INTUITION & LOGIC

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Alternatives Analysis Summary Memorandum

To: City of Creve Coeur, Missouri
By: Mark Meyer, PE
Date: 09-25-2013
Re: Creve Coeur Dam and Channel

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OBJECTIVE:

The objectives of the Alternatives Analysis are:

1. Identify the City's design goals and objectives for this project.
2. Identify Alternative Design Elements acceptable to the City to achieve design goals and objectives.
3. Provide concept images for each Alternative Design Element.
4. Provide opinion of probable construction cost for each Alternative Design Element.
5. Summarize Alternative Design Elements and costs to address each design component.

APPROACH:

Intuition & Logic's (I&L) approach to achieving the Alternatives Analysis is as follows:

1. Geotech site visit to assess dam and spillway for information during Alternatives Analysis Meeting.
2. I&L to develop preliminary Hydrologic and Hydraulic calculations for all ponds and east channel for use during Alternatives Analysis Meeting.
3. Hold Alternatives Analysis Meeting with City Officials and Design Team to discuss City goals, objectives and potential Alternative Design Elements.
4. Develop ideas identified at the Alternatives Meeting into design alternatives.
5. Develop opinions of probable construction costs for each Alternative Design Element.
6. Obtain concept photos illustrating the possible finished look of each Alternative Design Element.
7. Summarize the Alternatives and Costs in an Alternatives Analysis Summary Memorandum.

RESULTS:

Hydrology

The following table contains the flow rates and watershed information from the Hydrologic analysis. The final design elements will be designed to accommodate the appropriate storm events. Storm Events are designated by the flowrate in cubic feet per second (cfs) associated with the storm frequency (eg. 100 year, 24 hour storm (Q100)):

	Pond	**East Channel**
Drainage Area	114.9 Acres	71.8 Acres
CN	88	81
Tc	30.0 Min	17.4 Min
Q1 flowrate	144 cfs	76 cfs
Q2 flowrate	199 cfs	115 cfs
Q5 flowrate	218 cfs	128 cfs
Q10 flowrate	307 cfs	194 cfs
Q25 flowrate	450 cfs	305 cfs
Q50 flowrate	547 cfs	381 cfs
Q100 flowrate	585 cfs	411 cfs

*no design has been completed yet, flow rates are provisional and are intended to aid in development of order of magnitude cost estimates

The flow rates do not reflect flow attenuation or storage from the existing ponds.

Alternatives Analysis Meeting

An alternatives analysis meeting was held on September 4th, 2013 with the following City of Creve Coeur and design team members in attendance:

Jim Heines – City of Creve Coeur
Matt Wohlberg – City of Creve Coeur
Kirsten Barnes – City of Creve Coeur
Mark Perkins – City of Creve Coeur
Klaus-Dieter Rausch – SWT
Dennis Boll - Geotechnology
Tim Dean – I&L
Mark Meyer – I&L
Laura Barrett – SWT

The meeting discussions were focused on three potential project areas:

1. Lower Pond, Dam and Lower Channel Area – this area includes the lower pond, dam, spillway, lower channel from the spillway to the 60” pipe culvert, the bridge across the existing spillway, the bridge across the east channel about 80 feet upstream of the confluence and the lower 80 feet of the east channel from the bridge to the confluence.

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2. Upper Ponds Area – this area includes the 3 ponds north of the Lower Pond.
3. East Channel Area – this area includes the east channel from the bridge (80 ft upstream of the confluence) to the culvert outfall from residential neighborhood immediately east of the golf course.

The design goals and objectives were discussed for each of the three project areas and alternatives to meet the objectives were identified. A total of 19 design objectives and 33 Alternative Design Elements were identified for the 3 project areas.

17 potential Alternative Design Elements were identified to address 9 design objectives for the Lower Pond, Dam and Lower Channel Area. The following Tables contain the identified design objectives and Alternative Design Elements for the Lower Pond, Dam and Lower Channel Area:

LOWER POND, DAM AND LOWER CHANNEL AREA OBJECTIVES AND ALTERNATIVES

Alternative / Design Objective	1. Fix Dam Piping Issue	2. Improve Spillway Aesthetic	3. Improve Channel Aesthetic	4. Improve Pond Water Quality	5. Improve Flooding	6. Keep upper access for walkers	7. Keep mature trees on golf course	8. Address Algae Problem in Pond	9. Discourage Golfers from Entering Pond	10. Improving lower pond aesthetic	11. Removal of accumulated silt in ponds	12. Sustainable , low-maintenance-cost improvements
1. ***Remove Existing Concrete Spillway**	X	X								X		X
2. ***Remove Existing Concrete Channel**	X	X	X							X		X
3. ***Remove Bridge over lower Channel**			X									
4. ***Natural Boulders Pond Outfall**	X	X								X		X
5. ***OPTION - Drop Structure and Pipe instead of Boulder Pond Outfall**	X											X
6. ***Rebuild Dam**	X											
7. ***Remove Bridge over East Channel**					X							
8. ***Boulder and Rock Lower Channel**			X		X					X		X
9. ***Flood Benching, Multi-Tier Lower Channel**			X		X			X		X		
10. ***Cart Path on Dam**						X						
11. **Replace Bridge over Channel**			X									
12. **Circulating Boulder Water Fall Pond Outfall**				X				X		X		
13. **Circulating Waterfall off East Side of #5 Green**				X				X		X		
14. **Bubbler System (solar with electric backup)**				X				X		X		
15. **Deep Pond Center (10'-15')**				X				X		X	X	X
16. **Wetland Shelves**				X				X	X	X	X	X
17. **Filter and Buffer Vegetation at Pond Edge**				X				X	X	X		X
18. **Boulder Pond Edge**									X			
19. **Boulder edge with drop area at #5 green**									X			

