DRAINAGE BASIN PLANNING STUDY

FOR

SMITH CREEK

TECHNICAL ADDENDUM

J R ENGINEERING
A Subsidiary of

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June 2001

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DRAINAGE BASIN PLANNING STUDY
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Physical and Drainage Structures Inventory

Reach	Feature Number	Feature Type	Feature Size	Feature Length	Feature Condition	Feature Physical Location	10/100-yr Existing Flow Rate/Adequecy	Other Physical Infrastructures	General Comments
SC01	SC01050	Natural Damming				Approx. 1050 ft. upstream of confluence	N/A		Is along portion of stream where a lot of ponding is occuring, but is the only significant dam that occurs in area.
SC01	SC01930	Sheet Flow	N.A.	N.A.	N.A.	From steep bank Northwest of SC01950	N/A		Natural sheet flow coming down steep bank. Occurs for about 30 ft. along bank.
SC01	SC01950	Damming and ponding	~150' long, 4" deep				N/A		Ponding occurring due to distinct damming.
SC01	SC02250	Stone Arch culvert	14' wide, 13' high, 6' radius arch	100 ft.	Good		559/2068/A	Flared inlet. Steep drop at downstream end/outlet.	Sediment deposit in outlet. RR grade crossing
SC01	SC02690	Drainage Channel	Top width - 11'4"			50 ft. north of SC02780	N/A		Made of concrete and concrete blocks. Channel carrying highway runoff down to Smith Creek.
SC01	SC02750	Drainage Channel	Top width - 11'4"			400 ft. south of SC02780	N/A		Made of concrete and concrete blocks. Channel carrying highway runoff down to Smith Creek.
SC02	SC02780	2 - Box Culverts Side by Side	2 - 10' by 10'	115 ft.	Good	West side of I-25 (S. bound) at entrance ramp/hwy. Interchange	559/2068/A	Flared inlet and outlet. Ponding at entrance ~ 60' long and 8' deep.	In left culvert, sediment runs from D/S end U/S ~70'. In right, sediment exists through entire length.
SC02	SC02950	R.C.P.	40" diameter	810 ft.		Runs parallel to I-25 on S. bound side between S. and N. bound roads.	N/A	50" by 50" trashrack at outlet. Banks are very soft.	Inlet is in man hole. - 2' drop at outlet not including sediment.
SC02	SC03300	2 - Box Culverts Side by Side	2 - 10' by 10'	115 ft.	Good	Northgate exit from N. bound I-25.	559/2068/A	Flared inlet.	Flow is through left box. Sediment deposit in left at outlet - 6" deep and runs U/S - 20'. Sediment does exist in right box.
SC02	SC03360	Drainage Channels (3)	Trapezoidal 2@ 4' x 2'4" 1 @ 5'8"x3'6"	2 @ 30' 1 @ 60'	Good	East side of N. bound I-25 at SC03300.	N/A		Trapezoidal channels draining highway water into Smith Creek.
SC02	SC03930	Drop	6' drop				N/A		A natural occurring drop of -6'
SC02	SC03950	R.C.P.	24" diameter			Off Stream Across I-25 exit to Northgate/Gleneagle.	N/A	Flared outlet.	
SC02	SC03960	Ponding	6" deep			Slightly upstream of 6' drop.	N/A		
SC02	SC04230	R.C.P.	24" diameter			Off Stream Across I-25 exit to Northgate E. bound.	N/A	Flared inlet and outlet (48" wide).	~2" deep sediment at outlet.

Physical and Drainage Structures Inventory

Reach	Feature Number	Feature Type	Feature Size	Feature Length	Feature Condition	Feature Physical Location	10/100-yr Existing Flow Rate/Adequecy	Other Physical Infrastructures	General Comments
SC02	SC04380	Slope Protection		250 ft.			N/A		Riprap of concrete slabls - 16 to 25 in^2 in size.
SC02	SC04460	Drainage Channel	9 ft. Wide	45 ft.		On slope east of SC04500.	N/A		Concrete trainagular shaped channel running directly into SC04500.
SC02	SC04300	R.C.P.	24" diameter	60 ft.	Good	Off Stream under Northgate Rd just east of interchange.	N/A	Flared inlet and outlet.	Inlet - 1/3 full with debris and sediment. Outlet - 2/3 full with debris and sediment. No flow.
SC02	SC04560	R.C.P.	24" diameter	60 ft.	Good	Off stream. Under highway entrance (N. bound) from Northgate Rd.	N/A	Flared outlet. Flared inlet with concrete slab surrounding at top.	No flow.
SC02	SC04820	C.M.P.	24" diameter			Access road to mining museum.	547/2016/IA	Gate at inlet.	Gate is creating ponding. Depth of ponding at outlet is 8".
SC02	SC05230	Ponding					N/A		Ponding occurring slightly south of, yet connected to Smith Creek.
SC02	SC05560	C.M.P.	Oval - 3' by 39"	72 ft.		Under Northgate after it splits w/Gleneagle.	550/2016/TA		Flow is smooth but is a lot of buildup of debris at entrance 18" drop at outlet.
SC03	SC06770	Drop	4'				N/A		Natural drop of ~4'.
SC03	SC07300	C.M.P.	12" diameter	50 ft.		Outlet for pond at SC07305.	550/2016/TA	Inlet pipe appers to be 14" in diameter Poor trash rack at entrance.	Flow at outlet is 1/2 full. Drop inlet - morning glory type. Considerable amount of ponding at outlet.
SC03	SC07305	Damming		400 ft.			550/2016/TA		Man made ponding built to possibly create ponding for irrigation or cattle.
SC04	SC10250	Damming	pond - 580'	400 ft.	Good	Off Stream. Under Sun Hills Dr. west of driveway = SH00360.	N/A		
SC04	SC10740	C.M.P.	18" diameter	40 ft.	Good	Off stream. Under Sun Hills Dr. west of driveway - SH00360.	N/A		
SC04	SC10990	C.M.P.	18" diameter	40 ft.		Off stream. Under Walsen Rd.	N/A		Appears to be small tributary here leading to Smith Creek. Street numbering = WL00360.
SC04	SC11810	C.M.P.	18" diameter	50 ft.		Off stream. Under Walsen Rd. right at driveway.	N/A		Street number = WL01100.
SC04	SC12110	C.M.P.	18" diameter	50 ft.		Off stream. Under Walsen Rd.	N/A		Street number - WL01420.

Physical and Drainage Structures Inventory

Reach	Feature Number	Feature Type	Feature Size	Feature Length	Feature Condition	Feature Physical Location	10/100-yr Existing Flow Rate/Adequecy	Other Physical Infrastructures	General Comments
SC05	SC12950	R.C.P.	48" diameter	60 ft.	Poor	Under private property access road.	473/1754/IA	Pond located up-stream. Flow is being regulated by boards at inlet in pond.	Pipe has split near outlet thus last section does not have flow through it but rather around/under and off to the side.
SC05	SC14100	C.M.P.	24" diameter	48 ft.	Good	Off stream. Under Walsen Rd.	N/A		2" of sediment built up at inlet. Outlet - 1/3 full of sediment.
SC05	SC15600	C.M.P.	36" diameter	30 ft.	Good	Under a private property access road.	464/1770/IA	Flared inlet.	A lot of low lying small shrub type trees surrounding.
SC06	SC17610	C.M.P.	36" diameter	50 ft.	Poor	Under Pleier Dr.	Included w/next feature.		Has been placed at slope greater than U/S bed and does not tie into U/S bed thus water has eroded sides of pipe and enters through sides.
SC06	SC17630	C.M.P.	60" diameter	60 ft.		Under Pleier Dr.	460/1704/IA		No water flow through this pipe - flow is through SC17610. - is at higher elevation than SC17610
SC08	SC21940	Drop Concrete & Gabion Structures	60' across 20' long incl. D/S "apron"		Good	Southeast of water treatment facility	N/A	Side slopes of sill appear to be 2:1	Concrete on top of gabions creating sill type structure. Gabions on side slopes as well.
SC08	SC21990	Drop Concrete & Gabion Structures	60' across 20' long incl. D/S "apron"		Good	Southeast of water treatment facility	N/A	Side slopes of sill appear to be 2:1	Concrete on top of gabions creating sill type structure. Gabions on side slopes as well.
SC08	SC22030	Drop Concrete & Gabion Structures	60' across 20' long incl. D/S "apron"		Good	Southeast of water treatment facility	N/A	Side slopes of sill appear to be 2:1	Concrete on top of gabions creating sill type structure. Gabions on side slopes as well.
SC08	SC22130	Drop Concrete & Gabion Structures	60' across 20' long incl. D/S "apron"		Good	Southeast of water treatment facility	N/A	Side slopes of sill appear to be 2:1	Concrete on top of gabions creating sill type structure. Gabions on side slopes as well.
SC08	SC22370	Water Treatment Facility					N/A		Consists of 3 ponds
SC08	SC23010	Dirversion Out at 23010 In at 23650				South of Spring Valley Dr. Just north of water treatment facility	N/A	Outlet pipe appears to be ~10" in diameter	Diversion from Smith Creek leading to a dam/pond then back to Smith Creek. Flow in and out is very small.
SC10	SC25480	C.M.P.	36" diameter	70 ft.	Good	Under Stella Drive	89/368/IA		Scour has occurred at outlet - hole has been filled with debris
SC10	SC25630	C.M.P.	18" diameter	~40 ft.		Fox Run Park. Under road just east of entrance drive.	IA		
SC10	SC25800	C.M.P.	12" diameter	~35 ft.		Off stream, Fox Run Park. Under road just east of SC25630	IA		
SC10	SC25970	C.M.P.	12" diameter	36 ft.	Good	Under parking area drive in Fox Run Park.	IA		

Physical and Drainage Structures Inventory

Reach	Feature Number	Feature Type	Feature Size	Feature Length	Feature Condition	Feature Physical Location	10/100-yr Existing Flow Rate/Adequecy	Other Physical Infrastructures	General Comments
SC10	SC26750	C.M.P.	12" diameter	40 ft.	Good	Under circle drive through Fox Run Park	N/A		Flow from outlet runs across grass/soccer field.
SC10	SC26810	C.M.P.	24" diameter	36 ft.	Good	Off stream. Fox Run Park.	N/A		
SC10	SC28280	C.M.P.	24" diameter	~25 ft.	Poor	Under Rollercoaster Rd. at base of hill rising to the north	60/206/IA		Is bent down and angling to the north, sediment.
TA01	TA00000	Confluence	N.A.	N.A.	N.A.	SC12280	N/A		
TA01	TA00450	C.M.P.	48" diameter	50 ft.		Under Watson Rd.	78/238/IA		Sediment deposited along entire length 1 to 2" deep. No present flow.
TA01	TA01170	C.M.P.	48" diameter	60 ft.	Good	Under Shelty Rd.	75/225/IA	Riprap at entrance ~2' by 2' and runs for 10'	Buildup of sediment at outlet. Inlet appears to be at higher elevation than channel for ~60' U/S. (No present flow.)
TA01	TA01710	C.M.P.	36" diameter	45 ft.	Good	Under Sun Hills Dr.	73/220/IA		24" opening at inlet yet sediment appears to be 2-4" deep - has pipe crushed? Outlet - 7/8 full of sediment
TA01	TA02680	C.M.P.	33" diameter	48 ft.	Good	Under Sun Hills Dr.	65/192/IA		Inlet- does have some sediment. Outlet - 1/2 full with sediment.
TA01	TA03650	C.M.P.	24" diameter	45 ft.	Good	Under Sun Hills Dr.	65/192/IA		Inlet - 1/2 full with sediment. Outlet - 3/4 full with sediment.
TB01	TB00000	Confluence	N.A.	N.A.	N.A.	SC19470	N/A		
TB01	TB02710	C.M.P.	36" diameter	50 ft.	Poor	Under Spring Valley Dr.	149/541/IA		Has buckled in several places.
TB01	TB03850	C.M.P.	24" diameter	~40 ft.	Good	Off stream. Under Sun Hills Dr. = SH10150	N/A		Street numbering = SH10150
TB01	TB04030	C.M.P.	24" diameter	50 ft.	Good	Off stream. Under Sun Hills Dr.	Included w/next feature.		
TB01	TB04130	R.C.P.	Oval - 36" by 24"	80 ft.	Good	Across "T" intersection w/Sun Hills Dr. and Stella Dr.	119/353/IA		Drop at outlet has caused scouring to occur.
TC01	TC00000	Confluence	N.A.	N.A.	N.A.	SC24200	N/A		

