

**FALCON DRAINAGE BASIN PLANNING STUDY**  
**SELECTED PLAN REPORT**  
**FINAL - SEPTEMBER 2015**

Prepared for:



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## 6.0 PLAN DEVELOPMENT DESIGN

### 6.1. Introduction

The purpose of the plan development design effort was to refine the selected detention and reach alternatives for the Falcon Watershed and finalize proposed infrastructure improvements and associated implementation costs. The recommended detention and reach alternatives, outlined in Section 5.0, were vetted through one public meeting and several project team meetings. The Sub Regional Detention Alternative along with the corresponding reach alternatives were selected to carry forward into plan development. The detention pond and reach components from the selected alternative were analyzed using a more detailed set of criteria to ensure that the recommendation would be feasible for future implementation. The outcome of the selected plan development design is a conceptual set of infrastructure improvements and costs for use in the fee development phase of this DBPS. All backup calculations and data are provided in Appendix D.

### 6.2. Selected Detention Alternative

The Sub Regional Detention Alternative that was recommended in Section 5.3 was refined by:

- Performing rough grading at each potential location.
- Maximizing storage for ponds based on existing site conditions.
- Modifying the SSD curves to target EURV or WQCV, and 100-yr volume with no spillway overtopping as outlined in Section 5-3. The EURV target outflow was based on releasing the EURV over 72 hours. The WQCV drain time was 40 hours. 100-yr target outflows were historical 100-yr flow where possible given storage constraints; selected as either the existing 100-yr flow or the lowest attainable 100-yr peak flow based on pond limitations. Release rates were greater than historic in some cases due to storage limitations. Storage and discharge requirements were calculated based on the guidelines outlined in the UDFCD DCM, Vol. 2.
- Assessing the hydrologic benefit of each pond.
- Spillway overtopping based on stage and storage calculations at 2 ft above the spillway elevation.

Full spectrum detention was incorporated into all existing and proposed detention ponds where applicable for this alternative. However, in some cases other controls were used due to pond volume limitations. A detailed analysis and summary for all of the detention ponds in the selected alternative are provided in Appendix D.

#### 6.2.1. Detention Pond Classification

The selected detention alternative consists of 23 ponds that fall within 2 different classifications: existing constructed ponds and proposed ponds. All ponds are shown graphically in Figure 6-1.

##### Existing Constructed Ponds

Existing constructed ponds include PBH C, PBH A, PBH B1, PBH B2, M 1, R WUS, WH H, M 2, R MN, WH 5, PB 4, WH 1N, WH 1S, WH 2, WH 3, and WH 4. These ponds are currently constructed and functioning within the Falcon Watershed. Each of these ponds was evaluated to determine if it could be retrofit to provide a benefit to the selected detention alternative. Table 6-1 shows the proposed modification to the outlet stages of each of the existing constructed ponds.

**Table 6-1. Existing Pond Outlet Modifications**

Pond	Proposed Outlet Stages
Paintbrush Hills Pond C	EURV + 100-yr
Paintbrush Hills Pond A	WQCV + 100-yr
Paintbrush Hills Pond B1	Existing Configuration
Paintbrush Hills Pond B2	EURV + 100-yr
The Meadows Pond #1	EURV + 100-yr
Regional Pond WU South	EURV + 100-yr
Woodmen Hills Pond H	Existing Configuration
The Meadows Pond #2	EURV + 100-yr
Regional Pond MN	WQCV + 100-yr
Woodmen Hills Pond #5	EURV + 100-yr
Paint Brush Hills Pond #4	Existing Configuration
Woodmen Hills Pond #1 North	100-yr Only
Woodmen Hills Pond #1 South	EURV Only
Woodmen Hills Pond #2	EURV + 100-yr
Woodmen Hills Pond #3	WQCV + 100-yr
Woodmen Hills Pond #4	EURV + 100-yr

Both Woodmen Hills Pond H and Paint Brush Hills Pond #4 are grossly undersized and both of the spillways currently overtop during the 100-yr storm. As a result, no retrofit solution was provided for these ponds. It is recommended that on-site detention be incorporated upstream of these ponds to reduce flooding at these locations. The drainage area that needs to be mitigated by an EURV or WQCV at these pond locations was accounted for in downstream detention ponds.