* Combined in base approach

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6 potential Alternative Design Elements were identified to address 3 design objectives for the Upper Pond Area. The following Tables contain the identified design objectives and Alternative Design Elements for the Upper Ponds Area:

UPPER PONDS AREA OBJECTIVES AND ALTERNATIVES

Alternative / Design Objective	1. Improve Water Quality In Ponds	2. Improve Aesthetics of Pond Edge	3. Address Wet Area at end of #6 Fairway
1. **Dredge – 10'-15' deep center**	X	X	
2. **Dredge – 6' depth**	X		X
3. **HDS @ Olde Cabin Road**	X	X	
4. **Remove rip-rap on Pond 2 & 3 w/ vegetation to water**	X	X	
5. **Remove rip-rap on Pond 2 & 3 w/boulder edge**		X	
6. **Meadow @ end of #6 fairway**			X

10 potential Alternative Design Elements were identified to address 7 design objectives for the East Channel Area. The following Tables contain the identified design objectives and Alternative Design Elements for the East Channel Area:

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EAST CHANNEL AREA OBJECTIVES AND ALTERNATIVES								
Alternative / **Design Objective**	**1. Low Vegetation at Approach to #3 Green**	**2. Low Vegetation in front of #4 Tee**	**3. Remove Invasive Species Along Channel**	**4. Fix Retaining Wall at #4 Tee**	**5. Improve Channel Crossing at #4 Tee**	**6. Replace Cart Path Along Channel**	**7. Replace #3 Bridge to Match Others**	**8. Improve Channel aesthetics**
1. **Boulder Edge Channel at #3**	X	X						X
2. **Boulder Edge Channel at #4**	X		X					X
3. **Restore Channel from #4 bridge to Lower Pond Project**	X	X						X
4. **Near #5 eliminate honey suckle and re-vegetate**	X		X					X
5. **Replace #4 retaining wall with MBW**				X				X
6. **Replace #4 retaining wall with Boulder Wall**				X				X
7. **Replace Culvert Crossing at #4**					X			X
8. **Replace cart path along Channel from #3 to #5**						X		X
9. **Replace bridge at #3 to match others**							X	X
10. **Circulating Boulder Water Fall Pond Outfall**								X

Construction Cost Opinion

An order of magnitude opinion of probable construction cost was developed for each Alternative Design Element. Cost opinions are based on local bid tab databases and recent project experience for similar construction. The cost opinions are presented in 2013 dollars and intended for use in establishing budgeted ranges for potential future projects.

The first 10 lower pond Alternative Design Elements were combined as the base design. This base design will remove the existing dam, spillway, channel, short bridge over lower channel, and associated concrete on the east channel as well as remove the existing bridge over the east channel. The dam, spillway and lower channel will be replaced using a natural boulder look or a drop structure and pipe. The existing cart path over the spillway will also be replaced. This base option will address the current need to replace the degraded and leaking dam, spillway and lower concrete channel and restore cart access to the #5 green. The following tables provide the construction cost opinion for the base project and each Alternative Design Element:

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DAM AND CHANNEL BASE PROJECT					
Area	**Alternative**	**Unit**	**Quantity**	**Unit Cost**	**Sub Total**
Lower Pond	Remove Existing Concrete Spillway	LUMP	1	$1,000	$ 1,000
Lower Pond	Remove Existing Concrete Channel	LUMP	1	$10,000	$ 10,000
Lower Pond	Remove Bridge over lower Channel	LUMP	1	$1,000	$ 1,000
Lower Pond	Remove Bridge over East Channel	LUMP	1	$1,000	$ 1,000
Lower Pond	Rebuild Dam Embankment	CY	800	$50	$ 40,000
Lower Pond	*Natural Boulders Pond Outfall	SF	500	$50	$ 25,000
Lower Pond	*OPTIONAL - Drop Structure and Pipe instead of Boulder Pond Outfall (these two options are treated as mutually exclusive)	Lump	1	$40,000	$ 40,000
Lower Pond	Boulder and Rock Lower Channel	LF	100	$600	$ 60,000
Lower Pond	Flood Benching, Multi-Tier Lower Channel	CY	800	$35	$ 28,000
Lower Pond	Cart Path on Dam	LF	200	$50	$ 10,000
		Subtotal (drop structure option) =			**$ 196, 000**
		Subtotal (boulder outfall option) =			**$ 206,000**

* Represents an either/or alternative item

The following table presents the remaining Alternative Design Elements (base project removed):

