.48**	**10.846**
#5	1	9.200	0.016	0.000	0.000	47.000	S	0.00	0.000
	2	155.600	0.375	0.000	0.000	54.000	S	0.42	0.338
	∑	**164.800**						**0.42**	**0.338**
#4	1	9.500	0.058	0.000	0.000	74.000	F	5.52	0.395
	∑	**174.300**						**5.52**	**0.733**
#3	**∑**	**1,320.700**						**26.17**	**11.579**
#2	1	16.600	0.056	0.000	0.000	47.000	S	0.00	0.000
	2	4.600	0.048	0.000	0.000	57.000	S	0.07	0.029
	∑	**1,341.900**						**26.21**	**11.607**
#1	**∑**	**1,341.900**						**6.49**	**10.640**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	30.40	270.56	890.00	4.410	0.056
#2	**1**	**Time of Concentration:**					**0.056**
#2	2	3. Short grass pasture	34.00	274.04	806.00	4.660	0.048
#2	**2**	**Time of Concentration:**					**0.048**
#4	1	3. Short grass pasture	35.00	351.05	1,003.00	4.730	0.058
#4	**1**	**Time of Concentration:**					**0.058**
#5	1	3. Short grass pasture	22.00	49.72	226.00	3.750	0.016
#5	**1**	**Time of Concentration:**					**0.016**
#5	2	3. Short grass pasture	11.60	426.64	3,677.93	2.720	0.375

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	**2**	**Time of Concentration:**					**0.375**
#6	1	3. Short grass pasture	26.00	275.85	1,061.00	4.070	0.072
#6	**1**	**Time of Concentration:**					**0.072**
#6	2	3. Short grass pasture	14.00	198.66	1,419.00	2.990	0.131
#6	**2**	**Time of Concentration:**					**0.131**
#7	1	3. Short grass pasture	8.60	276.31	3,212.90	2.340	0.381
#7	**1**	**Time of Concentration:**					**0.381**
#7	2	3. Short grass pasture	3.00	25.05	835.00	1.380	0.168
#7	**2**	**Time of Concentration:**					**0.168**
#9	1	3. Short grass pasture	5.00	25.15	503.00	1.780	0.078
#9	**1**	**Time of Concentration:**					**0.078**
#9	2	5. Nearly bare and untilled, and alluvial valley fans	7.10	49.70	700.00	2.660	0.073
#9	**2**	**Time of Concentration:**					**0.073**
#10	1	3. Short grass pasture	4.70	124.36	2,646.00	1.730	0.424
#10	**1**	**Time of Concentration:**					**0.424**
#10	2	3. Short grass pasture	11.00	126.17	1,147.00	2.650	0.120
#10	**2**	**Time of Concentration:**					**0.120**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.50	1.50	100.00	1.220	0.022
#10	**3**	**Time of Concentration:**					**0.022**
#10	4	3. Short grass pasture	9.80	124.46	1,270.00	2.500	0.141
#10	**4**	**Time of Concentration:**					**0.141**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	14.00	143.22	1,023.00	3.740	0.075
#11	**1**	**Time of Concentration:**					**0.075**
#11	2	5. Nearly bare and untilled, and alluvial valley fans	17.00	75.48	444.00	4.120	0.029
#11	**2**	**Time of Concentration:**					**0.029**
#11	3	3. Short grass pasture	6.60	100.05	1,515.90	2.050	0.205
#11	**3**	**Time of Concentration:**					**0.205**
#11	4	5. Nearly bare and untilled, and alluvial valley fans	5.20	24.80	477.00	2.280	0.058
#11	**4**	**Time of Concentration:**					**0.058**
#11	5	3. Short grass pasture	8.40	124.48	1,482.00	2.310	0.178
#11	**5**	**Time of Concentration:**					**0.178**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	18.60	99.84	536.80	4.310	0.034
#13	**1**	**Time of Concentration:**					**0.034**
#13	2	3. Short grass pasture	16.00	101.75	636.00	3.200	0.055
#13	**2**	**Time of Concentration:**					**0.055**
#13	3	3. Short grass pasture	16.00	126.24	789.00	3.200	0.068
#13	**3**	**Time of Concentration:**					**0.068**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.12	202.40	2.230	0.025
#13	**4**	**Time of Concentration:**					**0.025**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	5	3. Short grass pasture	5.50	25.13	457.00	1.870	0.067
#13	**5**	**Time of Concentration:**					**0.067**
#13	6	3. Short grass pasture	7.00	104.72	1,496.00	2.110	0.196
#13	**6**	**Time of Concentration:**					**0.196**
#15	1	3. Short grass pasture	15.00	74.85	498.99	3.090	0.044
#15	**1**	**Time of Concentration:**					**0.044**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	11.50	125.46	1,091.00	3.390	0.089
#15	**2**	**Time of Concentration:**					**0.301**
#15	3	3. Short grass pasture	11.30	100.00	885.00	2.680	0.091
#15	**3**	**Time of Concentration:**					**0.091**
#15	4	5. Nearly bare and untilled, and alluvial valley fans	12.00	130.80	1,090.00	3.460	0.087
#15	**4**	**Time of Concentration:**					**0.087**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	6.60	74.58	1,130.00	2.560	0.122
#17	**1**	**Time of Concentration:**					**0.122**
#17	2	3. Short grass pasture	7.40	298.66	4,036.00	2.170	0.516
#17	**2**	**Time of Concentration:**					**0.516**
#17	3	3. Short grass pasture	11.80	24.89	211.00	2.740	0.021
#17	**3**	**Time of Concentration:**					**0.021**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	8.50	44.88	528.00	2.910	0.050
#18	**1**	**Time of Concentration:**					**0.050**
#18	2	3. Short grass pasture	9.30	653.32	7,025.00	2.430	0.803
#18	**2**	**Time of Concentration:**					**0.803**
#18	3	3. Short grass pasture	8.50	25.07	295.00	2.330	0.035
#18	**3**	**Time of Concentration:**					**0.035**
#18	4	3. Short grass pasture	1.50	7.74	516.00	0.970	0.147
#18	**4**	**Time of Concentration:**					**0.147**
#18	5	3. Short grass pasture	10.60	124.86	1,178.00	2.600	0.125
#18	**5**	**Time of Concentration:**					**0.125**
#18	6	3. Short grass pasture	9.50	99.84	1,051.00	2.460	0.118
#18	**6**	**Time of Concentration:**					**0.118**
#18	7	3. Short grass pasture	8.50	50.23	591.00	2.330	0.070
#18	**7**	**Time of Concentration:**					**0.070**

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Streeter & Buckskin Ditches
100 Year 24 Hour Storm Event

Channel Demonstration

Post-Mining Condition

Tony Tennyson

Tri-State Generation & Transmission Association, Inc.
1100 West 116th Avenue
Westminster, CO 80234

Phone: (970) 326-3560
Email: ttennyson@tristategt.org

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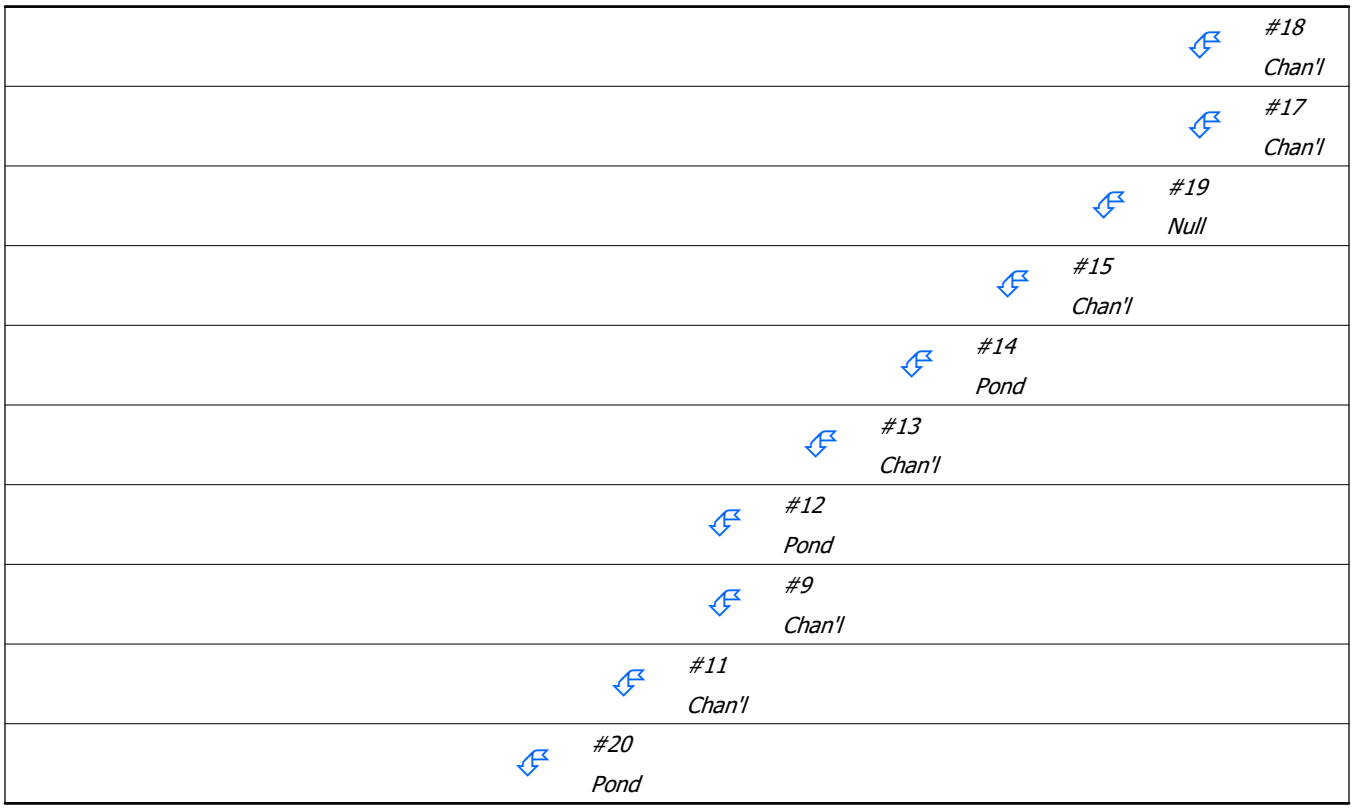
General Information

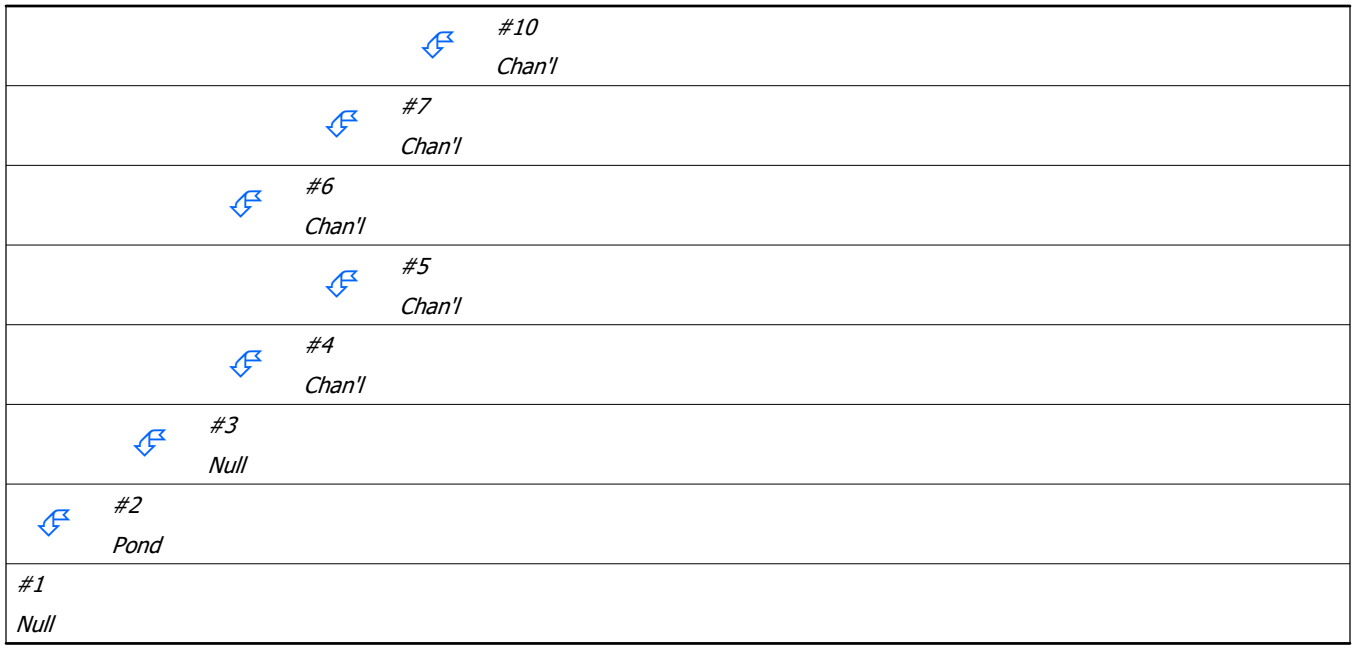
Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	2.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below Streeter Pond
Pond	#2	==>	#1	0.000	0.000	Streeter Pond
Null	#3	==>	#2	0.000	0.000	Null Above Streeter Pond
Channel	#4	==>	#3	0.000	0.000	Streeter Ditch 0+00 to 10+00
Channel	#5	==>	#4	0.000	0.000	Streeter South Side Ditch
Channel	#6	==>	#3	0.000	0.000	Streeter Ditch 10+00 to 25+00
Channel	#7	==>	#6	0.000	0.000	Streeter Ditch 25+00 to 45+00 Streeter Ditch 25+00 to 45+00
Channel	#9	==>	#11	0.000	0.000	Stoker Ditch
Channel	#10	==>	#7	0.000	0.000	Streeter Ditch 45+00 to 80+00
Channel	#11	==>	#20	0.000	0.000	Streeter Ditch 80+00 to 91+00
Pond	#12	==>	#11	0.000	0.000	SD-2 Stockpond
Channel	#13	==>	#12	0.000	0.000	Streeter Ditch 91+00 to 111+00
Pond	#14	==>	#13	0.000	0.000	SD-3 Stockpond
Channel	#15	==>	#14	0.000	0.000	Streeter Ditch 111+00 to 125+00
Channel	#17	==>	#19	0.000	0.000	Buckskin Ditch
Channel	#18	==>	#19	0.000	0.000	Streeter Ditch 125+00 to 187+00
Null	#19	==>	#15	0.011	0.370	Null at Confluence Buckskin/Streeter
Pond	#20	==>	#10	0.000	0.000	SD-1 Stockpond





Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#19	8. Large gullies, diversions, and low flowing streams	2.60	5.20	200.00	4.83	0.011
#19	**Muskingum K:**					**0.011**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#18		316.200	316.200	81.91	14.63
#17		135.700	135.700	39.20	4.77
#19		0.000	451.900	97.39	19.40
#15		143.100	595.000	127.95	23.03
#14	In	0.000	595.000	127.95	23.03
	Out			100.86	20.07
#13		99.000	694.000	110.56	23.64
#12	In	0.000	694.000	110.56	23.64
	Out			92.09	20.68
#9		19.600	19.600	19.06	1.43
#11		71.400	785.000	98.11	24.87
#20	In	0.000	785.000	98.11	24.87
	Out			84.36	21.91
#10		160.900	945.900	84.44	22.14
#7		142.400	1,088.300	84.65	22.37
#6		58.100	1,146.400	84.65	22.44
#5		164.800	164.800	1.42	0.92
#4		9.500	174.300	7.93	1.49
#3		0.000	1,320.700	86.97	23.93
#2	In	21.200	1,341.900	87.09	24.01
	Out			32.16	22.99
#1		0.000	1,341.900	32.16	22.99

Structure Detail:

Structure #18 (Vegetated Channel)

Streeter Ditch 125+00 to 187+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	2.6	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	81.91 cfs		81.91 cfs	
Depth:	0.89 ft		1.33 ft	
Top Width:	20.32 ft		23.00 ft	
Velocity:	5.23 fps		3.23 fps	
X-Section Area:	15.67 sq ft		25.35 sq ft	
Hydraulic Radius:	0.760 ft		1.082 ft	
Froude Number:	1.05		0.54	
Roughness Coefficient:	0.0383		0.0783	

Structure #17 (Vegetated Channel)

Buckskin Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	4.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	39.20 cfs		39.20 cfs	
Depth:	0.63 ft		1.01 ft	
Top Width:	15.77 ft		18.06 ft	
Velocity:	4.49 fps		2.58 fps	
X-Section Area:	8.73 sq ft		15.18 sq ft	
Hydraulic Radius:	0.547 ft		0.826 ft	
Froude Number:	1.06		0.50	
Roughness Coefficient:	0.0443		0.1015	

Structure #19 (Null)

Null at Confluence Buckskin/Streeter

Structure #15 (Vegetated Channel)

Streeter Ditch 111+00 to 125+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	2.6	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	127.95 cfs		127.95 cfs	
Depth:	1.07 ft		1.52 ft	
Top Width:	21.42 ft		24.14 ft	
Velocity:	6.57 fps		4.29 fps	
X-Section Area:	19.48 sq ft		29.80 sq ft	
Hydraulic Radius:	0.895 ft		1.210 ft	
Froude Number:	1.21		0.68	
Roughness Coefficient:	0.0339		0.0635	

Structure #14 (Pond)

SD-3 Stockpond

Pond Inputs:

Initial Pool Elev:	97.00 ft
Initial Pool:	1.05 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
103.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	104.44 ft
Dewater Time:	0.60 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
90.01	0.050	0.001	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		
101.00	0.554	2.473	0.000		
102.00	0.761	3.127	0.000		
103.00	1.000	4.005	0.000		Spillway #1
104.00	1.010	5.010	48.400	13.85	
104.44	1.014	5.458	100.863	0.65	Peak Stage
105.00	1.020	6.025	167.398		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	0.000	0.000
102.00	0.000	0.000
103.00	0.000	0.000
104.00	48.400	48.400
105.00	167.398	167.398

Structure #13 (Vegetated Channel)

Streeter Ditch 91+00 to 111+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	3.2	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	110.56 cfs		110.56 cfs	
Depth:	0.94 ft		1.37 ft	
Top Width:	20.67 ft		23.20 ft	
Velocity:	6.56 fps		4.24 fps	
X-Section Area:	16.85 sq ft		26.09 sq ft	
Hydraulic Radius:	0.803 ft		1.104 ft	
Froude Number:	1.28		0.70	
Roughness Coefficient:	0.0351		0.0671	

Structure #12 (Pond)

SD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	97.00 ft
Initial Pool:	1.05 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
103.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	104.37 ft
Dewater Time:	0.62 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
90.01	0.050	0.001	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		
101.00	0.554	2.473	0.000		
102.00	0.761	3.127	0.000		
103.00	1.000	4.005	0.000		Spillway #1
104.00	1.020	5.015	48.400	13.95	
104.37	1.027	5.393	92.092	0.85	Peak Stage
105.00	1.040	6.045	167.398		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	0.000	0.000
102.00	0.000	0.000
103.00	0.000	0.000
104.00	48.400	48.400
105.00	167.398	167.398

Structure #9 (Vegetated Channel)

Stoker Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.0:1	7.0:1	3.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	19.06 cfs		19.06 cfs	
Depth:	0.92 ft		1.42 ft	
Top Width:	9.37 ft		13.38 ft	
Velocity:	3.64 fps		1.74 fps	
X-Section Area:	5.23 sq ft		10.95 sq ft	
Hydraulic Radius:	0.546 ft		0.797 ft	
Froude Number:	0.86		0.34	
Roughness Coefficient:	0.0473		0.1272	

Structure #11 (Vegetated Channel)

Streeter Ditch 80+00 to 91+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	3.0:1	3.0:1	3.2	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	98.11 cfs		98.11 cfs	
Depth:	0.90 ft		1.32 ft	
Top Width:	20.39 ft		22.91 ft	
Velocity:	6.17 fps		3.93 fps	
X-Section Area:	15.91 sq ft		24.98 sq ft	
Hydraulic Radius:	0.769 ft		1.071 ft	
Froude Number:	1.23		0.66	
Roughness Coefficient:	0.0362		0.0710	

Structure #20 (Pond)

SD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	97.00 ft
Initial Pool:	1.05 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
103.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	104.30 ft
Dewater Time:	0.63 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		
99.00	0.339	1.649	0.000		
100.00	0.380	2.008	0.000		
101.00	0.554	2.473	0.000		
102.00	0.761	3.127	0.000		
103.00	1.000	4.005	0.000		Spillway #1
104.00	1.010	5.010	48.400	14.10	
104.30	1.013	5.317	84.364	0.90	Peak Stage
105.00	1.020	6.025	167.398		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
91.00	0.000	0.000
92.00	0.000	0.000
93.00	0.000	0.000
94.00	0.000	0.000
95.00	0.000	0.000
96.00	0.000	0.000
97.00	0.000	0.000
98.00	0.000	0.000
99.00	0.000	0.000
100.00	0.000	0.000
101.00	0.000	0.000
102.00	0.000	0.000
103.00	0.000	0.000
104.00	48.400	48.400
105.00	167.398	167.398

Structure #10 (Vegetated Channel)

Streeter Ditch 45+00 to 80+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	2.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	84.44 cfs		84.44 cfs	
Depth:	1.07 ft		1.58 ft	
Top Width:	18.41 ft		21.47 ft	
Velocity:	5.19 fps		3.20 fps	
X-Section Area:	16.26 sq ft		26.41 sq ft	
Hydraulic Radius:	0.866 ft		1.201 ft	
Froude Number:	0.97		0.51	
Roughness Coefficient:	0.0368		0.0745	

Structure #7 (Riprap Channel)

Streeter Ditch 25+00 to 45+00

Streeter Ditch 25+00 to 45+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	2.0			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	84.65 cfs	
Depth:	0.70 ft	
Top Width:	16.18 ft	
Velocity*:		
X-Section Area:	9.83 sq ft	
Hydraulic Radius:	0.599 ft	
Froude Number*:		

	w/o Freeboard	w/ Freeboard
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #6 (Riprap Channel)

Streeter Ditch 10+00 to 25+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	10.9			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	84.65 cfs	
Depth:	0.75 ft	
Top Width:	8.99 ft	
Velocity*:		
X-Section Area:	5.60 sq ft	
Hydraulic Radius:	0.599 ft	
Froude Number*:		
Manning's n*:		
Dmin:	5.00 in	
D50:	15.00 in	
Dmax:	18.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Vegetated Channel)

Streeter South Side Ditch

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.0:1	7.0:1	3.0	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	1.42 cfs		1.42 cfs	
Depth:	0.35 ft		0.72 ft	
Top Width:	4.82 ft		7.79 ft	
Velocity:	1.18 fps		0.40 fps	
X-Section Area:	1.20 sq ft		3.54 sq ft	
Hydraulic Radius:	0.245 ft		0.445 ft	
Froude Number:	0.42		0.10	
Roughness Coefficient:	0.0851		0.3748	

Structure #4 (Riprap Channel)

Streeter Ditch 0+00 to 10+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	28.3			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.93 cfs	
Depth:	0.03 ft	
Top Width:	6.11 ft	
Velocity*:		
X-Section Area:	0.16 sq ft	
Hydraulic Radius:	0.027 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Null)

Null Above Streeter Pond

Structure #2 (Pond)

Streeter Pond

Pond Inputs:

Initial Pool Elev:	6,583.00 ft
Initial Pool:	1.41 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
12.00	3.00	18.00	87.00	4.50	0.0150	6,585.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,588.00	50.00	1.50:1	1.50:1	20.00

Pond Results:

Peak Elevation:	6,588.67 ft
Dewater Time:	1.98 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,579.00	0.045	0.000	0.000		
6,580.00	0.140	0.088	0.000		
6,581.00	0.356	0.328	0.000		
6,582.00	0.560	0.783	0.000		
6,583.00	0.692	1.407	0.000		Low hole SPW #1
6,584.00	0.873	2.188	0.840	11.24*	
6,585.00	1.159	3.201	1.188	10.31*	Spillway #1
6,586.00	1.398	4.478	3.782	6.90	
6,587.00	1.876	6.109	5.348	4.35	
6,588.00	2.120	8.106	6.550	4.35	Spillway #2

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,588.67	2.250	9.585	32.163	10.30	Peak Stage
6,589.00	2.324	10.328	45.017		
6,590.00	2.465	12.722	150.324		
6,591.00	2.607	15.258	302.542		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,579.00	0.000	0.000	0.000
6,580.00	0.000	0.000	0.000
6,581.00	0.000	0.000	0.000
6,582.00	0.000	0.000	0.000
6,583.00	4.00>0.000	0.000	0.000
6,584.00	0.840	0.000	0.840
6,585.00	1.188	0.000	1.188
6,586.00	3.782	0.000	3.782
6,587.00	5.348	0.000	5.348
6,588.00	6.550	0.000	6.550
6,589.00	7.563	37.453	45.017
6,590.00	8.456	141.868	150.324
6,591.00	9.263	293.279	302.542

Structure #1 (Null)

Null Below Streeter Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#18	1	8.500	0.050	0.000	0.000	80.000	F	9.72	0.729
	2	213.800	0.803	0.000	0.000	74.000	F	73.74	12.109
	3	10.200	0.035	0.000	0.000	62.000	M	3.13	0.242
	4	11.600	0.147	0.000	0.000	62.000	M	1.64	0.225
	5	55.100	0.125	0.000	0.000	62.000	M	7.78	1.067
	6	6.300	0.118	0.000	0.000	47.000	S	0.02	0.008
	7	10.700	0.070	0.000	0.000	62.000	M	3.29	0.254
	Σ	**316.200**						**81.91**	**14.633**
#17	1	31.200	0.122	0.000	0.000	80.000	F	35.67	2.674
	2	101.900	0.516	0.000	0.000	62.000	M	8.12	1.936
	3	2.600	0.021	0.000	0.000	74.000	F	2.17	0.157
	Σ	**135.700**						**39.20**	**4.767**
#19	**Σ**	**451.900**						**97.39**	**19.400**
#15	1	6.600	0.044	0.000	0.000	47.000	M	0.02	0.008
	2	83.200	0.301	0.000	0.000	47.000	S	0.13	0.078
	3	16.600	0.091	0.000	0.000	62.000	M	5.10	0.395
	4	36.700	0.087	0.000	0.000	80.000	F	41.96	3.146
	Σ	**595.000**						**127.95**	**23.027**
#14	**Σ**	**595.000**						**127.95**	**23.027**
#13	1	32.800	0.034	0.000	0.000	80.000	F	37.50	2.812
	2	6.900	0.055	0.000	0.000	47.000	S	0.02	0.009
	3	20.300	0.068	0.000	0.000	47.000	S	0.05	0.028
	4	8.200	0.025	0.000	0.000	80.000	F	9.38	0.703
	5	2.900	0.067	0.000	0.000	47.000	S	0.00	0.000
	6	27.900	0.196	0.000	0.000	47.000	S	0.04	0.026
	Σ	**694.000**						**110.56**	**23.644**
#12	**Σ**	**694.000**						**110.56**	**23.644**
#9	1	4.000	0.078	0.000	0.000	62.000	F	1.23	0.095
	2	15.600	0.073	0.000	0.000	80.000	F	17.84	1.337
	Σ	**19.600**						**19.06**	**1.432**
#11	1	17.700	0.075	0.000	0.000	80.000	F	20.24	1.517
	2	6.800	0.029	0.000	0.000	80.000	F	7.77	0.583
	3	27.900	0.205	0.000	0.000	47.000	S	0.04	0.026
	4	7.200	0.058	0.000	0.000	80.000	F	8.23	0.617
	5	11.800	0.178	0.000	0.000	47.000	S	0.02	0.010