##### Proposed Ponds

Proposed ponds include ponds SR 1, SR 2, SR 3, SR 4, R 1, SR 6, and R 2. These ponds are not constructed or planned for and are recommended as a part of the selected detention alternative. Table 6-2 shows the hydraulic configurations for the proposed ponds.

**Table 6-2. Proposed Pond Outlet Configurations**

Pond	Outlet Stages
Sub Regional Pond SR1	WQCV + 100-yr
Sub Regional Pond SR2	EURV Only
Sub Regional Pond SR3	EURV Only
Sub Regional Pond SR4	WQCV + 100-yr
Regional Pond R1	EURV + 100-yr
Sub Regional Pond SR6	EURV + 100-yr
Regional Pond R2	EURV Only

#### 6.2.2. Hydrologic Results

The hydrologic results for the selected detention alternative are shown in Table 6-3. These results reflect all 23 ponds shown in Figure 6-1.

**Table 6-3. Selected Detention Alternative Results**

Location	HEC-HMS Element	Sub Regional Peak Flow (cfs)	
		2-year	100-year
<b>West Tributary</b>			
Raygor Rd.	JWT030	9	85
Stapleton Rd.	JWT120	55	710
Woodmen Rd.	JWT210	81	1,000
Hwy. 24	JWT250	64	980
Falcon Hwy.	JWT260	70	1,000
Garrett Rd.	JWT320	80	1,500
East Blaney Rd.	JWT354	140	2,200
Upstream of Bennett Ranch Tributary	JWT374_Outlet	140	2,200
<b>Middle Tributary</b>			
Woodmen Hills Dr.	JMT010	5	99
Woodmen Rd.	JMT070	31	840
Hwy. 24	JMT106	33	840
Falcon Hwy.	JMT110	34	860
Confluence with West Tributary	RMT114	34	860
<b>East Tributary</b>			
Stapleton Dr.	JET020	9	200
Woodmen Hills Dr.	JET040	10	260
Eastonville Rd.	JET060	13	360
Hwy. 24	JET090	31	300
Pinto Pony Rd.	JET100	32	300
Falcon Hwy.	JET120	50	400
Garrett Rd.	JET160	67	640
Confluence with West Tributary	RET164	66	630

**6.2.3. Detention Pond Sizes & Cost Estimate**

The detention ponds sizes and costs estimate as a result of selected detention alternative are provided in Table 6-4. Assumptions that were used in developing the detention pond cost estimate are as follows:

- Land requirement for proposed ponds is based on proposed rough grading and the corresponding footprint at the spillway stage.
- Construction cost based on \$24,500/ac-ft as documented in the Jimmy Camp Creek DBPS - FSD Costs Memo. Engineering costs were removed from construction cost and added later to the subtotal.
- Land cost was estimated as \$50,000/ac based on the current (2013) El Paso County Parks land value of \$46,954/ac.
- Improvement cost was estimated at \$20,000 per modified pond to retrofit existing outlet structures for EURV/WQCV and 100-yr flood control. Not all existing ponds were retrofit.