COST OPINIONS BY ALTERNATIVES					
Area	**Alternative**	**Unit**	**Quantity**	**Unit Cost**	**Sub Total**
Lower Pond	Replace Bridge over Channel	LF	30	$ 1,000	$ 30,000
Lower Pond	Circulating Boulder Water Fall Pond Outfall	LUMP	1	$ 75,000	$ 75,000
Lower Pond	Circulating Waterfall off East Side of #5 Green	LUMP	1	$ 125,000	$ 125,500
Lower Pond	Bubbler System (solar with electric backup)	LUMP	1	$ 15,000	$ 15,000
Lower Pond	Deep Pond Center (10'-15')	CY	1,300	$ 100	$ 130,000
Lower Pond	Wetland Shelves	SY	330	$ 35	$ 11,550
Lower Pond	Filter and Buffer Vegetation at Pond Edge	SY	1,450	$ 10	$ 14,500
Lower Pond	Boulder Pond Edge	SF	800	$ 100	$ 80,000
Lower Pond	Boulder edge with drop area at #5 green	LF	100	$ 50	$ 5,000
Upper Ponds	Dredge – 10'-15' deep center	CY	2,400	$ 100	$ 240,000
Upper Ponds	Dredge – 6' depth	CY	700	$ 100	$ 70,000
Upper Ponds	HDS @ Olde Cabin Road	LUMP	1	$ 100,000	$ 100,000
Upper Ponds	Remove rip-rap on Pond 2 & 3 w/ vegetation to water	SY	1,600	$ 30	$ 48,000
Upper Ponds	Remove rip-rap on Pond 2 & 3 w/boulder edge	SF	1,000	$ 75	$ 75,000
Upper Ponds	Meadow @ end of #6 fairway	SY	4,000	$ 10	$ 40,000
East Channel	*Boulder Edge Channel at #3	LF	130	$ 300	$ 39,000
East Channel	*Boulder Edge Channel at #4	LF	130	$ 300	$ 39,000

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COST OPINIONS BY ALTERNATIVES					
Area	**Alternative**	**Unit**	**Quantity**	**Unit Cost**	**Sub Total**
East Channel	*Restore Channel from #4 bridge to Lower Pond Project	LF	200	$ 300	$ 60,000
East Channel	*Near #5 eliminate honey suckle and re-vegetate	Acre	0.5	$ 30,000	$ 15,000
East Channel	*Replace #4 retaining wall with MBW	SF	900	$ 25	$ 22,500
East Channel	Replace #4 retaining wall with Boulder Wall	SF	900	$ 50	$ 45,000
East Channel	*Replace Culvert Crossing at #4	LUMP	1	$ 10,000	$ 10,000
East Channel	Replace cart path along Channel from #3 to #5	LF	500	$ 50	$ 25,000
East Channel	Replace bridge at #3 to match others	LF	40	$ 1,000	$ 40,000

Alternative Design Elements

The following pages present concept photos, data and cost information for each of the Alternative Design Elements.

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Alternative Design Element: Natural Boulders Pond Outfall.
(Estimated Cost - $25,000)

Design Objective(s): Fix Dam Piping Issue, Improve Spillway Aesthetic

Area: Base Approach Item, Lower Pond

Description: The emergency spillway for the pond is constructed using natural boulders and ledge rock to create the cascading aesthetic of a waterfall during flow events.

Unit Cost: $50 per square foot of boulder face. Unit cost includes excavation, grading, and boulder element construction.

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Alternative Design Element: Drop Structure and Pipe Pond Outfall.
(Estimated Cost - $40,000)

Design Objective(s): Fix Dam Piping Issue

Area: Alternative to Base Approach Item of "*Natural Boulders Pond Outfall*" - Lower Pond

Description: Stand pipe drop structure and pipe flow under the dam

Unit Cost: $40,000 Lump

Alternative Design Element: Boulder and Rock Lower Channel.
(Estimated Cost - $60,000)

Design Objective(s): Improve Flooding, Improve Channel Aesthetic

Area: Base Approach Item - Lower Pond

Description: The channel below the pond outfall is stabilized and restored with rock enhancements, improving stream channel stability and hydraulic function.

Unit Cost: $600 per linear foot. Unit cost includes excavation, grading, rock structure construction and re-vegetation.

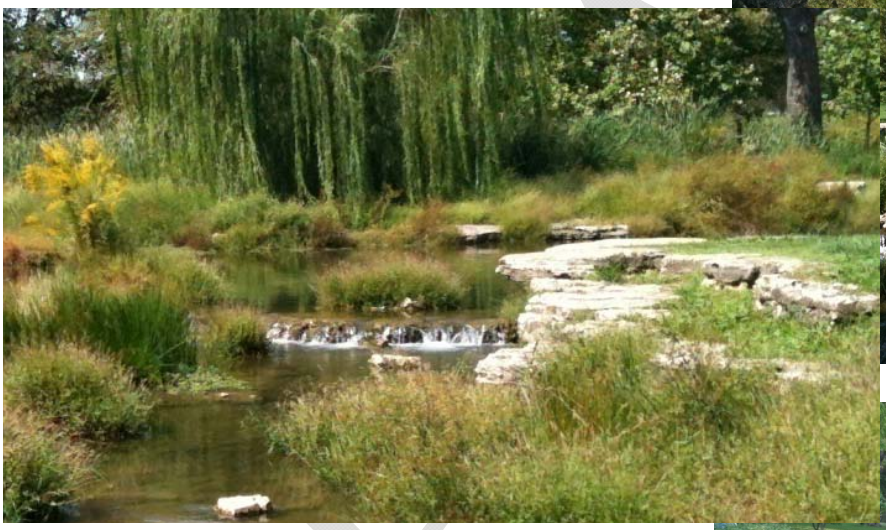
Alternative Design Element: Flood Benching, Multi-tier lower channel (Estimated Cost - $40,000)

Design Objective(s): Improve Flooding, Improve Channel Aesthetic

Area: Base Approach Item - Lower Pond

Description: Flood Benches are an alternative to a trapezoidal channel below the pond spillway. The flood benches are terraces constructed on both sides of the channel below the pond outfall adding hydraulic capacity and storage to the channel.

