

Custer West Dam  
Summary of Design Report Alternatives  
Updated 9/4/15

Alternative

- 1) Do Nothing: Leave existing Dam and outlet works as is. This could result in possible notice of violation and fines.
- 2) Complete Embankment Removal and Add Fishing Pond: Complete Removal of Existing Dam Embankment and installation of a single 12 foot deep 'side channel' dig out fishing/recreation pond (approximately 3 acre surface area) located below the elevation of the existing bottom of stream channel, and near the location of the existing embankment. Note: This estimate does not include fishing docks, pathways, special parking additions or other amenities. (Existing Golf Course Access Road would not remain).
- 3) Minimal Option: Removal of broken outlet works pipes and structure(s) only and replacement with a larger open box culvert through the existing embankment -- (Existing Golf Course Access Road would remain in place).
- 3a) Improved Wetlands Option (Basic and Enhanced): Install a large open pipe culvert into the existing embankment, install a silt drop out (forebay area), construct shallow wetland 'side channel' dig out zones to help encourage the establishment of shallow water vegetated wetland zones alongside a re-directed low flow channel, and construct a deeper (Zone 4) Fishing Pond area. Note: A Basic version and an Enhanced version have been included (See full report). Sizing of the water conservation storage areas is estimated to stay below the Existing 30 Ac-Ft Water Right (for recreational use) Permit. (Existing Golf Course Access Road would remain in place).
- 4) Medium Capacity Water Storage: Remove Existing Dam Embankment and Construct a properly compacted, lower height Embankment and Outlet Works Spillway (sufficient to assure public safety but beneath the threshold storage and height requirements so that it no longer qualifies as a 'Dam' under current state dam regulations). Consequently, the Access Road to the Golf Course would be via the existing Wazi Lane. The water conservation storage area is estimated to stay below the Existing 30 Ac-Ft Water Right (for recreational use) Permit. The outlet works spillway would be designed for more frequent storm events, and the overall embankment would be armored for safe overtopping to handle larger storm events.
- 5) Large Capacity Water Storage: Remove the Existing Substandard Dam Embankment Section, and replace with a properly compacted Dam Embankment and Outlet Works in its place (to match the current elevation and dam conservation storage capacity; approximately 120 ac-ft, therefore re-permitting required). --- The Golf Course

Attached

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Access Road would be reconstructed across a new embankment and spillway area. Scheduling Impacts: would be dependent upon timing of new SD DENR permits being obtained by March 2015, or later, before final design, bid and construction phases can be initiated. This option would be classified as a high hazard dam by the SD DENR and require design for a 50% PMF (Probable Maximum Flood) Event. The cost shown could go higher depending on the outcome of further design/analysis. Also, additional studies and investigation to perform an "Incremental Damage Assessment" to determine the downstream effects of a dam breach, may be required with this option.

6) Original Idea Project Scope:

Remove only the top 5 feet of existing dam embankment, armor the entire surface to protect against an overtopping event, replace the outlet works pipe and structure, and install a 10 foot deep fishing pond area -- (Golf Course Access Road would not remain). By making these changes, the water conservation storage area was anticipated to remain below the Existing 30 Ac-Ft Water Right (for recreational use) Permit. This original scope idea is not feasible because of the poorly compacted embankment soils which will not allow for any other improvements to be made, without a total reconstruction.

COSTS ---- Construction Only Costs and Schedule Summary Comparison\* - Table 1

Alternative	SD DENR Permitting	Probable Cost	Construction Duration
1) Do Nothing	NO	Unknown	Not Feasible
2) Complete Removal, Add Fishing Pond	NO	\$1.1 M	5 months of construction
3) Minimal Option - No Rec. Benefits	NO	\$100-140 K	1 month of construction
3a) Improved Wetlands			
3a) Basic	NO	\$1.5 M	6 months of construction
3a) Enhanced	NO	\$1.95 M	1 year of construction
4) Medium Capacity Water Storage	NO	\$1.6 M	6 months of construction
5) Large Capacity Water Storage	YES	\$2.3 M	1 year of construction
6) Original Idea Scope	NO	Not Feasible	Not Feasible

\*Provisions: Any schedules or completion dates, budgets, or estimates of cost noted in this report represent Consultant's professional judgment based on its experience and available information. Since neither Consultant nor Client has control over the cost of labor, materials, or equipment, the contractor's methods of determining prices, or over competitive bidding or market conditions, Consultant cannot and does not warrant or represent that actual schedules, budgets, or completion dates or actual costs will not vary from schedules or completion dates, budgets, or estimates of cost prepared by Consultant or proposed, established, or approved by Client.