Physical and Drainage Structures Inventory

Reach	Feature Number	Feature Type	Feature Size	Feature Length	Feature Condition	Feature Physical Location	10/100-yr Existing Flow Rate/Adequecy	Other Physical Infrastructures	General Comments
TC01	TC01130	C.M.P.	18" diameter	54 ft.	Unknown	Under Raton Rd.	115/457/IA	Appears to have a flared outlet.	Outlet is completely filled with sediment. Inlet is down in hole but very little sediment deposit here.
TC01	TC01900	C.M.P.	24" diameter	42 ft.	Good	Under Rollercoaster Rd.	115/457/IA		
N/A	TCA0000	Confluence				TC03130	N/A		
N/A	TCB0000	Confluence				TC05950	N/A		
TD01	TD00000	Confluence	N.A.	N.A.	N.A.	SC24870	N/A		
TD01	TD00790	Free Flow	N.A.	N.A.	N.A.	Over Stella Dr. Southwest boundary of Fox Run Park	N/A		Appears to be no pipe running under Stella Dr. for tributary D to flow through. Simply flows over road.
TD01	TD01010	C.M.P.	18" diameter	40 ft.	Good	Off stream. Fox Run Park.	IA for 100-year	Flared outlet.	Flow of water through here appears to eventually lead into tributary D. Pipe is running through mound toward Stella Dr.
TD01	TD01060	C.M.P.	18" diameter	40 ft.		Fox Run Park. Under west circle drive.	IA for 100-year		
TD01	TD01090	C.M.P.	18" diameter	25 ft.	Good	Off Stream. Fox Run Park. Under western circle drive.	IA for 100-year		Flow from pipe appears to both run back over road to TD01010 and along road to TD01060
TD01	TD01450	C.M.P.	12" diameter			Fox Run Park. Under road just west of main entrance drive.	IA		Outlet unfound. Covered with vegetation and filled with sediment.
TD01	TD01560	C.M.P.	18" diameter	30 ft.	Good	Fox Run Park. Under western circle drive	IA for 100-year		Outlet is in grated inlet structure.
TD01	TD01690	C.M.P.	18" diameter	36 ft.		Fox Run Park. Under entrance to western circle	IA for 100-year		Inlet - 1/2 full with sediment. Outlet - 1/2 full with sediment and vegetation.
TD01	TD02080	C.M.P.	18" diameter	75 ft.	Good	Fox Run Park. Under main circle drive at northern "Y" intersection	IA for 100-year	Flared outlet.	
TD01	TD03180	C.M.P.	18" X 24" Oval	36 ft.	Good	Fox Run Park. Under road leading up to loockout circle drive.	IA for 100-year		
TD01	TD03690	C.M.P.	18" diameter	40 ft.	Good	Fox Run Park. Near start of circle drive at lookout.	IA for 100-year		Pipe is located under mound not road.

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Reach	Feature Number	Feature Type	Feature Size	Feature Length	Feature Condition	Feature Physical Location	10/100-yr Existing Flow Rate/Adequecy	Other Physical Infrastructures	General Comments
N/A	TE00000	Confluence				SC269830	N/A		
N/A	RC01390	C.M.P.	28" diameter	~40 ft.		Under Rollercoaster Rd. slightly north of Timberidge Lane	N/A		Can't see outlet - is filled with sediment.
N/A	ED00940	C.M.P.	18" diameter	~40 ft.		Under Timberidge Lane.	N/A		Sedimetn at outlet/filled.
N/A	ED01470	C.M.P.	18" diameter	~40 ft.		Under Timberidge Lane.	N/A		
N/A	ST02460	C.M.P.	18" diameter	~40 ft.		Under Silverton Rd.	N/A		Outlet is filled with sediment
N/A	ST03700	C.M.P.	18" diameter	~40 ft.	Poor	Under Silverton Rd.	N/A		Outlet is smashed/destroyed
N/A	ST04130	C.M.P.	18" diameter	~40 ft.		Under Silverton Rd.	N/A		
N/A	RT02990	C.M.P.	18" diameter	~50 ft.	Poor	Under Raton Rd. righ at intersection with Craig Dr.	N/A		Inlet and outlet smashed.
N/A	RT03770	C.M.P.	18" diameter	~40 ft.	Poor	Under Raton Rd. just east of waste water treatment facility.	N/A		
N/A	RT04630	C.M.P.	18" diameter	~40 ft.		Under Rollercoaster Rd.	N/A		Appears to be a channel present
N/A	SH00990	C.M.P.	18" diameter	40 ft.	Good	Under Sun Hills Dr.	N/A		Debris and sediment at outlet. Inlet has wooden board structure placed in front obstructing flow.
N/A	SH05530	C.M.P.	2 x 24" diameter	36 ft.	Good	Under Sun Hills Dr just east of intersectin with Rangely Dr.	N/A		
N/A	SH06300	C.M.P.	18" diameter	40 ft.	Poor	Under Sun Hills Dr.	N/A		Inlet and outlet are battered and beaten.
N/A	SH06490	C.M.P.	24" diameter	40 ft.	Good	Under Sun Hills Dr.	N/A		
N/A	SH07270	C.M.P.	18" diameter	40 ft.	Good	Under Sun Hills Dr.	N/A		Scour occurring at outlet.

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N/A	SH09130	C.M.P.	18" diameter	42 ft.	Poor	Under Sun Hills Dr.	N/A		Outlet is crushed.
N/A	SV01790	C.M.P.	18" diameter	~40 ft.		Under Spring Valley Dr.	N/A		Outlet is filled with sediment.
N/A	SL02700	C.M.P.	18" diameter	40 ft.	Poor	Under Spring Valley Dr.	N/A		Outlet has been crushed.
N/A	RC05560	C.M.P.	36" diameter	~40 ft.	Poor	Under Rollercoaster Rd. between Rocky Heights Dr. and Stagecoach Rd.	N/A		Pipe has hole near inlet.
N/A	RC09680	C.M.P.	18" diameter	36 ft.	Good	Under Rollercoaster Rd. at base of hill rising to the south	N/A		Sediment at outlet ~ 6"-10" deep.
N/A	RV00900	C.M.P.	18" diameter	50 ft.	Poor	Under Reiville Dr.	N/A		Hole in pipe at outlet.
N/A	SV00960	C.M.P.	18" diameter	~50 ft.		Under Spring Valley Dr.	N/A		
N/A	MP00160	C.M.P.	18" diameter	~50 ft.		Under Mountain Pine Lane.	N/A		
N/A	MP00260	C.M.P.	18" diameter	~50 ft.		Under Mountain Pine Lane.	N/A		
N/A	RH01040	C.M.P.	18" diameter	~50 ft.		Under Rocky Heights Dr.	N/A		Located a deep under road. Flow is in southwest direction.
N/A	SG01960	C.M.P.	18" diameter	~50 ft.		Under Stagecoach Rd.	N/A		Flow paths down along Stagecoach Rd. is where a lot of flow will occur.
N/A	RT06170	C.M.P.	18" diameter	~40 ft.		Under Raton Rd.	N/A		Outlet is filled with sediment thus cannot find.
N/A	RT06680	C.M.P.	18" diameter	~40 ft.		Under Raton Rd.	N/A		
N/A	GE01240	C.M.P.	24" X 42" Oval	100 ft.	Good	Under Gleneagle Dr.	N/A		A lot of sediment at inlet. ~2" of sediment at outlet.
N/A	GE01280	C.M.P.	24" X 42" Oval	100 ft.	Poor	Under Gleneagle Dr.	N/A		A lot of sediment at inlet. ~2" of sediment at outlet. Buckled in center - almost completely blocking flow (located near entrance).

Environmental Inventory

Reach	Feature Location	Feature Type	General Comments
SC01	Confluence to Railroad Crossing.	Mature Riparian Woodland	* Mature willows along north side of creek. * Immature sandbar willows. * Herbaceous perennials, sedges, junas, scripus species.
SC01	Railroad to South - bound I-25.	Immarute Riparian Woodland	* Immature sandbar willows. * Herbaceous perennials, grasses, i.e. typus, heracleum species.
SC02	Southbound I-25 to Northbound I-25.	Mature Riparian Woodland	* Few mature willows * Herbaceous perennials, grassed, i.e. puccinellia, typha, heracleum species.
SC02	Northbound I-25 to driveway to Mining Museum.	Mature Riparian Woodland	* Mature willows and immature sandbar willows * Herbaceous perennials, grassed, i.e. puccinellia, typha, heracleum, equisetum species.
SC02	Pond upstream of Mining Museum Access Road.	Mature Riparian Woodland	* edge of pond surrounded by mature willows with understory of grasses/sedges, few immature saplings.
SC02	Mining Museum Pond to Northgate Road.	Immature Riparian Woodland	* Immature sandbar willows. * Herbaceous perennials/grasses/
SC03	Northgate Road to RES612	Mature Riparian Woodland	* Vegetation has been significantly grazed by cows. * Evidence of immature willow saplings. * Herbaceous perennials, grassed, i.e. scirpus, puccinellia, equisteum.
SC03	RES612	Emergent Wetland	* Edges of pond and inlet to pond have bulrushes, typha, scirpus species.
SC03	RES612 to RES610	Immature Riparian Woodland	* Below dam - mature willow species. * Area impacted by cows grazing young willows, sedges, grasses.
SC04 & SC05	RES610 to Private Property Access Road #1	Emergent Wetland	* Emergent wetland at pond transitioning to mature riparian wetland by driveway.
SC05	Private Property Access Road #1 to Pleier Drive.	Mature Riparian Wetland	* Old/young willows, aspen, cottonwoods. * Few grasses, sedges as understory.

Environmental Inventory

Reach	Feature Location	Feature Type	General Comments
SC06 & SC07	Pleier Drive to the Waste Water Treatment Facility	Riparian Schrubland	* Dense immature sandbar willow saplings. * Few understory grasses/sedges.
SC08	Waste Water Treatment Facility to Tributary C.	Riparian Schrubland	* Dense immature sandbar willow saplings. * Few understory grasses/sedges.
SC09 & SC10	Tributary C to Stella Road.	Grassland	* Ponderosa pine overstory with grasses as understory.
TA01	Confluence to third tributary crossing of Sun Hills Dr.	Grassland	* Grass-lined channel.
TB01	Confluence to tip of basin 105.	Grassland	* Grass-lined channel.
TC01	Confluence to crossing at Fools Gold Rd.	Grassland	* Grass-lined channel with few Ponderosa Pines.

WILDLIFE SPECIES LIST: SMITH CREEK DRAINAGE BASIN STUDY PROJECT, EL PASO COUNTY, COLORADO

HABITAT CODES: GAMBLE'S OAK, PONDEROSA PINE, GRASSLAND, WETLANDS, RIPARIAN, LOWER STREAM.