Unit Cost: $35 per cubic yard of excavation. Unit cost includes excavation, grading, and re-vegetation. Unit cost does not include boulders (this cost is included in the channel cost)



Alternative Design Element: Cart Path on Dam. (Estimated Cost - $10,000)

Design Objective(s): Maintain access to #5 Green for walkers, replace cart path along east channel

Area: Base Approach Item - Lower Pond, East Channel

Description: Remove and replace the existing cart path and base and replace it with a 4” compacted base and 4” thick 6’ wide asphalt trail.

Unit Cost: $50.00 per linear foot

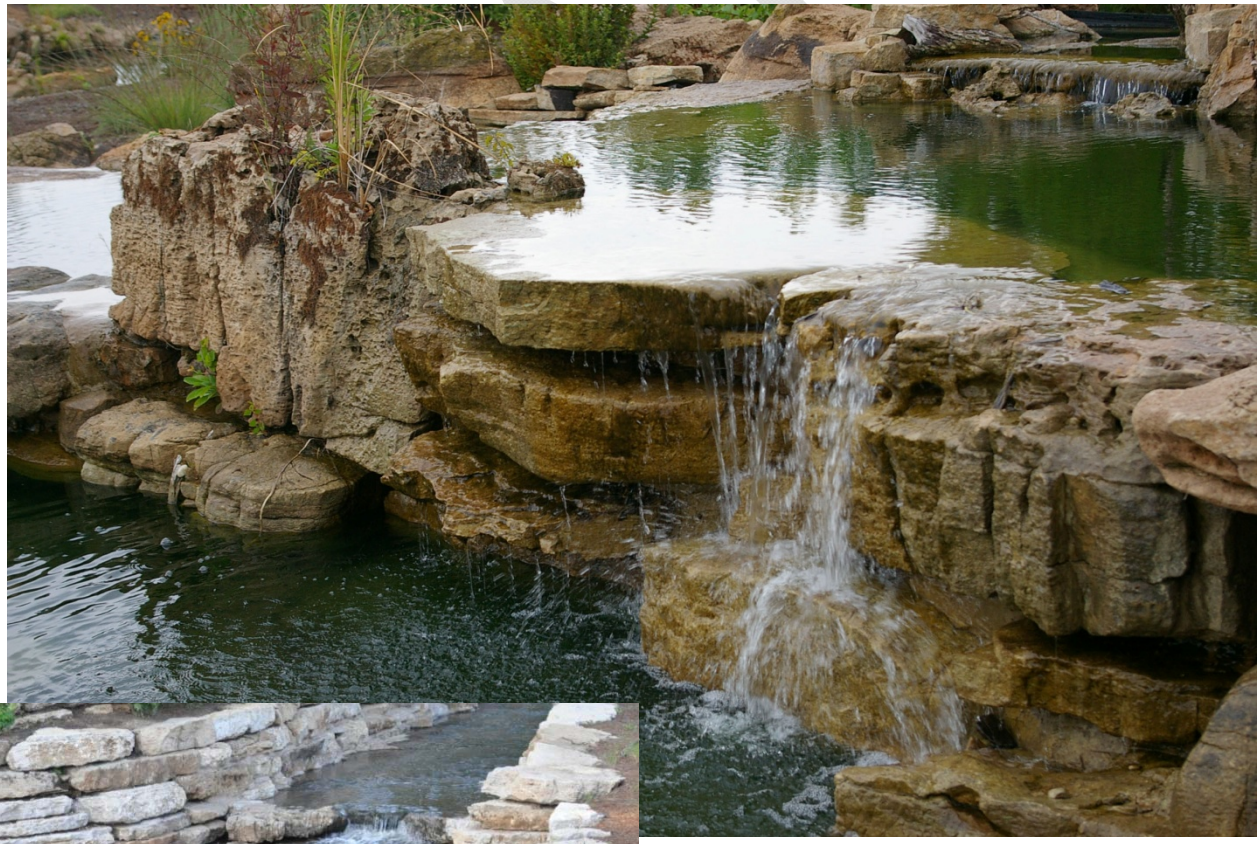
Alternative Design Element: Circulating Boulder Waterfall Pond Outfall. (Estimated Cost - $75,000; representing an additional $50,000 of cost when compared to the estimated cost of the "*Natural Boulders Pond Outfall"*)

Design Objective(s): Improves Spillway Aesthetic, Improves Channel Aesthetic, Improve Pond Water Quality, Address Algae Problem in Pond

Area: Alternative Item to Base Approach Item of "*Natural Boulders Pond Outfall* " - Lower Pond

Description: A pond water pump system is added to the boulder spillway and channel to create a steady flow of water re-circulated across the spillway, creating a persistent cascading aesthetic of a waterfall. This Alternative Design Element increases aesthetics of the spillway and channel while also improving water quality by pumping the newly oxygenated water back into the pond. The waterfall is not as effective as a bubbler system at oxygenating the pond.