**Table 6-4. Detention Pond Cost Estimate**

Pond	Pond Volume (ac-ft)	Land Requirement (ac)	Construction Cost (\$)	Land Cost (\$)	Improvement Cost (\$)	Total Cost (\$)
Paint Brush Hills Pond #4	1.34	-	\$ -	\$ -	\$ -	\$ -
Paint Brush Hills Pond A	2.62	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Paint Brush Hills Pond B1	9.17	-	\$ -	\$ -	\$ -	\$ -
Paint Brush Hills Pond B2	12.09	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Paint Brush Hills Pond C	6.77	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Regional Pond MN	7.53	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Regional Pond R1	25.00	18.8	\$ 532,609	\$ 940,420	\$ -	\$ 1,473,028
Regional Pond R2	3.13	5.1	\$ 66,634	\$ 255,974	\$ -	\$ 322,608
Regional Pond WU South	39.54	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Sub Regional Pond SR1	11.03	3.4	\$ 234,987	\$ 170,782	\$ -	\$ 405,769
Sub Regional Pond SR2	2.05	5.2	\$ 43,674	\$ 257,529	\$ -	\$ 301,203
Sub Regional Pond SR3	1.03	0.6	\$ 21,943	\$ 27,609	\$ -	\$ 49,552
Sub Regional Pond SR4	19.37	20.5	\$ 412,665	\$ 1,022,834	\$ -	\$ 1,435,500
Sub Regional Pond SR6	11.82	6.7	\$ 251,817	\$ 334,260	\$ -	\$ 586,078
The Meadows Pond #1	3.25	-	\$ -	\$ -	\$ 20,000	\$ 20,000
The Meadows Pond #2	7.94	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Woodmen Hills Pond #1 North	7.13	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Woodmen Hills Pond #1 South	8.78	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Woodmen Hills Pond #2	9.18	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Woodmen Hills Pond #3	8.35	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Woodmen Hills Pond #4	40.45	-	\$ -	\$ -	\$ 240,000	\$ 240,000
Woodmen Hills Pond #5	4.10	-	\$ -	\$ -	\$ 20,000	\$ 20,000
Woodmen Hills Pond H	2.66	-	\$ -	\$ -	\$ -	\$ -
Subtotal						\$ 5,053,738
Engineering/ Construction Admin. (15%)						\$ 758,061
Contingency (20%)						\$ 1,010,748
<b>Total</b>						<b>\$ 6,822,546</b>

Additional costs as a percentage of the subtotal construction cost include Engineering/Construction Administration (15%), and Contingency (20%). Detailed quantities and cost estimates are provided in Appendix D.

**6.2.4. Detention Pond Phasing Priority**

Detention pond construction or modification should be phased so that detention ponds located at the upper end of tributaries are constructed first and detention ponds located on the main stem are constructed last. This method of phasing helps reduce sediment issues that may be caused by construction activities if upstream ponds are developed after ponds on the main stem. In addition to pond location, consideration must also be given to the timing of new development. Detention ponds should generally be constructed or modified along with upstream development with an interim condition in place to mitigate the increased sediment load caused by construction.

Table 6-5 lists the phasing priority for each of the existing and proposed ponds. A phasing priority of “1” means the pond should be constructed or modified immediately or as soon as upstream/adjacent development begins. Higher phasing priority numbers indicate more upstream detention ponds must be built prior to construction of the pond in question.

**Table 6-5. Detention Pond Phasing Priority**

Pond	Phasing Priority	Constraint
Paint Brush Hills Pond #4	2	None
Paint Brush Hills Pond A	1	Modify after PBH-C
Paint Brush Hills Pond B1	1	None
Paint Brush Hills Pond B2	1	Modify after PBH-B1
Paint Brush Hills Pond C	1	Modify after SR1
Regional Pond MN	3	None
Regional Pond R1	4	Construct after R-WU, R-MN, and WH5
Regional Pond R2	4	Construct after R1 and WH4
Regional Pond WU South	3	Modify after SR3
Sub Regional Pond SR1	1	None
Sub Regional Pond SR2	2	Construct after PBH-A and PBH-B2
Sub Regional Pond SR3	3	Construct after SR2 and M1
Sub Regional Pond SR4	3	Construct after M2 and WH-H
Sub Regional Pond SR6	2	Construct after PBH4
The Meadows Pond #1	2	None
The Meadows Pond #2	2	None
Woodmen Hills Pond #1 North	3	Construct after SR6
Woodmen Hills Pond #1 South	3	Construct after WH1n
Woodmen Hills Pond #2	3	Construct after WH1s
Woodmen Hills Pond #3	3	Construct after WH2
Woodmen Hills Pond #4	4	Construct after WH3
Woodmen Hills Pond #5	3	None
Woodmen Hills Pond H	2	None

**6.3. Selected Reach Alternatives**

The selected reach alternatives, as defined in Section 5-4, were refined using the flows reported in Section 6.2. Additionally, all bridge and culvert crossings were evaluated as a part of the selected reach alternatives. A summary of the selected reach alternatives is provided graphically in Figure 6-1.