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	∑	**785.000**						**98.11**	**24.868**
#20	**∑**	**785.000**						**98.11**	**24.868**
#10	1	78.800	0.424	0.000	0.000	47.000	S	0.12	0.074
	2	65.200	0.120	0.000	0.000	47.000	S	0.16	0.091
	3	0.600	0.022	0.000	0.000	80.000	F	0.69	0.051
	4	16.300	0.141	0.000	0.000	47.000	S	0.03	0.015
	∑	**945.900**						**84.44**	**22.138**
#7	1	130.200	0.381	0.000	0.000	47.000	S	0.20	0.122
	2	12.200	0.168	0.000	0.000	57.000	S	0.29	0.111
	∑	**1,088.300**						**84.65**	**22.371**
#6	1	22.400	0.072	0.000	0.000	47.000	S	0.05	0.031
	2	35.700	0.131	0.000	0.000	47.000	S	0.06	0.034
	∑	**1,146.400**						**84.65**	**22.436**
#5	1	9.200	0.016	0.000	0.000	47.000	S	0.02	0.012
	2	155.600	0.375	0.000	0.000	54.000	S	1.42	0.904
	∑	**164.800**						**1.42**	**0.916**
#4	1	9.500	0.058	0.000	0.000	74.000	F	7.93	0.572
	∑	**174.300**						**7.93**	**1.489**
#3	**∑**	**1,320.700**						**86.97**	**23.925**
#2	1	16.600	0.056	0.000	0.000	47.000	S	0.04	0.023
	2	4.600	0.048	0.000	0.000	57.000	S	0.55	0.062
	∑	**1,341.900**						**87.09**	**24.010**
#1	**∑**	**1,341.900**						**32.16**	**22.995**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	30.40	270.56	890.00	4.410	0.056
#2	**1**	**Time of Concentration:**					**0.056**
#2	2	3. Short grass pasture	34.00	274.04	806.00	4.660	0.048
#2	**2**	**Time of Concentration:**					**0.048**
#4	1	3. Short grass pasture	35.00	351.05	1,003.00	4.730	0.058
#4	**1**	**Time of Concentration:**					**0.058**
#5	1	3. Short grass pasture	22.00	49.72	226.00	3.750	0.016
#5	**1**	**Time of Concentration:**					**0.016**
#5	2	3. Short grass pasture	11.60	426.64	3,677.93	2.720	0.375

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	**2**	**Time of Concentration:**					**0.375**
#6	1	3. Short grass pasture	26.00	275.85	1,061.00	4.070	0.072
#6	**1**	**Time of Concentration:**					**0.072**
#6	2	3. Short grass pasture	14.00	198.66	1,419.00	2.990	0.131
#6	**2**	**Time of Concentration:**					**0.131**
#7	1	3. Short grass pasture	8.60	276.31	3,212.90	2.340	0.381
#7	**1**	**Time of Concentration:**					**0.381**
#7	2	3. Short grass pasture	3.00	25.05	835.00	1.380	0.168
#7	**2**	**Time of Concentration:**					**0.168**
#9	1	3. Short grass pasture	5.00	25.15	503.00	1.780	0.078
#9	**1**	**Time of Concentration:**					**0.078**
#9	2	5. Nearly bare and untilled, and alluvial valley fans	7.10	49.70	700.00	2.660	0.073
#9	**2**	**Time of Concentration:**					**0.073**
#10	1	3. Short grass pasture	4.70	124.36	2,646.00	1.730	0.424
#10	**1**	**Time of Concentration:**					**0.424**
#10	2	3. Short grass pasture	11.00	126.17	1,147.00	2.650	0.120
#10	**2**	**Time of Concentration:**					**0.120**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.50	1.50	100.00	1.220	0.022
#10	**3**	**Time of Concentration:**					**0.022**
#10	4	3. Short grass pasture	9.80	124.46	1,270.00	2.500	0.141
#10	**4**	**Time of Concentration:**					**0.141**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	14.00	143.22	1,023.00	3.740	0.075
#11	**1**	**Time of Concentration:**					**0.075**
#11	2	5. Nearly bare and untilled, and alluvial valley fans	17.00	75.48	444.00	4.120	0.029
#11	**2**	**Time of Concentration:**					**0.029**
#11	3	3. Short grass pasture	6.60	100.05	1,515.90	2.050	0.205
#11	**3**	**Time of Concentration:**					**0.205**
#11	4	5. Nearly bare and untilled, and alluvial valley fans	5.20	24.80	477.00	2.280	0.058
#11	**4**	**Time of Concentration:**					**0.058**
#11	5	3. Short grass pasture	8.40	124.48	1,482.00	2.310	0.178
#11	**5**	**Time of Concentration:**					**0.178**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	18.60	99.84	536.80	4.310	0.034
#13	**1**	**Time of Concentration:**					**0.034**
#13	2	3. Short grass pasture	16.00	101.75	636.00	3.200	0.055
#13	**2**	**Time of Concentration:**					**0.055**
#13	3	3. Short grass pasture	16.00	126.24	789.00	3.200	0.068
#13	**3**	**Time of Concentration:**					**0.068**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.12	202.40	2.230	0.025
#13	**4**	**Time of Concentration:**					**0.025**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	5	3. Short grass pasture	5.50	25.13	457.00	1.870	0.067
#13	**5**	**Time of Concentration:**					**0.067**
#13	6	3. Short grass pasture	7.00	104.72	1,496.00	2.110	0.196
#13	**6**	**Time of Concentration:**					**0.196**
#15	1	3. Short grass pasture	15.00	74.85	498.99	3.090	0.044
#15	**1**	**Time of Concentration:**					**0.044**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	11.50	125.46	1,091.00	3.390	0.089
#15	**2**	**Time of Concentration:**					**0.301**
#15	3	3. Short grass pasture	11.30	100.00	885.00	2.680	0.091
#15	**3**	**Time of Concentration:**					**0.091**
#15	4	5. Nearly bare and untilled, and alluvial valley fans	12.00	130.80	1,090.00	3.460	0.087
#15	**4**	**Time of Concentration:**					**0.087**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	6.60	74.58	1,130.00	2.560	0.122
#17	**1**	**Time of Concentration:**					**0.122**
#17	2	3. Short grass pasture	7.40	298.66	4,036.00	2.170	0.516
#17	**2**	**Time of Concentration:**					**0.516**
#17	3	3. Short grass pasture	11.80	24.89	211.00	2.740	0.021
#17	**3**	**Time of Concentration:**					**0.021**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	8.50	44.88	528.00	2.910	0.050
#18	**1**	**Time of Concentration:**					**0.050**
#18	2	3. Short grass pasture	9.30	653.32	7,025.00	2.430	0.803
#18	**2**	**Time of Concentration:**					**0.803**
#18	3	3. Short grass pasture	8.50	25.07	295.00	2.330	0.035
#18	**3**	**Time of Concentration:**					**0.035**
#18	4	3. Short grass pasture	1.50	7.74	516.00	0.970	0.147
#18	**4**	**Time of Concentration:**					**0.147**
#18	5	3. Short grass pasture	10.60	124.86	1,178.00	2.600	0.125
#18	**5**	**Time of Concentration:**					**0.125**
#18	6	3. Short grass pasture	9.50	99.84	1,051.00	2.460	0.118
#18	**6**	**Time of Concentration:**					**0.118**
#18	7	3. Short grass pasture	8.50	50.23	591.00	2.330	0.070
#18	**7**	**Time of Concentration:**					**0.070**

Modeling a constant inflow using SEDCAD™ is somewhat complex. The methodology suggested by SEDCAD™ primary author, Pam Schwab, was used to model the impact of a constant inflow. In the current version of SEDCAD™, a fixed flow can only be input by inserting a "dummy" upstream reservoir with a watershed large enough to produce a "tank" flow, and then setting the output of the dummy reservoir as a constant "User Defined" outflow curve, independent of pool elevation in the dummy reservoir. A flow of 0.56 cfs (250 gpm) was conservatively utilized to represent the flow from the East Taylor Seep, which in reality is lower based on the seasonable availability of water. The watershed, time of concentration, and curve number utilized for this simulated flow are theoretical in natures. The synthesized 250 gpm flow was then dropped into directly into East Taylor Pond.

For the post mining case at the East Taylor Pond, the 10 year 24 hour storm produces 5.76 acre feet of runoff, and the entire storm event is contained below the principal spillway elevation. The 25 year 24 hour storm event peaks at the 6,953.0 elevation which is below the emergency spill way elevation of 6,954.0'.

East Taylor Permanent Post Mine Channels

The East Taylor watershed is comprised of three post-mining channels. One channel, the Taylor Ditch, conveys all the post mining surface water flows to the East Taylor Pond, while the East Taylor Ditch and Taylor Trib Ditch are tributaries to the Taylor Ditch. The locations of all three channels are presented on Map 12 and Figure Exh. 7-14ET-2. The channel profiles are presented on Map 33.

The assumed hydrologic condition for all three channels is the post mine condition when the entire East Taylor watershed is reclaimed and reporting to the East Taylor Pond.

Taylor Ditch

The area contributory to the Taylor Ditch in some locations is less than one square mile. However, portions of this channel pass over a permanent fill, and the lower portion below the confluence with the East Taylor Ditch is larger than one square mile so the modeled storm event required by rule is the 100 year 24 hour event. The entire length of the Taylor Ditch will be riprap lined. Two stock ponds TD-1 and TD-2 have been constructed inline in the channel to reduce peak flows from larger storm events, and provide a water source to support the post mine land use.

A SEDCAD™ model (100 Year 24 Hour Channel Demonstration model) has been included which evaluates the peak flow and total runoff volume for each of the channel segments for the 100 year, 24-hour storm event. The channel configurations for the 100 year, 24 hour storm for the Taylor Ditch summarized below.

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East Taylor Pond
10 Year - 24 Hour Storm Event

Effluent Demonstration

Post Mining

Tony Tennyson

Tri-State Generation & Transmission Assoication, Inc.
1100 West 116th Avenue
Westminster, CO 80234

Phone: (970) 824-1232
Email: ttennyson@tristategt.org

General Information

Storm Information:

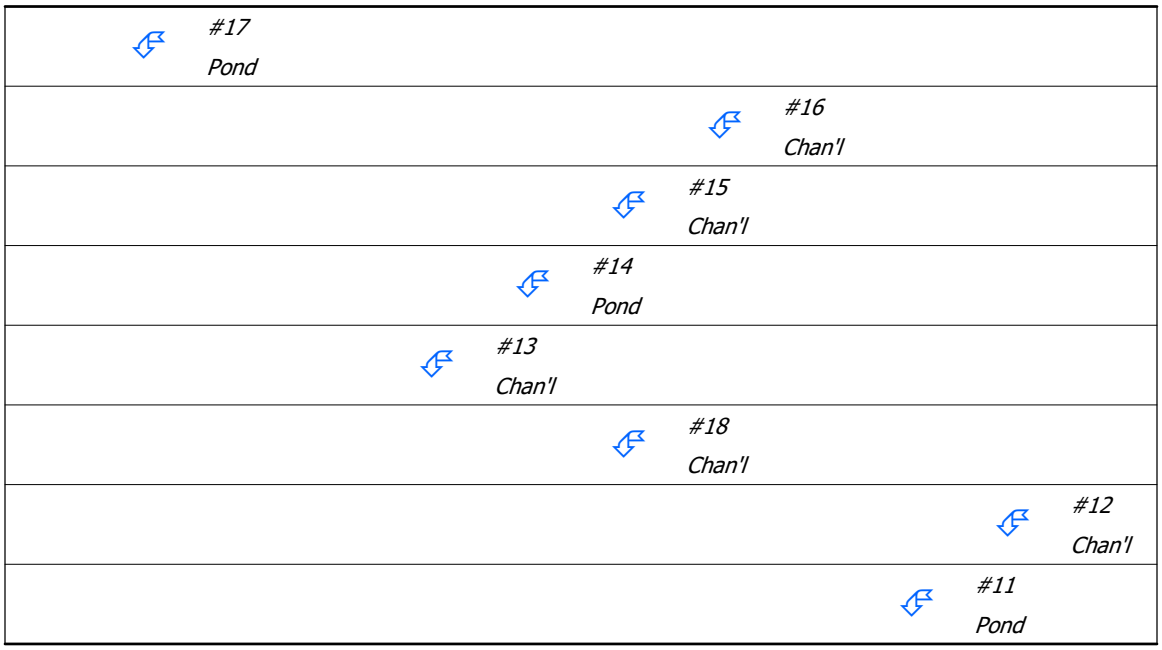
Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.800 inches

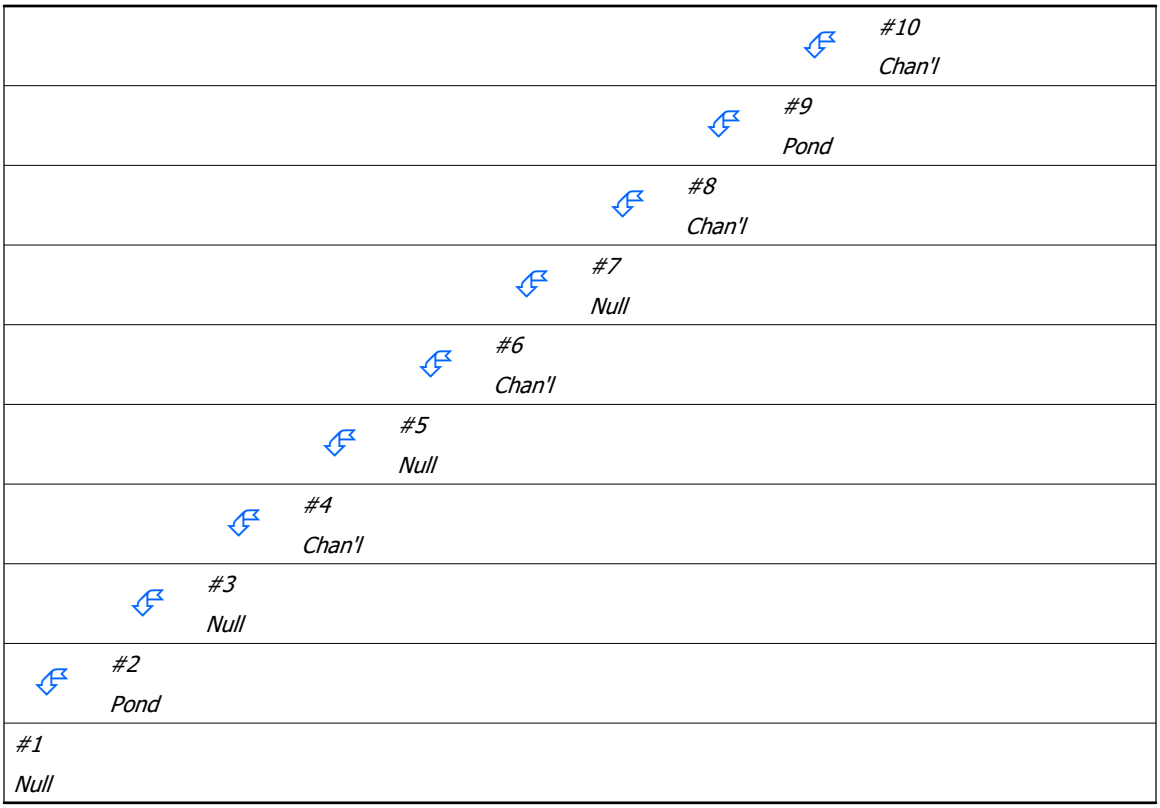
Particle Size Distribution:

Size (mm)	Colowyo Particle Size
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below East Taylor Pond
Pond	#2	==>	#1	0.000	0.000	East Taylor Pond
Null	#3	==>	#2	0.000	0.000	Null Above East Taylor Pond
Channel	#4	==>	#3	0.000	0.000	Taylor Ditch 0+00 to 10+00
Null	#5	==>	#4	0.000	0.000	Null At Confluence of Taylor/East Taylor Null at Confluence Taylor/East Taylor
Channel	#6	==>	#5	0.000	0.000	Taylor Ditch 10+00 to 35+00
Null	#7	==>	#6	0.000	0.000	Null at Confluence of Taylor/Taylor Trib
Channel	#8	==>	#7	0.000	0.000	Taylor Ditch 35+00 to TD-1 Stockpond
Pond	#9	==>	#8	0.000	0.000	TD-1 Stockpond
Channel	#10	==>	#9	0.000	0.000	Taylor Ditch TD-1 to TD-2 Stockpond
Pond	#11	==>	#10	0.000	0.000	TD-2 Stockpond
Channel	#12	==>	#11	0.000	0.000	Taylor Ditch TD-2 Stockpond to 117+58
Channel	#13	==>	#5	0.000	0.000	East Taylor Ditch 0+00 to ETD-1
Pond	#14	==>	#13	0.000	0.000	ETD-1 Stock Pond
Channel	#15	==>	#14	0.000	0.000	East Taylor Ditch - Veg ETD-1 to 38+30
Channel	#16	==>	#15	0.000	0.000	East Taylor Ditch 38+30 to 73+40
Pond	#17	==>	#2	0.000	0.000	Simulated 250 GPM - East Taylor Seep
Channel	#18	==>	#7	0.000	0.000	Taylor Trib Ditch




#10
Chan'l
#9
Pond
#8
Chan'l
#7
Null
#6
Chan'l
#5
Null
#4
Chan'l
#3
Null
#2
Pond
#1
Null

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#17	In	5.000	5.000	4.86	0.39	0.9	3,094	1.76	0.94
	Out			0.56	0.39	0.2	659	0.02	0.01
#16		154.500	154.500	3.35	0.73	24.0	148,016	84.23	13.29
#15		100.200	254.700	3.35	1.06	24.1	148,016	84.20	9.17
#14	In	0.000	254.700	3.35	1.06	24.1	148,016	84.20	9.17
	Out			0.00	0.00	24.1	0	0.00	0.00
#13		84.900	339.600	1.13	0.35	24.8	11,109	8.82	1.10
#18		6.000	6.000	0.05	0.02	0.0	661	0.38	0.29
#12		319.800	319.800	19.27	2.23	149.0	160,099	91.22	26.80
#11	In	0.000	319.800	19.27	2.23	149.0	160,099	91.22	26.80
	Out			1.18	0.37	0.0	0	0.00	0.00
#10		123.000	442.800	1.53	0.77	0.3	660	0.36	0.14
#9	In	0.000	442.800	1.53	0.77	0.3	660	0.36	0.14
	Out			1.52	0.27	0.0	1	0.00	0.00
#8		21.600	464.400	1.57	0.33	0.0	654	0.37	0.05
#7		0.000	470.400	1.60	0.35	0.1	656	0.37	0.07
#6		82.000	552.400	1.79	0.58	0.2	581	0.32	0.13
#5		0.000	892.000	2.06	0.94	25.0	11,109	8.79	0.54
#4		145.900	1,037.900	5.20	1.68	35.1	43,953	31.95	3.48
#3		0.000	1,037.900	5.20	1.68	35.1	43,953	31.95	3.48
#2	In	10.900	1,053.800	5.76	2.10	35.4	39,813	28.78	2.83
	Out			0.82	1.87	0.3	155	0.00	0.00
#1		0.000	1,053.800	0.82	1.87	0.3	155	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #17 (Simulated 250 GPM - East Taylor Seep):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	73.000%	100.000%
0.0400	33.000%	100.000%
0.0010	20.000%	86.424%

Structure #16 (East Taylor Ditch 38+30 to 73+40):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.282%
0.0400	33.127%
0.0010	20.077%

Structure #15 (East Taylor Ditch - Veg ETD-1 to 38+30):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.351%
0.0400	33.159%
0.0010	20.096%

Structure #14 (ETD-1 Stock Pond):

Size (mm)	In	Out
4.7500	100.000%	0.000%
0.0750	73.351%	0.000%
0.0400	33.159%	0.000%
0.0010	20.096%	0.000%

Structure #13 (East Taylor Ditch 0+00 to ETD-1):

Size (mm)	In/Out
4.7500	2.701%
0.0750	2.060%
0.0400	0.931%
0.0010	0.564%

Structure #18 (Taylor Trib Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #12 (Taylor Ditch TD-2 Stockpond to 117+58):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.055%
0.0400	33.025%
0.0010	20.015%

Structure #11 (TD-2 Stockpond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	73.055%	100.000%
0.0400	33.025%	100.000%
0.0010	20.015%	100.000%

Structure #10 (Taylor Ditch TD-1 to TD-2 Stockpond):

Size (mm)	In/Out
4.7500	100.000%
0.0750	83.002%
0.0400	37.526%
0.0010	22.746%

Structure #9 (TD-1 Stockpond):

Size (mm)	In	Out
4.7500	100.000%	100.000%

Size (mm)	In	Out
0.0750	83.002%	100.000%
0.0400	37.526%	100.000%
0.0010	22.746%	100.000%

Structure #8 (Taylor Ditch 35+00 to TD-1 Stockpond):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.137%
0.0400	33.341%
0.0010	20.407%

Structure #7 (Null at Confluence of Taylor/Taylor Trib):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.096%
0.0400	33.239%
0.0010	20.285%

Structure #6 (Taylor Ditch 10+00 to 35+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	80.058%
0.0400	36.247%
0.0010	22.009%

Structure #5 (Null At Confluence of Taylor/East Taylor Null at Confluence Taylor/East Taylor):

Size (mm)	In/Out
4.7500	3.450%
0.0750	2.661%
0.0400	1.203%
0.0010	0.730%

Structure #4 (Taylor Ditch 0+00 to 10+00):

Size (mm)	In/Out
4.7500	31.413%

Size (mm)	In/Out
0.0750	23.190%
0.0400	10.483%
0.0010	6.354%

Structure #3 (Null Above East Taylor Pond):

Size (mm)	In/Out
4.7500	31.413%
0.0750	23.190%
0.0400	10.483%
0.0010	6.354%

Structure #2 (East Taylor Pond):

Size (mm)	In	Out
4.7500	31.879%	100.000%
0.0750	23.681%	100.000%
0.0400	11.015%	100.000%
0.0010	6.822%	100.000%

Structure #1:

Size (mm)	In/Out
4.7500	100.000%
0.0750	100.000%
0.0400	100.000%
0.0010	100.000%

Structure Detail:

Structure #17 (Pond)

Simulated 250 GPM - East Taylor Seep

Pond Inputs:

Initial Pool Elev:	90.01 ft
Initial Pool:	0.00 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Pond Results:

Peak Elevation:	92.05 ft
H'graph Detention Time:	2.21 hrs
Pond Model:	CSTRS
Dewater Time:	0.40 days
Trap Efficiency:	76.86 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
90.01	0.050	0.001	0.000		
91.00	0.051	0.050	0.560		
92.00	0.190	0.164	0.560		
92.05	0.161	0.174	0.560	9.70	Peak Stage
93.00	0.260	0.388	0.560		
94.00	0.350	0.692	0.560		
95.00	0.440	1.086	0.560		
96.00	0.540	1.575	0.560		
97.00	0.650	2.169	0.560		
98.00	0.760	2.873	0.560		
99.00	0.880	3.693	0.560		
100.00	1.200	4.728	0.560		
101.00	1.240	5.948	0.560		
102.00	1.414	7.275	0.560		
103.00	1.600	8.781	0.560		

Detailed Discharge Table

Elevation (ft)	User-input discharge (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.560	0.560
92.00	0.560	0.560
93.00	0.560	0.560
94.00	0.560	0.560
95.00	0.560	0.560
96.00	0.560	0.560
97.00	0.560	0.560
98.00	0.560	0.560
99.00	0.560	0.560
100.00	0.560	0.560
101.00	0.560	0.560
102.00	0.560	0.560
103.00	0.560	0.560

Structure #16 (Riprap Channel)

East Taylor Ditch 38+30 to 73+40

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	9.5			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.35 cfs	
Depth:	0.06 ft	
Top Width:	12.33 ft	
Velocity*:		
X-Section Area:	0.67 sq ft	
Hydraulic Radius:	0.055 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	

	w/o Freeboard	w/ Freeboard
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #15 (Vegetated Channel)

East Taylor Ditch - Veg ETD-1 to 38+30

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	1.8	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	3.35 cfs		3.35 cfs	
Depth:	0.28 ft		0.62 ft	
Top Width:	13.71 ft		15.74 ft	
Velocity:	0.91 fps		0.39 fps	
X-Section Area:	3.66 sq ft		8.66 sq ft	
Hydraulic Radius:	0.265 ft		0.543 ft	
Froude Number:	0.31		0.09	
Roughness Coefficient:	0.0899		0.3437	

Structure #14 (Pond)

ETD-1 Stock Pond

Pond Inputs:

Initial Pool Elev:	7,287.01 ft
Initial Pool:	0.01 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,289.00	30.00	2.00:1	2.00:1	32.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,291.00	20.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	7,288.52 ft
H'graph Detention Time:	0.00 hrs
Pond Model:	CSTRS
Dewater Time:	0.00 days
Trap Efficiency:	0.00 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,287.00	0.661	0.000	0.000		Top of Sed. Storage
7,287.01	0.661	0.006	0.000		
7,288.00	0.708	0.684	0.000		
7,288.52	0.734	1.066	0.000	0.00	Peak Stage
7,289.00	0.757	1.416	0.000		Spillway #1
7,290.00	0.758	2.174	68.938		
7,291.00	0.759	2.932	239.116		Spillway #2
7,292.00	0.760	3.692	525.594		
7,293.00	0.762	4.453	944.414		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,287.00	0.000	0.000	0.000
7,287.01	0.000	0.000	0.000
7,288.00	0.000	0.000	0.000
7,289.00	0.000	0.000	0.000
7,290.00	68.938	0.000	68.938
7,291.00	239.116	0.000	239.116
7,292.00	488.655	36.939	525.594
7,293.00	814.228	130.185	944.414

Structure #13 (Riprap Channel)

East Taylor Ditch 0+00 to ETD-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	11.8			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.13 cfs	
Depth:	0.03 ft	
Top Width:	12.19 ft	
Velocity*:		
X-Section Area:	0.39 sq ft	
Hydraulic Radius:	0.032 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #18 (Riprap Channel)

Taylor Trib Ditch

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	17.0			

Riprap Channel Results:

Simons/OSM Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.05 cfs	
Depth:	0.02 ft	
Top Width:	12.10 ft	

	w/o Freeboard	w/ Freeboard
Velocity:	0.23 fps	
X-Section Area:	0.19 sq ft	
Hydraulic Radius:	0.016 ft	
Froude Number:	0.33	
Manning's n:	0.0324	
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #12 (Riprap Channel)

Taylor Ditch TD-2 Stockpond to 117+58

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	9.8	3.67		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.27 cfs	
Depth:	0.17 ft	3.84 ft
Top Width:	13.05 ft	35.07 ft
Velocity*:		
X-Section Area:	2.19 sq ft	
Hydraulic Radius:	0.167 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #11 (Pond)

TD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	7,445.00 ft

Initial Pool:	0.09 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,454.00	30.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	7,454.03 ft
H'graph Detention Time:	6.71 hrs
Pond Model:	CSTRS
Dewater Time:	0.10 days
Trap Efficiency:	100.00 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,443.00	0.014	0.000	0.000		Top of Sed. Storage
7,444.00	0.050	0.030	0.000		
7,445.00	0.079	0.094	0.000		
7,446.00	0.106	0.186	0.000		
7,447.00	0.133	0.305	0.000		
7,448.00	0.161	0.452	0.000		
7,449.00	0.190	0.627	0.000		
7,450.00	0.219	0.831	0.000		
7,451.00	0.249	1.065	0.000		
7,452.00	0.280	1.329	0.000		
7,453.00	0.313	1.625	0.000		
7,454.00	0.348	1.955	0.000		Spillway #1
7,454.03	0.352	1.965	1.183	2.50	Peak Stage
7,455.00	0.389	2.324	43.900		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,443.00	0.000	0.000
7,444.00	0.000	0.000
7,445.00	0.000	0.000
7,446.00	0.000	0.000
7,447.00	0.000	0.000
7,448.00	0.000	0.000
7,449.00	0.000	0.000
7,450.00	0.000	0.000
7,451.00	0.000	0.000
7,452.00	0.000	0.000
7,453.00	0.000	0.000
7,454.00	0.000	0.000
7,455.00	43.900	43.900

Structure #10 (Riprap Channel)

Taylor Ditch TD-1 to TD-2 Stockpond

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	6.8			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.53 cfs	
Depth:	0.05 ft	
Top Width:	12.33 ft	
Velocity*:		
X-Section Area:	0.66 sq ft	
Hydraulic Radius:	0.053 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #9 (Pond)

TD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	7,283.01 ft
Initial Pool:	0.00 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,287.00	20.00	2.00:1	2.00:1	30.00

Pond Results:

Peak Elevation:	7,287.02 ft
H'graph Detention Time:	3.38 hrs
Pond Model:	CSTRS
Dewater Time:	0.10 days
Trap Efficiency:	99.93 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,283.00	0.001	0.000	0.000		Top of Sed. Storage
7,283.01	0.001	0.000	0.000		
7,284.00	0.059	0.023	0.000		
7,285.00	0.159	0.128	0.000		
7,286.00	0.182	0.298	0.000		
7,287.00	0.213	0.495	0.000		Spillway #1
7,287.02	0.215	0.500	1.524	2.50	Peak Stage
7,288.00	0.247	0.725	71.329		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,283.00	0.000	0.000
7,283.01	0.000	0.000
7,284.00	0.000	0.000
7,285.00	0.000	0.000
7,286.00	0.000	0.000
7,287.00	0.000	0.000
7,288.00	71.329	71.329

Structure #8 (Riprap Channel)

Taylor Ditch 35+00 to TD-1 Stockpond

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	10.7			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.57 cfs	
Depth:	0.04 ft	
Top Width:	12.22 ft	
Velocity*:		
X-Section Area:	0.45 sq ft	
Hydraulic Radius:	0.037 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Null)

Null at Confluence of Taylor/Taylor Trib

Structure #6 (Riprap Channel)