Unit Cost: Lump sum - $75,000



Alternative Design Element: Circulating Waterfall off east side of the #5 Green. (Estimated Cost - $125,000)

Design Objective(s): Improve Pond Water Quality, Address Algae Problem in Pond

Area: Optional Additional Item - Lower Pond

Description: Natural ledge rock and boulders are used to create a waterfall east of the 5th green, by using the rocks and boulders to establish a persistent upper pool of water into which water is constantly pumped from the lower pond, creating a waterfall. This Alternative Design Element has the benefit of increasing water circulation within the lower pond, thereby increasing oxygen levels and maintaining a more consistent water temperature throughout the full depth of the water. The waterfall is not as effective as a bubbler system at oxygenating the pond.

Unit Cost: Lump sum - $125,000

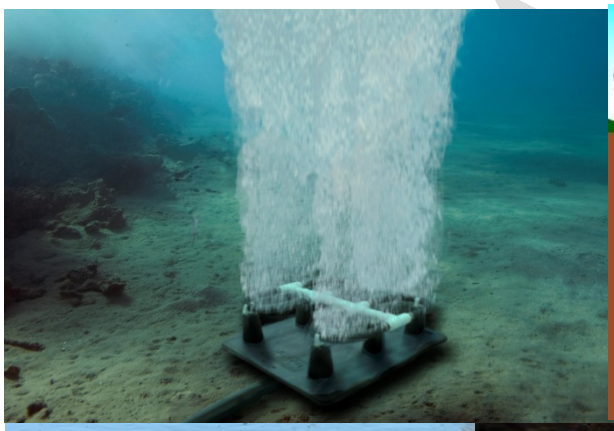
Alternative Design Element: Bubbler system [solar powered with electric back-up]. (Estimated Cost - $15,000)

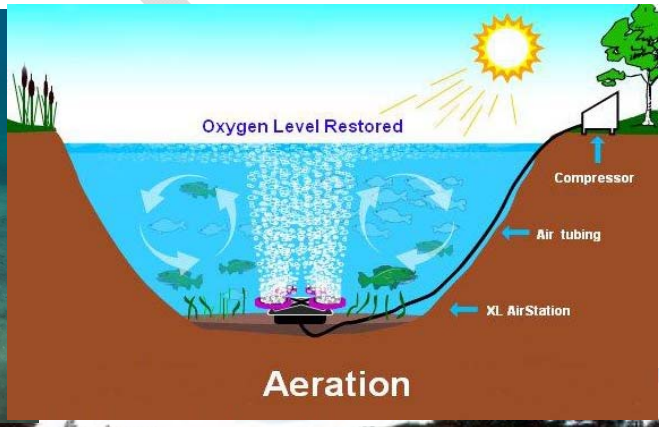
Design Objective(s): Improve Pond Water Quality, Address Algae Problem in Pond

Area: Optional Additional Item - Lower Pond

Description: A forced air system, utilizing a solar-powered pump with electrical back-up is used to provide aeration and water circulation within the pond. This Alternative Design Element has the benefit of increasing water circulation within the lower pond, thereby increasing oxygen levels and maintaining a more consistent water temperature throughout the full depth of the water. The bubbler system is the most effective method to oxygenate the pond water.

Unit Cost: Lump sum - $15,000 includes Air compressor, solar power supply, hosing, diffuser, electrical connection and installation.





Alternative Design Element: Deep pond center (dredging to a depth of 6' or 10-15').
(Estimated Cost - $370,000 for all three ponds)

Design Objective(s): Improve Pond Water Quality, Address Algae Problem in Pond

Area: Optional Additional Item - Lower Pond and Upper Ponds

Description: The pond bathymetry is increased through dredging excess sediments from the pond bed. Increases the depth of the pond, increasing total water volume, improving water temperatures, providing thermal refugia for desired fish species, and removes portions of the pond bed from the photic zone preventing nuisance vegetation and algae from directly accessing the excess nutrients available within while allowing naturally, occurring beneficial aerobic and anaerobic bacteria to complete the natural nutrient fixation process with direct competition from algae.

Unit Cost: $100 per cubic yard includes dredging of pond bed and offsite disposal of spoils.

Alternative Design Element: Filter and Buffer Vegetation at Pond Edge/ Wetland Shelves. (Estimated Cost - $26,000)

Design Objective(s): Improve Pond Water Quality, Address Algae Problem in Pond, Discourage Golfers from Entering Pond

Area: Optional Additional Item - Lower Pond

Description: A buffer strip of vegetation is established along the shore of the pond, within which aesthetically pleasing plantings of vegetation are established. Serving to trap and treat incoming nutrients and sediments before they enter they are able to enter the pond and become available for use by nuisance algae and aquatic plants, while serving to create a distinct boundary around the ponds shoreline and barrier to entry into the pond.

Unit Cost: $10 per square yard; includes grubbing the area of existing vegetation, preparing the planting surface and planting plugs and establishing seed.

Alternative Design Element: Boulder Pond Edge and Boulder Pond Edge with drop area at #5 Green. (Estimated Cost - $5,000)

Design Objective(s): Discourage Golfers from Entering Pond

Area: Upper ponds and Lower Pond

Description: A two foot drop to the water surface is created by lining the pond edge with natural boulders and ledge rock. Creating a vertical barrier to pond entry.