AMPHIBIANS	
SALAMANDER, TIGER	AMBYSTOMA-TIGRINUM
SPADEFOOT, PLAINS	SCAPHIOPUS-BOMBIFRONS
TOAD, WOODHOUSE'S	BUFO-WOODHOUSII
FROG, CHORUS, STRIPED	PSEUDACRIS-TRISERIATA
FROG, LEOPARD, PLAINS	RANA-BLAIRI
FROG, LEOPARD, NORTHERN	RANA-PIPIENS
BIRDS	
GREBE, PIED-BILLED	PODILYMBUS-PODICEPS
GREBE, HORNED	PODICEPS-AURITUS
GREBE, EARED	PODICIPEDS-NIGRICOLLIS
GREBE, WESTERN	AECHMOPHORUS-OCCIDENTALIS
CORMORANT, DOUBLE-CRESTED	PHALACROCORAX-AURITUS
BITTERN, AMERICAN	BOTAURUS-LENTIGINOSUS
BITTERN, LEAST	IXOBRYCHUS-EXILIS
HERON, BLUE, GREAT	ARDEA-HERODIAS
EGRET, GREAT	CASMERODIUS-ALBUS
EGRET, SNOWY	EGRETTA-THULA
HERON, BLUE, LITTLE	EGRETTA-CAERULEA
HERON, TRICOLORED	EGRETTA-TRICOLOR
EGRET, CATTLE	BUBULCUS-IBIS
HERON, GREEN-BACKED	BUTORIDES-STRIATUS
HERON, NIGHT, BLACK-CROWNED	NYCTICORAX-NYCTICORAX
HERON, NIGHT, YELLOW-CROWNED	NYCTICORAX-VIOLACEUS
IBIS, WHITE-FACED	**PLEGADIS-CHIHI++**
SWAN, TUNDRA	CYGNUS-COLUMBIANUS
GOOSE, WHITE-FRONTED, GREATER	ANSER-ALBIFRONS
GOOSE, SNOW	CHEN-CAERULESLENS
GOOSE, CANADA	BRANTA-CANADENSIS
DUCK, WOOD	AIX-SPONSA
TEAL, GREEN-WINGED	ANAS-CRECCA
DUCK, BLACK, AMERICAN	ANAS-RUBRIPES
MALLARD	ANAS-PLATYRHYNCHOS
PINTAIL, NORTHERN	ANAS-ACUTA
TEAL, BLUE-WINGED	ANAS-DISCORS
TEAL, CINNAMON	ANAS-CYANOPTERA
SHOVELER, NORTHERN	ANAS-CLYPEATA
GADWALL	ANAS-STREPERA
WIGEON, EURASIAN	ANAS-PENELOPE
WIGEON, AMERICAN	ANAS-AMERICANA
CANVASBACK	AYTHYA-VALISINERIA
REDHEAD	AYTHYA-AMERICANA
DUCK, RING-NECKED	AYTHYA-COLLARIS
SCAUP, LESSER	AYTHYA-AFFINIS
OLDSQUAW	CLANGULA-HYEMALIS
SCOTER, WHITE-WINGED	MELANITTA-FUSCA
GOLDENEYE, COMMON	BUCEPHALA-CLANGULA
GOLDENEYE, BARROW'S	BUCEPHALA-ISLANDICA
BUFFLEHEAD	BUCEPHALA-ALBEOLA
MERGANSER, HOODED	LOPHODYTES-CUCULLATUS
MERGANSER, COMMON	MERGUS-MERGANSER

WILDLIFE SPECIES LIST: SMITH CREEK DRAINAGE BASIN STUDY PROJECT, EL PASO COUNTY, COLORADO

HABITAT CODES: GAMBLE'S OAK, PONDEROSA PINE, GRASSLAND, WETLANDS, RIPARIAN, LOWER STREAM.

BIRDS (CON'T.)	
MERGANSER, RED-BREASTED	MERGUS-SERRATOR
DUCK, RUDDY	OXYURA-JAMAICENSIS
VULTURE, TURKEY	CATHARTES-AURA
EAGLE, BALD	**HALIAEETUS-LEUCOCEPHALUS*,##**
HARRIER, NORTHERN	CIRCUS-CYANEUS
HAWK, SHARP-SHINNED	ACCIPITER-STRIATUS
GOSHAWK	**ACCIPITER-GENTILIS++**
HAWK, RED-SHOULDERED	BUTEO-LINEATUS
HAWK, BROAD-WINGED	BUTEO-PLATYPTERUS
HAWK, SWAINSON'S	BUTEO-SWAINSONI
HAWK, RED-TAILED	BUTEO
HAWK, FERRUGINOUS	**BUTEO-REGALIS++**
HAWK, ROUGH-LEGGED	BUTEO-LAGOPUS
EAGLE, GOLDEN	AQUILA-CHRYSAETOS
KESTREL, AMERICAN	FALCO-SPARVERIUS
MERLIN	FALCO-COLUMBARIUS
FALCON, PEREGRINE	**FALCO-PEREGRINUS*,##**
GYRFALCON	FALCO-RUSTICOLUS
PHEASANT, RING-NECKED	PHASIANUS-COLCHICUS
GROUSE, BLUE	DENDRAGAPUS-OBSCURUS
GROUSE, SHARP-TAILED, PLAINS	**TYMPANUCHUS-PHASIANELLUS#**
TURKEY, WILD	MELEAGRIS-GALLOPAVO
RAIL, VIRGINIA	RALLUS-LIMICOLA
SORA	PORZANA-CAROLINA
MOORHEN, COMMON	GALLINULA-CHLOROPUS
COOT, AMERICAN	FULICA-AMERICANA
CRANE, LESSER SANDHILL	GRUS-CANADENSIS
CRANE, GREATER SANDHILL	**GRUS-CANADENSIS##**
CRANE, WHOOPING	**GRUS-AMERICANA*,#**
PLOVER, BLACK-BELLIED	PLUVIALIS-SQUATAROLA
PLOVER, SNOWY	**CHARADRIUS-ALEXANDRIUS++**
PLOVER, SEMIPALMATED	CHARADRIUS-SEMIPALMATUS
KILLDEER	CHARADRIUS-VOCIFERUS
PLOVER, MOUNTAIN	**CHARADRIUS-MONTAUS++**
STILT, BLACK-NECKED	HIMANTOPUS-MEXICANUS
AVOCET, AMERICAN	RECURVIROSTRA-AMERICANA
YELLOWLEGS, GREATER	TRINGA-MELANOLEUCA
YELLOWLEGS, LESSER	TRINGA-FLAUIPES
SANDPIPER, SOLITARY	TRINGA-SOLITARIA
WILLET	CATOPTROPHORUS-SEMIPALMATUS
SANDPIPER, SPOTTED	ACTITIS-MACULARIA
SANDPIPER, UPLAND	BARTRAMIA-LONGICAUDA
WHIMBREL	NUMENIUS-PHAEOPUS
CURLEW, LONG BILLED	NUMENIUS-AMERICANUS
GODWIT, MARBLED	LIMOSA-FEDOA
SANDPIPER, SEMIPALMATED	CALIDRIS-PUSILLA
SANDPIPER, LEAST	CALIDRIS-MINUTILLA
SANDPIPER, WHITE-RUMPED	CALIDRIS-FUSCICOLLIS
SANDPIPER, BAIRD'S	CALIDRIS-BAIRDII
SANDPIPER, PECTORAL	CALIDRIS-MELANOTOS
DUNLIN	CALIDRIS-ALPINA

WILDLIFE SPECIES LIST: SMITH CREEK DRAINAGE BASIN STUDY PROJECT, EL PASO COUNTY, COLORADO

HABITAT CODES: GAMBLE'S OAK, PONDEROSA PINE, GRASSLAND, WETLANDS, RIPARIAN, LOWER STREAM.

BIRDS (CON'T.)	
SANDPIPER, STILT	CALIDRIS-HIMANTOPUS
SANDPIPER, BUFF-BREASTED	TRYNGITES-SUBRUFICOLLIS
DOWITCHER, LONG-BILLED	LIMNODRAMUS-SCOLOPACEUS
SNIPE, COMMON	GALLINAGO-GALLINAGO
WOODCOCK, AMERICAN	SCOLOPAX-MINOR
PHALAROPE, WILSON'S	PHALAROPUS-TRICOLOR
PHALAROPE, RED-NECKED	PHALAROPUS-LOBATUS
GULL, FRANKLIN'S	LARUS-PIPIXCAN
GULL, BONAPARTE'S	LARUS-PHILADELPHIA
GULL, RING-BILLED	LARUS-DELAWARENSIS
GULL, CALIFORNIA	LARUS-CALIFORNICUS
TERN, COMMON	STERNA-HIRUNDO
TERN, FORSTER'S	STERNA-FORSTERI
TERN, BLACK	**CHLIDONIAS-NIGER++**
DOVE, ROCK	COLUMBA-LIVIA
PIGEON, BAND-TAILED	COLUMBA-FASCIATA
DOVE, MOURNING	ZENAIDA-MACROURA
CUCKOO, BLACK-BILLED	COCCYZUS-ERYTHROPTHALMUS
ANI, GROOVE-BILLED	CROTOPHAGA-SULCIROSTRIS
OWL, BARN, COMMON	TYTO-ALBA
OWL, SCREECH, COMMON	OTUS-ASIO
OWL, GREAT-HORNED	BUBO-VIRGINIANUS
OWL, SNOWY	NYCTEA-SCANDIACA
OWL, PYGMY, NORTHERN	GLAUCIDIUM-GNOMA
OWL, BURROWING	ATHENE-CUNICULARIA
OWL, SPOTTED	**STRIX-OCCIDENTALIS**,##**
OWL, LONG-EARED	ASIO-OTUS
OWL, SHORT-EARED	ASIO-FLAMMEUS
OWL, SAW-WHET, NORTHERN	AEGOLIUS-ACADICUS
NIGHTHAWK, COMMON	CHORDEILES-MINOR
POORWILL, COMMON	PHALAENOPTILUS-NUTTALLI
WHIP-POOR-WILL	CAPRIMULGUS-VOCIFERUS
SWIFT, CHIMNEY	CHAETURA-PELAGICA
SWIFT, WHITE-THROATED	AERONAUTES-SAXATALIS
HUMMINGBIRD, MAGNIFICENT	EUGENES-FULGENS
HUMMINGBIRD, BLACK-CHINNED	ARCHILOCHUS-ALEXANDRI
HUMMINGBIRD, CALLIOPE	STELLULA-CALLIOPE
HUMMINGBIRD, BROAD-TAILED	SELASPHORUS-PLATYCERCUS
HUMMINGBIRD, RUFOUS	SELASPHORUS-RUFUS
KINGFISHER, BELTED	CERYLE-ALCYON
WOODPECKER, LEWIS'	MELANERPES-LEWIS
WOODPECKER, RED-HEADED	MELANERPES-ERYTHROCEPHALUS
WOODPECKER, RED-BELLIED	MELANERPES-CAROLINUS
SAPSUCKER, YELLOW-BELLIED	SPHYRAPICUS-VARIUS
SAPSUCKER, WILLIAMSON'S	SPHYRAPICUS-THYROIDEUS
WOODPECKER, LADDER-BACKED	PICOIDES-SCALARIS
WOODPECKER, DOWNY	PICOIDES-PUBESCENS
WOODPECKER, HAIRY	PICOIDES-VILLOSUS
WOODPECKER, THREE-TOED	PICOIDES-TRIDACTYLUS
FLICKER, NORTHERN	COLAPTES-AURATUS
FLYCATCHER, OLIVE-SIDED	CONTOPUS-BOREALIS

WILDLIFE SPECIES LIST: SMITH CREEK DRAINAGE BASIN STUDY PROJECT, EL PASO COUNTY, COLORADO

HABITAT CODES: GAMBLE'S OAK, PONDEROSA PINE, GRASSLAND, WETLANDS, RIPARIAN, LOWER STREAM.

BIRDS (CON'T.)