Taylor Ditch 10+00 to 35+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	7.1			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.79 cfs	
Depth:	0.06 ft	
Top Width:	12.33 ft	
Velocity*:		
X-Section Area:	0.67 sq ft	
Hydraulic Radius:	0.054 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Null)

Null At Confluence of Taylor/East Taylor Null at Confluence Taylor/East Taylor

Structure #4 (Riprap Channel)

Taylor Ditch 0+00 to 10+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	6.9			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.20 cfs	
Depth:	0.09 ft	

	w/o Freeboard	w/ Freeboard
Top Width:	12.52 ft	
Velocity*:		
X-Section Area:	1.07 sq ft	
Hydraulic Radius:	0.085 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Null)

Null Above East Taylor Pond

Structure #2 (Pond)

East Taylor Pond

Pond Inputs:

Initial Pool Elev:	6,944.00 ft
Initial Pool:	2.87 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
18.00	10.00	18.00	122.00	4.00	0.0150	6,952.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,954.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	6,947.03 ft
H'graph Detention Time:	11.93 hrs
Pond Model:	CSTRS
Dewater Time:	1.24 days
Trap Efficiency:	99.02 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,930.00	0.001	0.000	0.000		Top of Sed. Storage
6,931.00	0.036	0.014	0.000		
6,932.00	0.076	0.069	0.000		
6,933.00	0.110	0.161	0.000		
6,934.00	0.134	0.283	0.000		
6,935.00	0.156	0.428	0.000		
6,936.00	0.178	0.595	0.000		
6,937.00	0.201	0.785	0.000		
6,938.00	0.226	0.998	0.000		
6,939.00	0.252	1.237	0.000		
6,940.00	0.280	1.504	0.000		
6,941.00	0.310	1.799	0.000		
6,942.00	0.340	2.123	0.000		
6,943.00	0.373	2.480	0.000		
6,944.00	0.409	2.871	0.000		Low hole SPW #1
6,945.00	0.446	3.298	0.473	10.94*	
6,946.00	0.486	3.764	0.669	10.00	
6,947.00	0.527	4.270	0.819	8.40	
6,947.03	0.529	4.287	0.823	0.50	Peak Stage
6,948.00	0.571	4.819	0.945		
6,949.00	0.615	5.412	1.057		
6,950.00	0.660	6.049	1.158		
6,951.00	0.706	6.732	1.251		
6,952.00	0.754	7.462	1.337		Spillway #1
6,953.00	0.804	8.241	8.509		
6,954.00	0.857	9.072	12.033		Spillway #2
6,955.00	0.975	9.987	63.138		
6,956.00	1.033	10.991	184.415		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,930.00	0.000	0.000	0.000
6,931.00	0.000	0.000	0.000
6,932.00	0.000	0.000	0.000
6,933.00	0.000	0.000	0.000
6,934.00	0.000	0.000	0.000

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,935.00	0.000	0.000	0.000
6,936.00	0.000	0.000	0.000
6,937.00	0.000	0.000	0.000
6,938.00	0.000	0.000	0.000
6,939.00	0.000	0.000	0.000
6,940.00	0.000	0.000	0.000
6,941.00	0.000	0.000	0.000
6,942.00	0.000	0.000	0.000
6,943.00	0.000	0.000	0.000
6,944.00	3.00>0.000	0.000	0.000
6,945.00	0.473	0.000	0.473
6,946.00	0.669	0.000	0.669
6,947.00	0.819	0.000	0.819
6,948.00	0.945	0.000	0.945
6,949.00	1.057	0.000	1.057
6,950.00	1.158	0.000	1.158
6,951.00	1.251	0.000	1.251
6,952.00	1.337	0.000	1.337
6,953.00	8.509	0.000	8.509
6,954.00	12.033	0.000	12.033
6,955.00	14.738	48.400	63.138
6,956.00	17.018	167.398	184.415

Structure #1 (Null)

Null Below East Taylor Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#17	1	5.000	0.005	0.000	0.000	90.000	S	4.86	0.385
	Σ	**5.000**						**4.86**	**0.385**
#16	1	142.100	0.518	0.000	0.000	62.000	M	0.62	0.464
	2	6.500	0.024	0.000	0.000	80.000	F	3.35	0.241
	3	5.900	0.074	0.000	0.000	62.000	M	0.04	0.024
	Σ	**154.500**						**3.35**	**0.729**
#15	1	28.500	0.142	0.000	0.000	62.000	M	0.14	0.095
	2	71.700	0.230	0.000	0.000	62.000	M	0.34	0.236
	Σ	**254.700**						**3.35**	**1.060**
#14	Σ	**254.700**						**3.35**	**1.060**
#13	1	18.000	0.128	0.000	0.000	62.000	M	0.09	0.060
	2	64.700	0.349	0.000	0.000	62.000	M	0.30	0.212
	3	2.200	0.045	0.000	0.000	80.000	F	1.13	0.081
	Σ	**339.600**						**1.13**	**0.353**
#18	1	6.000	0.032	0.000	0.000	62.000	M	0.05	0.024
	Σ	**6.000**						**0.05**	**0.024**
#12	1	25.800	0.125	0.000	0.000	47.000	S	0.00	0.000
	2	242.800	0.593	0.000	0.000	62.000	M	1.04	0.794
	3	37.400	0.089	0.000	0.000	80.000	F	19.27	1.384
	4	13.800	0.089	0.000	0.000	62.000	M	0.10	0.056
	Σ	**319.800**						**19.27**	**2.234**
#11	Σ	**319.800**						**19.27**	**2.234**
#10	1	13.000	0.019	0.000	0.000	47.000	S	0.00	0.000
	2	43.900	0.100	0.000	0.000	62.000	M	0.33	0.179
	3	66.100	0.229	0.000	0.000	62.000	M	0.32	0.218
	Σ	**442.800**						**1.53**	**0.769**
#9	Σ	**442.800**						**1.53**	**0.769**
#8	1	7.500	0.044	0.000	0.000	47.000	S	0.00	0.000
	2	9.700	0.060	0.000	0.000	62.000	M	0.07	0.040
	3	4.400	0.048	0.000	0.000	62.000	M	0.03	0.018
	Σ	**464.400**						**1.57**	**0.330**
#7	Σ	**470.400**						**1.60**	**0.355**
#6	1	19.000	0.070	0.000	0.000	47.000	S	0.00	0.000

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	2	26.400	0.105	0.000	0.000	62.000	M	0.20	0.108
	3	36.600	0.184	0.000	0.000	62.000	M	0.18	0.121
	Σ	**552.400**						**1.79**	**0.584**
#5	Σ	**892.000**						**2.06**	**0.937**
#4	1	7.900	0.053	0.000	0.000	80.000	F	4.07	0.292
	2	126.900	0.386	0.000	0.000	62.000	M	0.58	0.414
	3	8.500	0.041	0.000	0.000	62.000	M	0.06	0.035
	4	2.600	0.019	0.000	0.000	47.000	S	0.00	0.000
	Σ	**1,037.900**						**5.20**	**1.679**
#3	Σ	**1,037.900**						**5.20**	**1.679**
#2	1	0.700	0.006	0.000	0.000	61.000	S	0.00	0.000
	2	1.100	0.015	0.000	0.000	61.000	S	0.00	0.000
	3	9.100	0.104	0.000	0.000	62.000	M	0.07	0.037
	Σ	**1,053.800**						**5.76**	**2.101**
#1	Σ	**1,053.800**						**0.82**	**1.866**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#17	1	0.300	10.00	1.00	0.8000	0.3800	1	0.9	3,094	1.76	0.94
	Σ							**0.9**	**3,094**	**1.76**	**0.94**
#16	1	0.300	400.00	12.00	0.0100	0.3800	1	0.3	463	0.23	0.20
	2	0.300	150.00	15.00	0.8000	0.3800	1	23.8	148,016	84.36	39.77
	3	0.300	200.00	5.00	0.0100	0.3800	1	0.0	83	0.05	0.04
	Σ							**24.0**	**148,016**	**84.23**	**13.29**
#15	1	0.300	400.00	8.40	0.0100	0.3800	1	0.0	210	0.11	0.09
	2	0.300	400.00	8.00	0.0100	0.3800	1	0.1	213	0.11	0.09
	Σ							**24.1**	**148,016**	**84.20**	**9.17**
#14	Σ							**24.1**	**148,016**	**84.20**	**9.17**
#13	1	0.300	400.00	12.00	0.0100	0.3800	1	0.0	396	0.20	0.17
	2	0.300	400.00	10.00	0.0100	0.3800	1	0.1	290	0.14	0.12
	3	0.300	100.00	2.00	0.8000	0.3800	1	0.6	11,109	6.33	2.93
	Σ							**24.8**	**11,109**	**8.82**	**1.10**
#18	1	0.300	200.00	26.00	0.0100	0.3800	1	0.0	661	0.38	0.29

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**0.0**	**661**	**0.38**	**0.29**
#12	1	0.300	400.00	13.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	10.00	0.0100	0.3800	1	0.3	320	0.15	0.14
	3	0.300	400.00	10.00	0.8000	0.3800	1	148.7	160,099	91.25	43.09
	4	0.300	200.00	4.50	0.0100	0.3800	1	0.0	83	0.05	0.04
	Σ							**149.0**	**160,099**	**91.22**	**26.80**
#11	Σ							**149.0**	**160,099**	**91.22**	**26.80**
#10	1	0.300	100.00	20.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	17.00	0.0100	0.3800	1	0.1	786	0.45	0.34
	3	0.300	400.00	13.00	0.0100	0.3800	1	0.1	506	0.25	0.22
	Σ							**0.3**	**660**	**0.36**	**0.14**
#9	Σ							**0.3**	**660**	**0.36**	**0.14**
#8	1	0.300	200.00	21.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	250.00	24.00	0.0100	0.3800	1	0.0	734	0.42	0.32
	3	0.300	200.00	20.00	0.0100	0.3800	1	0.0	477	0.27	0.21
	Σ							**0.0**	**654**	**0.37**	**0.05**
#7	Σ							**0.1**	**656**	**0.37**	**0.07**
#6	1	0.300	400.00	18.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	15.00	0.0100	0.3800	1	0.1	634	0.36	0.27
	3	0.300	400.00	13.00	0.0100	0.3800	1	0.1	477	0.24	0.20
	Σ							**0.2**	**581**	**0.32**	**0.13**
#5	Σ							**25.0**	**11,109**	**8.79**	**0.54**
#4	1	0.300	200.00	6.00	0.8000	0.3800	1	9.9	52,945	30.18	14.03
	2	0.300	400.00	12.00	0.0100	0.3800	1	0.2	477	0.24	0.20
	3	0.300	200.00	19.00	0.0100	0.3800	1	0.0	486	0.28	0.21
	4	0.300	100.00	20.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**35.1**	**43,953**	**31.95**	**3.48**
#3	Σ							**35.1**	**43,953**	**31.95**	**3.48**
#2	1	0.300	50.00	40.00	0.0800	0.9000	1	0.0	1	0.00	0.00
	2	0.300	100.00	48.00	0.0800	0.9000	1	0.0	1	0.00	0.00
	3	0.300	400.00	26.00	0.0100	0.3800	1	0.0	1,053	0.60	0.46
	Σ							**35.4**	**39,813**	**28.78**	**2.83**
#1	Σ							**0.3**	**155**	**0.00**	**0.00**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	40.00	48.80	122.00	5.050	0.006
#2	**1**	**Time of Concentration:**					**0.006**
#2	2	3. Short grass pasture	48.00	150.23	313.00	5.540	0.015
#2	**2**	**Time of Concentration:**					**0.015**
#2	3	3. Short grass pasture	26.00	397.02	1,527.00	4.070	0.104
#2	**3**	**Time of Concentration:**					**0.104**
#4	1	4. Cultivated, straight row	6.00	25.38	423.00	2.180	0.053
#4	**1**	**Time of Concentration:**					**0.053**
#4	2	3. Short grass pasture	12.00	462.24	3,852.00	2.770	0.386
#4	**2**	**Time of Concentration:**					**0.386**
#4	3	3. Short grass pasture	19.00	99.37	523.00	3.480	0.041
#4	**3**	**Time of Concentration:**					**0.041**
#4	4	3. Short grass pasture	20.00	50.40	252.00	3.570	0.019
#4	**4**	**Time of Concentration:**					**0.019**
#6	1	3. Short grass pasture	18.00	154.08	856.00	3.390	0.070
#6	**1**	**Time of Concentration:**					**0.070**
#6	2	3. Short grass pasture	15.00	175.35	1,169.00	3.090	0.105
#6	**2**	**Time of Concentration:**					**0.105**
#6	3	3. Short grass pasture	13.00	248.04	1,908.00	2.880	0.184
#6	**3**	**Time of Concentration:**					**0.184**
#8	1	3. Short grass pasture	21.00	122.64	584.00	3.660	0.044
#8	**1**	**Time of Concentration:**					**0.044**
#8	2	3. Short grass pasture	24.00	204.48	852.00	3.910	0.060
#8	**2**	**Time of Concentration:**					**0.060**
#8	3	3. Short grass pasture	20.00	125.80	629.00	3.570	0.048
#8	**3**	**Time of Concentration:**					**0.048**
#10	1	3. Short grass pasture	20.00	49.80	249.00	3.570	0.019
#10	**1**	**Time of Concentration:**					**0.019**
#10	2	3. Short grass pasture	17.00	202.98	1,194.00	3.290	0.100
#10	**2**	**Time of Concentration:**					**0.100**
#10	3	3. Short grass pasture	13.00	309.91	2,384.00	2.880	0.229
#10	**3**	**Time of Concentration:**					**0.229**
#12	1	3. Short grass pasture	9.00	97.38	1,082.00	2.400	0.125
#12	**1**	**Time of Concentration:**					**0.125**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	10.00	102.10	1,021.00	3.160	0.089
#12	**3**	**Time of Concentration:**					**0.089**
#12	4	3. Short grass pasture	5.00	28.60	572.00	1.780	0.089
#12	**4**	**Time of Concentration:**					**0.089**
#13	1	3. Short grass pasture	12.00	153.59	1,280.00	2.770	0.128
#13	**1**	**Time of Concentration:**					**0.128**
#13	2	3. Short grass pasture	10.00	317.10	3,171.00	2.520	0.349

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	**2**	**Time of Concentration:**					**0.349**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	2.00	4.64	232.00	1.410	0.045
#13	**3**	**Time of Concentration:**					**0.045**
#15	1	3. Short grass pasture	8.40	99.62	1,186.00	2.310	0.142
#15	**1**	**Time of Concentration:**					**0.142**
#15	2	3. Short grass pasture	8.00	150.23	1,878.00	2.260	0.230
#15	**2**	**Time of Concentration:**					**0.230**
#16	1	3. Short grass pasture	12.00	620.64	5,172.00	2.770	0.518
#16	**1**	**Time of Concentration:**					**0.518**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	15.00	51.15	341.00	3.870	0.024
#16	**2**	**Time of Concentration:**					**0.024**
#16	3	3. Short grass pasture	5.00	23.85	477.00	1.780	0.074
#16	**3**	**Time of Concentration:**					**0.074**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	25.00	25.00	100.00	5.000	0.005
#17	**1**	**Time of Concentration:**					**0.005**
#18	1	3. Short grass pasture	26.00	124.53	479.00	4.070	0.032
#18	**1**	**Time of Concentration:**					**0.032**

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East Taylor Pond
25 Year - 24 Hour Storm Event

Emergency Spillway Demonstration

Post Mining

Tony Tennyson

Tri-State Generation & Transmission Assoication, Inc.
1100 West 116th Avenue
Westminster, CO 80234

Phone: (970) 824-1232
Email: ttennyson@tristategt.org

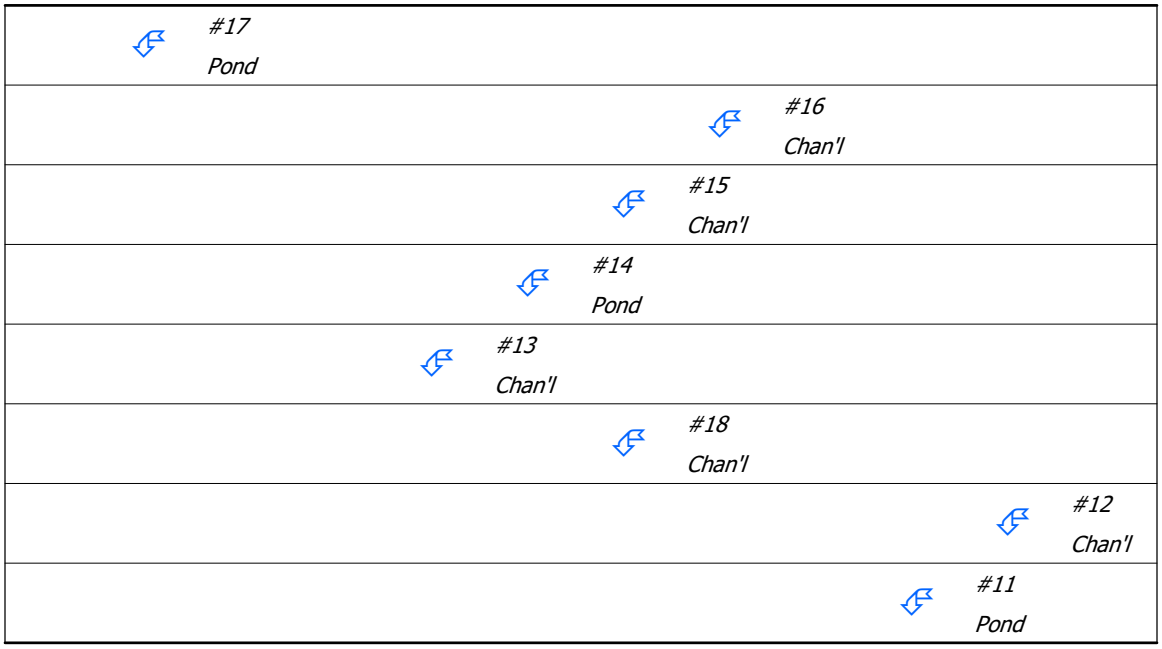
General Information

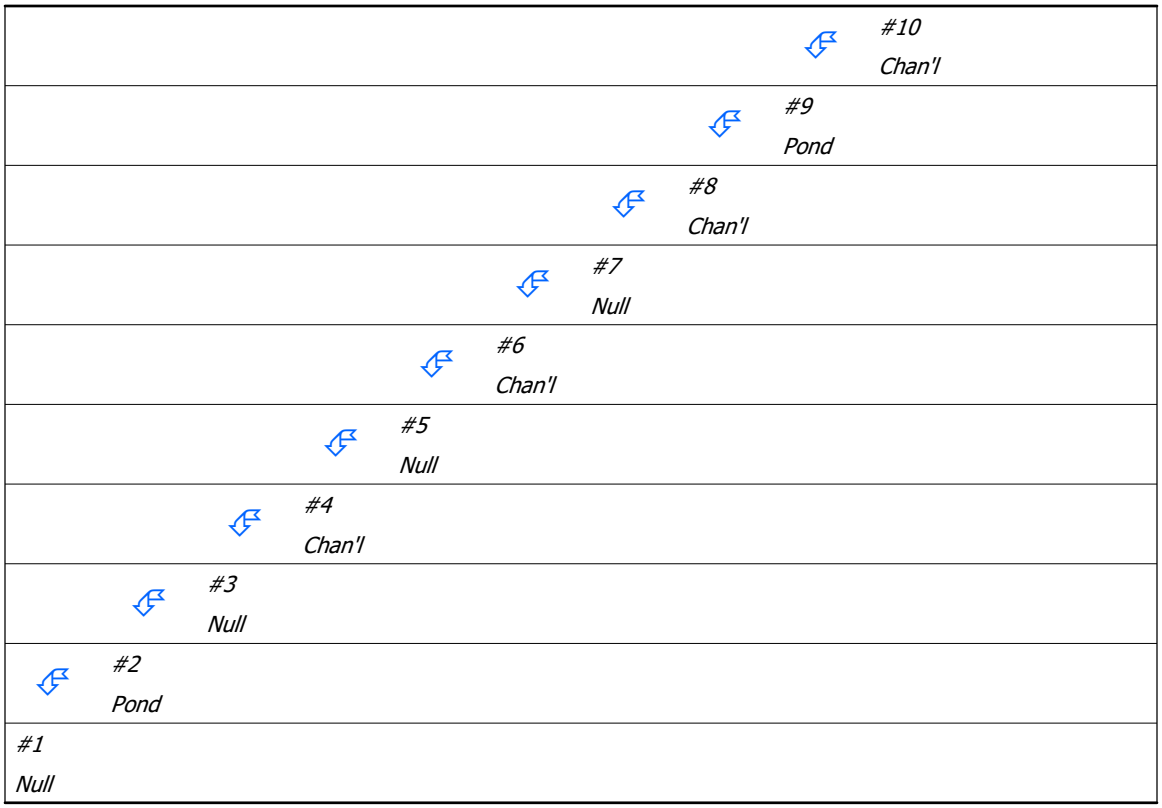
Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below East Taylor Pond
Pond	#2	==>	#1	0.000	0.000	East Taylor Pond
Null	#3	==>	#2	0.000	0.000	Null Above East Taylor Pond
Channel	#4	==>	#3	0.000	0.000	Taylor Ditch 0+00 to 10+00
Null	#5	==>	#4	0.000	0.000	Null At Confluence of Taylor/East Taylor Null at Confluence Taylor/East Taylor
Channel	#6	==>	#5	0.000	0.000	Taylor Ditch 10+00 to 35+00
Null	#7	==>	#6	0.000	0.000	Null at Confluence of Taylor/Taylor Trib
Channel	#8	==>	#7	0.000	0.000	Taylor Ditch 35+00 to TD-1 Stockpond
Pond	#9	==>	#8	0.000	0.000	TD-1 Stockpond
Channel	#10	==>	#9	0.000	0.000	Taylor Ditch TD-1 to TD-2 Stockpond
Pond	#11	==>	#10	0.000	0.000	TD-2 Stockpond
Channel	#12	==>	#11	0.000	0.000	Taylor Ditch TD-2 Stockpond to 117+58
Channel	#13	==>	#5	0.000	0.000	East Taylor Ditch 0+00 to ETD-1
Pond	#14	==>	#13	0.000	0.000	ETD-1 Stock Pond
Channel	#15	==>	#14	0.000	0.000	East Taylor Ditch - Veg ETD-1 to 38+30
Channel	#16	==>	#15	0.000	0.000	East Taylor Ditch 38+30 to 73+40
Pond	#17	==>	#2	0.000	0.000	Simulated 250 GPM - East Taylor Seep
Channel	#18	==>	#7	0.000	0.000	Taylor Trib Ditch




#10
Chan'l
#9
Pond
#8
Chan'l
#7
Null
#6
Chan'l
#5
Null
#4
Chan'l
#3
Null
#2
Pond
#1
Null

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#17	In	5.000	5.000	6.87	0.56
	Out			0.56	0.56
#16		154.500	154.500	6.62	2.00
#15		100.200	254.700	8.73	3.08
#14	In	0.000	254.700	8.73	3.08
	Out			3.24	1.67
#13		84.900	339.600	4.31	2.69
#18		6.000	6.000	0.83	0.08
#12		319.800	319.800	34.12	5.11
#11	In	0.000	319.800	34.12	5.11
	Out			7.68	3.25
#10		123.000	442.800	9.77	4.55
#9	In	0.000	442.800	9.77	4.55
	Out			9.71	4.05
#8		21.600	464.400	10.01	4.24
#7		0.000	470.400	10.14	4.32
#6		82.000	552.400	11.34	5.06
#5		0.000	892.000	13.00	7.75
#4		145.900	1,037.900	17.22	9.71
#3		0.000	1,037.900	17.22	9.71
#2	In	10.900	1,053.800	19.23	10.41
	Out			8.52	8.08
#1		0.000	1,053.800	8.52	8.08

Structure Detail:

Structure #17 (Pond)

Simulated 250 GPM - East Taylor Seep

Pond Inputs:

Initial Pool Elev:	90.01 ft
Initial Pool:	0.00 ac-ft

Pond Results:

Peak Elevation:	92.54 ft
Dewater Time:	0.26 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
90.01	0.050	0.001	0.000		
91.00	0.051	0.050	0.560		
92.00	0.190	0.164	0.560		
92.54	0.212	0.285	0.560	6.20	Peak Stage
93.00	0.260	0.388	0.560		
94.00	0.350	0.692	0.560		
95.00	0.440	1.086	0.560		
96.00	0.540	1.575	0.560		
97.00	0.650	2.169	0.560		
98.00	0.760	2.873	0.560		
99.00	0.880	3.693	0.560		
100.00	1.200	4.728	0.560		
101.00	1.240	5.948	0.560		
102.00	1.414	7.275	0.560		
103.00	1.600	8.781	0.560		

Detailed Discharge Table

Elevation (ft)	User-input discharge (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.560	0.560
92.00	0.560	0.560
93.00	0.560	0.560
94.00	0.560	0.560
95.00	0.560	0.560
96.00	0.560	0.560
97.00	0.560	0.560
98.00	0.560	0.560
99.00	0.560	0.560
100.00	0.560	0.560
101.00	0.560	0.560
102.00	0.560	0.560
103.00	0.560	0.560

Structure #16 (Riprap Channel)

East Taylor Ditch 38+30 to 73+40

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	9.5			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.62 cfs	
Depth:	0.08 ft	
Top Width:	12.49 ft	
Velocity*:		
X-Section Area:	1.00 sq ft	
Hydraulic Radius:	0.080 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #15 (Vegetated Channel)

East Taylor Ditch - Veg ETD-1 to 38+30

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	1.8	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	8.73 cfs		8.73 cfs	
Depth:	0.43 ft		0.83 ft	
Top Width:	14.56 ft		16.98 ft	
Velocity:	1.54 fps		0.73 fps	
X-Section Area:	5.66 sq ft		12.03 sq ft	
Hydraulic Radius:	0.385 ft		0.697 ft	
Froude Number:	0.44		0.15	
Roughness Coefficient:	0.0684		0.2163	

Structure #14 (Pond)

ETD-1 Stock Pond

Pond Inputs:

Initial Pool Elev:	7,287.01 ft
Initial Pool:	0.01 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,289.00	30.00	2.00:1	2.00:1	32.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,291.00	20.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	7,289.05 ft
Dewater Time:	0.46 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,287.00	0.661	0.000	0.000		
7,287.01	0.661	0.006	0.000		
7,288.00	0.708	0.684	0.000		
7,289.00	0.757	1.416	0.000		Spillway #1
7,289.05	0.734	1.452	3.239	11.05	Peak Stage
7,290.00	0.758	2.174	68.938		
7,291.00	0.759	2.932	239.116		Spillway #2
7,292.00	0.760	3.692	525.594		
7,293.00	0.762	4.453	944.414		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,287.00	0.000	0.000	0.000
7,287.01	0.000	0.000	0.000
7,288.00	0.000	0.000	0.000
7,289.00	0.000	0.000	0.000
7,290.00	68.938	0.000	68.938
7,291.00	239.116	0.000	239.116
7,292.00	488.655	36.939	525.594
7,293.00	814.228	130.185	944.414

Structure #13 (Riprap Channel)

East Taylor Ditch 0+00 to ETD-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	11.8			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.31 cfs	
Depth:	0.06 ft	
Top Width:	12.34 ft	
Velocity*:		
X-Section Area:	0.68 sq ft	
Hydraulic Radius:	0.055 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #18 (Riprap Channel)

Taylor Trib Ditch

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	17.0			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.83 cfs	
Depth:	0.02 ft	
Top Width:	12.13 ft	
Velocity*:		
X-Section Area:	0.26 sq ft	
Hydraulic Radius:	0.021 ft	
Froude Number*:		
Manning's n*:		

	w/o Freeboard	w/ Freeboard
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #12 (Riprap Channel)

Taylor Ditch TD-2 Stockpond to 117+58

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	9.8	3.67		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	34.12 cfs	
Depth:	0.28 ft	3.95 ft
Top Width:	13.67 ft	35.69 ft
Velocity*:		
X-Section Area:	3.58 sq ft	
Hydraulic Radius:	0.260 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #11 (Pond)

TD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	7,445.00 ft
Initial Pool:	0.09 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,454.00	30.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	7,454.17 ft
Dewater Time:	0.55 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,443.00	0.014	0.000	0.000		
7,444.00	0.050	0.030	0.000		
7,445.00	0.079	0.094	0.000		
7,446.00	0.106	0.186	0.000		
7,447.00	0.133	0.305	0.000		
7,448.00	0.161	0.452	0.000		
7,449.00	0.190	0.627	0.000		
7,450.00	0.219	0.831	0.000		
7,451.00	0.249	1.065	0.000		
7,452.00	0.280	1.329	0.000		
7,453.00	0.313	1.625	0.000		
7,454.00	0.348	1.955	0.000		Spillway #1
7,454.17	0.357	2.020	7.679	13.10	Peak Stage
7,455.00	0.389	2.324	43.900		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,443.00	0.000	0.000
7,444.00	0.000	0.000
7,445.00	0.000	0.000
7,446.00	0.000	0.000
7,447.00	0.000	0.000
7,448.00	0.000	0.000
7,449.00	0.000	0.000
7,450.00	0.000	0.000
7,451.00	0.000	0.000