Unit Cost: $50 per linear foot of face; includes excavation, grading and boulder pond edge construction.

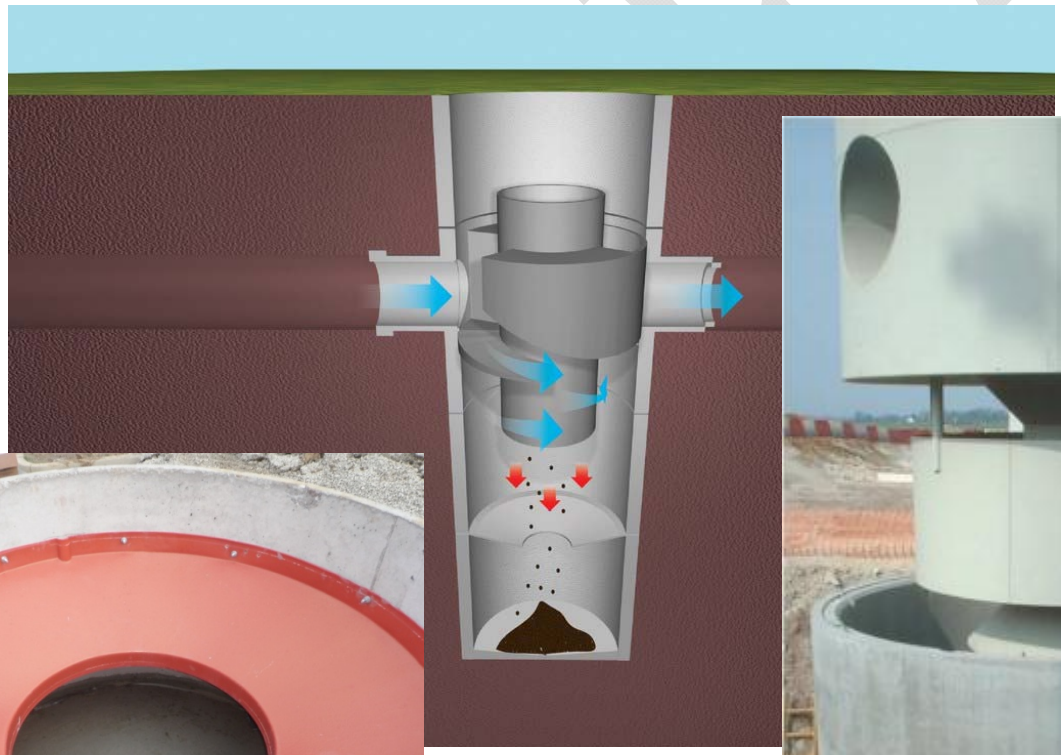
Alternative Design Element: Hydro-Dynamic Seperator Unit.
(Estimated Cost - $100,000)

Design Objective(s): Improve Water Quality in Ponds

Area: Optional Additional Item - Upper Ponds and Lower Pond

Description: A series of pre-cast concrete structures is used to create a swirling vertex of water, which in combination with a sump creates a sediment and pollutant trap in which pollutants with low-densities (oil byproducts and suspended organics) are collected in the upper chamber while sediments are trapped within the sump.

Unit Cost: $100,000 Lump Sum, includes the necessary HDS units, fittings, piping, excavation, installation and grading.



Alternative Design Element: Remove Rip-Rap, replace with vegetation to pond edge. (Estimated Cost - $48,000)

Design Objective(s): Improve Aesthetics of Pond Edge

Area: Optional Additional Item - Upper Ponds

Description: Rip-rap is removed from the shore lines of the upper ponds and replaced with a vegetated edge.

Unit Cost: $30 per square yard; includes removal and disposal of rip-rap, grading and planting of vegetation.

Alternative Design Element: Remove Rip-Rap, replace with boulder edge. (Estimated Cost - $75,000 representing an additional $27,000 of cost when compared to the estimated cost of the "*Natural Boulders Pond Outfall*")

Design Objective(s): Improve Aesthetics of Pond Edge

Area: Optional Additional Item - Upper Ponds

Description: Rip-rap is removed from the shore lines of the upper ponds and replaced with a boulder pond edge.

Unit Cost: $75 per square foot of face; includes removal and disposal of rip-rap, grading and construction of boulder edge.

Alternative Design Element: Meadow at end of #6 Fairway.
(Estimated Cost - $40,000)

Design Objective(s): Improve Aesthetics of Pond Edge, Address Wet Area at end of #6 Fairway

Area: Optional Additional Item - Upper Ponds

Description: The existing wet area / seep is planted with a host of site appropriate grass and forb species with a mowed edge.

Unit Cost: $10 per square yard; includes grading, planting area preparation and planting of containerized, plug and seed.

Alternative Design Element: Boulder Edge Channel at #3 and #4.
(Estimated Cost - $78,000)

Design Objective(s): Low Vegetation at #3 and #4

Area: Optional Additional Item - East Channel

Description: The east channel is restored and stabilized using a boulder edge channel.

Unit Cost: $300 per linear foot; includes excavation grading, and planting of containerized, plug and seed.

Alternative Design Element: Restore Channel from #4 Bridge to Lower Pond. (Estimated Cost - $60,000)

Design Objective(s): Remove Invasive Species Along Channel

Area: Optional Additional Item - East Channel

Description: The channel between the #4 fairway bridge and the lower pond is restored with invasive vegetation removed.