**6.3.1. Reach Evaluation**

A summary of the reach screening results is provided in Table 6-6.

**Table 6-6. Selected Reach Alternatives**

Alternative	Length (ft)
Natural Channel Design	13,216
Protect in Place	64,325
Roadside Ditch Improvement	7,519
Small Drop Structures w/Toe Protection	50,751
<b>Total</b>	<b>135,811</b>

**6.3.2. Bridge & Culvert Crossing Evaluation**

All of the bridge and culvert crossings on the main stem of the creek were evaluated for adherence to DCM criteria. Bridge and culvert crossings were analyzed using the 100-year peak flow from the selected detention alternative. The culvert and bridge design criteria listed in the DCM, Pg. 6-10 was used to evaluate the adequacy of each crossing. The results of the evaluation are provided in Table 6-7.

**Falcon DBPS  
Developer Costs**

Drainage Fees			
Reach/Pond	Reach Length (ft)	Improvement	Cost
RWT354	16	Roadside Ditch	\$ 23,544
RMT106	226	Small Drop Structures w/Toe Protection	\$ 212,322
RMT114	1,667	Small Drop Structures w/Toe Protection	\$ 853,693
RWT150	3,741	Natural Channel Design	\$ 765,482
RWT210_upstream	2,132	Natural Channel Design	\$ 593,011
RWT124_upstream	1,246	Small Drop Structures w/Toe Protection	\$ 640,054
RWT174	1,871	Small Drop Structures w/Toe Protection	\$ 606,335
RWT234	2,129	Small Drop Structures w/Toe Protection	\$ 976,863
RET020	1,915	Small Drop Structures w/Toe Protection	\$ 1,169,444
RWT094	2,145	Natural Channel Design	\$ 246,213
RWT296	1,134	Small Drop Structures w/Toe Protection	\$ 223,458
RWT122	518	Natural Channel Design	\$ 71,367
Channel Subtotal			\$ 6,381,788
Engineering/Construction Admin (15%)			\$ 957,268
Contingency (20%)			\$ 1,276,358
<b>Channel Total</b>			<b>\$ 8,615,414</b>
WT 14	66	Crossing - Culvert	\$ 31,585
WT 13	53	Crossing - Culvert	\$ 28,525
MT 6-2	220	Crossing - Culvert	\$ 181,365
Culvert Subtotal			\$ 241,475
Engineering/Construction Admin (15%)			\$ 36,221
Contingency (20%)			\$ 48,295
<b>Culvert Total</b>			<b>\$ 325,991</b>
Paint Brush Hills Pond A		Detention Pond	\$ 20,000
Paint Brush Hills Pond C		Detention Pond	\$ 20,000
Regional Pond R1		Detention Pond	\$ 1,473,028
Regional Pond R2		Detention Pond	\$ 322,608
Sub Regional Pond SR2		Detention Pond	\$ 301,203
Sub Regional Pond SR3		Detention Pond	\$ 49,552
Sub Regional Pond SR4		Detention Pond	\$ 1,435,500
Sub Regional Pond SR6		Detention Pond	\$ 586,078
The Meadows Pond #1		Detention Pond	\$ 20,000
Woodmen Hills Pond H		Detention Pond	\$ -
Detention Subtotal			\$ 4,227,969
Engineering/Construction Admin (15%)			\$ 634,195
Contingency (20%)			\$ 845,594
<b>Detention Total</b>			<b>\$ 5,707,758</b>
<b>Grand Total</b>			<b>\$ 14,649,163</b>