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,452.00	0.000	0.000
7,453.00	0.000	0.000
7,454.00	0.000	0.000
7,455.00	43.900	43.900

Structure #10 (Riprap Channel)

Taylor Ditch TD-1 to TD-2 Stockpond

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	6.8			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.77 cfs	
Depth:	0.13 ft	
Top Width:	12.77 ft	
Velocity*:		
X-Section Area:	1.59 sq ft	
Hydraulic Radius:	0.124 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #9 (Pond)

TD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	7,283.01 ft
Initial Pool:	0.00 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,287.00	20.00	2.00:1	2.00:1	30.00

Pond Results:

Peak Elevation:	7,287.14 ft
Dewater Time:	0.55 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,283.00	0.001	0.000	0.000		
7,283.01	0.001	0.000	0.000		
7,284.00	0.059	0.023	0.000		
7,285.00	0.159	0.128	0.000		
7,286.00	0.182	0.298	0.000		
7,287.00	0.213	0.495	0.000		Spillway #1
7,287.14	0.219	0.527	9.706	13.10	Peak Stage
7,288.00	0.247	0.725	71.329		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,283.00	0.000	0.000
7,283.01	0.000	0.000
7,284.00	0.000	0.000
7,285.00	0.000	0.000
7,286.00	0.000	0.000
7,287.00	0.000	0.000
7,288.00	71.329	71.329

Structure #8 (Riprap Channel)

Taylor Ditch 35+00 to TD-1 Stockpond

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	10.7			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.01 cfs	
Depth:	0.10 ft	
Top Width:	12.61 ft	
Velocity*:		
X-Section Area:	1.25 sq ft	
Hydraulic Radius:	0.099 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Null)

Null at Confluence of Taylor/Taylor Trib

Structure #6 (Riprap Channel)

Taylor Ditch 10+00 to 35+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	7.1			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.34 cfs	
Depth:	0.14 ft	
Top Width:	12.84 ft	
Velocity*:		
X-Section Area:	1.73 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.134 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Null)

Null At Confluence of Taylor/East Taylor Null at Confluence Taylor/East Taylor

Structure #4 (Riprap Channel)

Taylor Ditch 0+00 to 10+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	6.9			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	17.22 cfs	
Depth:	0.19 ft	
Top Width:	13.14 ft	
Velocity*:		
X-Section Area:	2.40 sq ft	
Hydraulic Radius:	0.182 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Null)

Null Above East Taylor Pond

Structure #2 (Pond)

East Taylor Pond

Pond Inputs:

Initial Pool Elev:	6,944.00 ft
Initial Pool:	2.87 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
18.00	10.00	18.00	122.00	4.00	0.0150	6,952.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,954.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	6,953.00 ft
Dewater Time:	2.87 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,930.00	0.001	0.000	0.000		
6,931.00	0.036	0.014	0.000		
6,932.00	0.076	0.069	0.000		
6,933.00	0.110	0.161	0.000		
6,934.00	0.134	0.283	0.000		
6,935.00	0.156	0.428	0.000		
6,936.00	0.178	0.595	0.000		
6,937.00	0.201	0.785	0.000		
6,938.00	0.226	0.998	0.000		
6,939.00	0.252	1.237	0.000		
6,940.00	0.280	1.504	0.000		
6,941.00	0.310	1.799	0.000		
6,942.00	0.340	2.123	0.000		
6,943.00	0.373	2.480	0.000		
6,944.00	0.409	2.871	0.000		Low hole SPW #1
6,945.00	0.446	3.298	0.473	10.94*	
6,946.00	0.486	3.764	0.669	8.43*	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,947.00	0.527	4.270	0.819	7.48*	
6,948.00	0.571	4.819	0.945	7.02*	
6,949.00	0.615	5.412	1.057	6.78*	
6,950.00	0.660	6.049	1.158	7.00	
6,951.00	0.706	6.732	1.251	6.85	
6,952.00	0.754	7.462	1.337	6.85	Spillway #1
6,953.00	0.804	8.241	8.509	7.30	
6,953.00	0.806	8.244	8.519	0.20	Peak Stage
6,954.00	0.857	9.072	12.033		Spillway #2
6,955.00	0.975	9.987	63.138		
6,956.00	1.033	10.991	184.415		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,930.00	0.000	0.000	0.000
6,931.00	0.000	0.000	0.000
6,932.00	0.000	0.000	0.000
6,933.00	0.000	0.000	0.000
6,934.00	0.000	0.000	0.000
6,935.00	0.000	0.000	0.000
6,936.00	0.000	0.000	0.000
6,937.00	0.000	0.000	0.000
6,938.00	0.000	0.000	0.000
6,939.00	0.000	0.000	0.000
6,940.00	0.000	0.000	0.000
6,941.00	0.000	0.000	0.000
6,942.00	0.000	0.000	0.000
6,943.00	0.000	0.000	0.000
6,944.00	3.00>0.000	0.000	0.000
6,945.00	0.473	0.000	0.473
6,946.00	0.669	0.000	0.669
6,947.00	0.819	0.000	0.819
6,948.00	0.945	0.000	0.945
6,949.00	1.057	0.000	1.057
6,950.00	1.158	0.000	1.158
6,951.00	1.251	0.000	1.251
6,952.00	1.337	0.000	1.337

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,953.00	8.509	0.000	8.509
6,954.00	12.033	0.000	12.033
6,955.00	14.738	48.400	63.138
6,956.00	17.018	167.398	184.415

Structure #1 (Null)

Null Below East Taylor Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#17	1	5.000	0.005	0.000	0.000	90.000	S	6.87	0.563
	Σ	**5.000**						**6.87**	**0.563**
#16	1	142.100	0.518	0.000	0.000	62.000	M	4.23	1.513
	2	6.500	0.024	0.000	0.000	80.000	F	5.54	0.408
	3	5.900	0.074	0.000	0.000	62.000	M	0.81	0.079
	Σ	**154.500**						**6.62**	**1.999**
#15	1	28.500	0.142	0.000	0.000	62.000	M	1.52	0.309
	2	71.700	0.230	0.000	0.000	62.000	M	3.20	0.769
	Σ	**254.700**						**8.73**	**3.078**
#14	Σ	**254.700**						**8.73**	**3.078**
#13	1	18.000	0.128	0.000	0.000	62.000	M	0.96	0.195
	2	64.700	0.349	0.000	0.000	62.000	M	2.26	0.691
	3	2.200	0.045	0.000	0.000	80.000	F	1.88	0.138
	Σ	**339.600**						**4.31**	**2.691**
#18	1	6.000	0.032	0.000	0.000	62.000	M	0.83	0.080
	Σ	**6.000**						**0.83**	**0.080**
#12	1	25.800	0.125	0.000	0.000	47.000	S	0.00	0.000
	2	242.800	0.593	0.000	0.000	62.000	M	6.98	2.585
	3	37.400	0.089	0.000	0.000	80.000	F	31.90	2.345
	4	13.800	0.089	0.000	0.000	62.000	M	1.91	0.184
	Σ	**319.800**						**34.12**	**5.114**
#11	Σ	**319.800**						**34.12**	**5.114**
#10	1	13.000	0.019	0.000	0.000	47.000	S	0.00	0.000
	2	43.900	0.100	0.000	0.000	62.000	M	6.06	0.585
	3	66.100	0.229	0.000	0.000	62.000	M	2.95	0.709
	Σ	**442.800**						**9.77**	**4.546**
#9	Σ	**442.800**						**9.77**	**4.546**
#8	1	7.500	0.044	0.000	0.000	47.000	S	0.00	0.000
	2	9.700	0.060	0.000	0.000	62.000	M	1.34	0.129
	3	4.400	0.048	0.000	0.000	62.000	M	0.61	0.059
	Σ	**464.400**						**10.01**	**4.238**
#7	Σ	**470.400**						**10.14**	**4.317**
#6	1	19.000	0.070	0.000	0.000	47.000	S	0.00	0.000

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	2	26.400	0.105	0.000	0.000	62.000	M	3.65	0.352
	3	36.600	0.184	0.000	0.000	62.000	M	1.85	0.394
	Σ	**552.400**						**11.34**	**5.063**
#5	Σ	**892.000**						**13.00**	**7.755**
#4	1	7.900	0.053	0.000	0.000	80.000	F	6.74	0.495
	2	126.900	0.386	0.000	0.000	62.000	M	4.18	1.350
	3	8.500	0.041	0.000	0.000	62.000	M	1.17	0.113
	4	2.600	0.019	0.000	0.000	47.000	S	0.00	0.000
	Σ	**1,037.900**						**17.22**	**9.713**
#3	Σ	**1,037.900**						**17.22**	**9.713**
#2	1	0.700	0.006	0.000	0.000	61.000	S	0.07	0.003
	2	1.100	0.015	0.000	0.000	61.000	S	0.12	0.009
	3	9.100	0.104	0.000	0.000	62.000	M	1.26	0.121
	Σ	**1,053.800**						**19.23**	**10.410**
#1	Σ	**1,053.800**						**8.52**	**8.085**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	40.00	48.80	122.00	5.050	0.006
#2	**1**	**Time of Concentration:**					**0.006**
#2	2	3. Short grass pasture	48.00	150.23	313.00	5.540	0.015
#2	**2**	**Time of Concentration:**					**0.015**
#2	3	3. Short grass pasture	26.00	397.02	1,527.00	4.070	0.104
#2	**3**	**Time of Concentration:**					**0.104**
#4	1	4. Cultivated, straight row	6.00	25.38	423.00	2.180	0.053
#4	**1**	**Time of Concentration:**					**0.053**
#4	2	3. Short grass pasture	12.00	462.24	3,852.00	2.770	0.386
#4	**2**	**Time of Concentration:**					**0.386**
#4	3	3. Short grass pasture	19.00	99.37	523.00	3.480	0.041
#4	**3**	**Time of Concentration:**					**0.041**
#4	4	3. Short grass pasture	20.00	50.40	252.00	3.570	0.019
#4	**4**	**Time of Concentration:**					**0.019**
#6	1	3. Short grass pasture	18.00	154.08	856.00	3.390	0.070
#6	**1**	**Time of Concentration:**					**0.070**
#6	2	3. Short grass pasture	15.00	175.35	1,169.00	3.090	0.105
#6	**2**	**Time of Concentration:**					**0.105**
#6	3	3. Short grass pasture	13.00	248.04	1,908.00	2.880	0.184
#6	**3**	**Time of Concentration:**					**0.184**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#8	1	3. Short grass pasture	21.00	122.64	584.00	3.660	0.044
#8	**1**	**Time of Concentration:**					**0.044**
#8	2	3. Short grass pasture	24.00	204.48	852.00	3.910	0.060
#8	**2**	**Time of Concentration:**					**0.060**
#8	3	3. Short grass pasture	20.00	125.80	629.00	3.570	0.048
#8	**3**	**Time of Concentration:**					**0.048**
#10	1	3. Short grass pasture	20.00	49.80	249.00	3.570	0.019
#10	**1**	**Time of Concentration:**					**0.019**
#10	2	3. Short grass pasture	17.00	202.98	1,194.00	3.290	0.100
#10	**2**	**Time of Concentration:**					**0.100**
#10	3	3. Short grass pasture	13.00	309.91	2,384.00	2.880	0.229
#10	**3**	**Time of Concentration:**					**0.229**
#12	1	3. Short grass pasture	9.00	97.38	1,082.00	2.400	0.125
#12	**1**	**Time of Concentration:**					**0.125**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	10.00	102.10	1,021.00	3.160	0.089
#12	**3**	**Time of Concentration:**					**0.089**
#12	4	3. Short grass pasture	5.00	28.60	572.00	1.780	0.089
#12	**4**	**Time of Concentration:**					**0.089**
#13	1	3. Short grass pasture	12.00	153.59	1,280.00	2.770	0.128
#13	**1**	**Time of Concentration:**					**0.128**
#13	2	3. Short grass pasture	10.00	317.10	3,171.00	2.520	0.349
#13	**2**	**Time of Concentration:**					**0.349**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	2.00	4.64	232.00	1.410	0.045
#13	**3**	**Time of Concentration:**					**0.045**
#15	1	3. Short grass pasture	8.40	99.62	1,186.00	2.310	0.142
#15	**1**	**Time of Concentration:**					**0.142**
#15	2	3. Short grass pasture	8.00	150.23	1,878.00	2.260	0.230
#15	**2**	**Time of Concentration:**					**0.230**
#16	1	3. Short grass pasture	12.00	620.64	5,172.00	2.770	0.518
#16	**1**	**Time of Concentration:**					**0.518**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	15.00	51.15	341.00	3.870	0.024
#16	**2**	**Time of Concentration:**					**0.024**
#16	3	3. Short grass pasture	5.00	23.85	477.00	1.780	0.074
#16	**3**	**Time of Concentration:**					**0.074**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	25.00	25.00	100.00	5.000	0.005
#17	**1**	**Time of Concentration:**					**0.005**
#18	1	3. Short grass pasture	26.00	124.53	479.00	4.070	0.032
#18	**1**	**Time of Concentration:**					**0.032**

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Taylor Ditch
100 Year - 24 Hour Storm Event

Ditch Size Demonstration

Post Mining

Tony Tennyson

Tri-State Generation & Transmission Assoication, Inc.
1100 West 116th Avenue
Westminster, CO 80234

Phone: (970) 824-1232
Email: ttennyson@tristategt.org

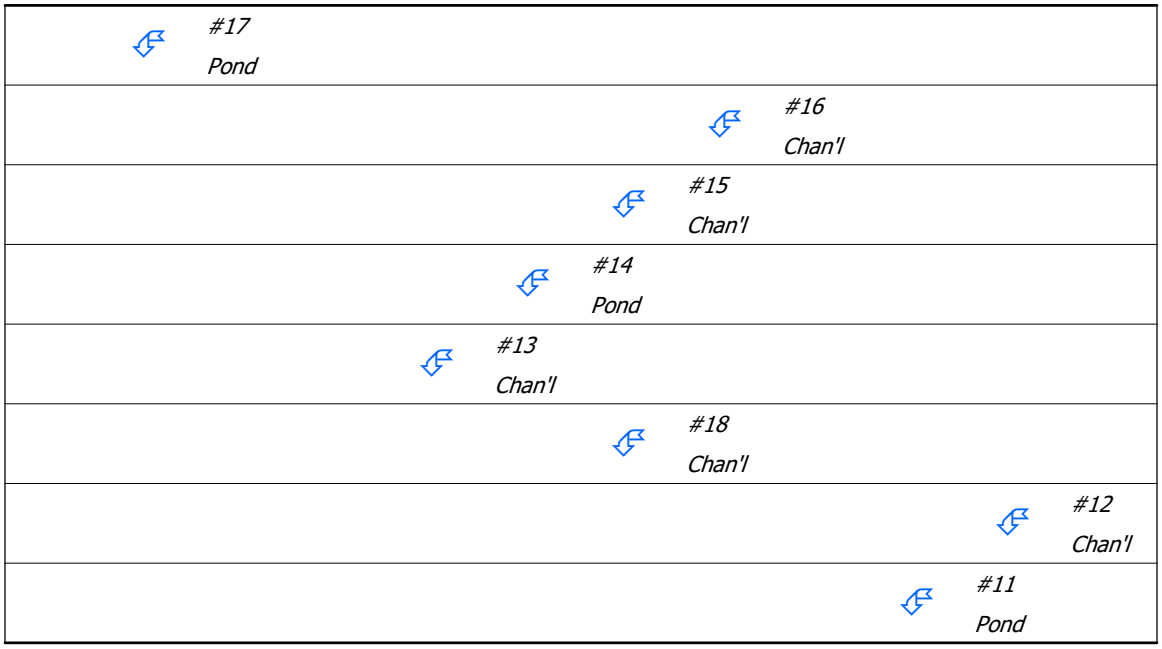
General Information

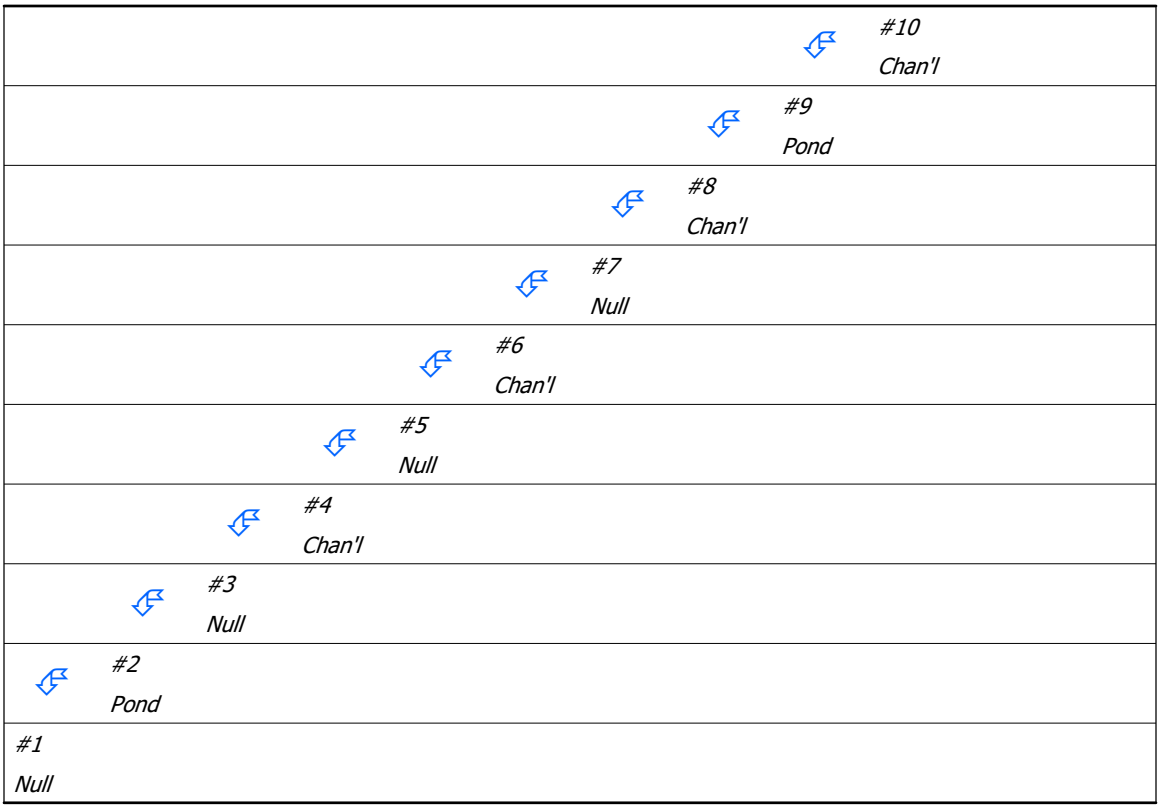
Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	2.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below East Taylor Pond
Pond	#2	==>	#1	0.000	0.000	East Taylor Pond
Null	#3	==>	#2	0.000	0.000	Null Above East Taylor Pond
Channel	#4	==>	#3	0.000	0.000	Taylor Ditch 0+00 to 10+00
Null	#5	==>	#4	0.000	0.000	Null At Confluence of Taylor/East Taylor Null at Confluence Taylor/East Taylor
Channel	#6	==>	#5	0.000	0.000	Taylor Ditch 10+00 to 35+00
Null	#7	==>	#6	0.000	0.000	Null at Confluence of Taylor/Taylor Trib
Channel	#8	==>	#7	0.000	0.000	Taylor Ditch 35+00 to TD-1 Stockpond
Pond	#9	==>	#8	0.000	0.000	TD-1 Stockpond
Channel	#10	==>	#9	0.000	0.000	Taylor Ditch TD-1 to TD-2 Stockpond
Pond	#11	==>	#10	0.000	0.000	TD-2 Stockpond
Channel	#12	==>	#11	0.000	0.000	Taylor Ditch TD-2 Stockpond to 117+58
Channel	#13	==>	#5	0.000	0.000	East Taylor Ditch 0+00 to ETD-1
Pond	#14	==>	#13	0.000	0.000	ETD-1 Stock Pond
Channel	#15	==>	#14	0.000	0.000	East Taylor Ditch - Veg ETD-1 to 38+30
Channel	#16	==>	#15	0.000	0.000	East Taylor Ditch 38+30 to 73+40
Pond	#17	==>	#2	0.000	0.000	Simulated 250 GPM - East Taylor Seep
Channel	#18	==>	#7	0.000	0.000	Taylor Trib Ditch




#10
Chan'l
#9
Pond
#8
Chan'l
#7
Null
#6
Chan'l
#5
Null
#4
Chan'l
#3
Null
#2
Pond
#1
Null

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#17	In	5.000	5.000	8.49	0.71
	Out			0.56	0.71
#16		154.500	154.500	13.25	3.40
#15		100.200	254.700	22.28	5.32
#14	In	0.000	254.700	22.28	5.32
	Out			10.80	3.91
#13		84.900	339.600	14.42	5.68
#18		6.000	6.000	1.84	0.14
#12		319.800	319.800	49.39	8.17
#11	In	0.000	319.800	49.39	8.17
	Out			24.13	6.31
#10		123.000	442.800	31.46	8.63
#9	In	0.000	442.800	31.46	8.63
	Out			30.40	8.14
#8		21.600	464.400	30.99	8.48
#7		0.000	470.400	31.24	8.63
#6		82.000	552.400	34.97	9.98
#5		0.000	892.000	41.15	15.66
#4		145.900	1,037.900	52.28	18.95
#3		0.000	1,037.900	52.28	18.95
#2	In	10.900	1,053.800	53.71	19.92
	Out			26.91	17.50
#1		0.000	1,053.800	26.91	17.50

Structure Detail:

Structure #17 (Pond)

Simulated 250 GPM - East Taylor Seep

Pond Inputs:

Initial Pool Elev:	90.01 ft
Initial Pool:	0.00 ac-ft

Pond Results:

Peak Elevation:	92.97 ft
Dewater Time:	0.21 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
90.01	0.050	0.001	0.000		
91.00	0.051	0.050	0.560		
92.00	0.190	0.164	0.560		
92.97	0.257	0.381	0.560	5.10	Peak Stage
93.00	0.260	0.388	0.560		
94.00	0.350	0.692	0.560		
95.00	0.440	1.086	0.560		
96.00	0.540	1.575	0.560		
97.00	0.650	2.169	0.560		
98.00	0.760	2.873	0.560		
99.00	0.880	3.693	0.560		
100.00	1.200	4.728	0.560		
101.00	1.240	5.948	0.560		
102.00	1.414	7.275	0.560		
103.00	1.600	8.781	0.560		

Detailed Discharge Table

Elevation (ft)	User-input discharge (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000
90.01	0.000	0.000
91.00	0.560	0.560
92.00	0.560	0.560
93.00	0.560	0.560
94.00	0.560	0.560
95.00	0.560	0.560
96.00	0.560	0.560
97.00	0.560	0.560
98.00	0.560	0.560
99.00	0.560	0.560
100.00	0.560	0.560
101.00	0.560	0.560
102.00	0.560	0.560
103.00	0.560	0.560

Structure #16 (Riprap Channel)

East Taylor Ditch 38+30 to 73+40

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	9.5			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.25 cfs	
Depth:	0.13 ft	
Top Width:	12.80 ft	
Velocity*:		
X-Section Area:	1.65 sq ft	
Hydraulic Radius:	0.128 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #15 (Vegetated Channel)

East Taylor Ditch - Veg ETD-1 to 38+30

Trapezoidal Vegetated Channel Inputs:

Material: Tall fescue

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	1.8	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	22.28 cfs		22.28 cfs	
Depth:	0.63 ft		1.10 ft	
Top Width:	15.79 ft		18.58 ft	
Velocity:	2.54 fps		1.33 fps	
X-Section Area:	8.78 sq ft		16.77 sq ft	
Hydraulic Radius:	0.549 ft		0.886 ft	
Froude Number:	0.60		0.25	
Roughness Coefficient:	0.0527		0.1388	

Structure #14 (Pond)

ETD-1 Stock Pond

Pond Inputs:

Initial Pool Elev:	7,287.01 ft
Initial Pool:	0.01 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,289.00	30.00	2.00:1	2.00:1	32.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,291.00	20.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	7,289.16 ft
Dewater Time:	0.55 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,287.00	0.661	0.000	0.000		
7,287.01	0.661	0.006	0.000		
7,288.00	0.708	0.684	0.000		
7,289.00	0.757	1.416	0.000		Spillway #1
7,289.16	0.737	1.535	10.804	13.20	Peak Stage
7,290.00	0.758	2.174	68.938		
7,291.00	0.759	2.932	239.116		Spillway #2
7,292.00	0.760	3.692	525.594		
7,293.00	0.762	4.453	944.414		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,287.00	0.000	0.000	0.000
7,287.01	0.000	0.000	0.000
7,288.00	0.000	0.000	0.000
7,289.00	0.000	0.000	0.000
7,290.00	68.938	0.000	68.938
7,291.00	239.116	0.000	239.116
7,292.00	488.655	36.939	525.594
7,293.00	814.228	130.185	944.414

Structure #13 (Riprap Channel)

East Taylor Ditch 0+00 to ETD-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	11.8			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	14.42 cfs	
Depth:	0.13 ft	
Top Width:	12.78 ft	
Velocity*:		
X-Section Area:	1.61 sq ft	
Hydraulic Radius:	0.126 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #18 (Riprap Channel)

Taylor Trib Ditch

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	17.0			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.84 cfs	
Depth:	0.03 ft	
Top Width:	12.17 ft	
Velocity*:		
X-Section Area:	0.34 sq ft	
Hydraulic Radius:	0.028 ft	
Froude Number*:		
Manning's n*:		

	w/o Freeboard	w/ Freeboard
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #12 (Riprap Channel)

Taylor Ditch TD-2 Stockpond to 117+58

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	9.8			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	49.39 cfs	
Depth:	0.38 ft	
Top Width:	14.27 ft	
Velocity*:		
X-Section Area:	4.96 sq ft	
Hydraulic Radius:	0.345 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #11 (Pond)

TD-2 Stockpond

Pond Inputs:

Initial Pool Elev:	7,445.00 ft
Initial Pool:	0.09 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,454.00	30.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	7,454.55 ft
Dewater Time:	0.59 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,443.00	0.014	0.000	0.000		
7,444.00	0.050	0.030	0.000		
7,445.00	0.079	0.094	0.000		
7,446.00	0.106	0.186	0.000		
7,447.00	0.133	0.305	0.000		
7,448.00	0.161	0.452	0.000		
7,449.00	0.190	0.627	0.000		
7,450.00	0.219	0.831	0.000		
7,451.00	0.249	1.065	0.000		
7,452.00	0.280	1.329	0.000		
7,453.00	0.313	1.625	0.000		
7,454.00	0.348	1.955	0.000		Spillway #1
7,454.55	0.371	2.158	24.134	14.05	Peak Stage
7,455.00	0.389	2.324	43.900		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,443.00	0.000	0.000
7,444.00	0.000	0.000
7,445.00	0.000	0.000
7,446.00	0.000	0.000
7,447.00	0.000	0.000
7,448.00	0.000	0.000
7,449.00	0.000	0.000
7,450.00	0.000	0.000
7,451.00	0.000	0.000

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,452.00	0.000	0.000
7,453.00	0.000	0.000
7,454.00	0.000	0.000
7,455.00	43.900	43.900

Structure #10 (Riprap Channel)

Taylor Ditch TD-1 to TD-2 Stockpond

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	6.8			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	31.46 cfs	
Depth:	0.31 ft	
Top Width:	13.83 ft	
Velocity*:		
X-Section Area:	3.95 sq ft	
Hydraulic Radius:	0.283 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #9 (Pond)

TD-1 Stockpond

Pond Inputs:

Initial Pool Elev:	7,283.01 ft
Initial Pool:	0.00 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,287.00	20.00	2.00:1	2.00:1	30.00

Pond Results:

Peak Elevation:	7,287.43 ft
Dewater Time:	0.59 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,283.00	0.001	0.000	0.000		
7,283.01	0.001	0.000	0.000		
7,284.00	0.059	0.023	0.000		
7,285.00	0.159	0.128	0.000		
7,286.00	0.182	0.298	0.000		
7,287.00	0.213	0.495	0.000		Spillway #1
7,287.43	0.228	0.593	30.395	14.10	Peak Stage
7,288.00	0.247	0.725	71.329		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,283.00	0.000	0.000
7,283.01	0.000	0.000
7,284.00	0.000	0.000
7,285.00	0.000	0.000
7,286.00	0.000	0.000
7,287.00	0.000	0.000
7,288.00	71.329	71.329

Structure #8 (Riprap Channel)