IMPROVED WETLANDS OPTION - 3A

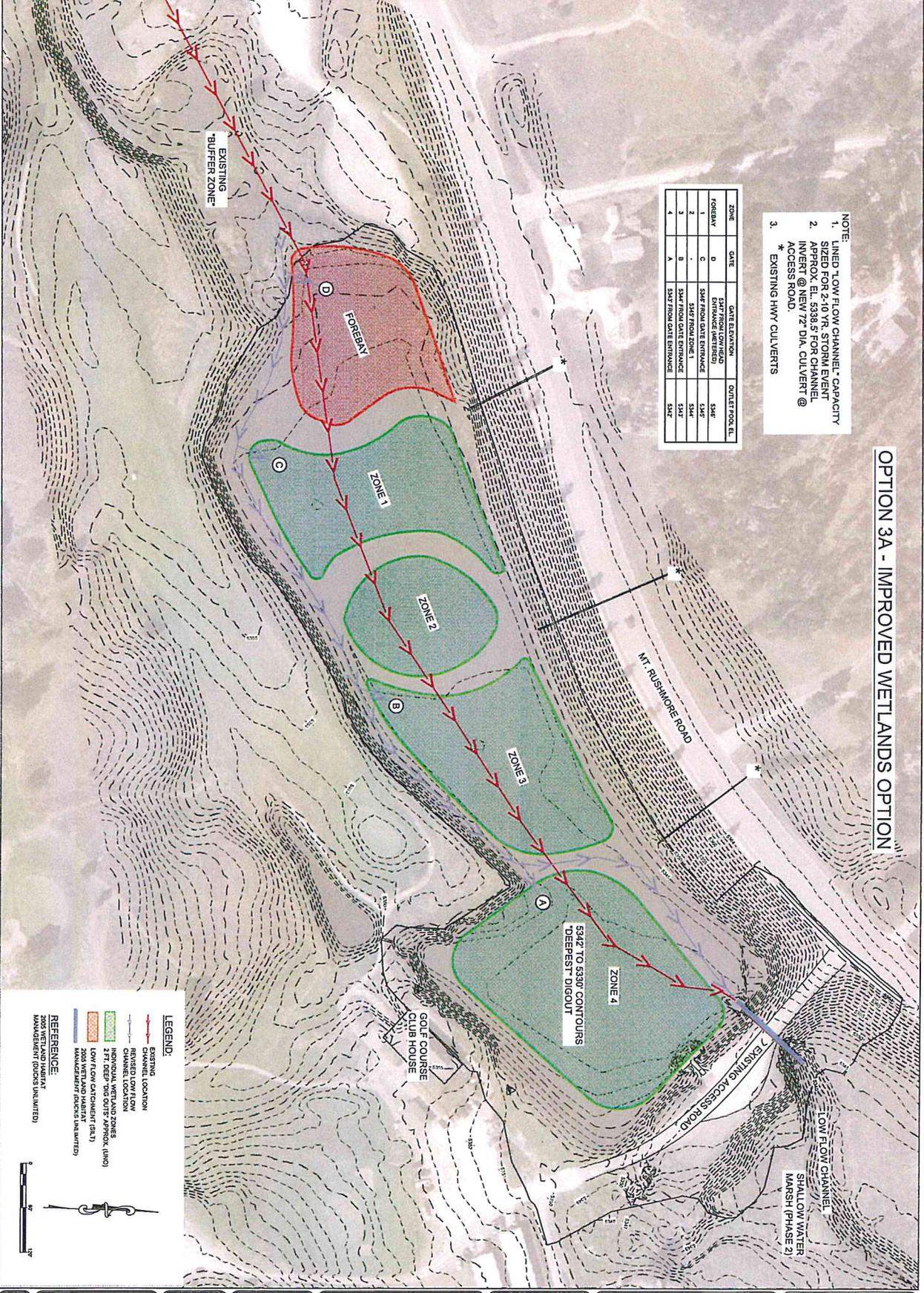
29-Jul-15 DRAFT

Custer (Basic) Package (Phase 1)