Unit Cost: $300 per linear foot; includes excavation grading, and planting of containerized, plug and seed.

Alternative Design Element: Replace #4 Retaining Wall with Modular Block Retaining Wall. (Estimated Cost - $22,500)

Design Objective(s): Fix Retaining Wall at #4

Area: Optional Additional Item - East Channel

Description: The retaining wall at the #4 tee box is replaced with a modular block retaining wall.

Unit Cost: $25 per square foot; includes removal and disposal of existing retaining wall grading, and construction of new retaining wall.

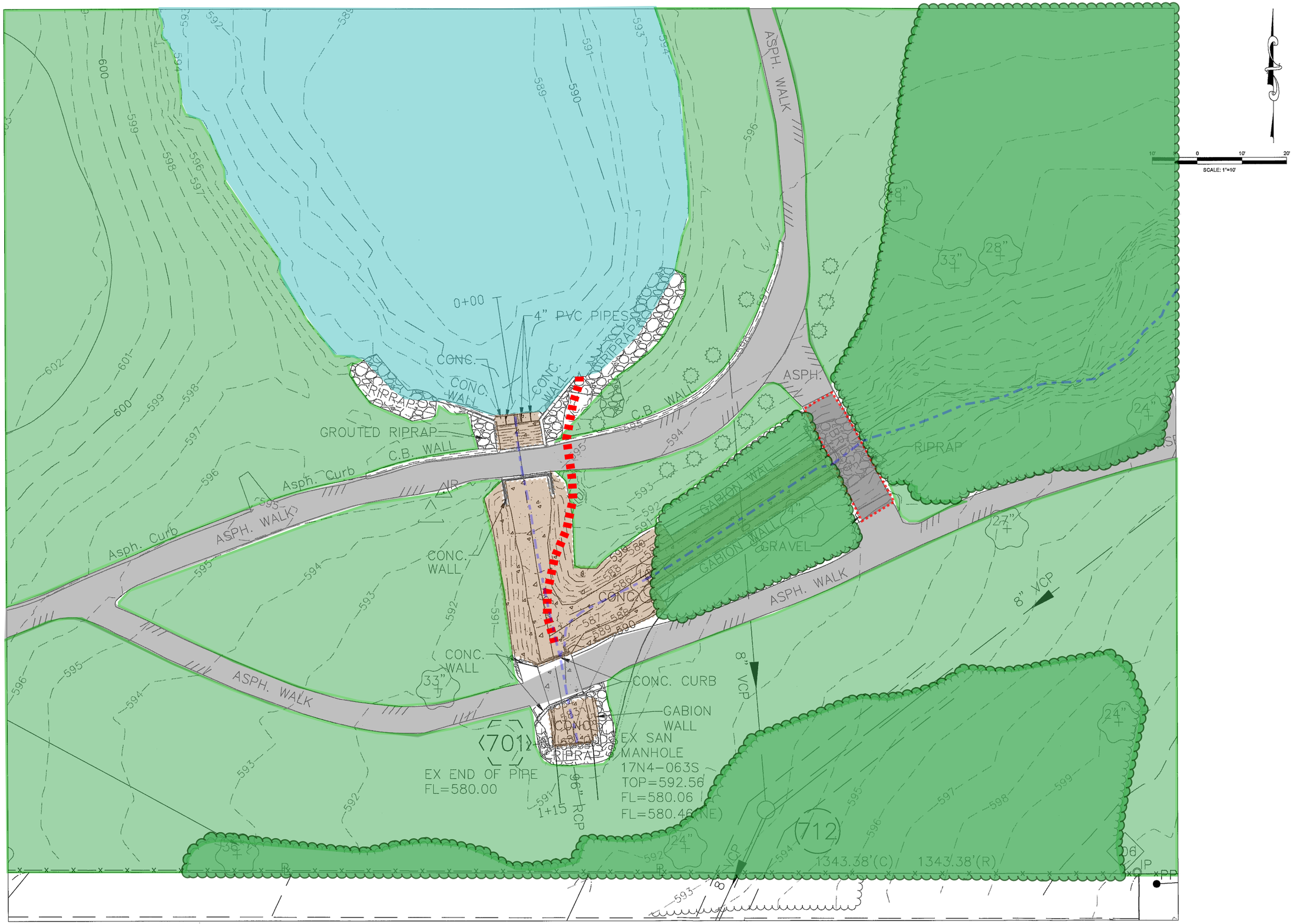
Alternative Design Element: Replace #4 Retaining Wall with Boulder Retaining Wall. (Estimated Cost - $45,000 representing an additional $20,000 of cost when compared to the estimated cost of the "*Retaining Wall with Modular Block Retaining Wall*")

Design Objective(s): Fix Retaining Wall at #4

Area: Optional Additional Item - East Channel

Description: The retaining wall at the #4 tee box is replaced with a boulder wall.

Unit Cost: $50 per square foot; includes removal and disposal of existing retaining wall grading, and construction of new retaining wall.