Taylor Ditch 35+00 to TD-1 Stockpond

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	10.7			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	30.99 cfs	
Depth:	0.25 ft	
Top Width:	13.50 ft	
Velocity*:		
X-Section Area:	3.19 sq ft	
Hydraulic Radius:	0.235 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Null)

Null at Confluence of Taylor/Taylor Trib

Structure #6 (Riprap Channel)

Taylor Ditch 10+00 to 35+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	7.1			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	34.97 cfs	
Depth:	0.33 ft	
Top Width:	13.97 ft	
Velocity*:		
X-Section Area:	4.25 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.302 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Null)

Null At Confluence of Taylor/East Taylor Null at Confluence Taylor/East Taylor

Structure #4 (Riprap Channel)

Taylor Ditch 0+00 to 10+00

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	6.9			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	52.28 cfs	
Depth:	0.45 ft	
Top Width:	14.72 ft	
Velocity*:		
X-Section Area:	6.06 sq ft	
Hydraulic Radius:	0.407 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Null)

Null Above East Taylor Pond

Structure #2 (Pond)

East Taylor Pond

Pond Inputs:

Initial Pool Elev:	6,944.00 ft
Initial Pool:	2.87 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
18.00	10.00	18.00	122.00	4.00	0.0150	6,952.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,954.00	20.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	6,954.29 ft
Dewater Time:	3.11 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,930.00	0.001	0.000	0.000		
6,931.00	0.036	0.014	0.000		
6,932.00	0.076	0.069	0.000		
6,933.00	0.110	0.161	0.000		
6,934.00	0.134	0.283	0.000		
6,935.00	0.156	0.428	0.000		
6,936.00	0.178	0.595	0.000		
6,937.00	0.201	0.785	0.000		
6,938.00	0.226	0.998	0.000		
6,939.00	0.252	1.237	0.000		
6,940.00	0.280	1.504	0.000		
6,941.00	0.310	1.799	0.000		
6,942.00	0.340	2.123	0.000		
6,943.00	0.373	2.480	0.000		
6,944.00	0.409	2.871	0.000		Low hole SPW #1
6,945.00	0.446	3.298	0.473	10.94*	
6,946.00	0.486	3.764	0.669	8.43*	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,947.00	0.527	4.270	0.819	7.48*	
6,948.00	0.571	4.819	0.945	7.02*	
6,949.00	0.615	5.412	1.057	6.78*	
6,950.00	0.660	6.049	1.158	7.00	
6,951.00	0.706	6.732	1.251	6.85	
6,952.00	0.754	7.462	1.337	6.85	Spillway #1
6,953.00	0.804	8.241	8.509	2.60	
6,954.00	0.857	9.072	12.033	5.40	Spillway #2
6,954.29	0.914	9.338	26.912	5.40	Peak Stage
6,955.00	0.975	9.987	63.138		
6,956.00	1.033	10.991	184.415		

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,930.00	0.000	0.000	0.000
6,931.00	0.000	0.000	0.000
6,932.00	0.000	0.000	0.000
6,933.00	0.000	0.000	0.000
6,934.00	0.000	0.000	0.000
6,935.00	0.000	0.000	0.000
6,936.00	0.000	0.000	0.000
6,937.00	0.000	0.000	0.000
6,938.00	0.000	0.000	0.000
6,939.00	0.000	0.000	0.000
6,940.00	0.000	0.000	0.000
6,941.00	0.000	0.000	0.000
6,942.00	0.000	0.000	0.000
6,943.00	0.000	0.000	0.000
6,944.00	3.00>0.000	0.000	0.000
6,945.00	0.473	0.000	0.473
6,946.00	0.669	0.000	0.669
6,947.00	0.819	0.000	0.819
6,948.00	0.945	0.000	0.945
6,949.00	1.057	0.000	1.057
6,950.00	1.158	0.000	1.158
6,951.00	1.251	0.000	1.251
6,952.00	1.337	0.000	1.337
6,953.00	8.509	0.000	8.509

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,954.00	12.033	0.000	12.033
6,955.00	14.738	48.400	63.138
6,956.00	17.018	167.398	184.415

Structure #1 (Null)

Null Below East Taylor Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#17	1	5.000	0.005	0.000	0.000	90.000	S	8.49	0.712
	Σ	**5.000**						**8.49**	**0.712**
#16	1	142.100	0.518	0.000	0.000	62.000	M	11.30	2.700
	2	6.500	0.024	0.000	0.000	80.000	F	7.43	0.557
	3	5.900	0.074	0.000	0.000	62.000	M	1.81	0.140
	Σ	**154.500**						**13.25**	**3.397**
#15	1	28.500	0.142	0.000	0.000	62.000	M	4.02	0.552
	2	71.700	0.230	0.000	0.000	62.000	M	8.83	1.373
	Σ	**254.700**						**22.28**	**5.321**
#14	**Σ**	**254.700**						**22.28**	**5.321**
#13	1	18.000	0.128	0.000	0.000	62.000	M	2.54	0.348
	2	64.700	0.349	0.000	0.000	62.000	M	6.46	1.233
	3	2.200	0.045	0.000	0.000	80.000	F	2.52	0.188
	Σ	**339.600**						**14.42**	**5.681**
#18	1	6.000	0.032	0.000	0.000	62.000	M	1.84	0.143
	Σ	**6.000**						**1.84**	**0.143**
#12	1	25.800	0.125	0.000	0.000	47.000	S	0.04	0.024
	2	242.800	0.593	0.000	0.000	62.000	M	17.81	4.613
	3	37.400	0.089	0.000	0.000	80.000	F	42.76	3.206
	4	13.800	0.089	0.000	0.000	62.000	M	4.24	0.328
	Σ	**319.800**						**49.39**	**8.171**
#11	**Σ**	**319.800**						**49.39**	**8.171**
#10	1	13.000	0.019	0.000	0.000	47.000	S	0.03	0.018
	2	43.900	0.100	0.000	0.000	62.000	M	13.48	1.044
	3	66.100	0.229	0.000	0.000	62.000	M	8.15	1.266
	Σ	**442.800**						**31.46**	**8.635**
#9	**Σ**	**442.800**						**31.46**	**8.635**
#8	1	7.500	0.044	0.000	0.000	47.000	S	0.02	0.010
	2	9.700	0.060	0.000	0.000	62.000	M	2.98	0.231
	3	4.400	0.048	0.000	0.000	62.000	M	1.35	0.105
	Σ	**464.400**						**30.99**	**8.484**
#7	**Σ**	**470.400**						**31.24**	**8.627**
#6	1	19.000	0.070	0.000	0.000	47.000	S	0.05	0.026

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	2	26.400	0.105	0.000	0.000	62.000	M	8.11	0.628
	3	36.600	0.184	0.000	0.000	62.000	M	4.96	0.704
	Σ	**552.400**						**34.97**	**9.984**
#5	**Σ**	**892.000**						**41.15**	**15.665**
#4	1	7.900	0.053	0.000	0.000	80.000	F	9.03	0.677
	2	126.900	0.386	0.000	0.000	62.000	M	11.97	2.409
	3	8.500	0.041	0.000	0.000	62.000	M	2.61	0.202
	4	2.600	0.019	0.000	0.000	47.000	S	0.00	0.000
	Σ	**1,037.900**						**52.28**	**18.953**
#3	**Σ**	**1,037.900**						**52.28**	**18.953**
#2	1	0.700	0.006	0.000	0.000	61.000	S	0.19	0.011
	2	1.100	0.015	0.000	0.000	61.000	S	0.30	0.024
	3	9.100	0.104	0.000	0.000	62.000	M	2.79	0.216
	Σ	**1,053.800**						**53.71**	**19.916**
#1	**Σ**	**1,053.800**						**26.91**	**17.502**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	40.00	48.80	122.00	5.050	0.006
#2	**1**	**Time of Concentration:**					**0.006**
#2	2	3. Short grass pasture	48.00	150.23	313.00	5.540	0.015
#2	**2**	**Time of Concentration:**					**0.015**
#2	3	3. Short grass pasture	26.00	397.02	1,527.00	4.070	0.104
#2	**3**	**Time of Concentration:**					**0.104**
#4	1	4. Cultivated, straight row	6.00	25.38	423.00	2.180	0.053
#4	**1**	**Time of Concentration:**					**0.053**
#4	2	3. Short grass pasture	12.00	462.24	3,852.00	2.770	0.386
#4	**2**	**Time of Concentration:**					**0.386**
#4	3	3. Short grass pasture	19.00	99.37	523.00	3.480	0.041
#4	**3**	**Time of Concentration:**					**0.041**
#4	4	3. Short grass pasture	20.00	50.40	252.00	3.570	0.019
#4	**4**	**Time of Concentration:**					**0.019**
#6	1	3. Short grass pasture	18.00	154.08	856.00	3.390	0.070
#6	**1**	**Time of Concentration:**					**0.070**
#6	2	3. Short grass pasture	15.00	175.35	1,169.00	3.090	0.105
#6	**2**	**Time of Concentration:**					**0.105**
#6	3	3. Short grass pasture	13.00	248.04	1,908.00	2.880	0.184
#6	**3**	**Time of Concentration:**					**0.184**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#8	1	3. Short grass pasture	21.00	122.64	584.00	3.660	0.044
#8	**1**	**Time of Concentration:**					**0.044**
#8	2	3. Short grass pasture	24.00	204.48	852.00	3.910	0.060
#8	**2**	**Time of Concentration:**					**0.060**
#8	3	3. Short grass pasture	20.00	125.80	629.00	3.570	0.048
#8	**3**	**Time of Concentration:**					**0.048**
#10	1	3. Short grass pasture	20.00	49.80	249.00	3.570	0.019
#10	**1**	**Time of Concentration:**					**0.019**
#10	2	3. Short grass pasture	17.00	202.98	1,194.00	3.290	0.100
#10	**2**	**Time of Concentration:**					**0.100**
#10	3	3. Short grass pasture	13.00	309.91	2,384.00	2.880	0.229
#10	**3**	**Time of Concentration:**					**0.229**
#12	1	3. Short grass pasture	9.00	97.38	1,082.00	2.400	0.125
#12	**1**	**Time of Concentration:**					**0.125**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	10.00	102.10	1,021.00	3.160	0.089
#12	**3**	**Time of Concentration:**					**0.089**
#12	4	3. Short grass pasture	5.00	28.60	572.00	1.780	0.089
#12	**4**	**Time of Concentration:**					**0.089**
#13	1	3. Short grass pasture	12.00	153.59	1,280.00	2.770	0.128
#13	**1**	**Time of Concentration:**					**0.128**
#13	2	3. Short grass pasture	10.00	317.10	3,171.00	2.520	0.349
#13	**2**	**Time of Concentration:**					**0.349**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	2.00	4.64	232.00	1.410	0.045
#13	**3**	**Time of Concentration:**					**0.045**
#15	1	3. Short grass pasture	8.40	99.62	1,186.00	2.310	0.142
#15	**1**	**Time of Concentration:**					**0.142**
#15	2	3. Short grass pasture	8.00	150.23	1,878.00	2.260	0.230
#15	**2**	**Time of Concentration:**					**0.230**
#16	1	3. Short grass pasture	12.00	620.64	5,172.00	2.770	0.518
#16	**1**	**Time of Concentration:**					**0.518**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	15.00	51.15	341.00	3.870	0.024
#16	**2**	**Time of Concentration:**					**0.024**
#16	3	3. Short grass pasture	5.00	23.85	477.00	1.780	0.074
#16	**3**	**Time of Concentration:**					**0.074**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	25.00	25.00	100.00	5.000	0.005
#17	**1**	**Time of Concentration:**					**0.005**
#18	1	3. Short grass pasture	26.00	124.53	479.00	4.070	0.032
#18	**1**	**Time of Concentration:**					**0.032**

Appendix Exh. 7-14S
Section 16 Pond, Temporary, and Permanent Channels

The location of the Section 16 Pond is presented on Map 12. The profiles of the associated permanent channels associated with the Section 16 Pond watershed are presented on Map 33. These channels consist of the Section 16 Fill Ditch and Trib F, and their design information is presented in this appendix. The as-built configuration for the Section 16 Pond is presented on Figure Exh. 7-14S-1, and Figure Exh. 7-14S-2 provides the breakdown of drainage areas and hydrologic conditions for this sediment pond in the post mining condition.

Exhibit 7, Item 14 in Volume 2D describes the hydrologic methodology used in sediment pond and post mine channel assumptions. Runoff curve numbers assigned to the undisturbed and reclaimed lands in various stages of reclamation have been selected in accordance with Table 1 in the Introductory Text for Exhibit 7 in Volume 2D. For channels protected by a riprap liner, selection of minimum riprap size is done using the Simons/OSM method in SEDCAD^{TM}. For channels to be protected by a vegetative liner, the permissible velocities are also determined using SEDCAD^{TM} routines.

Section 16 Pond

The following pages present the results of the SEDCAD^{TM} models for the hydrologic conditions under the post mining condition. At this stage the oldest reclamation (most Phase III released) is on the eastern extent of the reclaimed Section 16 Pit, and the younger (topsoil and seeded) reclamation is the western reaches of the Section 16 Pond watershed.

The SEDCAD^{TM} model herein provides the results of the 10 year 24 hour design storm and demonstrates the Section 16 Pond will meet the applicable settleable solids standard under this modeled storm event. The second SEDCAD^{TM} model demonstrates that the Section 16 Pond emergency spillway elevation is capable of containing the 25 year 24 hour storm.

For the post mining case at the Section 16 Pond, the 10 year 24 hour storm produces 1.6-acre feet of runoff, and the seattlable solids discharge is 0.0 ml/l. The 25 year 24 hour storm event peaks at the 7,751.4’ elevation, which is below the emergency spillway elevation of 7,754.5.

West and East Section 16 Ditches (Temporary)

The East Section 16 Ditch is designed to be trapezoidal in cross section with a 2-foot bottom width, left side slope ratio of 1H:1V, a right side slopes ratio of 7H:1V, and depth of at least 0.5 feet. The West Section 16 Ditch is a vegetated channel.

The West Section 16 Ditch from station 0+00 to 45+00 is trapezoidal in cross section with a 2 foot bottom width, left side slope ratio of 1H:1V, a right side slopes ratio of 7H:1V, and depth of at least 0.5 feet. This segment is a vegetated channel.

The West Section 16 Ditch from station 45+00 to 63+57 is trapezoidal in cross section with a 10 foot bottom width, left side slope ratio of 4H:1V, right side slope ratio of 2H:1V, and a depth of at least 1.0 feet. This segment of the ditch is a vegetated channel.

The location of the East and West Section 16 Ditches can be found on Map 12.

Section 16 Permanent Channels

The Section 16 watershed is comprised of two post-mining channels, the Section 16 Fill Ditch and Trib F respectively. The locations of both channels are presented on Map 12 and Figure Exh. 7-14S-2, and the channel profiles are presented on Map 33 and 33B.

The assumed hydrologic condition for both channels is the post mine condition when the entire Section watershed is reclaimed and reporting to the Section 16 Pond.

Section 16 Fill Ditch

The Section 16 Fill Ditch conveys a very small area of Section 16 reclamation areas into the South Collection Ditch ultimately reporting to the Prospect Pond drainage system.

The ditch is designed to meet the requirements of Rule 4.05.3 for drainages less than one square mile. The drainage area of this basin is about 12.4 acres, all of which is now Phase III released. The steepest portions have a slope of about 17.8 percent. The overall length of the channel is about 860 feet.

A SEDCAD™ model has been included which evaluates the peak flow for the 10 year, 24-hour storm event. The channel configurations for the 10 year, 24 hour storm event for the Section 16 Fill Ditch is summarized below.

Section 16 Fill Ditch

Station	Peak Flow (CFS)	Average Slope (%)	Channel Type	Side Slopes	Erosion Protection
Station 0+00 to 8+60	1.77	17.8	Trapezoidal 12’ bottom	3H:1V	Riprap, D50 = 12”

Because the flow is so small in this watershed, the SEDCAD™ demonstration had to use a triangular ditch (zero bottom width) with 3H:1V side slopes, but as construction dictates, the ditch may have a bottom width up to 12 feet based simply on the minimum width of a dozer blade.

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Exhibit 7, Item 20, Part B
West Taylor Pond and Channels

The location of the West Taylor Pond is presented on Map 12. The profiles of the associated permanent channels associated with the West Taylor Pond watershed are presented on Map 33B. These channels consist of the West Fork Taylor Ditch, East Fork Taylor Ditch, Trib 1 through Trib 6 ditches and the terrace ditches that will be constructed across the West Taylor Fill. The permanent channel design information for all channels is presented in this exhibit. The as-built configuration for the West Taylor Pond is presented on Figure Exh. 7-20C-1, and Figure Exh. 720C-2 provides the breakdown of drainage areas and hydrologic conditions for this sediment pond in the post mining condition.

Exhibit 7, Item 14 in Volume 2D describes the hydrologic methodology used in sediment pond and post mine channel assumptions. Runoff curve numbers assigned to the undisturbed and reclaimed lands in various stages of reclamation have been selected in accordance with Table 1 in the Introductory Text for Exhibit 7 in Volume 2D. For channels protected by a riprap liner, selection of minimum riprap size is done using the Simons/OSM method in SEDCAD^{TM}. For channels to be protected by a vegetative liner, the permissible velocities are also determined using SEDCAD^{TM} routines.

West Taylor Pond

The following pages present the results of the SEDCAD^{TM} models for the post mining condition. At this stage the oldest reclamation is on the eastern and southern extent of the reclaimed South Taylor Pit, and the younger (topsoil and seeded) reclamation is the northern reaches of the West Taylor Pond watershed very near the West Taylor Pond.

The SEDCAD^{TM} model herein provides the results of the 10 year 24 hour design storm and demonstrates the West Taylor Pond will meet the applicable settleable solids standard under this modeled storm event. The second SEDCAD^{TM} model demonstrates that the West Taylor Pond emergency spillway elevation is capable of containing the 25 year 24 hour storm.

The final post mining topographic surface and the final locations of the permanent drainage channels as presented on Map 12 were used to model the watershed for the post-mining condition. Four in-stream stock ponds (WFSP-1, WFSP-2, EFSP-1, and, EFSP-2) are included in the permanent channels to decrease peak flows from the modeled storm events, and to provide a water source to support the post-mining land use. A typical design for of each stock pond in the West Taylor Pond watershed are provided on Figure 2.05-6 in Volume 1. However, depending on the ground conditions encountered during reclamation, these stockponds may be constructed similar to ETD-1 (please see Figure Exh. 7-20ET-3) in the East Taylor watershed.

In summary, the post mining case at the West Taylor Pond, the 10 year 24 hour storm produces 5.10 acre feet of runoff, and the seattlable solids discharge is 0.2 ml/l. The 25 year 24 hour storm event peaks at the 7,473.71’ elevation, which is well below the emergency spill way elevation of 7,475.0’.

Permanent Post Mine Channels

The West Taylor watershed is comprised of two primary post-mining channels and six tributaries channels. Both of the primary channels convey the post mining surface water flows to the West Taylor Pond, while the six tributaries channels route water to both primary post mining channels. The locations of both the primary and tributary channels are presented on Map 12 and Figure Exh. 7-20B-2. The channel profiles are presented on Map 33B.

The assumed hydrologic condition for all three channels is the post mine condition when the entire West Taylor watershed is reclaimed and reporting to the West Taylor Pond.

West and East Fork Taylor Ditch

The area contributory to each permanent primary channel is less than one square mile, making the appropriate storm event the 10 year, 24 hour event as specified in Rule 4.05.3. However, portions of these channels pass over permanent fills, so the correct storm event required by Rule 4.09.2 becomes the 100 year, 24 hour event. For simplicity, both primary channels are modeled to this larger event.

The upper segments of the primary channels are flat enough that a vegetative liner will provide sufficient erosion protection, even for the 100 year flow. However, both channels below the lower stock ponds require riprap lining to ensure long-term stability.

A SEDCAD model has been included below which evaluates the peak flow and total runoff volume for each of the channel segments for the 100 year, 24-hour storm event. The channel configurations for the 100 year, 24 hour storm event for both primary channels are described on the tables below.

East Fork Taylor Ditch

Station	Peak Flow (CFS)	Average Slope (%)	Channel Type	Side Slopes	Minimum Depth (Feet)	Erosion Protection
Station 0+00 to EFSP-1	101.31	25	Trapezoidal 12’ bottom	3H:1V	4.0	Riprap, D50 = 18”
EFSP-1 to EFSP-2	125.52	1.5	Trapezoidal 12’ bottom	3H:1V	4.0	Vegetation
EFSP-2 to Station 124+03	26.40	4.7	Trapezoidal 12’ bottom	3H:1V	4.0	Vegetation

West Fork Taylor Ditch

Station	Peak Flow (CFS)	Average Slope (%)	Channel Type	Side Slopes	Minimum Depth (Feet)	Erosion Protection
Station 0+00 to WFSP-1	27.48	26	Trapezoidal 12' bottom	3H:1V	4.0	Riprap, D50 = 9"
WFSP-1 to WFSP-2	46.52	1.3	Trapezoidal 12' bottom	3H:1V	4.0	Vegetation
WFSP-2 to Station 40+00	72.61	1.5	Trapezoidal 12' bottom	3H:1V	4.0	Vegetation
Station 40+00 to 83+05	26.85	8	Trapezoidal 12' bottom	3H:1V	4.0	Vegetation

Tributary Ditches

The six post mine tributaries channels (Trib's 1 through 6) will be constructed to break up long continuous slopes and minimize erosion in the South Taylor reclamation areas. They will also convey flow to the two primary channels. These six tributaries were modeled in accordance with Rule 4.05.3(3) for the 10-year 24-hour event.

A very small portion of Trib 1 flows over a permanent fill, which in accordance with Rule 4.09.2(7) makes the appropriate storm event for this small portion of channel the 100-year, 24 hour storm event. Since it is minor portion of the channel flows over permanent fill, Trib 1 is modeled to the 10-year, 24-hour storm event.

A summary of the configurations for each tributary channel is provided on the table below.

Post Mine Tributary Channels

Tribuary Name	Peak Flow (CFS)	Average Slope (%)	Channel Type	Side Slopes	Minimum Depth (Feet)	Erosion Protection
Trib 1	9.76	5.0	Trapezoidal 6' bottom	3H:1V	2.0	Vegetation
Trib 2	5.26	11.0	Trapezoidal 6' bottom	3H:1V	2.0	Vegetation
Trib 3	0.11	11.0	Trapezoidal 6' bottom	3H:1V	2.0	Vegetation
Trib 4	0.05	16.0	Trapezoidal 6' bottom	3H:1V	2.0	Vegetation
Trib 5	0.09	4.0	Trapezoidal 6' bottom	3H:1V	2.0	Vegetation
Trib 6	0.15	6.0	Trapezoidal 6' bottom	3H:1V	2.0	Vegetation

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West Taylor Pond
10 Yr - 24 Hr Strom Event

Effluent Demonstration

Post Mining

Tony Tennyson

Tri-State Generation & Transmission Association, Inc.
1100 West 116th Avenue
Westminster, CO 80234

Phone: (970) 824-1232
Email: ttennyson@tristategt.org

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.800 inches

Particle Size Distribution:

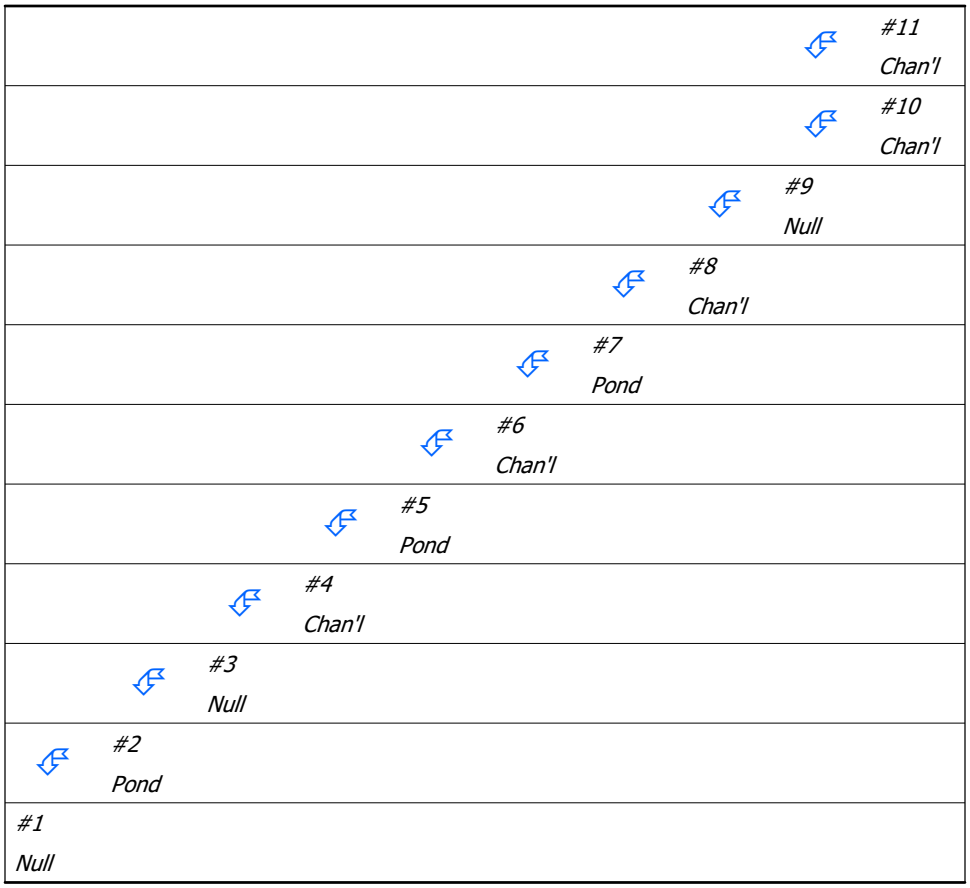
Size (mm)	Colowyo Particle Size
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below West Taylor Pond
Pond	#2	==>	#1	0.000	0.000	West Taylor Pond
Null	#3	==>	#2	0.000	0.000	Null Above West Taylor Pond
Channel	#4	==>	#3	0.000	0.000	0+00 to WFSP-1 West Fork Taylor Ditch
Pond	#5	==>	#4	0.000	0.000	WFSP-1 Stock Pond
Channel	#6	==>	#5	0.000	0.000	Channel WFSP-1 to WFSP-2
Pond	#7	==>	#6	0.000	0.000	WFSP-2 Stockpond
Channel	#8	==>	#7	0.000	0.000	WFSP-2 to Station 40+00
Null	#9	==>	#8	0.000	0.000	Null Confluence Trib 1
Channel	#10	==>	#9	0.000	0.000	Trib 1
Channel	#11	==>	#9	0.000	0.000	West Fork Station 40+00 to 83+05
Null	#13	==>	#4	0.000	0.000	Null Confluence West 7800' Terrace Ditch
Channel	#14	==>	#13	0.000	0.000	West 7800' Terrace Ditch
Null	#15	==>	#4	0.000	0.000	Null 7700' Terrace Ditch
Channel	#16	==>	#15	0.000	0.000	7700' Terrace Ditch
Channel	#17	==>	#3	0.000	0.000	East Fork Taylor Ditch 0+00 to EFSP-1
Null	#18	==>	#17	0.000	0.000	Null 7600' Terrace Ditch
Channel	#19	==>	#18	0.000	0.000	7600' Terrace Ditch
Null	#20	==>	#17	0.000	0.000	Null 7800' Terrace Ditch
Channel	#21	==>	#20	0.000	0.000	East 7800' Terrace Ditch
Pond	#22	==>	#17	0.000	0.000	EFSP-1 Stock Pond
Channel	#23	==>	#22	0.000	0.000	EFSP-1 to EFSP-2 Veg Channel
Pond	#24	==>	#23	0.000	0.000	EFSP-2 Stockpond
Channel	#25	==>	#24	0.000	0.000	EFSP-2 to Station 124+03
Null	#26	==>	#25	0.000	0.000	Null Confluence Trib 2
Channel	#27	==>	#26	0.000	0.000	Trib 2
Null	#28	==>	#25	0.000	0.000	Null Confluence Trib 3
Channel	#29	==>	#28	0.000	0.000	Trib 3
Null	#30	==>	#25	0.000	0.000	Null Confluence Trib 5
Channel	#31	==>	#30	0.000	0.000	Trib 5
Null	#32	==>	#25	0.000	0.000	Null Confluence Trib 4
Channel	#33	==>	#32	0.000	0.000	Trib 4
Null	#34	==>	#25	0.000	0.000	Null Confluence Trib 6
Channel	#35	==>	#34	0.000	0.000	Trib 6

#35 Chan'l


#34
Null
#33
Chan'l
#32
Null
#31
Chan'l
#30
Null
#29
Chan'l
#28
Null
#27
Chan'l
#26
Null
#25
Chan'l
#24
Pond
#23
Chan'l
#22
Pond
#21
Chan'l
#20
Null
#19
Chan'l
#18
Null
#17
Chan'l
#16
Chan'l
#15
Null
#14
Chan'l
#13
Null