PEWEE, WOOD, WESTERN	CONTOPUS-SORDIDULUS
FLYCATCHER, WILLOW	EMPIDONAX-TRAILLII
FLYCATCHER, LEAST	EMPIDONAX-MINIMUS
FLYCATCHER, HAMMOND'S	EMPIDONAX-HAMMONDII
FLYCATCHER, DUSKY	EMPIDONAX-OBERHOLSERI
FLYCATCHER, GRAY	EMPIDONAX-WRIGHTII
FLYCATCHER, WESTERN	EMPIDONAX-DIFFICILIS
PHOEBE, SAY'S	SAYORNIS-SAYA
FLYCATCHER, VERMILION	PYROCEPHALUS-RUBINUS
FLYCATCHER, ASH-THROATED	MYIARCHUS-CINERASCENS
KINGBIRD, CASSIN'S	TYRANNUS-VOCIFERANUS
KINGBIRD, WESTERN	TYRANNUS-VERTICALIS
KINGBIRD, EASTERN	TYRANNUS-TYRANNUS
SWALLOW, TREE	TACHYCINETA-BICOLOR
SWALLOW, VIOLET-GREEN	TACHYCINETA-THALASSINA
SWALLOW, ROUGH-WINGED, NORTHERN	STELGIDOPTERYX-SERRIPENNIS
SWALLOW, BANK	RIPARIA-RIPARIA
SWALLOW, CLIFF	HIRUNDO-PYRRHONOTA
SWALLOW, BARN	HIRUNDO-RUSTICA
JAY, GRAY	PERISOREUS-CANADENSIS
JAY, STELLER'S	CYANOCITTA-STELLERI
JAY, BLUE	CYANOCITTA-CRISTATA
JAY, SCRUB	APHELOCOMA-COERULESCENS
JAY, PINYON	GYMNORHINUS-CYANOCEPHALUS
NUTCRACKER, CLARK'S	NUCIFRAGA-COLUMBIANA
MAGPIE, BLACK-BILLED	PICA-PICA
CROW, AMERICAN	CORVUS-BRACHYRHYNCHOS
RAVEN, CHIHUAHUAN	CORVUS-CRYPTOLEUCUS
RAVEN, NORTHERN	CORVUS-CORAX
CHICKADEE, BLACK-CAPPED	PARUS-ATRICAPILLUS
CHICKADEE, MOUNTAIN	PARUS-GAMBELI
TITMOUSE, PLAIN	PARUS-/INORNATUS
BUSHTIT	PSALTRIPARUS-MINIMUS
NUTHATCH, RED-BREASTED	SITTA-CANADENSIS
NUTHATCH, WHITE-BREASTED	SITTA-CAROLINENSIS
NUTHATCH, PYGMY	SITTA-PYGMAEA
CREEPER, BROWN	CERTHIA-AMERICANA
WREN, ROCK	SALPINCTES-OBSOLETUS
WREN, CANYON	CATHERPES-MEXICANUS
WREN, CAROLINA	THRYOTHORUS-LUDOVICIANUS
WREN, BEWICK'S	THRYOMANES-BEWICKII
WREN, HOUSE	TROGLODYTES-AEDON
WREN, WINTER	TROGLODYTES-TROGLODYTES
WREN, SEDGE	CISTOTHORUS-PLATENSIS
WREN, MARSH	CISTOTHORUS-PALUSTRIS
KINGLET, GOLDEN-CROWNED	REGULUS-SATRAPA
KINGLET, RUBY-CROWNED	REGULUS-CALENDULA
GNATCATCHER, BLUE-GRAY	POLIOPTILA-CAERULEA
BLUEBIRD, EASTERN	SIALIA-SIALIS
BLUEBIRD, WESTERN	SIALIA-MEXICANA
BLUEBIRD, MOUNTAIN	SIALIA-CURRUCOIDES

WILDLIFE SPECIES LIST: SMITH CREEK DRAINAGE BASIN STUDY PROJECT, EL PASO COUNTY, COLORADO

HABITAT CODES: GAMBLE'S OAK, PONDEROSA PINE, GRASSLAND, WETLANDS, RIPARIAN, LOWER STREAM.

BIRDS (CON'T.)	
SOLITAIRE, TOWNSEND'S	MYADESTES-TOWNSENDI
VEERY	CATHARUS-FUSCESCENS
THRUSH, GRAY-CHEEKED	CATHARUS-MINIMUS
THRUSH, SWAINSON'S	CATHARUS-USTULATUS
THRUSH, HERMIT	CATHARUS-GUTTATUS
THRUSH, WOOD	HYLOCICHZA-MUSTELINA
ROBIN, AMERICAN	TURDAS-MIGRATORIUS
THRUSH, VARIED	IXOREUS-NAEVIUS
CATBIRD, GRAY	DUMETELLA-CAROLINENSIS
MOCKINGBIRD	MIMUS-POLYGLOTTOS
THRASHER, SAGE	OREOSCOPTES-MONTANUS
THRASHER, BROWN	TOXOSTOMA-RUFUM
THRASHER, CURVE-BILLED	TOXOSTOMA-CURVIROSTRE
PIPIT, WATER	ANTHUS-SPINOLETTA
WAXWING, BOHEMIAN	BOMBYCILLA-GARRULUS
WAXWING, CEDAR	BOMBYCILLA-CEDRORUM
SHRIKE, NORTHERN	LANIUS-EXCUBITOR
SHRIKE, LOGGERHEAD	**LANIUS-LUDOVICIANUS++**
STARLING, EUROPEAN	STURNUS-VULGARIS
VIREO, BELL'S	VIREO-BELLII
VIREO, SOLITARY	VIREO-SOLITARIUS
VIREO, WARBLING	VIREO-GILVUS
VIREO, PHILADELPHIA	VIREO-PHILADELPHICUS
VIREO, RED-EYED	VIREO-OLIVACEOUS
WARBLER, GOLDEN-WINGED	VERMIUORA-CHRYSOPTERA
WARBLER, TENNESSEE	VERMIVORA-PEREGRINA
WARBLER, ORANGE-CROWNED	VERMIVORA-CELATA
WARBLER, NASHVILLE	VERMIVORA-RUFICAPILLA
WARBLER, VIRGINIA'S	VERMIVORA-VIRGINIAE
PARULA, NORTHERN	PARULA-AMERICANA
WARBLER, YELLOW	DENDROICA-PETECHIA
WARBLER, CHESTNUT-SIDED	DENDROICA-PENSYLVANICA
WARBLER, MAGNOLIA	DENDROICA-MAGNOLIA
WARBLER, YELLOW-RUMPED	DEODROICA-CORONATA
WARBLER, GRAY, BLACK-THROATED	DENDROICA-NIGRESCENS
WARBLER, TOWNSEND'S	DENDROICA-TOWNSENDI
WARBLER, GREEN, BLACK-THROATED	DENDROICA-VIRENS
WARBLER, GRACE'S	DENDROICA-GRACIAE
WARBLER, PINE	DENDROICA-PINUS
WARBLER, PALM	DENDROICA-PALMARUM
WARBLER, BAY-BREASTED	DENDROICA-CASTANEA
WARBLER, BLACKPOLL	DENDROICA-STRIATA
WARBLER, BLACK-AND-WHITE	MNIOTILTA-VARIA
REDSTART, AMERICAN	SETOPHAGA-RUTICILLA
WARBLER, PROTHONOTARY	PROTONOTARIA-CITREA
WARBLER, WORM-EATING	HELMITHEROS-VERMIVORUS
OVENBIRD	SEIURUS-AUROCAPILLUS
WATERTHRUSH, NORTHERN	SEIURUS-NOVEBORACENSIS
WARBLER, MOURNING	OPORONIS-PHILADELPHIA
WARBLER, MACGILLIVRAY'S	OPORORNIS-TOLMIEI
YELLOWTHROAT, COMMON	GEOTHLYPIS-TRICHAS

WILDLIFE SPECIES LIST: SMITH CREEK DRAINAGE BASIN STUDY PROJECT, EL PASO COUNTY, COLORADO

HABITAT CODES: GAMBLE'S OAK, PONDEROSA PINE, GRASSLAND, WETLANDS, RIPARIAN, LOWER STREAM.

BIRDS (CON'T.)	
GOLDFINCH, LESSER	CARDUELIS-PSALTRIA
GOLDFINCH, AMERICAN	CARDUELIS-TRISTIS
GROSBEAK, EVENING	COCCOTHRAUSTES-VESPERTINUS
SPARROW, HOUSE	PASSER-DOMESTICUS
FISH	
SUCKER, WHITE	CATOSTOMUS-COMMERSONI
SUCKER, LONGNOSE	CATOSTOMUS-CATOSTOMUS
STONEROLLER, CENTRAL	CAMPOSTOMA-ANOMALUM
CHUB, SPECKLED, ARKANSAS RIVER	**HYBOPSIS-AESTIVALIS++**
CHUB, FLATHEAD	HYBOPSIS-GRACILIS
MOSQUITOFISH	GAMBUSIA-AFFINIS
KILLIFISH, PLAINS	FUNDULUS-ZEBRINUS
SUNFISH, GREEN	LEPOMIS-CYANELLUS
SUNFISH, ORANGESPOTTED	LEPOMIS-HUMILIS
BASS, LARGEMOUTH	MICROPTERUS-SALMOIDES
BULLHEAD, BLACK	ICTALURUS-MELAS
MAMMALS	
OPOSSUM, VIRGINIA	DIDELPHIS-VIRGINIANA
SHREW, MASKED	SOREX-CINEREUS
SHREW, DWARF	SOREX-NANUS
SHREW, WATER	SOREX-PALUSTRIS
SHREW, MERRIAM'S	SOREX-MERRIAMS
MYOTIS, BROWN, LITTLE	MYOTIS-LUCIFUGUS
MYOTIS, YUMA	MYOTIS-YUMANENSIS
MYOTIS, LONG-EARED	MYOTIS-EVOTIS
MYOTIS, LONG-LEGGED	MYOTIS-VOLANS
MYOTIS, SMALL-FOOTED	MYOTIS-LEIBII
BAT, BROWN, BIG	EPTESICUS-FUSCUS
BAT, HOARY	LASIURUS-CINEREUS
COTTONTAIL, NUTTALL'S	SYLVILAGUS-NUTTALLII
COTTONTAIL, DESERT	SYLVILAGUS-AUDUBONII
JACKRABBIT, WHITE-TAILED	LEPUS-TOWNSENPII
JACKRABBIT, BLACK-TAILED	LEPUS-CALIFORNICUS
CHIPMUNK, LEAST	EUTAMIAS-MINIMUS
CHIPMUNK, COLORADO	EUTAMIAS-QUADRIVITTATUS
SQUIRREL, GROUND, THIRTEEN-LINED	SPERMOPHILUS-TRIDECEMLINEATUS
SQUIRREL, ROCK	SPERMOPHILUS-VARIESATUS
SQUIRREL, GROUND, GOLDEN-MANTLED	SPERMOPHILUS-LATERALIS
PRAIRIE DOG, BLACK-TAILED	CYNOMYS-LUDOVICIANUS
SQUIRREL, ABERT'S	SCIURUS-ABERTI
SQUIRREL, FOX	SCIURUS-SCIURUS NIGER
GOPHER, POCKET, BOTTA'S	THOMOMYS-BOTTAE
GOPHER, POCKET, NORTHERN	THOMOMYS-TALPOIDES
GOPHER, POCKET, PLAINS	GEOMYS-BURSARIUS
MOUSE, POCKET, OLIVE-BACKED	PEROGNATHUS-FASCIATUS
MOUSE, POCKET, PLAINS	PEROGNATHUS-FLAVESCENS
MOUSE, POCKET, SILKY	PEROGNATHUS-FLAVUS
MOUSE, POCKET, HISPID	PEROGNATHUS-HISPIDUS
RAT, KANGAROO, ORD'S	DIPODOMYS-ORD11
BEAVER	CASTOR-CANADENIS

WILDLIFE SPECIES LIST: SMITH CREEK DRAINAGE BASIN STUDY PROJECT, EL PASO COUNTY, COLORADO

HABITAT CODES: GAMBLE'S OAK, PONDEROSA PINE, GRASSLAND, WETLANDS, RIPARIAN, LOWER STREAM.