CITY OF CREVE COEUR, MO. 1949

INTUITION & LOGIC

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Creve Coeur Dam and Channel

Creve Coeur, St Louis County, Missouri

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Professional Engineer Seal
Mark Edward Meyer
2000150043

Expiration Date: Dec. 31, 2014

Rev	Date	Description
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Project No. 1207
Designed: TPD
Drawn: AMO
Checked: TPD
Approved: MEM
Sheet Title:

Sheet Number:

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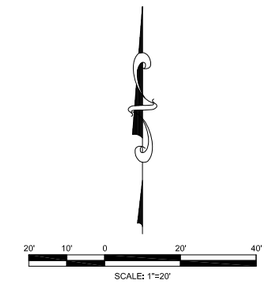

OPTION 1: BASIC DAM AND CHANNEL

Remove the existing dam and spillway and construct a new earthen dam and a concrete box culvert for a spillway. Line the outfall path and the reconfigured east channel with limestone rock. Include plantings in east channel to restore a riparian corridor.

- **A** New dam with re-routed cart path
- **B** Box culvert spillway
- **C** Outfall lined with limestone rock
- **D** East channel re-aligned and lined with limestone
- **E** Modular block wall at pipe entrance
- **F** Existing 96" pipe

ESTIMATED COST: $180,000

MSD P - 0000000-00, BASEMAP 17N3

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CITY OF CREVE COEUR, MO. 1949

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Creve Coeur Dam and Channel
Creve Coeur, St Louis County, Missouri

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Professional Engineer Seal
Mark Edward Meyer
2000150043

Expiration Date: Dec. 31, 2014

Rev	Date	Description
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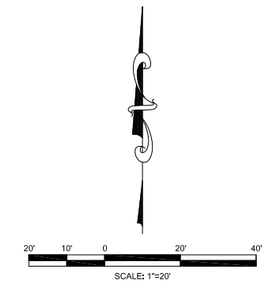
Project No. 1311
Designed: TPD
Drawn: JDF
Checked: TPD
Approved: MEM
Sheet Title:

PLAN AND PROFILE

Sheet Number:

4 OF XX



OPTION 2: ENHANCED DAM AND CHANNEL

Remove the existing dam and spillway and construct a new earthen dam and a concrete box culvert for a spillway. Line the outfall path and the reconfigured east channel with ledge rock or similar as necessary. Mask the spillway with ledge rock and place ledge rock throughout the area for aesthetic enhancements. Include selected native plantings in east channel and at rock outcroppings.

- **A** New dam with re-routed cart path
- **B** Box culvert spillway with ledge rock masking
- **C** Outfall lined with ledge rock
- **D** East channel re-aligned and lined with ledge rock
- **E** Ledge rock wall at pipe entrance
- **F** Existing 96" pipe
- **G** Ledge rock outcropping

ESTIMATED COST: $210,000

MSD P - 0000000-00, BASEMAP 17N3

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CITY OF CREVE COEUR, MO. 1949

INTUITION LOGIC

ILINC Engineering Incorporated
MO Certificate of Authority
2000152987
16253 Swingley Ridge Rd.
Suite 100
Chesterfield, MO 63017
Phone (636) 777-3000
Fax (314) 432-5812

Creve Coeur Dam and Channel
Creve Coeur, St Louis County, Missouri

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Professional Engineer Seal
Mark Edward Meyer
2000150043

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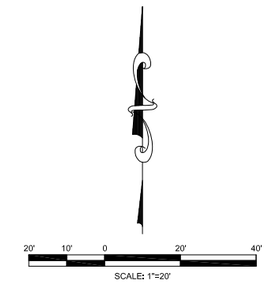

OPTION 3: BASIC DAM, CHANNEL, AND LAKE

Remove the existing dam and spillway and construct a new earthen dam and a concrete box culvert for a spillway. Line the outfall path and the reconfigured east channel with limestone rock. Include plantings in east channel to restore a riparian corridor. Excavate silt and pond base to create a deep center channel.

- **A** New dam with re-routed cart path
- **B** Box culvert spillway
- **C** Outfall lined with limestone rock
- **D** East channel re-aligned and lined with limestone
- **E** Modular block wall at pipe entrance
- **F** Existing 96" pipe
- **G** Excavate silt to create deep (15') channel

ESTIMATED COST: $325,000

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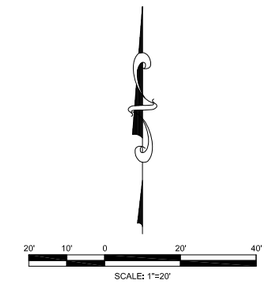

OPTION 4: ENHANCED DAM, CHANNEL, & LAKE

Remove the existing dam and spillway and construct a new earthen dam and a concrete box culvert for a spillway. Line the outfall path and the reconfigured east channel with ledge rock or similar as necessary. Use ledge rock to mask the spillway, to line the east and west banks of the lake, and as aesthetic enhancements. Excavate silt and pond base to create deep thread, and shape banks to create wetland shelves. Include selected native plantings along banks, east channel, and wetland shelves.

- **A** New dam with re-routed cart path
- **B** Box culvert spillway with ledge rock masking
- **C** Outfall lined with ledge rock
- **D** East channel re-aligned and lined with ledge rock
- **E** Ledge rock wall at pipe entrance
- **F** Existing 96" pipe
- **G** Ledge rock pond edge and outcropping
- **H** Remove silt to create deep (15') channel
- **I** Wetland shelves with selected plantings

ESTIMATED COST: $440,000

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