#11
Chan'l
#10
Chan'l
#9
Null
#8
Chan'l
#7
Pond
#6
Chan'l
#5
Pond
#4
Chan'l
#3
Null
#2
Pond
#1
Null

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#35		31.000	31.000	0.15	0.10	0.0	272	0.14	0.12
#34		0.000	31.000	0.15	0.10	0.0	272	0.14	0.12
#33		6.600	6.600	0.05	0.03	0.0	442	0.25	0.19
#32		0.000	6.600	0.05	0.03	0.0	442	0.25	0.19
#31		18.800	18.800	0.09	0.06	0.0	82	0.04	0.03
#30		0.000	18.800	0.09	0.06	0.0	82	0.04	0.03
#29		14.000	14.000	0.11	0.06	0.0	388	0.22	0.17
#28		0.000	14.000	0.11	0.06	0.0	388	0.22	0.17
#27		25.100	25.100	5.26	0.44	35.1	139,589	79.56	32.31
#26		0.000	25.100	5.26	0.44	35.1	139,589	79.56	32.31
#25		129.200	224.700	5.87	1.14	36.8	130,836	74.48	13.08
#24	In	0.000	224.700	5.87	1.14	36.8	130,836	74.48	13.08
	Out			0.00	0.00	36.8	0	0.00	0.00
#23		141.900	366.600	51.68	3.87	721.1	262,703	152.82	70.37
#22	In	0.000	366.600	51.68	3.87	721.1	262,703	152.82	70.37
	Out			3.88	2.68	0.0	1,440	0.00	0.00
#21		3.000	3.000	0.02	0.01	0.0	300	0.17	0.14
#20		0.000	3.000	0.02	0.01	0.0	300	0.17	0.14
#19		4.000	4.000	0.03	0.02	0.0	484	0.28	0.21
#18		0.000	4.000	0.03	0.02	0.0	484	0.28	0.21
#17		35.100	408.700	5.93	3.14	72.1	243,349	138.65	9.77
#16		7.300	7.300	0.06	0.03	0.0	519	0.30	0.22
#15		0.000	7.300	0.06	0.03	0.0	519	0.30	0.22
#14		1.900	1.900	0.01	0.00	0.0	1,577	0.90	0.84
#13		0.000	1.900	0.01	0.00	0.0	1,577	0.90	0.84
#11		181.300	181.300	6.03	0.80	7.7	19,417	10.00	3.63
#10		64.500	64.500	9.76	1.17	50.6	144,085	80.80	17.35
#9		0.000	245.800	14.49	1.97	58.3	140,530	77.96	11.81
#8		13.300	259.100	20.88	2.46	117.3	138,841	78.08	19.11
#7	In	0.000	259.100	20.88	2.46	117.3	138,841	78.08	19.11
	Out			1.55	1.19	0.0	1	0.00	0.00
#6		94.500	353.600	18.47	2.93	83.7	73,639	39.85	11.70
#5	In	0.000	353.600	18.47	2.93	83.7	73,639	39.85	11.70
	Out			2.04	1.66	0.0	0	0.00	0.00
#4		35.400	398.200	3.81	1.97	22.3	122,943	70.07	5.98
#3		0.000	806.900	9.74	5.10	94.3	197,690	112.65	8.51
#2	In	27.600	834.500	9.74	5.10	94.3	197,690	112.65	8.51
	Out			4.72	4.92	22.6	5,141	0.22	0.15
#1		0.000	834.500	4.72	4.92	22.6	5,139	0.22	0.15

Particle Size Distribution(s) at Each Structure

Structure #35 (Trib 6):

Size (mm)	In/Out
4.7500	100.000%
0.0750	94.402%
0.0400	42.675%
0.0010	25.864%

Structure #34 (Null Confluence Trib 6):

Size (mm)	In/Out
4.7500	100.000%
0.0750	94.402%
0.0400	42.675%
0.0010	25.864%

Structure #33 (Trib 4):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #32 (Null Confluence Trib 4):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #31 (Trib 5):

Size (mm)	In/Out
4.7500	100.000%
0.0750	94.602%
0.0400	42.765%
0.0010	25.918%

Structure #30 (Null Confluence Trib 5):

Size (mm)	In/Out
4.7500	100.000%
0.0750	94.602%
0.0400	42.765%
0.0010	25.918%

Structure #29 (Trib 3):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #28 (Null Confluence Trib 3):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #27 (Trib 2):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #26 (Null Confluence Trib 2):

Size (mm)	In/Out
4.7500	100.000%

Size (mm)	In/Out
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #25 (EFSP-2 to Station 124+03):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.202%
0.0400	33.098%
0.0010	20.059%

Structure #24 (EFSP-2 Stockpond):

Size (mm)	In	Out
4.7500	100.000%	0.000%
0.0750	73.202%	0.000%
0.0400	33.098%	0.000%
0.0010	20.059%	0.000%

Structure #23 (EFSP-1 to EFSP-2 Veg Channel):

Size (mm)	In/Out
4.7500	94.894%
0.0750	69.273%
0.0400	31.315%
0.0010	18.979%

Structure #22 (EFSP-1 Stock Pond):

Size (mm)	In	Out
4.7500	94.894%	100.000%
0.0750	69.273%	100.000%
0.0400	31.315%	100.000%
0.0010	18.979%	100.000%

Structure #21 (East 7800' Terrace Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%

Size (mm)	In/Out
0.0400	33.000%
0.0010	20.000%

Structure #20 (Null 7800' Terrace Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #19 (7600' Terrace Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #18 (Null 7600' Terrace Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #17 (East Fork Taylor Ditch 0+00 to EFSP-1):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.009%
0.0400	33.023%
0.0010	20.028%

Structure #16 (7700' Terrace Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%

Size (mm)	In/Out
0.0010	20.000%

Structure #15 (Null 7700' Terrace Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #14 (West 7800' Terrace Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #13 (Null Confluence West 7800' Terrace Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.000%
0.0010	20.000%

Structure #11 (West Fork Station 40+00 to 83+05):

Size (mm)	In/Out
4.7500	100.000%
0.0750	90.487%
0.0400	40.905%
0.0010	24.791%

Structure #10 (Trib 1):

Size (mm)	In/Out
4.7500	100.000%
0.0750	75.913%
0.0400	34.317%
0.0010	20.798%

Structure #9 (Null Confluence Trib 1):

Size (mm)	In/Out
4.7500	100.000%
0.0750	77.838%
0.0400	35.187%
0.0010	21.326%

Structure #8 (WFSP-2 to Station 40+00):

Size (mm)	In/Out
4.7500	100.000%
0.0750	75.404%
0.0400	34.087%
0.0010	20.659%

Structure #7 (WFSP-2 Stockpond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	75.404%	100.000%
0.0400	34.087%	100.000%
0.0010	20.659%	100.000%

Structure #6 (Channel WFSP-1 to WFSP-2):

Size (mm)	In/Out
4.7500	100.000%
0.0750	82.148%
0.0400	37.135%
0.0010	22.506%

Structure #5 (WFSP-1 Stock Pond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	82.148%	100.000%
0.0400	37.135%	100.000%
0.0010	22.506%	100.000%

Structure #4 (0+00 to WFSP-1 West Fork Taylor Ditch):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.000%
0.0400	33.001%
0.0010	20.001%

Structure #3 (Null Above West Taylor Pond):

Size (mm)	In/Out
4.7500	100.000%
0.0750	73.007%
0.0400	33.018%
0.0010	20.021%

Structure #2 (West Taylor Pond):

Size (mm)	In	Out
4.7500	100.000%	100.000%
0.0750	73.007%	100.000%
0.0400	33.018%	100.000%
0.0010	20.021%	83.724%

Structure #1:

Size (mm)	In/Out
4.7500	100.000%
0.0750	100.000%
0.0400	100.000%
0.0010	83.724%

Structure Detail:

Structure #35 (Vegetated Channel)

Trib 6

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	6.0	D, B	1.78			6.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.15 cfs		0.15 cfs	
Depth:	0.07 ft	1.85 ft	0.22 ft	2.00 ft
Top Width:	6.43 ft	17.11 ft	7.30 ft	17.98 ft
Velocity:	0.33 fps		0.10 fps	
X-Section Area:	0.45 sq ft		1.44 sq ft	
Hydraulic Radius:	0.069 ft		0.195 ft	
Froude Number:	0.22		0.04	
Roughness Coefficient:	0.1846		1.1808	

Structure #34 (Null)

Null Confluence Trib 6

Structure #33 (Vegetated Channel)

Trib 4

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	16.0	D, B	1.88			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.05 cfs		0.05 cfs	
Depth:	0.03 ft	1.91 ft	0.12 ft	2.00 ft
Top Width:	6.20 ft	17.48 ft	6.70 ft	17.98 ft
Velocity:	0.24 fps		0.07 fps	
X-Section Area:	0.21 sq ft		0.74 sq ft	
Hydraulic Radius:	0.033 ft		0.109 ft	
Froude Number:	0.23		0.04	
Roughness Coefficient:	0.2544		1.9965	

Structure #32 (Null)

Null Confluence Trib 4

Structure #31 (Vegetated Channel)

Trib 5

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	4.0	D, B	1.79			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.09 cfs		0.09 cfs	
Depth:	0.07 ft	1.86 ft	0.21 ft	2.00 ft
Top Width:	6.40 ft	17.14 ft	7.27 ft	18.01 ft
Velocity:	0.22 fps		0.06 fps	
X-Section Area:	0.41 sq ft		1.40 sq ft	
Hydraulic Radius:	0.064 ft		0.191 ft	
Froude Number:	0.15		0.03	
Roughness Coefficient:	0.2150		1.5359	

Structure #30 (Null)

Null Confluence Trib 5

Structure #29 (Vegetated Channel)

Trib 3

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	11.0	D, B	1.84			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.11 cfs		0.11 cfs	
Depth:	0.05 ft	1.89 ft	0.16 ft	2.00 ft
Top Width:	6.31 ft	17.35 ft	6.97 ft	18.01 ft
Velocity:	0.33 fps		0.10 fps	
X-Section Area:	0.32 sq ft		1.05 sq ft	
Hydraulic Radius:	0.051 ft		0.150 ft	
Froude Number:	0.26		0.05	
Roughness Coefficient:	0.2033		1.3743	

Structure #28 (Null)

Null Confluence Trib 3

Structure #27 (Vegetated Channel)

Trib 2

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	11.0	D, B	1.49			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	5.26 cfs		5.26 cfs	
Depth:	0.27 ft	1.76 ft	0.51 ft	2.00 ft
Top Width:	7.61 ft	16.55 ft	9.08 ft	18.02 ft

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Velocity:	2.88 fps		1.36 fps	
X-Section Area:	1.82 sq ft		3.88 sq ft	
Hydraulic Radius:	0.237 ft		0.419 ft	
Froude Number:	1.04		0.37	
Roughness Coefficient:	0.0655		0.2036	

Structure #26 (Null)

Null Confluence Trib 2

Structure #25 (Vegetated Channel)

EFSP-2 to Station 124+03

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	4.7	D, B	3.45			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	5.87 cfs		5.87 cfs	
Depth:	0.27 ft	3.72 ft	0.55 ft	4.00 ft
Top Width:	13.62 ft	34.32 ft	15.28 ft	35.98 ft
Velocity:	1.70 fps		0.79 fps	
X-Section Area:	3.46 sq ft		7.45 sq ft	
Hydraulic Radius:	0.252 ft		0.482 ft	
Froude Number:	0.59		0.20	
Roughness Coefficient:	0.0755		0.2515	

Structure #24 (Pond)

EFSP-2 Stockpond

Pond Inputs:

Initial Pool Elev:	92.00 ft
Initial Pool:	0.15 ac-ft

*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	1.50	0.0150	98.00	0.50	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	97.85 ft
H'graph Detention Time:	0.00 hrs
Pond Model:	CSTRS
Dewater Time:	0.00 days
Trap Efficiency:	0.00 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
97.85	0.296	1.285	0.000	0.00	Peak Stage
98.00	0.301	1.329	0.000		Spillway #1
99.00	0.339	1.649	2.094		
100.00	0.380	2.008	4.263		Spillway #2
101.00	0.554	2.473	30.516		
102.00	0.761	3.127	98.736		
103.00	1.000	4.005	207.246		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000	0.000
91.00	0.000	0.000	0.000
92.00	0.000	0.000	0.000
93.00	0.000	0.000	0.000
94.00	0.000	0.000	0.000
95.00	0.000	0.000	0.000
96.00	0.000	0.000	0.000
97.00	0.000	0.000	0.000
98.00	0.000	0.000	0.000
99.00	(3)>2.094	0.000	2.094
100.00	(5)>4.263	0.000	4.263
101.00	(6)>5.033	25.483	30.516
102.00	(6)>5.701	93.036	98.736
103.00	(6)>6.275	200.972	207.246

Structure #23 (Vegetated Channel)

EFSP-1 to EFSP-2 Veg Channel

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	1.5	D, B	2.51			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	51.68 cfs		51.68 cfs	
Depth:	0.95 ft	3.46 ft	1.49 ft	4.00 ft
Top Width:	17.69 ft	32.75 ft	20.96 ft	36.02 ft
Velocity:	3.67 fps		2.10 fps	
X-Section Area:	14.09 sq ft		24.60 sq ft	
Hydraulic Radius:	0.783 ft		1.147 ft	
Froude Number:	0.72		0.34	
Roughness Coefficient:	0.0422		0.0952	

Structure #22 (Pond)

EFSP-1 Stock Pond

Pond Inputs:

Initial Pool Elev:	92.00 ft
Initial Pool:	0.15 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	1.50	0.0150	98.00	0.50	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	99.82 ft
H'graph Detention Time:	3.11 hrs
Pond Model:	CSTRS
Dewater Time:	0.87 days
Trap Efficiency:	100.00 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		Spillway #1

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
99.00	0.339	1.649	2.094	15.05	
99.82	0.373	1.945	3.878	5.80	Peak Stage
100.00	0.380	2.008	4.263		Spillway #2
101.00	0.554	2.473	30.516		
102.00	0.761	3.127	98.736		
103.00	1.000	4.005	207.246		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000	0.000
91.00	0.000	0.000	0.000
92.00	0.000	0.000	0.000
93.00	0.000	0.000	0.000
94.00	0.000	0.000	0.000
95.00	0.000	0.000	0.000
96.00	0.000	0.000	0.000
97.00	0.000	0.000	0.000
98.00	0.000	0.000	0.000
99.00	(3)>2.094	0.000	2.094
100.00	(5)>4.263	0.000	4.263
101.00	(6)>5.033	25.483	30.516
102.00	(6)>5.701	93.036	98.736
103.00	(6)>6.275	200.972	207.246

Structure #21 (Vegetated Channel)

East 7800' Terrace Ditch

Triangular Vegetated Channel Inputs:

Material: Smooth brome

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	3.0:1	1.5	D, B				7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.02 cfs		0.02 cfs	
Depth:	0.22 ft		0.51 ft	
Top Width:	0.99 ft		2.31 ft	
Velocity:	0.21 fps		0.04 fps	
X-Section Area:	0.11 sq ft		0.59 sq ft	
Hydraulic Radius:	0.101 ft		0.234 ft	
Froude Number:	0.11		0.01	
Roughness Coefficient:	0.1901		1.8047	

Structure #20 (Null)

Null 7800' Terrace Ditch

Structure #19 (Vegetated Channel)

7600' Terrace Ditch

Triangular Vegetated Channel Inputs:

Material: Smooth brome

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	3.0:1	1.5	D, B	2.45			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.03 cfs		0.03 cfs	
Depth:	0.24 ft	2.69 ft	0.55 ft	3.00 ft
Top Width:	1.08 ft	12.11 ft	2.46 ft	13.49 ft
Velocity:	0.23 fps		0.04 fps	
X-Section Area:	0.13 sq ft		0.67 sq ft	
Hydraulic Radius:	0.110 ft		0.250 ft	
Froude Number:	0.12		0.02	
Roughness Coefficient:	0.1786		1.6044	

Structure #18 (Null)

Null 7600' Terrace Ditch

Structure #17 (Riprap Channel)

East Fork Taylor Ditch 0+00 to EFSP-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	25.0	3.96		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.93 cfs	
Depth:	0.04 ft	4.00 ft
Top Width:	12.21 ft	35.97 ft
Velocity*:		
X-Section Area:	0.43 sq ft	
Hydraulic Radius:	0.035 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #16 (Vegetated Channel)

7700' Terrace Ditch

Triangular Vegetated Channel Inputs:

Material: Smooth brome

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	3.0:1	1.5	D, B	2.38			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.06 cfs		0.06 cfs	
Depth:	0.29 ft	2.67 ft	0.62 ft	3.00 ft
Top Width:	1.29 ft	12.00 ft	2.81 ft	13.52 ft

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Velocity:	0.30 fps		0.06 fps	
X-Section Area:	0.19 sq ft		0.88 sq ft	
Hydraulic Radius:	0.131 ft		0.285 ft	
Froude Number:	0.14		0.02	
Roughness Coefficient:	0.1569		1.2529	

Structure #15 (Null)

Null 7700' Terrace Ditch

Structure #14 (Vegetated Channel)

West 7800' Terrace Ditch

Triangular Vegetated Channel Inputs:

Material: Smooth brome

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	3.0:1	1.5	D, B	2.54			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.01 cfs		0.01 cfs	
Depth:	0.19 ft	2.73 ft	0.46 ft	3.00 ft
Top Width:	0.87 ft	12.30 ft	2.09 ft	13.52 ft
Velocity:	0.17 fps		0.03 fps	
X-Section Area:	0.08 sq ft		0.48 sq ft	
Hydraulic Radius:	0.088 ft		0.212 ft	
Froude Number:	0.10		0.01	
Roughness Coefficient:	0.2097		2.1769	

Structure #13 (Null)

Null Confluence West 7800' Terrace Ditch

Structure #11 (Vegetated Channel)

West Fork Station 40+00 to 83+05

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	8.0	D, B	3.53			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	6.03 cfs		6.03 cfs	
Depth:	0.23 ft	3.76 ft	0.47 ft	4.00 ft
Top Width:	13.39 ft	34.57 ft	14.80 ft	35.98 ft
Velocity:	2.05 fps		0.97 fps	
X-Section Area:	2.95 sq ft		6.24 sq ft	
Hydraulic Radius:	0.219 ft		0.418 ft	
Froude Number:	0.77		0.26	
Roughness Coefficient:	0.0745		0.2437	

Structure #10 (Vegetated Channel)

Trib 1

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	5.0	D, B	1.21			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	9.76 cfs		9.76 cfs	
Depth:	0.44 ft	1.65 ft	0.79 ft	2.00 ft
Top Width:	8.65 ft	15.91 ft	10.75 ft	18.01 ft
Velocity:	3.02 fps		1.47 fps	
X-Section Area:	3.23 sq ft		6.62 sq ft	
Hydraulic Radius:	0.367 ft		0.602 ft	
Froude Number:	0.87		0.33	

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Roughness Coefficient:	0.0565		0.1610	

Structure #9 (Null)

Null Confluence Trib 1

Structure #8 (Vegetated Channel)

WFSP-2 to Station 40+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	1.5	D, B	2.86			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	20.88 cfs		20.88 cfs	
Depth:	0.65 ft	3.51 ft	1.14 ft	4.00 ft
Top Width:	15.89 ft	33.05 ft	18.84 ft	36.00 ft
Velocity:	2.31 fps		1.19 fps	
X-Section Area:	9.05 sq ft		17.58 sq ft	
Hydraulic Radius:	0.562 ft		0.915 ft	
Froude Number:	0.54		0.22	
Roughness Coefficient:	0.0539		0.1447	

Structure #7 (Pond)

WFSP-2 Stockpond

Pond Inputs:

Initial Pool Elev:	91.00 ft
Initial Pool:	0.06 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	5.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	1.00	0.0150	98.00	0.90	0.00

Pond Results:

Peak Elevation:	98.74 ft
H'graph Detention Time:	4.83 hrs
Pond Model:	CSTRS
Dewater Time:	0.69 days
Trap Efficiency:	100.00 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		Spillway #2
98.74	0.329	1.566	1.549	16.55	Peak Stage
99.00	0.339	1.649	2.094		
100.00	0.380	2.008	3.745		Spillway #1
101.00	0.554	2.473	18.584		
102.00	0.761	3.127	61.251		
103.00	1.000	4.005	135.506		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000	0.000
91.00	0.000	0.000	0.000
92.00	0.000	0.000	0.000
93.00	0.000	0.000	0.000
94.00	0.000	0.000	0.000
95.00	0.000	0.000	0.000
96.00	0.000	0.000	0.000
97.00	0.000	0.000	0.000
98.00	0.000	0.000	0.000
99.00	0.000	(3)>2.094	2.094
100.00	0.000	(6)>3.745	3.745
101.00	14.046	(6)>4.538	18.584
102.00	56.062	(6)>5.189	61.251
103.00	129.713	(6)>5.793	135.506

Structure #6 (Vegetated Channel)

Channel WFSP-1 to WFSP-2

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	1.3	D, B	2.85			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	18.47 cfs		18.47 cfs	
Depth:	0.64 ft	3.49 ft	1.15 ft	4.00 ft
Top Width:	15.86 ft	32.96 ft	18.90 ft	36.00 ft
Velocity:	2.06 fps		1.04 fps	
X-Section Area:	8.97 sq ft		17.77 sq ft	
Hydraulic Radius:	0.558 ft		0.922 ft	
Froude Number:	0.48		0.19	
Roughness Coefficient:	0.0559		0.1546	

Structure #5 (Pond)

WFSP-1 Stock Pond

Pond Inputs:

Initial Pool Elev:	91.00 ft
Initial Pool:	0.06 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	0.00 %

**No sediment capacity defined*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	1.50	0.0150	98.00	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	98.97 ft
H'graph Detention Time:	4.97 hrs
Pond Model:	CSTRS
Dewater Time:	0.78 days
Trap Efficiency:	100.00 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		Top of Sed. Storage
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		Spillway #1
98.97	0.338	1.640	2.037	18.70	Peak Stage

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
99.00	0.339	1.649	2.094		
100.00	0.380	2.008	4.162		Spillway #2
101.00	0.554	2.473	30.351		
102.00	0.761	3.127	98.545		
103.00	1.000	4.005	207.032		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000	0.000
91.00	0.000	0.000	0.000
92.00	0.000	0.000	0.000
93.00	0.000	0.000	0.000
94.00	0.000	0.000	0.000
95.00	0.000	0.000	0.000
96.00	0.000	0.000	0.000
97.00	0.000	0.000	0.000
98.00	0.000	0.000	0.000
99.00	(3)>2.094	0.000	2.094
100.00	(6)>4.162	0.000	4.162
101.00	(6)>4.868	25.483	30.351
102.00	(6)>5.509	93.036	98.545
103.00	(6)>6.061	200.972	207.032

Structure #4 (Riprap Channel)

0+00 to WFSP-1 West Fork Taylor Ditch

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	26.0	3.98		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.81 cfs	

	w/o Freeboard	w/ Freeboard
Depth:	0.02 ft	4.00 ft
Top Width:	12.12 ft	36.00 ft
Velocity*:		
X-Section Area:	0.24 sq ft	
Hydraulic Radius:	0.020 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Null)

Null Above West Taylor Pond

Structure #2 (Pond)

West Taylor Pond

Pond Inputs:

Initial Pool Elev:	7,468.00 ft
Initial Pool:	1.77 ac-ft
*Sediment Storage:	0.00 ac-ft
Dead Space:	20.00 %

**No sediment capacity defined*

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
18.00	10.50	18.00	150.00	2.00	0.0150	7,471.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,475.00	30.00	2.00:1	2.00:1	30.00

Pond Results:

Peak Elevation:	7,471.51 ft
H'graph Detention Time:	5.39 hrs
Pond Model:	CSTRS
Dewater Time:	1.46 days
Trap Efficiency:	76.09 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,455.00	0.022	0.000	0.000		Top of Sed. Storage
7,456.00	0.032	0.027	0.000		
7,457.00	0.043	0.064	0.000		
7,458.00	0.054	0.113	0.000		
7,459.00	0.066	0.173	0.000		
7,460.00	0.079	0.245	0.000		
7,461.00	0.103	0.336	0.000		
7,462.00	0.139	0.456	0.000		
7,463.00	0.162	0.607	0.000		
7,464.00	0.188	0.781	0.000		
7,465.00	0.213	0.981	0.000		
7,466.00	0.244	1.209	0.000		
7,467.00	0.279	1.470	0.000		
7,468.00	0.312	1.766	0.000		Low hole SPW #1
7,469.00	0.360	2.102	0.473	8.60*	
7,470.00	0.389	2.476	0.669	8.05	
7,471.00	0.430	2.886	0.819	8.30	Spillway #1
7,471.51	0.445	3.112	4.725	10.10	Peak Stage
7,472.00	0.463	3.332	8.509		
7,473.00	0.503	3.814	12.033		
7,474.00	0.541	4.336	14.738		
7,475.00	0.580	4.897	17.018		Spillway #2
7,476.00	0.581	5.477	83.791		
7,477.00	0.582	6.058	246.034		
7,478.00	0.583	6.641	483.806		
7,479.00	0.584	7.224	794.453		
7,480.00	0.585	7.809	1,172.300		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,455.00	0.000	0.000	0.000
7,456.00	0.000	0.000	0.000
7,457.00	0.000	0.000	0.000
7,458.00	0.000	0.000	0.000
7,459.00	0.000	0.000	0.000
7,460.00	0.000	0.000	0.000
7,461.00	0.000	0.000	0.000
7,462.00	0.000	0.000	0.000
7,463.00	0.000	0.000	0.000
7,464.00	0.000	0.000	0.000
7,465.00	0.000	0.000	0.000
7,466.00	0.000	0.000	0.000
7,467.00	0.000	0.000	0.000
7,468.00	3.00>0.000	0.000	0.000
7,469.00	0.473	0.000	0.473
7,470.00	0.669	0.000	0.669
7,471.00	0.819	0.000	0.819
7,472.00	8.509	0.000	8.509
7,473.00	12.033	0.000	12.033
7,474.00	14.738	0.000	14.738
7,475.00	17.018	0.000	17.018
7,476.00	19.026	64.765	83.791
7,477.00	20.842	225.191	246.034
7,478.00	22.512	461.294	483.806
7,479.00	24.066	770.387	794.453
7,480.00	25.526	1,146.774	1,172.300

Structure #1 (Null)

Null Below West Taylor Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#35	1	31.000	0.224	0.000	0.000	62.000	M	0.15	0.102
	Σ	**31.000**						**0.15**	**0.102**
#34	Σ	**31.000**						**0.15**	**0.102**
#33	1	6.600	0.043	0.000	0.000	62.000	M	0.05	0.027
	Σ	**6.600**						**0.05**	**0.027**
#32	Σ	**6.600**						**0.05**	**0.027**
#31	1	18.800	0.247	0.000	0.000	62.000	M	0.09	0.062
	Σ	**18.800**						**0.09**	**0.062**
#30	Σ	**18.800**						**0.09**	**0.062**
#29	1	14.000	0.059	0.000	0.000	62.000	M	0.11	0.057
	Σ	**14.000**						**0.11**	**0.057**
#28	Σ	**14.000**						**0.11**	**0.057**
#27	1	14.900	0.094	0.000	0.000	62.000	M	0.11	0.061
	2	10.200	0.050	0.000	0.000	80.000	F	5.26	0.377
	Σ	**25.100**						**5.26**	**0.438**
#26	Σ	**25.100**						**5.26**	**0.438**
#25	1	128.000	0.877	0.000	0.000	62.000	M	0.53	0.418
	2	0.500	0.018	0.000	0.000	80.000	F	0.26	0.015
	3	0.700	0.024	0.000	0.000	80.000	F	0.36	0.022
	Σ	**224.700**						**5.87**	**1.141**
#24	Σ	**224.700**						**5.87**	**1.141**
#23	1	2.500	0.021	0.000	0.000	47.000	S	0.00	0.000
	2	89.600	0.104	0.000	0.000	80.000	F	46.17	3.316
	3	4.900	0.200	0.000	0.000	62.000	M	0.02	0.016
	4	4.400	0.046	0.000	0.000	80.000	F	2.27	0.163
	5	34.200	0.063	0.000	0.000	62.000	M	0.26	0.140
	6	6.300	0.097	0.000	0.000	80.000	F	3.25	0.233
	Σ	**366.600**						**51.68**	**3.868**
#22	Σ	**366.600**						**51.68**	**3.868**
#21	1	3.000	0.006	0.000	0.000	62.000	M	0.02	0.011
	Σ	**3.000**						**0.02**	**0.011**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#20	**Σ**	**3.000**						**0.02**	**0.011**
#19	1	4.000	0.016	0.000	0.000	62.000	M	0.03	0.016
	Σ	**4.000**						**0.03**	**0.016**
#18	**Σ**	**4.000**						**0.03**	**0.016**
#17	1	10.400	0.022	0.000	0.000	80.000	M	5.36	0.385
	2	1.100	0.014	0.000	0.000	80.000	M	0.57	0.041
	3	0.600	0.026	0.000	0.000	62.000	M	0.00	0.000
	4	0.600	0.020	0.000	0.000	62.000	M	0.00	0.000
	5	0.900	0.021	0.000	0.000	62.000	M	0.00	0.000
	6	21.500	0.090	0.000	0.000	47.000	S	0.00	0.000
	Σ	**408.700**						**5.93**	**3.136**
#16	1	7.300	0.015	0.000	0.000	62.000	M	0.06	0.030
	Σ	**7.300**						**0.06**	**0.030**
#15	**Σ**	**7.300**						**0.06**	**0.030**
#14	1	1.900	0.008	0.000	0.000	62.000	M	0.01	0.002
	Σ	**1.900**						**0.01**	**0.002**
#13	**Σ**	**1.900**						**0.01**	**0.002**
#11	1	98.000	0.045	0.000	0.000	47.000	S	0.00	0.000
	2	29.600	0.171	0.000	0.000	74.000	F	6.03	0.621
	3	53.700	0.137	0.000	0.000	62.000	M	0.27	0.179
	Σ	**181.300**						**6.03**	**0.800**
#10	1	8.600	0.032	0.000	0.000	80.000	F	4.43	0.318
	2	36.800	0.141	0.000	0.000	74.000	F	7.57	0.772
	3	19.100	0.105	0.000	0.000	62.000	M	0.14	0.078
	Σ	**64.500**						**9.76**	**1.168**
#9	**Σ**	**245.800**						**14.49**	**1.968**
#8	1	8.600	0.044	0.000	0.000	80.000	F	4.43	0.318
	2	4.700	0.013	0.000	0.000	80.000	F	2.42	0.174
	Σ	**259.100**						**20.88**	**2.460**
#7	**Σ**	**259.100**						**20.88**	**2.460**
#6	1	43.000	0.095	0.000	0.000	47.000	S	0.00	0.000
	2	0.400	0.015	0.000	0.000	62.000	M	0.00	0.000
	3	1.600	0.020	0.000	0.000	47.000	S	0.00	0.000
	4	1.200	0.022	0.000	0.000	47.000	S	0.00	0.000
	5	11.600	0.051	0.000	0.000	80.000	F	5.98	0.429
	6	36.700	0.140	0.000	0.000	80.000	F	14.70	1.310