REPTILES	
TURTLE, SNAPPING, COMMON	CHELYDRA-SERPENTINA
TURTLE, PAINTED	CHRYSEMYS-PICTA
LIZARD, HORNED, SHORT	PHRYNOSOMA-DOUGLASSII
LIZARD, FENCE, EASTERN	SCELOPORUS-UNDULATUS
SKINK, VARIABLE	EUMECES-MULTIVIRGATUS
RACER, YELLOWBELLY	COLUBER-CONSTRICTOR
SNAKE, HOGNOSE, WESTERN	HETERODON-NASICUS
SNAKE, MILK	LAMPROPELTIS-TRIANGULUM
COACHWHIP	MASTICOPHIS-FLAGELLUM
WHIPSNAKE, STRIPED	MASTICOPHIS-TAENIATUS
SNAKE, GOPHER	PITUOPHIS-MELANOLEUCUS
SNAKE, GARTER, PLAINS	THAMNOPHIS-RADIX
SNAKE, GARTER, TERRESTRIAL, WESTERN	THAMNOPHIS-ELEGANS
SNAKE, RATTLER, WESTERN	CROTALUS-VIRIDIS

* FEDERAL ENDANGERED
** FEDERAL THREATENED
\+ FEDERAL CATEGORY 1
++ FEDERAL CATEGORY 2

\# STATE ENDANGERED
STATE THREATENED

Muller Engineering Company, Inc.
DESIGN NOTES AND COMPUTATIONS

Subject: SMITH CREEK DRAINAGE BASIN, Sheet No. 1 Of ____

Prepared By: ECH Checked By: _____ Date: 10/28/94 Project No.: 3328

ON ONE OF THE MAPS OF THE BASIN, THE TYPE OF GROUND COVER NEAR/AROUND THE CREEK HAS BEEN DESIGNATED IN ORDER TO DETERMINE THE MANNING'S n VALUES FOR THE ROUTING.

DESIGNATIONS:

- HIGH GRASSY WEEDS
- FOREST/ AREA w/ LOW SPACED AS MUCH GROUND COVER
- SHRUBS (SAND BAR WILLOWS) / LOW LYING TREES AND GRASSY
- LOW LYING GRASS
- MARSH - LOT OF PONDS
- AREA FILLED W/ A LOT OF BUSH.

MANNING'S n VALUES $(n = (n_0 + n_1 + n_2 + n_3 + n_4) m_5)$

- n_0 = MATERIAL INVOLVED = EARTH = 0.020
  n_1 = DEGREE of IRREGULARITY = MINOR = 0.005
  n_2 = VARIATIONS of CHANNEL CROSS SECTION = GRADUATE = 0.000
  n_3 = RELATIVE EFFECT of OBSTRUCTIONS = NEGLIGIBLE = 0.000
  n_4 = VEGETATION = VERY HIGH = 0.06
  m_5 = DEGREE of MEANDERING = MINOR = 1.0

  $n = 0.085$

- n_0 = EARTH = 0.02
  n_1 = SMOOTH = 0.000
  n_2 = GRADUAL = 0.000
  n_3 = APPRECIABLE = 0.025
  n_4 = MEDIUM = 0.03
  m_5 = MINOR = 1.0

  $n = 0.055$

Muller Engineering Company, Inc.
DESIGN NOTES AND COMPUTATIONS

Subject: SMITH ARROYO DRAINAGE BASIN Sheet No. 2 Of ____

Prepared By: ECH Checked By: _____ Date: 10/30/94 Project No.: 7335

MANNING'S n VALUES:

—— ° ° n_0 = EARTH = 0.02

n_1 = SMOOTH = 0.000

n_2 = GRADUAL = 0.000

n_3 = SEVERE = 0.04

n_4 = MEDIUM = 0.025

m_5 = APPRECIABLE = 1.15

$n = 0.0498$

—— ° ° n_0 = EARTH = 0.02

n_1 = SMOOTH = 0.000

n_2 = GRADUAL = 0.000

n_3 = NEGLIGIBLE = 0.000

n_4 = MEDIUM (LOWER REACH) = 0.10, LOW (UPPER REACH) = 0.07

m_5 = MINOR = 1.0

n = LOWER REACH = 0.12 n = UPPER REACHES = 0.09

—— ° ° n_0 = EARTH = 0.02

n_1 = MINOR = 0.005

n_2 = ALTERNATING FREQUENTLY = 0.012

n_3 = APPRECIABLE = 0.030

n_4 = LOW = 0.005

m_5 = APPRECIABLE = 1.15

$n = 0.0713$

—— ° ° n_0 = EARTH = 0.02

n_1 = SMOOTH = 0.000

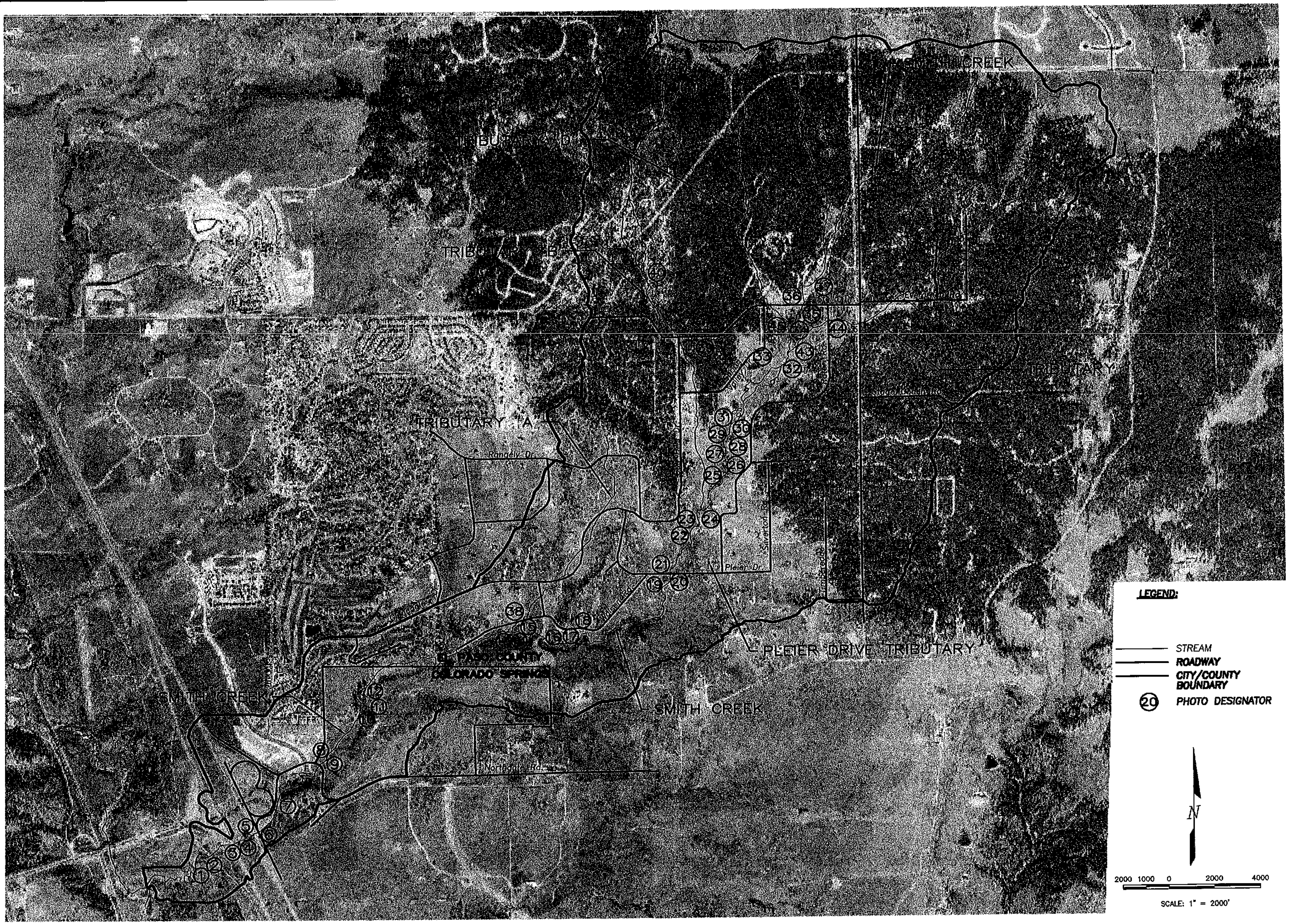
n_2 = GRADUAL = 0.000

n_3 = SEVERE = 0.050

n_4 = MEDIUM = 0.012

m_5 = MINOR = 1.0

$n = 0.082$



UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
PICOLAN, INC.
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www.jrengineering.com

	BY	DATE
No.		

H-SCALE	1"=1000'
V-SCALE	N/A
DATE	4/27/01
DESIGNED BY	
DRAWN BY	MSD
CHECKED BY	

SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PICTURE LEGEND

SHEET 1 OF 1
JOB NO. 8896.90

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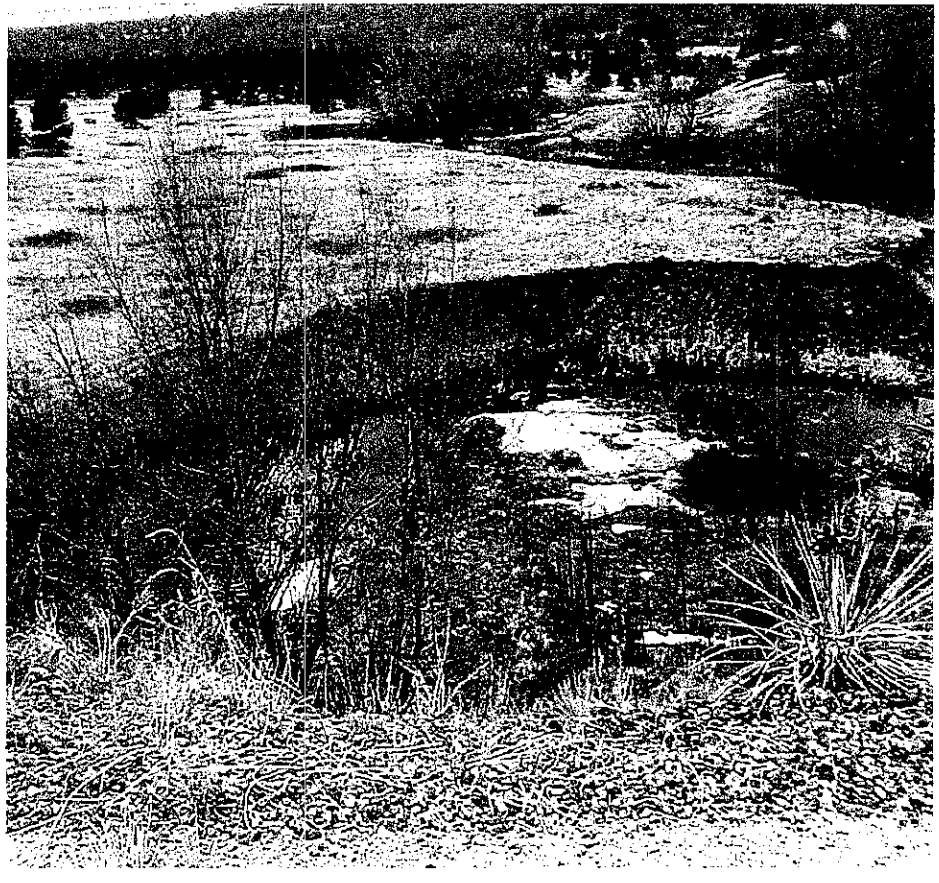
Pictorial Walk-Through
April 2001