Bridge Fees			
Reach/Pond	Reach Length (ft)	Improvement	Cost
WT 5-2	43	Crossing - Bridge	\$ 718,121
MT 7	58	Crossing - Bridge	\$ 207,465
MT 6	200	Crossing - Bridge	\$ 166,177
MT 1	45	Crossing - Bridge	\$ 433,032
Subtotal			\$ 1,524,796
Engineering/Construction Admin (15%)			\$ 228,719
Contingency (20%)			\$ 304,959
<b>Total</b>			<b>\$ 2,058,474</b>

## 7.0 FEE DEVELOPMENT

### 7.1. Introduction

The objective of the fee development exercise was to determine the equitable share of drainage improvement costs that a developer is responsible for paying to El Paso County if they wish to plat a property. This fee is a function of the total cost for the selected plan outlined in Section 6 and will be used by the County to pay for drainage improvements that are necessary as a result of development. The product of this calculation is a unit fee (cost/impervious acre) that is a one-time charge to the developer based on the number of impervious acres within the platted property.

### 7.2. Developable Land

The Falcon Watershed has a total area of 6,847 acres. The entirety of the watershed is within the County with 1,969 acres unplatted, according to the GIS dataset received from the County. This dataset also includes unplatted areas that can't be developed because of specific land use designations. Table 7-1 provides a summary of land classifications in the Falcon Watershed. A complete summary of unplatted area land use is provided in Appendix E.

**Table 7-1. Land Classification**

Classification	Area (acres)
Platted	3,670
Unplatted	1,969
Other	1,208
<b>Total</b>	<b>6,847</b>

The projected impervious acreage within unplatted areas totals 645.58 acres. A summary of land classification within the Falcon Watershed is provided in Figure 7-3.

### 7.3. Fee Calculation & County Cost

The total cost for the Selected Plan was separated into a Development Fee, County Cost, Metropolitan District Cost, and Drainage and Bridge Funds. A description of how the aforementioned were defined is as follows:

- **County Cost** – Drainage improvement costs that are the responsibility of the County as shown in Figure 7-1.
- **Metropolitan District Cost** – Drainage improvement costs that are the responsibility of a metropolitan district as shown in Figure 7-2.
- **Development Fee** – All drainage improvement costs that are directly associated with new development.
- **Drainage and Bridge Funds** – The balance of drainage and bridge funds as of August 2015 was \$584,134 and \$510,777, respectively, with a liability of \$300,000 cost for this DBPS (an additional contract amendment increased the cost of this DBPS to \$339,088).

The anticipated reimbursements due for work completed in the Falcon Watershed are approximately equivalent to the available drainage and bridge funds. As a result, reimbursements were not included in

the fee calculation. Drainage improvements that are required as a result of new development are listed in Appendix E.

The costs apportioned to County and metropolitan district drainage improvements are provided in Table 7-2 and Table 7-3. The bridge improvement fees shown in Table 7-2 and Table 7-3 were determined by classification of the crossing as either a bridge or a culvert. This classification was based on the DCM criteria.

**Table 7-2. County Cost**

Drainage Improvements	\$ 24,051,349
Bridge Improvements	\$ 2,887,437
<b>Total Cost</b>	<b>\$ 26,938,786</b>

**Table 7-3. Metropolitan District Cost**

Drainage Improvements	\$ 3,972,407
Bridge Improvements	\$ 1,855,620
<b>Total Cost</b>	<b>\$ 5,828,027</b>

The development cost and corresponding fee calculations based on impervious acreage are provided in Table 7-4 and 7-5.

**Table 7-4. Development Drainage Cost and Fee**

Drainage Improvements	\$ 14,649,163
DBPS Cost	\$ 339,088
<b>Total Cost</b>	<b>\$ 14,988,251</b>
<b>Drainage Fee (per imp. ac.)</b>	<b>\$ 23,217</b>

**Table 7-5. Development Bridge Cost and Fee**

Bridge Improvements	\$ 2,058,474
<b>Total Cost</b>	<b>\$ 2,058,474</b>
<b>Bridge Fee (per imp. ac.)</b>	<b>\$ 3,189</b>