Item No.	Item Description	Units	Qty (Est.)	Unit Cost	Total Cost
1	Mobilization	Lot	1	\$67,500.00	\$67,500.00
2	Incidental Work	LS	1	\$8,000.00	\$8,000.00
3	Construction Staking	LS	1	\$5,000.00	\$5,000.00
4	Clearing and Grubbing	LS	1	\$2,000.00	\$2,000.00
5	Remove Existing Outlet Works	LS	1	\$15,000.00	\$15,000.00
6	Rock Construction Entrance (VTC)	EA	1	\$500.00	\$500.00
7	Temporary Stream Diversion	LF	1405	\$25.00	\$35,125.00
8	Digout (Zone 4) Excavation	CY	25000	\$22.00	\$550,000.00
9	Zone Entrance Gates	EA	3	\$4,500.00	\$13,500.00
10	Box Culvert 8'X4' Precast	LF	80	\$765.00	\$61,200.00
11	Box Culvert Precast end section	EA	2	\$6,160.00	\$12,320.00
12	Zones 1 to 3 Earthwork Excavation	Cy	39775	\$8.00	\$318,200.00
13	Metering manhole for Forebay Area	LS	1	\$8,000.00	\$8,000.00
14	Cable-crete Reinforced Low Flow Channel	SF	16860	\$20.00	\$337,200.00
15	Rip Rap reinforced Hi-Flow Channel	Ton	706	\$70.00	\$49,420.00
16	Seeding and Restoration	LS	1	\$15,000.00	\$15,000.00
17	Erosion Control	LS	1	\$2,500.00	\$2,500.00
18	Road Repair and restore - Asphalt	LS	1	\$2,000.00	\$2,000.00
					<u>\$1,502,465.00</u> Phase 1

Custer (Enhanced) Package (also includes Basic Package items noted above)

Item No.	Item Description	Units	Qty (Est.)	Unit Cost	Total Cost
1	Armoring Zone 1 (Rip Rap)	Ton	334	\$70.00	\$23,380.00
2	Armoring Zone 2 (Rip Rap)	Ton	192	\$70.00	\$13,440.00
3	Armoring Zone 3 (Rip Rap)	Ton	320	\$70.00	\$22,400.00
4	Armoring Zone 4 (Rip Rap)	Ton	342	\$70.00	\$23,940.00
5	Concrete Lining (Forebay Area)	sy	4260	\$31.00	\$132,060.00
6	Walking Path (4') Zone 1	SY	445	\$31.00	\$13,795.00
7	Walking Path (4') Zone 2	Sy	255	\$31.00	\$7,905.00
8	Walking Path (4') Zone 3	Sy	425	\$31.00	\$13,175.00
9	Walking Path (4') Zone 4	Sy	455	\$31.00	\$14,105.00
10	Asphalt Bike Path (Dam to picnic area)	Ton	160	\$115.00	\$18,400.00
11	Special (Duck Habitat) Plantings	LS	1	\$120,000.00	\$120,000.00
12	Floating Pond Water Feature	LS	1	\$30,000.00	\$30,000.00
13	Interpretative Signs	LS	1	\$20,000.00	\$20,000.00
					<u>\$1,955,065.00</u> Phase 1 & 2
					<u>\$452,600.00</u> Phase 2 only



**NOTE:**

1. LINED LOW FLOW CHANNEL. CAPACITY SIZED FOR 2-10 YR. STORM EVENT
2. APPROX. E.L. 5338.5 FOR CHANNEL INVERT @ NEW 172 DIA. CULVERT @ ACCESS ROAD.
3. \* EXISTING HWY CULVERTS

ZONE	GATE	GATE CONTROL	SOCKET POOL E.L.
FOREBAY	D	5347 FROM ROAD ENTRANCE (LEFTED)	5348
1	C	5347 FROM GATE ENTRANCE	5347
2	-	5347 FROM ZONE 1	5347
3	B	5347 FROM GATE ENTRANCE	5347
4	A	5347 FROM GATE ENTRANCE	5347

**OPTION 3A - IMPROVED WETLANDS OPTION**

**LEGEND:**

- EXISTING CHANNEL LOCATION
- REVISED LOW FLOW CHANNEL LOCATION
- INDIVIDUAL WETLAND ZONES
- 2 FT. DEEP 300 GOLF'S APPROX. (L&M)
- LOW FLOW CAP CHANNEL (SLU)
- MANAGEMENT DITCHES (AS LIMITED)

**REFERENCE:**

- 2005 WETLAND HABITAT MANAGEMENT GUIDELINES (UNLIMITED)

<p><b>BANNER</b></p> <p>730 South Street, Suite 201 Rapid City, South Dakota 57701 1-605-323-6942 www.bannerengineering.com</p>	<p>FOR REVIEW ONLY NOT FOR CONSTRUCTION</p>	<p>PROJECT TITLE: CLUSTER WEST DAM RECONSTRUCTION OPTION 3A</p>	<p>PROJECT LOCATION: CLUSTER SOUTH DAKOTA</p>	<table border="1"> <thead> <tr> <th>REV.</th> <th>DATE</th> <th>DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	REV.	DATE	DESCRIPTION													<p>DRAWN BY: TSC CHECKED BY: JLM DESIGNED BY: JLM 208 NO. 22136 2015 DATE: JULY 2015</p>	<p>SHEET TITLE: OVERALL WETLAND AREA LAYOUT</p>	<p>SHEET NO.: 1,6</p>
	REV.	DATE	DESCRIPTION																			