- Photo #1
- Smith Creek near confluence with Monument Creek
- Looking downstream of Santa Fe trail on USAFA



Pictorial Walk-Through

- Photo #2
- Smith Creek near confluence with Monument Creek
- Looking upstream of Santa Fe trail on USAFA

Pictorial Walk-Through

- Photo #3
- Smith Creek west of southbound I-25 on USAFA
- Existing double-barrel 10' X 10' CBC
- Looking upstream

Pictorial Walk-Through

- Photo #4
- Smith Creek east of southbound I-25 on USAFA
- Entrance to existing double-barrel 10' X 10' CBC
- Looking upstream

Pictorial Walk-Through

- Photo #5
- Smith Creek west of northbound I-25 on USAFA
- Existing 10' X 10' double-barrel CBC
- Looking upstream

Pictorial Walk-Through

- Photo #6
- Smith Creek east of northbound I-25 on USAFA
- Entrance to existing 10' X 10' double-barrel CBC
- Looking upstream

Pictorial Walk-Through

- Photo #7
- Smith Creek on Mining Museum land east of northbound I-25
- Looking upstream

Pictorial Walk-Through

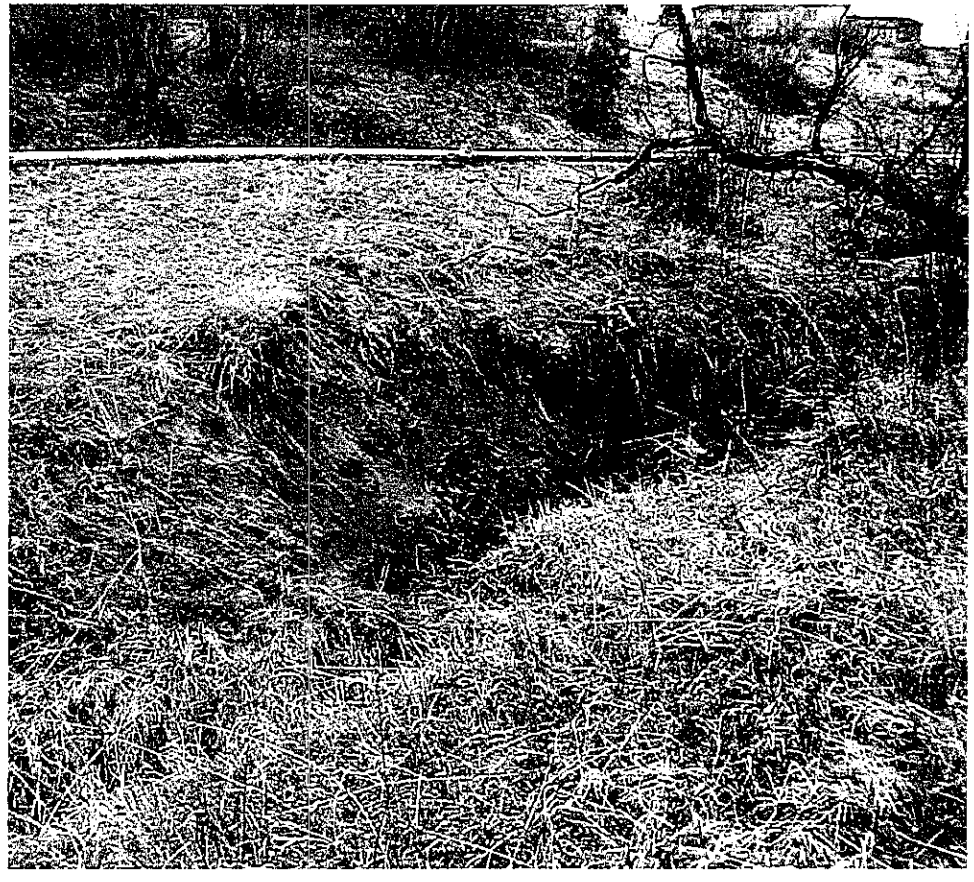
- Photo #8
- Smith Creek east of Northgate Road
- Existing 54" X 39" CMP
- Looking upstream

Pictorial Walk-Through

- Photo #9
- Smith Creek east of Northgate Road
- Looking upstream

Pictorial Walk-Through

- Photo #10
- Smith Creek northeast of Northgate Road on Picolan property
- Looking upstream



Pictorial Walk-Through

- Photo #11
- Smith Creek northeast of Northgate Road on Picolan property
- Looking upstream

Pictorial Walk-Through

- Photo #12
- Smith Creek northeast of Northgate Road on Picolan property
- Looking upstream

Pictorial Walk-Through

- Photo #13
- Confluence of Smith Creek and Tributary "A"
- Looking downstream on Smith Creek

Pictorial Walk-Through

- Photo #14
- Confluence of Tributary "A" and Smith Creek
- Looking upstream on Smith Creek

Pictorial Walk-Through

- Photo #15
- Smith Creek south of Walsen Road and Shelty Drive
- Looking south across stream channel

Pictorial Walk-Through

- Photo #16
- Smith Creek south of Walsen Road and Shelty Drive
- Failed 48" RCP
- Looking downstream

Pictorial Walk-Through

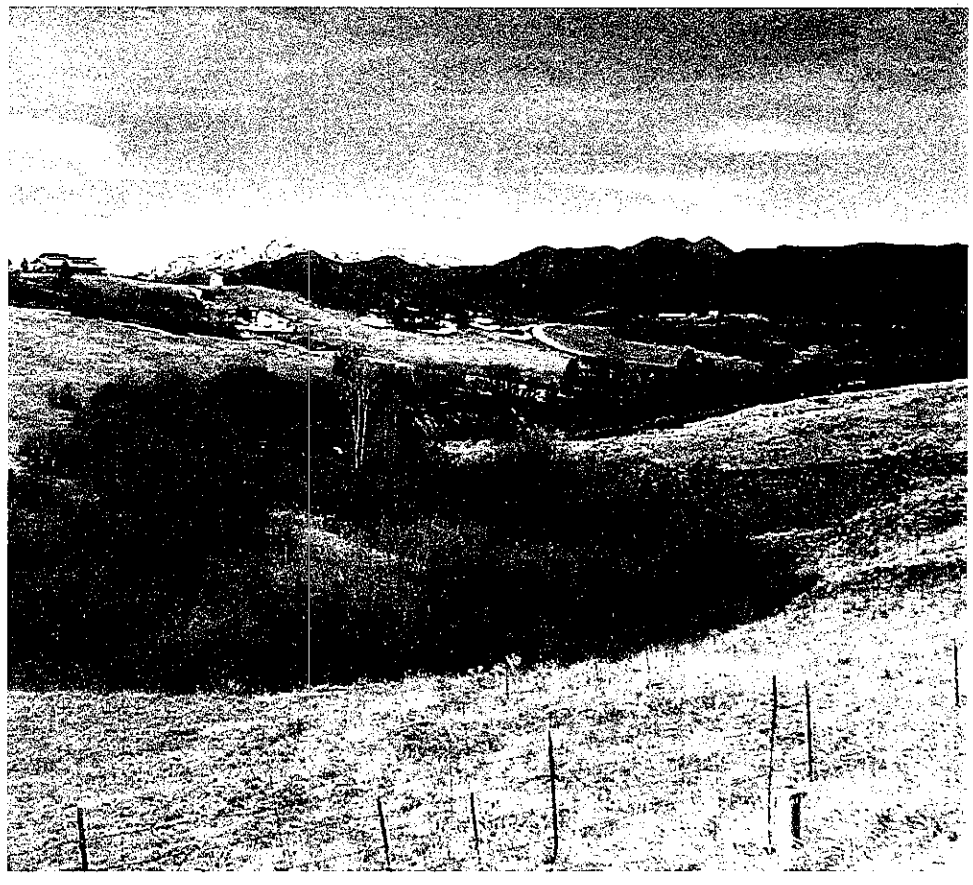
- Photo #17
- Smith Creek south of Walsen Road
- Looking southwest across the channel

Pictorial Walk-Through

- Photo #18
- Smith Creek south of Walsen Road
- Looking southeast across channel

Pictorial Walk-Through

- Photo #19
- Smith Creek south of Pleier Road
- Looking downstream



Pictorial Walk-Through

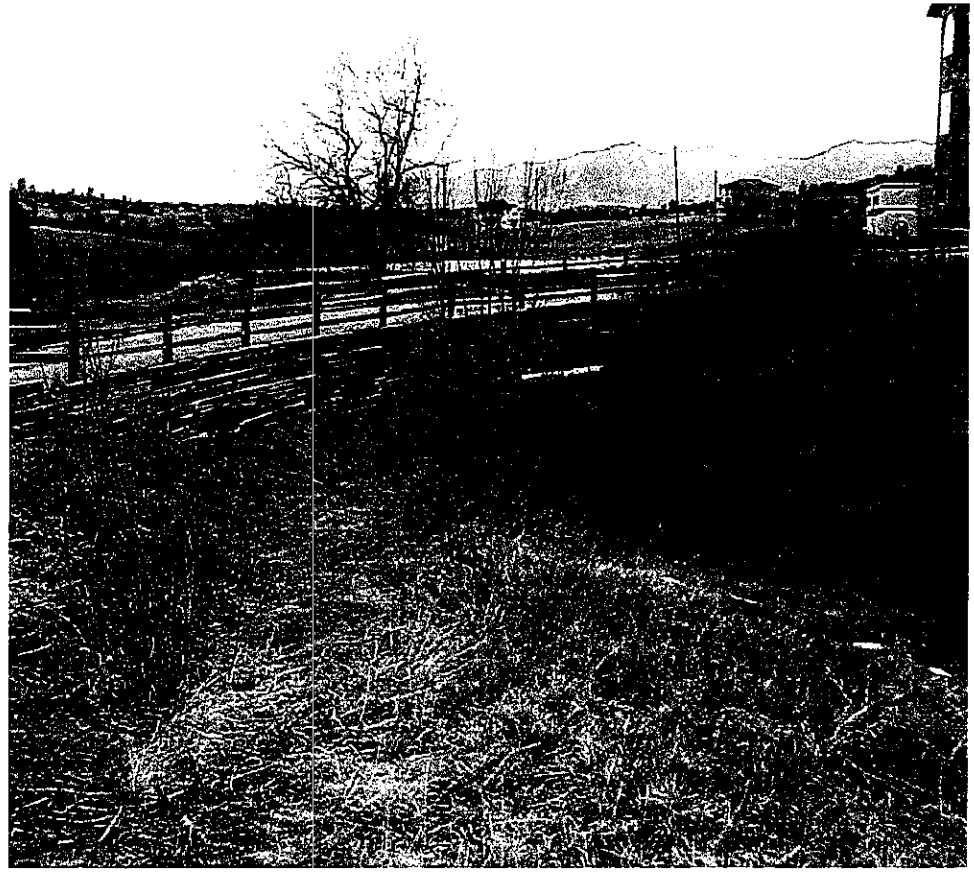
- Photo #20
- Smith Creek south of Pleier Road
- Existing 36” and 60” CMP
- Looking downstream

Pictorial Walk-Through

- Photo #21
- Smith Creek north of Pleier Road
- Existing 36" and 60" CMP
- Looking upstream