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**353.600**						**18.47**	**2.931**
#5	**Σ**	**353.600**						**18.47**	**2.931**
#4	1	6.400	0.037	0.000	0.000	80.000	M	3.30	0.237
	2	1.000	0.038	0.000	0.000	80.000	M	0.52	0.037
	3	2.800	0.019	0.000	0.000	47.000	S	0.00	0.000
	4	0.900	0.010	0.000	0.000	62.000	M	0.00	0.000
	5	23.300	0.094	0.000	0.000	47.000	S	0.00	0.000
	6	1.000	0.020	0.000	0.000	62.000	M	0.00	0.000
	Σ	**398.200**						**3.81**	**1.966**
#3	**Σ**	**806.900**						**9.74**	**5.102**
#2	1	10.500	0.051	0.000	0.000	47.000	S	0.00	0.000
	2	17.100	0.058	0.000	0.000	47.000	S	0.00	0.000
	Σ	**834.500**						**9.74**	**5.102**
#1	**Σ**	**834.500**						**4.72**	**4.921**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#35	1	0.300	400.00	10.00	0.0100	0.3800	1	0.0	272	0.14	0.12
	Σ							**0.0**	**272**	**0.14**	**0.12**
#34	**Σ**							**0.0**	**272**	**0.14**	**0.12**
#33	1	0.300	200.00	18.00	0.0100	0.3800	1	0.0	442	0.25	0.19
	Σ							**0.0**	**442**	**0.25**	**0.19**
#32	**Σ**							**0.0**	**442**	**0.25**	**0.19**
#31	1	0.300	200.00	5.00	0.0100	0.3800	1	0.0	82	0.04	0.03
	Σ							**0.0**	**82**	**0.04**	**0.03**
#30	**Σ**							**0.0**	**82**	**0.04**	**0.03**
#29	1	0.300	200.00	15.00	0.0100	0.3800	1	0.0	388	0.22	0.17
	Σ							**0.0**	**388**	**0.22**	**0.17**
#28	**Σ**							**0.0**	**388**	**0.22**	**0.17**
#27	1	0.300	200.00	11.00	0.0100	0.3800	1	0.0	260	0.15	0.11
	2	0.300	200.00	12.00	0.8000	0.3800	1	35.0	139,589	79.56	37.46

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**35.1**	**139,589**	**79.56**	**32.31**
#26	Σ							**35.1**	**139,589**	**79.56**	**32.31**
#25	1	0.300	400.00	13.00	0.0100	0.3800	1	0.2	493	0.24	0.21
	2	0.300	100.00	11.00	0.8000	0.3800	1	0.7	63,602	36.25	19.81
	3	0.300	100.00	9.00	0.8000	0.3800	1	0.7	46,634	26.58	13.65
	Σ							**36.8**	**130,836**	**74.48**	**13.08**
#24	Σ							**36.8**	**130,836**	**74.48**	**13.08**
#23	1	0.300	150.00	19.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	13.00	0.8000	0.3800	1	673.5	286,377	163.23	78.55
	3	0.300	200.00	1.00	0.0700	0.3800	1	0.0	97	0.05	0.04
	4	0.300	200.00	6.00	0.8000	0.3800	1	5.2	49,425	28.17	13.10
	5	0.300	400.00	1.60	0.0700	0.3800	1	0.0	256	0.15	0.11
	6	0.300	200.00	4.30	0.8000	0.3800	1	5.6	37,821	21.56	10.00
	Σ							**721.1**	**262,703**	**152.82**	**70.37**
#22	Σ							**721.1**	**262,703**	**152.82**	**70.37**
#21	1	0.300	50.00	26.00	0.0100	0.3800	1	0.0	300	0.17	0.14
	Σ							**0.0**	**300**	**0.17**	**0.14**
#20	Σ							**0.0**	**300**	**0.17**	**0.14**
#19	1	0.300	100.00	30.00	0.0100	0.3800	1	0.0	484	0.28	0.21
	Σ							**0.0**	**484**	**0.28**	**0.21**
#18	Σ							**0.0**	**484**	**0.28**	**0.21**
#17	1	0.300	200.00	20.00	0.8000	0.3800	1	67.4	251,013	143.07	68.49
	2	0.300	100.00	25.00	0.8000	0.3800	1	4.6	168,220	95.88	45.34
	3	0.300	100.00	30.00	0.0100	0.3800	1	0.0	1	0.00	0.00
	4	0.300	100.00	27.00	0.0100	0.3800	1	0.0	1	0.00	0.00
	5	0.300	100.00	33.00	0.0100	0.3800	1	0.0	1	0.00	0.00
	6	0.300	400.00	22.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**72.1**	**243,349**	**138.65**	**9.77**
#16	1	0.300	100.00	30.00	0.0100	0.3800	1	0.0	519	0.30	0.22
	Σ							**0.0**	**519**	**0.30**	**0.22**
#15	Σ							**0.0**	**519**	**0.30**	**0.22**
#14	1	0.300	75.00	30.00	0.0100	0.3800	1	0.0	1,577	0.90	0.84
	Σ							**0.0**	**1,577**	**0.90**	**0.84**
#13	Σ							**0.0**	**1,577**	**0.90**	**0.84**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#11	1	0.300	200.00	35.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	13.00	0.0700	0.3800	1	7.5	19,417	10.00	4.56
	3	0.300	400.00	20.00	0.0100	0.3800	1	0.2	851	0.43	0.36
	Σ							**7.7**	**19,417**	**10.00**	**3.63**
#10	1	0.300	200.00	16.00	0.8000	0.3800	1	41.9	193,209	110.12	52.26
	2	0.300	400.00	12.00	0.0700	0.3800	1	8.7	18,107	9.35	4.25
	3	0.300	400.00	16.00	0.0100	0.3800	1	0.1	661	0.38	0.29
	Σ							**50.6**	**144,085**	**80.80**	**17.35**
#9	Σ							**58.3**	**140,530**	**77.96**	**11.81**
#8	1	0.300	200.00	15.00	0.8000	0.3800	1	38.6	179,477	102.30	48.45
	2	0.300	100.00	22.00	0.8000	0.3800	1	20.4	173,530	98.91	46.80
	Σ							**117.3**	**138,841**	**78.08**	**19.11**
#7	Σ							**117.3**	**138,841**	**78.08**	**19.11**
#6	1	0.300	200.00	20.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	100.00	15.00	0.0100	0.3800	1	0.0	1	0.00	0.00
	3	0.300	50.00	12.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	4	0.300	50.00	11.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	5	0.300	200.00	5.70	0.8000	0.3800	1	14.5	52,802	30.10	14.00
	6	0.300	400.00	6.10	0.8000	0.3800	1	69.2	77,599	41.53	20.35
	Σ							**83.7**	**73,639**	**39.85**	**11.70**
#5	Σ							**83.7**	**73,639**	**39.85**	**11.70**
#4	1	0.300	200.00	11.00	0.8000	0.3800	1	18.5	118,211	67.38	31.63
	2	0.300	100.00	23.00	0.8000	0.3800	1	3.8	152,789	87.08	41.09
	3	0.300	100.00	20.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	4	0.300	100.00	20.00	0.0100	0.3800	1	0.0	1	0.00	0.00
	5	0.300	400.00	37.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	6	0.300	150.00	30.00	0.0100	0.3800	1	0.0	1	0.00	0.00
	Σ							**22.3**	**122,943**	**70.07**	**5.98**
#3	Σ							**94.3**	**197,690**	**112.65**	**8.51**
#2	1	0.300	400.00	45.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	2	0.300	400.00	40.00	0.0310	0.9000	1	0.0	1	0.00	0.00
	Σ							**94.3**	**197,690**	**112.65**	**8.51**
#1	Σ							**22.6**	**5,139**	**0.22**	**0.15**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	45.00	443.25	985.00	5.360	0.051
#2	**1**	**Time of Concentration:**					**0.051**
#2	2	3. Short grass pasture	40.00	425.60	1,064.00	5.050	0.058
#2	**2**	**Time of Concentration:**					**0.058**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	11.00	48.95	445.00	3.310	0.037
#4	**1**	**Time of Concentration:**					**0.037**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	23.00	49.45	215.00	4.790	0.012
		8. Large gullies, diversions, and low flowing streams	1.50	5.25	350.00	3.670	0.026
#4	**2**	**Time of Concentration:**					**0.038**
#4	3	3. Short grass pasture	20.00	50.00	250.00	3.570	0.019
#4	**3**	**Time of Concentration:**					**0.019**
#4	4	3. Short grass pasture	19.00	24.70	130.00	3.480	0.010
#4	**4**	**Time of Concentration:**					**0.010**
#4	5	3. Short grass pasture	37.00	475.45	1,285.00	4.860	0.073
		8. Large gullies, diversions, and low flowing streams	28.00	345.80	1,235.00	15.870	0.021
#4	**5**	**Time of Concentration:**					**0.094**
#4	6	3. Short grass pasture	30.00	97.80	326.00	4.380	0.020
#4	**6**	**Time of Concentration:**					**0.020**
#6	1	3. Short grass pasture	14.60	75.01	513.76	3.050	0.046
		8. Large gullies, diversions, and low flowing streams	1.50	5.67	378.00	3.670	0.028
#6	**1**	**Time of Concentration:**					**0.095**
#6	2	3. Short grass pasture	20.00	246.20	1,231.00	3.570	0.095
#6	**2**	**Time of Concentration:**					**0.015**
#6	3	2. Minimum tillage cultivation	6.00	73.19	1,220.00	1.220	0.277
		8. Large gullies, diversions, and low flowing streams	1.50	20.43	1,362.00	3.670	0.103
#6	**3**	**Time of Concentration:**					**0.020**
#6	4	2. Minimum tillage cultivation	6.00	26.51	442.00	1.220	0.100
		8. Large gullies, diversions, and low flowing streams	1.50	19.50	1,300.00	3.670	0.098
#6	**4**	**Time of Concentration:**					**0.022**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	5.70	25.19	442.00	2.380	0.051
#6	**5**	**Time of Concentration:**					**0.051**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	6.10	75.64	1,240.00	2.460	0.140
#6	**6**	**Time of Concentration:**					**0.140**
#8	1	3. Short grass pasture	15.00	73.80	492.00	3.090	0.044
#8	**1**	**Time of Concentration:**					**0.044**
#8	2	5. Nearly bare and untilled, and alluvial valley fans	22.00	50.38	229.00	4.690	0.013
#8	**2**	**Time of Concentration:**					**0.013**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	1	5. Nearly bare and untilled, and alluvial valley fans	16.00	75.19	470.00	4.000	0.032
#10	**1**	**Time of Concentration:**					**0.032**
#10	2	3. Short grass pasture	12.00	169.44	1,412.00	2.770	0.141
#10	**2**	**Time of Concentration:**					**0.141**
#10	3	3. Short grass pasture	16.00	194.72	1,217.00	3.200	0.105
#10	**3**	**Time of Concentration:**					**0.105**
#11	1	3. Short grass pasture	35.00	271.94	777.00	4.730	0.045
#11	**1**	**Time of Concentration:**					**0.045**
#11	2	3. Short grass pasture	13.00	231.79	1,783.00	2.880	0.171
#11	**2**	**Time of Concentration:**					**0.171**
#11	3	3. Short grass pasture	20.00	352.80	1,764.00	3.570	0.137
#11	**3**	**Time of Concentration:**					**0.137**
#14	1	3. Short grass pasture	30.00	40.80	135.99	4.380	0.008
#14	**1**	**Time of Concentration:**					**0.008**
#16	1	3. Short grass pasture	30.00	73.50	244.99	4.380	0.015
#16	**1**	**Time of Concentration:**					**0.015**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	20.00	73.40	367.00	4.470	0.022
#17	**1**	**Time of Concentration:**					**0.022**
#17	2	5. Nearly bare and untilled, and alluvial valley fans	24.80	49.60	200.00	4.970	0.011
		8. Large gullies, diversions, and low flowing streams	1.50	0.75	50.00	3.670	0.003
#17	**2**	**Time of Concentration:**					**0.014**
#17	3	3. Short grass pasture	30.00	80.40	268.00	4.380	0.016
		8. Large gullies, diversions, and low flowing streams	14.00	60.62	433.00	11.220	0.010
#17	**3**	**Time of Concentration:**					**0.026**
#17	4	3. Short grass pasture	27.00	49.95	185.00	4.150	0.012
		8. Large gullies, diversions, and low flowing streams	24.00	111.36	464.00	14.690	0.008
#17	**4**	**Time of Concentration:**					**0.020**
#17	5	3. Short grass pasture	33.00	74.25	225.00	4.590	0.013
		8. Large gullies, diversions, and low flowing streams	25.00	120.00	480.00	15.000	0.008
#17	**5**	**Time of Concentration:**					**0.021**
#17	6	3. Short grass pasture	33.00	448.80	1,360.00	4.590	0.082
		8. Large gullies, diversions, and low flowing streams	25.00	120.00	480.00	15.000	0.008
#17	**6**	**Time of Concentration:**					**0.090**
#19	1	3. Short grass pasture	30.00	78.00	260.00	4.380	0.016
#19	**1**	**Time of Concentration:**					**0.016**
#21	1	3. Short grass pasture	26.00	24.70	95.00	4.070	0.006
#21	**1**	**Time of Concentration:**					**0.006**
#23	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	23.28	582.00	2.000	0.080

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#23	**1**	**Time of Concentration:**					**0.021**
#23	2	8. Large gullies, diversions, and low flowing streams	1.00	4.92	492.00	3.000	0.045
		5. Nearly bare and untilled, and alluvial valley fans	13.00	99.84	768.00	3.600	0.059
#23	**2**	**Time of Concentration:**					**0.104**
#23	3	3. Short grass pasture	1.00	5.78	578.00	0.800	0.200
#23	**3**	**Time of Concentration:**					**0.200**
#23	4	5. Nearly bare and untilled, and alluvial valley fans	6.00	24.48	408.00	2.440	0.046
#23	**4**	**Time of Concentration:**					**0.046**
#23	5	3. Short grass pasture	19.00	152.00	800.00	3.480	0.063
#23	**5**	**Time of Concentration:**					**0.063**
#23	6	3. Short grass pasture	4.30	25.02	582.00	1.650	0.097
#23	**6**	**Time of Concentration:**					**0.097**
#25	1	3. Short grass pasture	4.00	148.44	3,711.00	1.600	0.644
		8. Large gullies, diversions, and low flowing streams	4.70	256.62	5,460.00	6.500	0.233
#25	**1**	**Time of Concentration:**					**0.877**
#25	2	3. Short grass pasture	20.00	75.00	375.00	3.570	0.029
#25	**2**	**Time of Concentration:**					**0.018**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	9.00	24.03	267.00	3.000	0.024
#25	**3**	**Time of Concentration:**					**0.024**
#27	1	3. Short grass pasture	11.00	99.00	900.00	2.650	0.094
#27	**1**	**Time of Concentration:**					**0.094**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	12.00	74.87	624.00	3.460	0.050
#27	**2**	**Time of Concentration:**					**0.050**
#29	1	3. Short grass pasture	15.00	99.00	660.00	3.090	0.059
#29	**1**	**Time of Concentration:**					**0.059**
#31	1	3. Short grass pasture	5.00	79.25	1,585.00	1.780	0.247
#31	**1**	**Time of Concentration:**					**0.247**
#33	1	3. Short grass pasture	18.00	95.04	528.00	3.390	0.043
#33	**1**	**Time of Concentration:**					**0.043**
#35	1	3. Short grass pasture	10.00	203.50	2,035.00	2.520	0.224
#35	**1**	**Time of Concentration:**					**0.224**

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West Taylor Pond
25 Yr - 24 Hr Strom Event

Emergency Spillway Demonstration

Post Mining

Tony Tennyson

Tri-State Generation & Transmission Association, Inc.
1100 West 116th Avenue
Westminster, CO 80234

Phone: (970) 824-1232
Email: ttennyson@tristategt.org

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Null Below West Taylor Pond
Pond	#2	==>	#1	0.000	0.000	West Taylor Pond
Null	#3	==>	#2	0.000	0.000	Null Above West Taylor Pond
Channel	#4	==>	#3	0.000	0.000	0+00 to WFSP-1 West Fork Taylor Ditch
Pond	#5	==>	#4	0.000	0.000	WFSP-1 Stock Pond
Channel	#6	==>	#5	0.000	0.000	Channel WFSP-1 to WFSP-2
Pond	#7	==>	#6	0.000	0.000	WFSP-2 Stockpond
Channel	#8	==>	#7	0.000	0.000	WFSP-2 to Station 40+00
Null	#9	==>	#8	0.000	0.000	Null Confluence Trib 1
Channel	#10	==>	#9	0.000	0.000	Trib 1
Channel	#11	==>	#9	0.000	0.000	West Fork Station 40+00 to 83+05
Null	#13	==>	#4	0.000	0.000	Null Confluence West 7800' Terrace Ditch
Channel	#14	==>	#13	0.000	0.000	West 7800' Terrace Ditch
Null	#15	==>	#4	0.000	0.000	Null 7700' Terrace Ditch
Channel	#16	==>	#15	0.000	0.000	7700' Terrace Ditch
Channel	#17	==>	#3	0.000	0.000	East Fork Taylor Ditch 0+00 to EFSP-1
Null	#18	==>	#17	0.000	0.000	Null 7600' Terrace Ditch
Channel	#19	==>	#18	0.000	0.000	7600' Terrace Ditch
Null	#20	==>	#17	0.000	0.000	Null 7800' Terrace Ditch
Channel	#21	==>	#20	0.000	0.000	East 7800' Terrace Ditch
Pond	#22	==>	#17	0.000	0.000	EFSP-1 Stock Pond
Channel	#23	==>	#22	0.000	0.000	EFSP-1 to EFSP-2 Veg Channel
Pond	#24	==>	#23	0.000	0.000	EFSP-2 Stockpond
Channel	#25	==>	#24	0.000	0.000	EFSP-2 to Station 124+03
Null	#26	==>	#25	0.000	0.000	Null Confluence Trib 2
Channel	#27	==>	#26	0.000	0.000	Trib 2
Null	#28	==>	#25	0.000	0.000	Null Confluence Trib 3
Channel	#29	==>	#28	0.000	0.000	Trib 3
Null	#30	==>	#25	0.000	0.000	Null Confluence Trib 5
Channel	#31	==>	#30	0.000	0.000	Trib 5
Null	#32	==>	#25	0.000	0.000	Null Confluence Trib 4
Channel	#33	==>	#32	0.000	0.000	Trib 4
Null	#34	==>	#25	0.000	0.000	Null Confluence Trib 6
Channel	#35	==>	#34	0.000	0.000	Trib 6


#34
Null
#33
Chan'l
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Null
#31
Chan'l
#30
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#27
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#26
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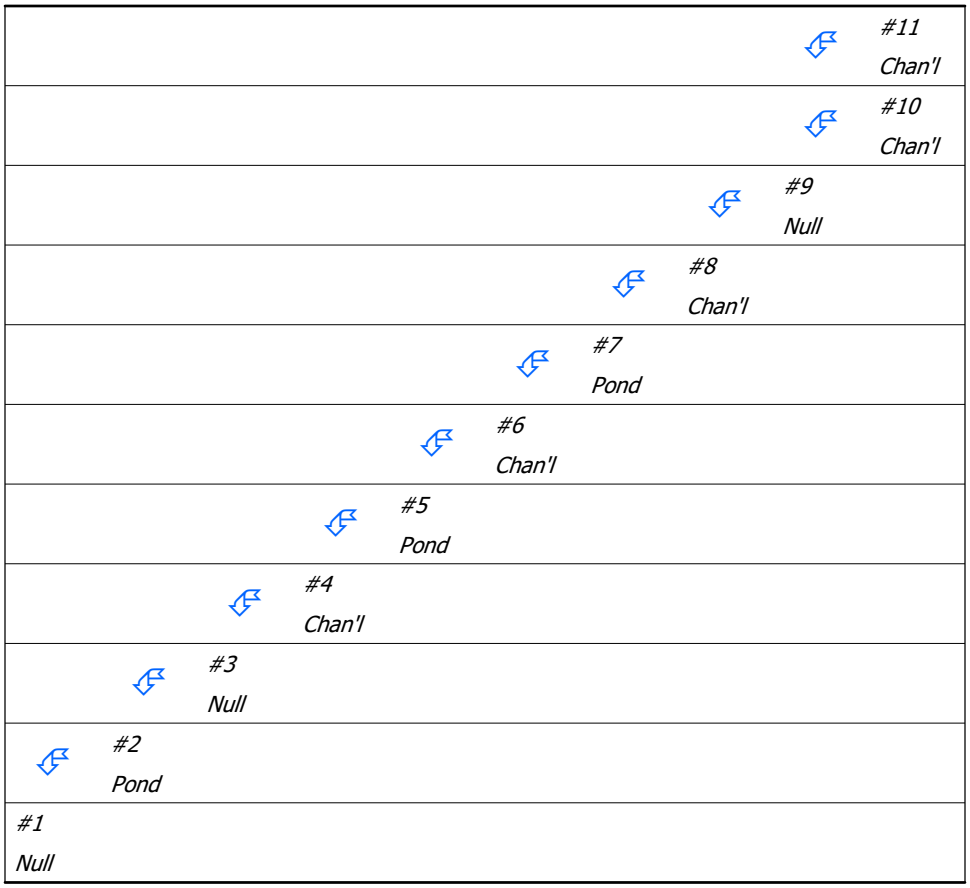
#11
Chan'l
#10
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#9
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#8
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#7
Pond
#6
Chan'l
#5
Pond
#4
Chan'l
#3
Null
#2
Pond
#1
Null

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#35		31.000	31.000	1.40	0.33
#34		0.000	31.000	1.40	0.33
#33		6.600	6.600	0.91	0.09
#32		0.000	6.600	0.91	0.09
#31		18.800	18.800	0.81	0.20
#30		0.000	18.800	0.81	0.20
#29		14.000	14.000	1.93	0.19
#28		0.000	14.000	1.93	0.19
#27		25.100	25.100	10.76	0.84
#26		0.000	25.100	10.76	0.84
#25		129.200	224.700	14.89	3.08
#24	In	0.000	224.700	14.89	3.08
	Out			2.38	1.89
#23		141.900	366.600	90.34	8.69
#22	In	0.000	366.600	90.34	8.69
	Out			32.00	7.51
#21		3.000	3.000	0.41	0.04
#20		0.000	3.000	0.41	0.04
#19		4.000	4.000	0.55	0.05
#18		0.000	4.000	0.55	0.05
#17		35.100	408.700	36.45	8.34
#16		7.300	7.300	1.01	0.10
#15		0.000	7.300	1.01	0.10
#14		1.900	1.900	0.26	0.03
#13		0.000	1.900	0.26	0.03
#11		181.300	181.300	15.39	1.77
#10		64.500	64.500	23.30	2.27
#9		0.000	245.800	34.54	4.04
#8		13.300	259.100	45.89	4.87
#7	In	0.000	259.100	45.89	4.87
	Out			6.64	3.60
#6		94.500	353.600	32.86	6.55
#5	In	0.000	353.600	32.86	6.55
	Out			8.68	5.28
#4		35.400	398.200	9.30	5.89
#3		0.000	806.900	44.30	14.22
#2	In	27.600	834.500	44.30	14.22
	Out			13.96	13.98
#1		0.000	834.500	13.96	13.98

Structure Detail:

Structure #35 (Vegetated Channel)

Trib 6

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	6.0	D, B	1.58			6.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	1.40 cfs		1.40 cfs	
Depth:	0.19 ft	1.77 ft	0.42 ft	2.00 ft
Top Width:	7.11 ft	16.59 ft	8.51 ft	17.99 ft
Velocity:	1.16 fps		0.46 fps	
X-Section Area:	1.21 sq ft		3.04 sq ft	
Hydraulic Radius:	0.169 ft		0.352 ft	
Froude Number:	0.49		0.14	
Roughness Coefficient:	0.0960		0.3939	

Structure #34 (Null)

Null Confluence Trib 6

Structure #33 (Vegetated Channel)

Trib 4

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	16.0	D, B	1.73			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.91 cfs		0.91 cfs	
Depth:	0.12 ft	1.85 ft	0.27 ft	2.00 ft
Top Width:	6.69 ft	17.07 ft	7.63 ft	18.01 ft
Velocity:	1.25 fps		0.49 fps	
X-Section Area:	0.73 sq ft		1.85 sq ft	
Hydraulic Radius:	0.108 ft		0.239 ft	
Froude Number:	0.67		0.18	
Roughness Coefficient:	0.1074		0.4652	

Structure #32 (Null)

Null Confluence Trib 4

Structure #31 (Vegetated Channel)

Trib 5

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	4.0	D, B	1.60			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.81 cfs		0.81 cfs	
Depth:	0.17 ft	1.77 ft	0.40 ft	2.00 ft
Top Width:	7.00 ft	16.60 ft	8.42 ft	18.02 ft
Velocity:	0.75 fps		0.28 fps	
X-Section Area:	1.08 sq ft		2.91 sq ft	
Hydraulic Radius:	0.153 ft		0.341 ft	
Froude Number:	0.34		0.08	
Roughness Coefficient:	0.1131		0.5242	

Structure #30 (Null)

Null Confluence Trib 5

Structure #29 (Vegetated Channel)

Trib 3

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	11.0	D, B	1.62			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	1.93 cfs		1.93 cfs	
Depth:	0.18 ft	1.80 ft	0.38 ft	2.00 ft
Top Width:	7.06 ft	16.78 ft	8.29 ft	18.01 ft
Velocity:	1.68 fps		0.71 fps	
X-Section Area:	1.15 sq ft		2.72 sq ft	
Hydraulic Radius:	0.162 ft		0.324 ft	
Froude Number:	0.73		0.22	
Roughness Coefficient:	0.0868		0.3277	

Structure #28 (Null)

Null Confluence Trib 3

Structure #27 (Vegetated Channel)

Trib 2

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	11.0	D, B	1.36			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	10.76 cfs		10.76 cfs	
Depth:	0.36 ft	1.72 ft	0.64 ft	2.00 ft
Top Width:	8.17 ft	16.33 ft	9.82 ft	17.98 ft

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Velocity:	4.19 fps		2.14 fps	
X-Section Area:	2.57 sq ft		5.03 sq ft	
Hydraulic Radius:	0.309 ft		0.502 ft	
Froude Number:	1.32		0.53	
Roughness Coefficient:	0.0538		0.1456	

Structure #26 (Null)

Null Confluence Trib 2

Structure #25 (Vegetated Channel)