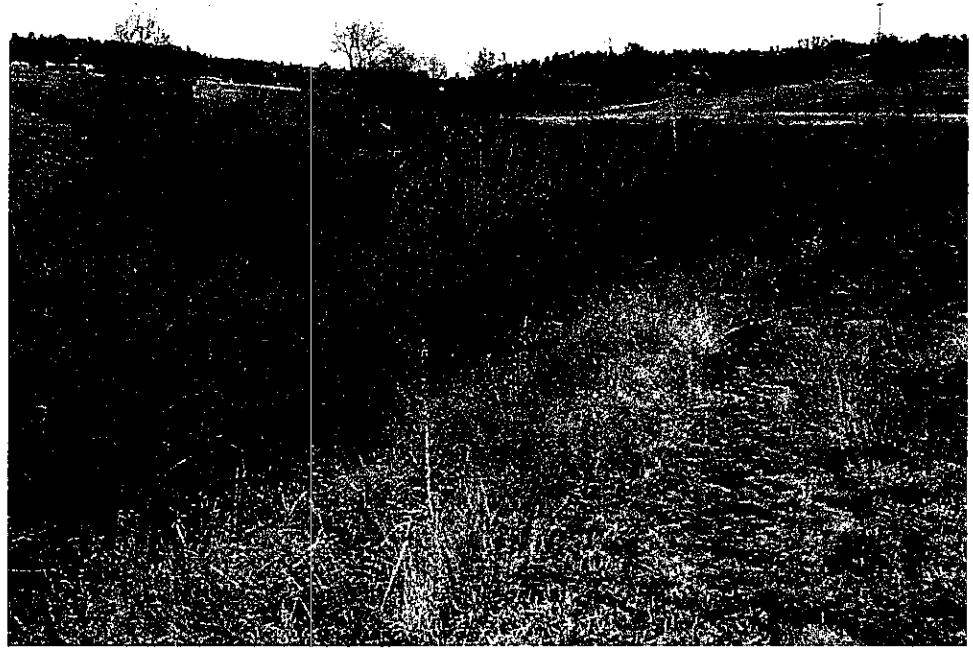
Pictorial Walk-Through

- Photo #22
- Smith Creek north of Pleier Road and west of Raton Road
- Existing private drive with timber embankment and 36" CMP
- Looking downstream



Pictorial Walk-Through

- Photo #23
- Smith Creek north of Pleier Road and west of Raton Road
- Looking upstream



Pictorial Walk-Through

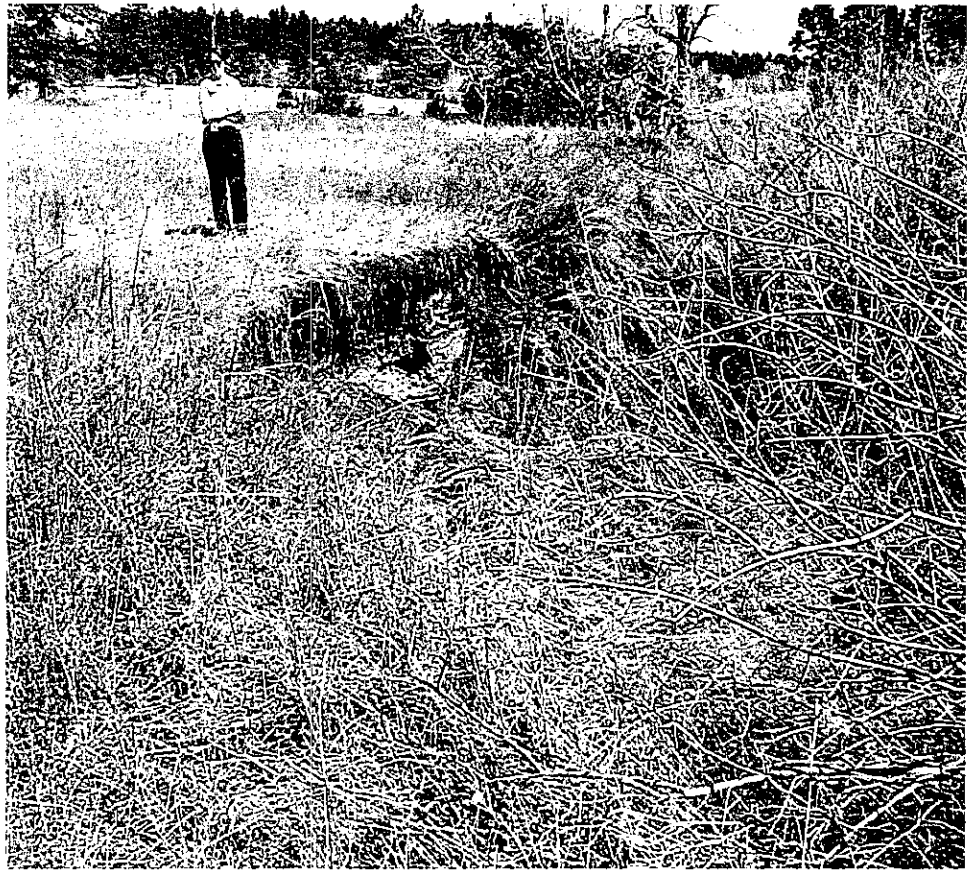
- Photo #24
- Smith Creek west of Raton Road and east of Sun Hills Road
- Looking downstream

Pictorial Walk-Through

- Photo #25
- Smith Creek west of Raton Road and east of Sun Hills Drive
- Looking east across the stream channel

Pictorial Walk-Through

- Photo #26
- Smith Creek west of Raton Road and east of Sun Hills Drive
- Looking upstream



Pictorial Walk-Through

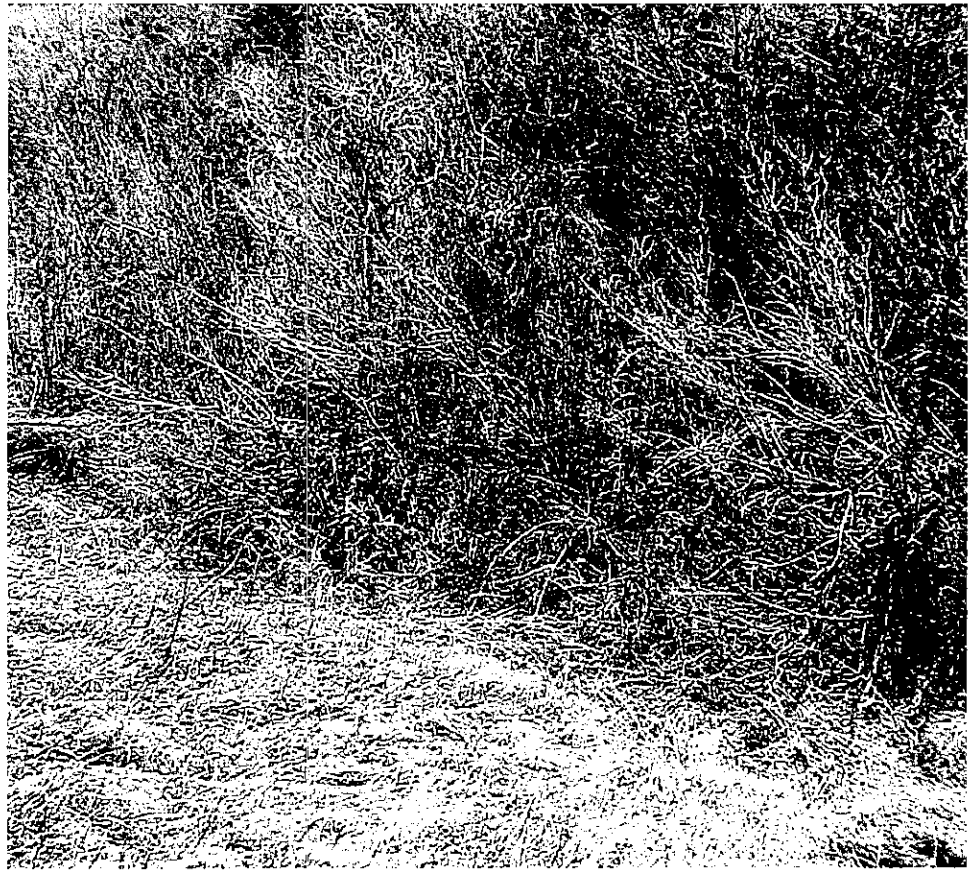
- Photo #27
- Smith Creek west of Raton Road and east of Sun Hills Drive
- Looking downstream

Pictorial Walk-Through

- Photo #28
- Smith Creek west of Raton Road and east of Sun Hills Drive
- Looking upstream

Pictorial Walk-Through

- Photo #29
- Smith Creek west of Raton Road and east of Sun Hills Drive
- Looking upstream

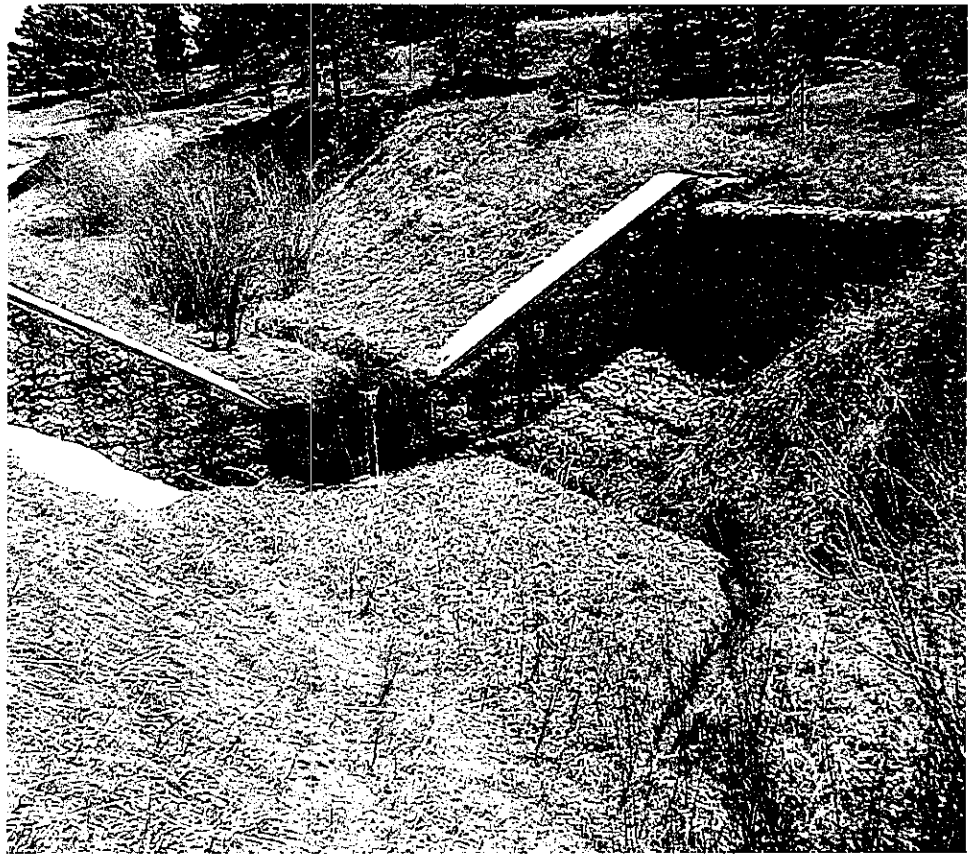


Pictorial Walk-Through

- Photo #30
- Smith Creek west of Raton Road and east of Sun Hills Drive
- Confluence of Smith Creek and Academy Sanitation District WWTP outfall

Pictorial Walk-Through

- Photo #31
- Smith Creek west of Raton Road and east of Sun Hills Drive
- ACOE drop structure east of Academy Sanitation District WWTP



Pictorial Walk-Through

- Photo #32
- Confluence of Smith Creek and Tributary "C"
- Looking downstream on Smith Creek

Pictorial Walk-Through

- Photo #33
- Smith Creek west of Raton Road and east of Sun Hills Drive
- Looking east across stream channel