EFSP-2 to Station 124+03

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	4.7	D, B	3.28			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	14.89 cfs		14.89 cfs	
Depth:	0.40 ft	3.68 ft	0.72 ft	4.00 ft
Top Width:	14.39 ft	34.07 ft	16.32 ft	36.00 ft
Velocity:	2.83 fps		1.46 fps	
X-Section Area:	5.27 sq ft		10.20 sq ft	
Hydraulic Radius:	0.363 ft		0.616 ft	
Froude Number:	0.82		0.33	
Roughness Coefficient:	0.0579		0.1599	

Structure #24 (Pond)

EFSP-2 Stockpond

Pond Inputs:

Initial Pool Elev:	92.00 ft
Initial Pool:	0.15 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	1.50	0.0150	98.00	0.50	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	99.13 ft
Dewater Time:	0.75 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		Spillway #1
99.00	0.339	1.649	2.094	15.65	
99.13	0.346	1.697	2.385	2.35	Peak Stage
100.00	0.380	2.008	4.263		Spillway #2
101.00	0.554	2.473	30.516		
102.00	0.761	3.127	98.736		
103.00	1.000	4.005	207.246		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000	0.000
91.00	0.000	0.000	0.000
92.00	0.000	0.000	0.000
93.00	0.000	0.000	0.000
94.00	0.000	0.000	0.000
95.00	0.000	0.000	0.000
96.00	0.000	0.000	0.000
97.00	0.000	0.000	0.000
98.00	0.000	0.000	0.000
99.00	(3)>2.094	0.000	2.094
100.00	(5)>4.263	0.000	4.263
101.00	(6)>5.033	25.483	30.516
102.00	(6)>5.701	93.036	98.736
103.00	(6)>6.275	200.972	207.246

Structure #23 (Vegetated Channel)

EFSP-1 to EFSP-2 Veg Channel

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	1.5	D, B	2.24			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	90.34 cfs		90.34 cfs	
Depth:	1.20 ft	3.44 ft	1.76 ft	4.00 ft
Top Width:	19.19 ft	32.63 ft	22.57 ft	36.01 ft
Velocity:	4.84 fps		2.97 fps	
X-Section Area:	18.68 sq ft		30.46 sq ft	
Hydraulic Radius:	0.954 ft		1.316 ft	
Froude Number:	0.86		0.45	
Roughness Coefficient:	0.0365		0.0738	

Structure #22 (Pond)

EFSP-1 Stock Pond

Pond Inputs:

Initial Pool Elev:	92.00 ft
Initial Pool:	0.15 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	1.50	0.0150	98.00	0.50	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	101.02 ft
Dewater Time:	1.15 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		Spillway #1
99.00	0.339	1.649	2.094	13.55	
100.00	0.380	2.008	4.263	5.85	Spillway #2
101.00	0.554	2.473	30.516		
101.02	0.575	2.487	32.004	8.10	Peak Stage
102.00	0.761	3.127	98.736		
103.00	1.000	4.005	207.246		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000	0.000
91.00	0.000	0.000	0.000
92.00	0.000	0.000	0.000
93.00	0.000	0.000	0.000
94.00	0.000	0.000	0.000
95.00	0.000	0.000	0.000
96.00	0.000	0.000	0.000
97.00	0.000	0.000	0.000
98.00	0.000	0.000	0.000
99.00	(3)>2.094	0.000	2.094
100.00	(5)>4.263	0.000	4.263
101.00	(6)>5.033	25.483	30.516
102.00	(6)>5.701	93.036	98.736
103.00	(6)>6.275	200.972	207.246

Structure #21 (Vegetated Channel)

East 7800' Terrace Ditch

Triangular Vegetated Channel Inputs:

Material: Smooth brome

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	3.0:1	1.5	D, B	2.03			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.41 cfs		0.41 cfs	
Depth:	0.52 ft	2.55 ft	0.97 ft	3.00 ft
Top Width:	2.33 ft	11.47 ft	4.39 ft	13.52 ft
Velocity:	0.69 fps		0.19 fps	
X-Section Area:	0.60 sq ft		2.14 sq ft	
Hydraulic Radius:	0.237 ft		0.445 ft	
Froude Number:	0.24		0.05	
Roughness Coefficient:	0.1016		0.5489	

Structure #20 (Null)

Null 7800' Terrace Ditch

Structure #19 (Vegetated Channel)

7600' Terrace Ditch

Triangular Vegetated Channel Inputs:

Material: Smooth brome

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	3.0:1	1.5	D, B	1.96			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.55 cfs		0.55 cfs	
Depth:	0.56 ft	2.52 ft	1.04 ft	3.00 ft
Top Width:	2.54 ft	11.36 ft	4.68 ft	13.50 ft
Velocity:	0.77 fps		0.23 fps	
X-Section Area:	0.72 sq ft		2.43 sq ft	
Hydraulic Radius:	0.258 ft		0.475 ft	
Froude Number:	0.26		0.06	
Roughness Coefficient:	0.0955		0.4878	

Structure #18 (Null)

Null 7600' Terrace Ditch

Structure #17 (Riprap Channel)

East Fork Taylor Ditch 0+00 to EFSP-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	25.0	3.83		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	36.45 cfs	
Depth:	0.17 ft	4.00 ft
Top Width:	13.05 ft	36.03 ft
Velocity*:		
X-Section Area:	2.19 sq ft	
Hydraulic Radius:	0.167 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #16 (Vegetated Channel)

7700' Terrace Ditch

Triangular Vegetated Channel Inputs:

Material: Smooth brome

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	3.0:1	1.5	D, B	1.81			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	1.01 cfs		1.01 cfs	
Depth:	0.67 ft	2.48 ft	1.19 ft	3.00 ft
Top Width:	3.03 ft	11.17 ft	5.34 ft	13.49 ft
Velocity:	0.99 fps		0.32 fps	
X-Section Area:	1.02 sq ft		3.17 sq ft	
Hydraulic Radius:	0.307 ft		0.542 ft	
Froude Number:	0.30		0.07	
Roughness Coefficient:	0.0839		0.3812	

Structure #15 (Null)

Null 7700' Terrace Ditch

Structure #14 (Vegetated Channel)

West 7800' Terrace Ditch

Triangular Vegetated Channel Inputs:

Material: Smooth brome

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	3.0:1	1.5	D, B	2.12			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	0.26 cfs		0.26 cfs	
Depth:	0.45 ft	2.57 ft	0.88 ft	3.00 ft
Top Width:	2.04 ft	11.58 ft	3.96 ft	13.50 ft
Velocity:	0.57 fps		0.15 fps	
X-Section Area:	0.46 sq ft		1.75 sq ft	
Hydraulic Radius:	0.207 ft		0.403 ft	
Froude Number:	0.21		0.04	
Roughness Coefficient:	0.1121		0.6617	

Structure #13 (Null)

Null Confluence West 7800' Terrace Ditch

Structure #11 (Vegetated Channel)

West Fork Station 40+00 to 83+05

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	8.0	D, B	3.39			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	15.39 cfs		15.39 cfs	
Depth:	0.34 ft	3.73 ft	0.61 ft	4.00 ft
Top Width:	14.06 ft	34.40 ft	15.69 ft	36.03 ft

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Velocity:	3.43 fps		1.81 fps	
X-Section Area:	4.48 sq ft		8.51 sq ft	
Hydraulic Radius:	0.316 ft		0.536 ft	
Froude Number:	1.07		0.43	
Roughness Coefficient:	0.0569		0.1538	

Structure #10 (Vegetated Channel)

Trib 1

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	5.0	D, B	1.98			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	23.30 cfs		23.30 cfs	
Depth:	0.63 ft	2.61 ft	1.02 ft	3.00 ft
Top Width:	9.80 ft	21.68 ft	12.14 ft	24.02 ft
Velocity:	4.65 fps		2.51 fps	
X-Section Area:	5.01 sq ft		9.28 sq ft	
Hydraulic Radius:	0.500 ft		0.744 ft	
Froude Number:	1.15		0.51	
Roughness Coefficient:	0.0450		0.1088	

Structure #9 (Null)

Null Confluence Trib 1

Structure #8 (Vegetated Channel)

WFSP-2 to Station 40+00

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	1.5	D, B	2.56			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	45.89 cfs		45.89 cfs	
Depth:	0.90 ft	3.46 ft	1.44 ft	4.00 ft
Top Width:	17.42 ft	32.78 ft	20.65 ft	36.01 ft
Velocity:	3.45 fps		1.95 fps	
X-Section Area:	13.28 sq ft		23.52 sq ft	
Hydraulic Radius:	0.750 ft		1.114 ft	
Froude Number:	0.70		0.32	
Roughness Coefficient:	0.0436		0.1005	

Structure #7 (Pond)

WFSP-2 Stockpond

Pond Inputs:

Initial Pool Elev:	91.00 ft
Initial Pool:	0.06 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	5.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	1.00	0.0150	98.00	0.90	0.00

Pond Results:

Peak Elevation:	100.20 ft
Dewater Time:	0.91 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		Spillway #2
99.00	0.339	1.649	2.094	12.45	
100.00	0.380	2.008	3.745	7.05	Spillway #1
100.20	0.467	2.099	6.640	2.40	Peak Stage
101.00	0.554	2.473	18.584		
102.00	0.761	3.127	61.251		
103.00	1.000	4.005	135.506		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000	0.000
91.00	0.000	0.000	0.000
92.00	0.000	0.000	0.000
93.00	0.000	0.000	0.000
94.00	0.000	0.000	0.000
95.00	0.000	0.000	0.000
96.00	0.000	0.000	0.000
97.00	0.000	0.000	0.000
98.00	0.000	0.000	0.000
99.00	0.000	(3)>2.094	2.094
100.00	0.000	(6)>3.745	3.745
101.00	14.046	(6)>4.538	18.584
102.00	56.062	(6)>5.189	61.251
103.00	129.713	(6)>5.793	135.506

Structure #6 (Vegetated Channel)

Channel WFSP-1 to WFSP-2

Trapezoidal Vegetated Channel Inputs:

Material: Smooth brome

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	1.3	D, B	2.63			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	32.86 cfs		32.86 cfs	
Depth:	0.82 ft	3.45 ft	1.37 ft	4.00 ft
Top Width:	16.92 ft	32.70 ft	20.19 ft	35.97 ft
Velocity:	2.77 fps		1.50 fps	
X-Section Area:	11.86 sq ft		21.97 sq ft	
Hydraulic Radius:	0.690 ft		1.065 ft	
Froude Number:	0.58		0.25	
Roughness Coefficient:	0.0478		0.1184	

Structure #5 (Pond)

WFSP-1 Stock Pond

Pond Inputs:

Initial Pool Elev:	91.00 ft
Initial Pool:	0.06 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	100.00	1.50	0.0150	98.00	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
100.00	20.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	100.17 ft
Dewater Time:	1.07 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
90.00	0.050	0.000	0.000		
91.00	0.072	0.061	0.000		
92.00	0.098	0.145	0.000		
93.00	0.128	0.258	0.000		
94.00	0.162	0.403	0.000		
95.00	0.200	0.583	0.000		
96.00	0.231	0.799	0.000		
97.00	0.265	1.046	0.000		
98.00	0.301	1.329	0.000		Spillway #1
99.00	0.339	1.649	2.094	13.65	
100.00	0.380	2.008	4.162	6.95	Spillway #2
100.17	0.465	2.089	8.683	5.00	Peak Stage
101.00	0.554	2.473	30.351		
102.00	0.761	3.127	98.545		
103.00	1.000	4.005	207.032		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
90.00	0.000	0.000	0.000
91.00	0.000	0.000	0.000
92.00	0.000	0.000	0.000
93.00	0.000	0.000	0.000
94.00	0.000	0.000	0.000
95.00	0.000	0.000	0.000
96.00	0.000	0.000	0.000
97.00	0.000	0.000	0.000
98.00	0.000	0.000	0.000
99.00	(3)>2.094	0.000	2.094
100.00	(6)>4.162	0.000	4.162
101.00	(6)>4.868	25.483	30.351
102.00	(6)>5.509	93.036	98.545
103.00	(6)>6.061	200.972	207.032

Structure #4 (Riprap Channel)

0+00 to WFSP-1 West Fork Taylor Ditch

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	26.0	3.95		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.30 cfs	
Depth:	0.05 ft	4.00 ft
Top Width:	12.29 ft	35.99 ft
Velocity*:		
X-Section Area:	0.58 sq ft	
Hydraulic Radius:	0.047 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Null)

Null Above West Taylor Pond

Structure #2 (Pond)

West Taylor Pond

Pond Inputs:

Initial Pool Elev:	7,468.00 ft
Initial Pool:	1.77 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
18.00	10.50	18.00	150.00	2.00	0.0150	7,471.00	2

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
7,475.00	30.00	2.00:1	2.00:1	30.00

Pond Results:

Peak Elevation:	7,473.71 ft
Dewater Time:	1.69 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,455.00	0.022	0.000	0.000		
7,456.00	0.032	0.027	0.000		
7,457.00	0.043	0.064	0.000		
7,458.00	0.054	0.113	0.000		
7,459.00	0.066	0.173	0.000		
7,460.00	0.079	0.245	0.000		
7,461.00	0.103	0.336	0.000		
7,462.00	0.139	0.456	0.000		
7,463.00	0.162	0.607	0.000		
7,464.00	0.188	0.781	0.000		
7,465.00	0.213	0.981	0.000		
7,466.00	0.244	1.209	0.000		
7,467.00	0.279	1.470	0.000		
7,468.00	0.312	1.766	0.000		Low hole SPW #1
7,469.00	0.360	2.102	0.473	8.60*	
7,470.00	0.389	2.476	0.669	8.05	
7,471.00	0.430	2.886	0.819	8.25	Spillway #1
7,472.00	0.463	3.332	8.509	8.00	
7,473.00	0.503	3.815	12.033	4.40	
7,473.71	0.530	4.186	13.960	3.35	Peak Stage
7,474.00	0.541	4.336	14.738		
7,475.00	0.580	4.897	17.018		Spillway #2
7,476.00	0.581	5.477	83.791		
7,477.00	0.582	6.059	246.034		
7,478.00	0.583	6.641	483.806		
7,479.00	0.584	7.225	794.453		
7,480.00	0.585	7.809	1,172.300		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
7,455.00	0.000	0.000	0.000
7,456.00	0.000	0.000	0.000
7,457.00	0.000	0.000	0.000
7,458.00	0.000	0.000	0.000
7,459.00	0.000	0.000	0.000
7,460.00	0.000	0.000	0.000
7,461.00	0.000	0.000	0.000
7,462.00	0.000	0.000	0.000
7,463.00	0.000	0.000	0.000
7,464.00	0.000	0.000	0.000
7,465.00	0.000	0.000	0.000
7,466.00	0.000	0.000	0.000
7,467.00	0.000	0.000	0.000
7,468.00	3.00>0.000	0.000	0.000
7,469.00	0.473	0.000	0.473
7,470.00	0.669	0.000	0.669
7,471.00	0.819	0.000	0.819
7,472.00	8.509	0.000	8.509
7,473.00	12.033	0.000	12.033
7,474.00	14.738	0.000	14.738
7,475.00	17.018	0.000	17.018
7,476.00	19.026	64.765	83.791
7,477.00	20.842	225.191	246.034
7,478.00	22.512	461.294	483.806
7,479.00	24.066	770.387	794.453
7,480.00	25.526	1,146.774	1,172.300

Structure #1 (Null)

Null Below West Taylor Pond

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#35	1	31.000	0.224	0.000	0.000	62.000	M	1.40	0.332
	Σ	**31.000**						**1.40**	**0.332**
#34	Σ	**31.000**						**1.40**	**0.332**
#33	1	6.600	0.043	0.000	0.000	62.000	M	0.91	0.088
	Σ	**6.600**						**0.91**	**0.088**
#32	Σ	**6.600**						**0.91**	**0.088**
#31	1	18.800	0.247	0.000	0.000	62.000	M	0.81	0.202
	Σ	**18.800**						**0.81**	**0.202**
#30	Σ	**18.800**						**0.81**	**0.202**
#29	1	14.000	0.059	0.000	0.000	62.000	M	1.93	0.186
	Σ	**14.000**						**1.93**	**0.186**
#28	Σ	**14.000**						**1.93**	**0.186**
#27	1	14.900	0.094	0.000	0.000	62.000	M	2.06	0.198
	2	10.200	0.050	0.000	0.000	80.000	F	8.70	0.640
	Σ	**25.100**						**10.76**	**0.838**
#26	Σ	**25.100**						**10.76**	**0.838**
#25	1	128.000	0.877	0.000	0.000	62.000	M	3.22	1.360
	2	0.500	0.018	0.000	0.000	80.000	F	0.43	0.028
	3	0.700	0.024	0.000	0.000	80.000	F	0.60	0.044
	Σ	**224.700**						**14.89**	**3.078**
#24	Σ	**224.700**						**14.89**	**3.078**
#23	1	2.500	0.021	0.000	0.000	47.000	S	0.00	0.000
	2	89.600	0.104	0.000	0.000	80.000	F	76.43	5.619
	3	4.900	0.200	0.000	0.000	62.000	M	0.24	0.052
	4	4.400	0.046	0.000	0.000	80.000	F	3.75	0.276
	5	34.200	0.063	0.000	0.000	62.000	M	4.72	0.455
	6	6.300	0.097	0.000	0.000	80.000	F	5.37	0.395
	Σ	**366.600**						**90.34**	**8.692**
#22	Σ	**366.600**						**90.34**	**8.692**
#21	1	3.000	0.006	0.000	0.000	62.000	M	0.41	0.040
	Σ	**3.000**						**0.41**	**0.040**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#20	**Σ**	**3.000**						**0.41**	**0.040**
#19	1	4.000	0.016	0.000	0.000	62.000	M	0.55	0.053
	Σ	**4.000**						**0.55**	**0.053**
#18	**Σ**	**4.000**						**0.55**	**0.053**
#17	1	10.400	0.022	0.000	0.000	80.000	M	8.87	0.652
	2	1.100	0.014	0.000	0.000	80.000	M	0.94	0.069
	3	0.600	0.026	0.000	0.000	62.000	M	0.08	0.003
	4	0.600	0.020	0.000	0.000	62.000	M	0.08	0.003
	5	0.900	0.021	0.000	0.000	62.000	M	0.12	0.008
	6	21.500	0.090	0.000	0.000	47.000	S	0.00	0.000
	Σ	**408.700**						**36.45**	**8.336**
#16	1	7.300	0.015	0.000	0.000	62.000	M	1.01	0.097
	Σ	**7.300**						**1.01**	**0.097**
#15	**Σ**	**7.300**						**1.01**	**0.097**
#14	1	1.900	0.008	0.000	0.000	62.000	M	0.26	0.025
	Σ	**1.900**						**0.26**	**0.025**
#13	**Σ**	**1.900**						**0.26**	**0.025**
#11	1	98.000	0.045	0.000	0.000	47.000	S	0.02	0.001
	2	29.600	0.171	0.000	0.000	74.000	F	12.95	1.188
	3	53.700	0.137	0.000	0.000	62.000	M	2.86	0.583
	Σ	**181.300**						**15.39**	**1.772**
#10	1	8.600	0.032	0.000	0.000	80.000	F	7.34	0.539
	2	36.800	0.141	0.000	0.000	74.000	F	16.23	1.475
	3	19.100	0.105	0.000	0.000	62.000	M	2.64	0.254
	Σ	**64.500**						**23.30**	**2.269**
#9	**Σ**	**245.800**						**34.54**	**4.040**
#8	1	8.600	0.044	0.000	0.000	80.000	F	7.34	0.539
	2	4.700	0.013	0.000	0.000	80.000	F	4.01	0.295
	Σ	**259.100**						**45.89**	**4.874**
#7	**Σ**	**259.100**						**45.89**	**4.874**
#6	1	43.000	0.095	0.000	0.000	47.000	S	0.00	0.000
	2	0.400	0.015	0.000	0.000	62.000	M	0.06	0.001
	3	1.600	0.020	0.000	0.000	47.000	S	0.00	0.000
	4	1.200	0.022	0.000	0.000	47.000	S	0.00	0.000
	5	11.600	0.051	0.000	0.000	80.000	F	9.90	0.727
	6	36.700	0.140	0.000	0.000	80.000	F	25.39	2.220

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**353.600**						**32.86**	**6.554**
#5	Σ	**353.600**						**32.86**	**6.554**
#4	1	6.400	0.037	0.000	0.000	80.000	M	5.46	0.401
	2	1.000	0.038	0.000	0.000	80.000	M	0.85	0.063
	3	2.800	0.019	0.000	0.000	47.000	S	0.00	0.000
	4	0.900	0.010	0.000	0.000	62.000	M	0.12	0.008
	5	23.300	0.094	0.000	0.000	47.000	S	0.00	0.000
	6	1.000	0.020	0.000	0.000	62.000	M	0.14	0.009
	Σ	**398.200**						**9.30**	**5.888**
#3	Σ	**806.900**						**44.30**	**14.223**
#2	1	10.500	0.051	0.000	0.000	47.000	S	0.00	0.000
	2	17.100	0.058	0.000	0.000	47.000	S	0.00	0.000
	Σ	**834.500**						**44.30**	**14.223**
#1	Σ	**834.500**						**13.96**	**13.980**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	3. Short grass pasture	45.00	443.25	985.00	5.360	0.051
#2	**1**	**Time of Concentration:**					**0.051**
#2	2	3. Short grass pasture	40.00	425.60	1,064.00	5.050	0.058
#2	**2**	**Time of Concentration:**					**0.058**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	11.00	48.95	445.00	3.310	0.037
#4	**1**	**Time of Concentration:**					**0.037**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	23.00	49.45	215.00	4.790	0.012
		8. Large gullies, diversions, and low flowing streams	1.50	5.25	350.00	3.670	0.026
#4	**2**	**Time of Concentration:**					**0.038**
#4	3	3. Short grass pasture	20.00	50.00	250.00	3.570	0.019
#4	**3**	**Time of Concentration:**					**0.019**
#4	4	3. Short grass pasture	19.00	24.70	130.00	3.480	0.010
#4	**4**	**Time of Concentration:**					**0.010**
#4	5	3. Short grass pasture	37.00	475.45	1,285.00	4.860	0.073
		8. Large gullies, diversions, and low flowing streams	28.00	345.80	1,235.00	15.870	0.021
#4	**5**	**Time of Concentration:**					**0.094**
#4	6	3. Short grass pasture	30.00	97.80	326.00	4.380	0.020
#4	**6**	**Time of Concentration:**					**0.020**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	1	3. Short grass pasture	14.60	75.01	513.76	3.050	0.046
		8. Large gullies, diversions, and low flowing streams	1.50	5.67	378.00	3.670	0.028
#6	**1**	**Time of Concentration:**					**0.095**
#6	2	3. Short grass pasture	20.00	246.20	1,231.00	3.570	0.095
#6	**2**	**Time of Concentration:**					**0.015**
#6	3	2. Minimum tillage cultivation	6.00	73.19	1,220.00	1.220	0.277
		8. Large gullies, diversions, and low flowing streams	1.50	20.43	1,362.00	3.670	0.103
#6	**3**	**Time of Concentration:**					**0.020**
#6	4	2. Minimum tillage cultivation	6.00	26.51	442.00	1.220	0.100
		8. Large gullies, diversions, and low flowing streams	1.50	19.50	1,300.00	3.670	0.098
#6	**4**	**Time of Concentration:**					**0.022**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	5.70	25.19	442.00	2.380	0.051
#6	**5**	**Time of Concentration:**					**0.051**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	6.10	75.64	1,240.00	2.460	0.140
#6	**6**	**Time of Concentration:**					**0.140**
#8	1	3. Short grass pasture	15.00	73.80	492.00	3.090	0.044
#8	**1**	**Time of Concentration:**					**0.044**
#8	2	5. Nearly bare and untilled, and alluvial valley fans	22.00	50.38	229.00	4.690	0.013
#8	**2**	**Time of Concentration:**					**0.013**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	16.00	75.19	470.00	4.000	0.032
#10	**1**	**Time of Concentration:**					**0.032**
#10	2	3. Short grass pasture	12.00	169.44	1,412.00	2.770	0.141
#10	**2**	**Time of Concentration:**					**0.141**
#10	3	3. Short grass pasture	16.00	194.72	1,217.00	3.200	0.105
#10	**3**	**Time of Concentration:**					**0.105**
#11	1	3. Short grass pasture	35.00	271.94	777.00	4.730	0.045
#11	**1**	**Time of Concentration:**					**0.045**
#11	2	3. Short grass pasture	13.00	231.79	1,783.00	2.880	0.171
#11	**2**	**Time of Concentration:**					**0.171**
#11	3	3. Short grass pasture	20.00	352.80	1,764.00	3.570	0.137
#11	**3**	**Time of Concentration:**					**0.137**
#14	1	3. Short grass pasture	30.00	40.80	135.99	4.380	0.008
#14	**1**	**Time of Concentration:**					**0.008**
#16	1	3. Short grass pasture	30.00	73.50	244.99	4.380	0.015
#16	**1**	**Time of Concentration:**					**0.015**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	20.00	73.40	367.00	4.470	0.022
#17	**1**	**Time of Concentration:**					**0.022**
#17	2	5. Nearly bare and untilled, and alluvial valley fans	24.80	49.60	200.00	4.970	0.011

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.50	0.75	50.00	3.670	0.003
#17	**2**	**Time of Concentration:**					**0.014**
#17	3	3. Short grass pasture	30.00	80.40	268.00	4.380	0.016
		8. Large gullies, diversions, and low flowing streams	14.00	60.62	433.00	11.220	0.010
#17	**3**	**Time of Concentration:**					**0.026**
#17	4	3. Short grass pasture	27.00	49.95	185.00	4.150	0.012
		8. Large gullies, diversions, and low flowing streams	24.00	111.36	464.00	14.690	0.008
#17	**4**	**Time of Concentration:**					**0.020**
#17	5	3. Short grass pasture	33.00	74.25	225.00	4.590	0.013
		8. Large gullies, diversions, and low flowing streams	25.00	120.00	480.00	15.000	0.008
#17	**5**	**Time of Concentration:**					**0.021**
#17	6	3. Short grass pasture	33.00	448.80	1,360.00	4.590	0.082
		8. Large gullies, diversions, and low flowing streams	25.00	120.00	480.00	15.000	0.008
#17	**6**	**Time of Concentration:**					**0.090**
#19	1	3. Short grass pasture	30.00	78.00	260.00	4.380	0.016
#19	**1**	**Time of Concentration:**					**0.016**
#21	1	3. Short grass pasture	26.00	24.70	95.00	4.070	0.006
#21	**1**	**Time of Concentration:**					**0.006**
#23	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	23.28	582.00	2.000	0.080
#23	**1**	**Time of Concentration:**					**0.021**
#23	2	8. Large gullies, diversions, and low flowing streams	1.00	4.92	492.00	3.000	0.045
		5. Nearly bare and untilled, and alluvial valley fans	13.00	99.84	768.00	3.600	0.059
#23	**2**	**Time of Concentration:**					**0.104**
#23	3	3. Short grass pasture	1.00	5.78	578.00	0.800	0.200
#23	**3**	**Time of Concentration:**					**0.200**
#23	4	5. Nearly bare and untilled, and alluvial valley fans	6.00	24.48	408.00	2.440	0.046
#23	**4**	**Time of Concentration:**					**0.046**
#23	5	3. Short grass pasture	19.00	152.00	800.00	3.480	0.063
#23	**5**	**Time of Concentration:**					**0.063**
#23	6	3. Short grass pasture	4.30	25.02	582.00	1.650	0.097
#23	**6**	**Time of Concentration:**					**0.097**
#25	1	3. Short grass pasture	4.00	148.44	3,711.00	1.600	0.644
		8. Large gullies, diversions, and low flowing streams	4.70	256.62	5,460.00	6.500	0.233
#25	**1**	**Time of Concentration:**					**0.877**
#25	2	3. Short grass pasture	20.00	75.00	375.00	3.570	0.029
#25	**2**	**Time of Concentration:**					**0.018**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	3	5. Nearly bare and untilled, and alluvial valley fans	9.00	24.03	267.00	3.000	0.024
#25	**3**	**Time of Concentration:**					**0.024**
#27	1	3. Short grass pasture	11.00	99.00	900.00	2.650	0.094
#27	**1**	**Time of Concentration:**					**0.094**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	12.00	74.87	624.00	3.460	0.050
#27	**2**	**Time of Concentration:**					**0.050**
#29	1	3. Short grass pasture	15.00	99.00	660.00	3.090	0.059
#29	**1**	**Time of Concentration:**					**0.059**
#31	1	3. Short grass pasture	5.00	79.25	1,585.00	1.780	0.247
#31	**1**	**Time of Concentration:**					**0.247**
#33	1	3. Short grass pasture	18.00	95.04	528.00	3.390	0.043
#33	**1**	**Time of Concentration:**					**0.043**
#35	1	3. Short grass pasture	10.00	203.50	2,035.00	2.520	0.224
#35	**1**	**Time of Concentration:**					**0.224**

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