Pictorial Walk-Through

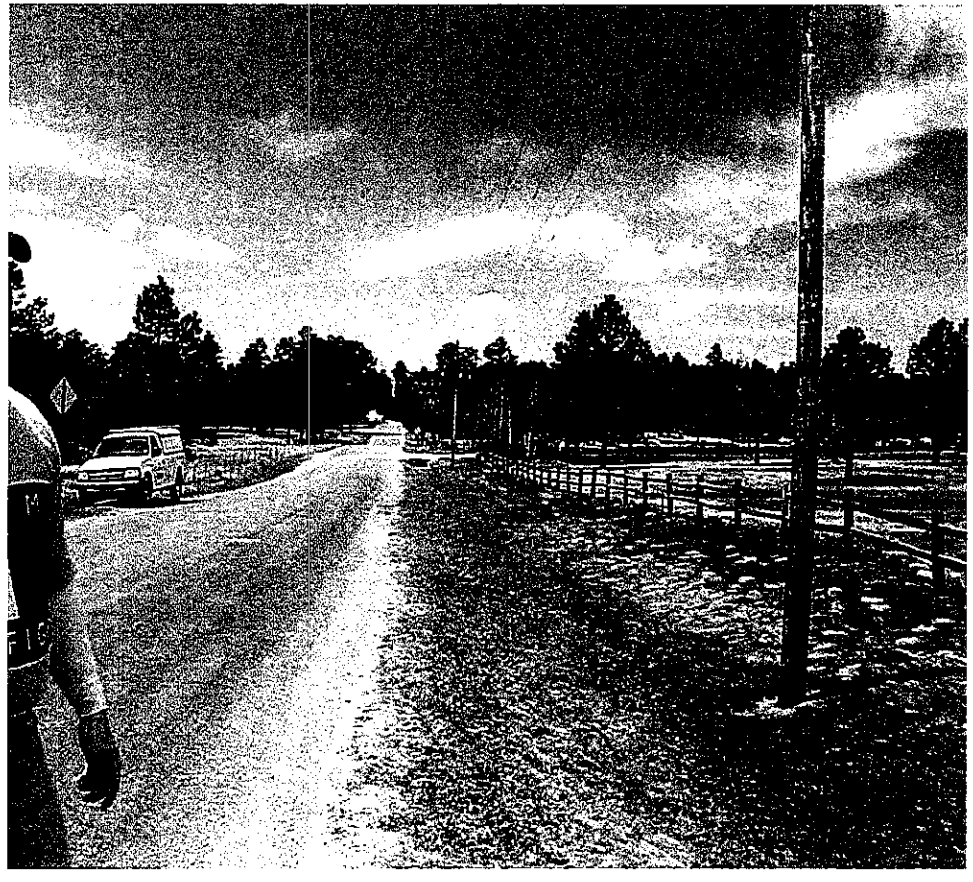
- Photo #34
- Confluence of Smith Creek and Tributary "D"
- Looking upstream on Smith Creek

Pictorial Walk-Through

- Photo #35
- Smith Creek south of Stella Drive
- Existing 36" CMP
- Looking downstream

Pictorial Walk-Through

- Photo #36
- Existing drainage swale from Fox Run park
- North of Stella Drive
- Looking west

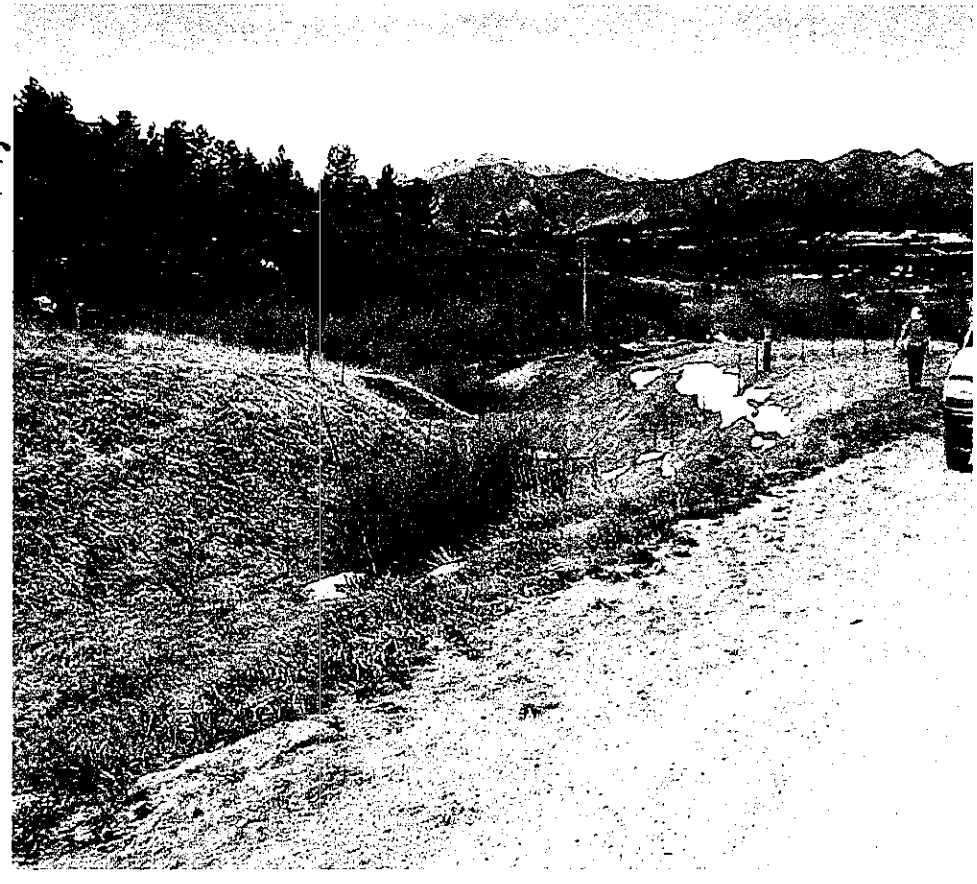


Pictorial Walk-Through

- Photo #37
- Smith Creek north of Stella Drive
- Existing 36" CMP
- Looking upstream

Pictorial Walk-Through

- Photo #38
- Tributary "A" south of Walsen Road
- Looking downstream



Pictorial Walk-Through

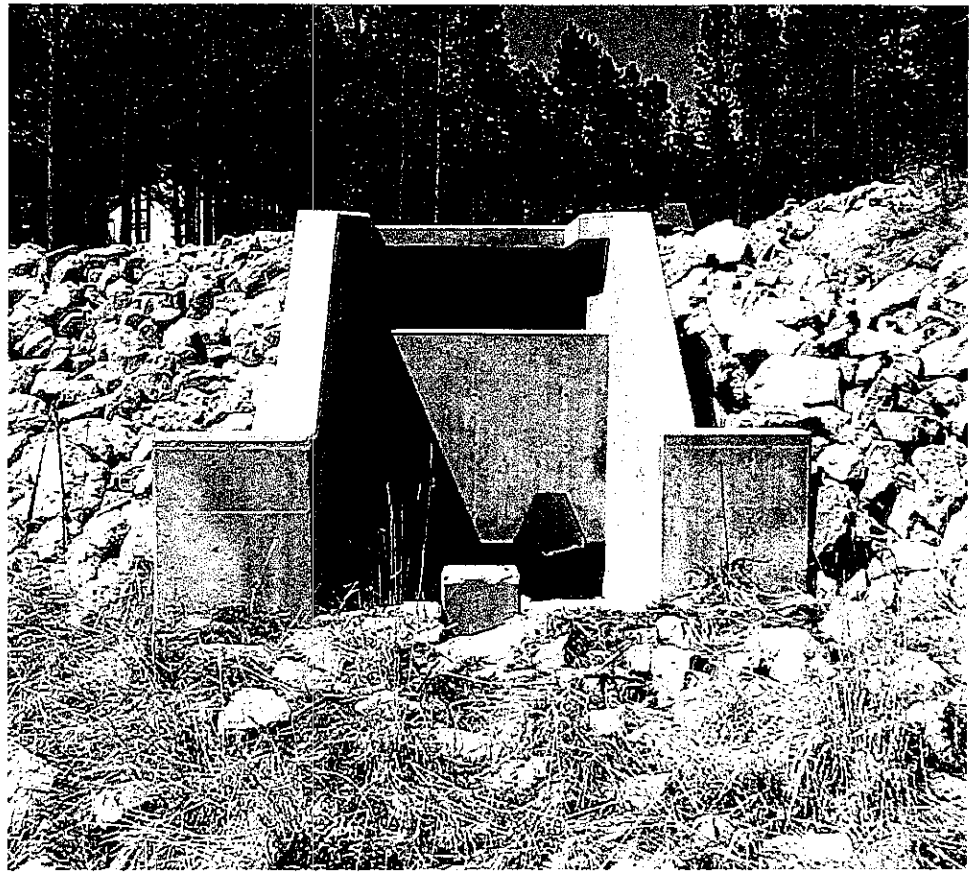
- Photo #39
- Tributary "B" east of Sun Hills Drive and south of Stella Drive
- Looking downstream

Pictorial Walk-Through

- Photo #40
- Tributary "B" north of Stella Drive
- Existing drainage easement behind Pleasant View Estates
- Looking upstream

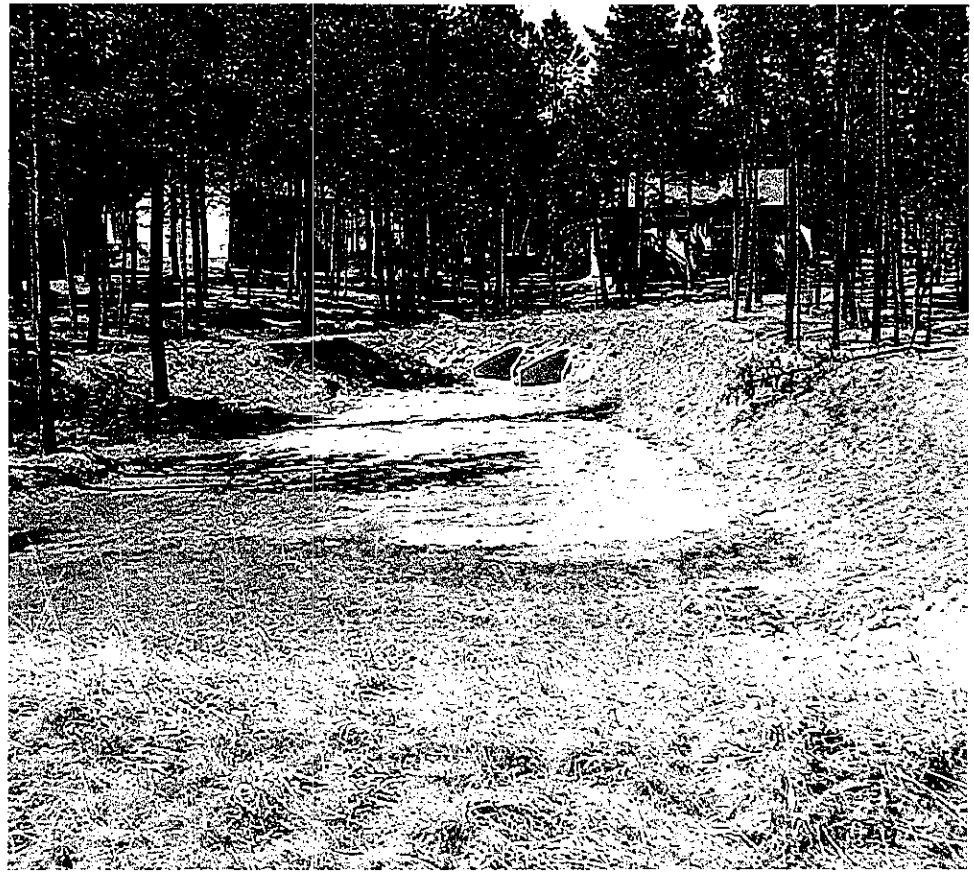
Pictorial Walk-Through

- Photo #41
- Tributary "B" north of Stella Drive
- Energy dissipation structure at outlet of detention pond
- Looking upstream at "Limit of Study"



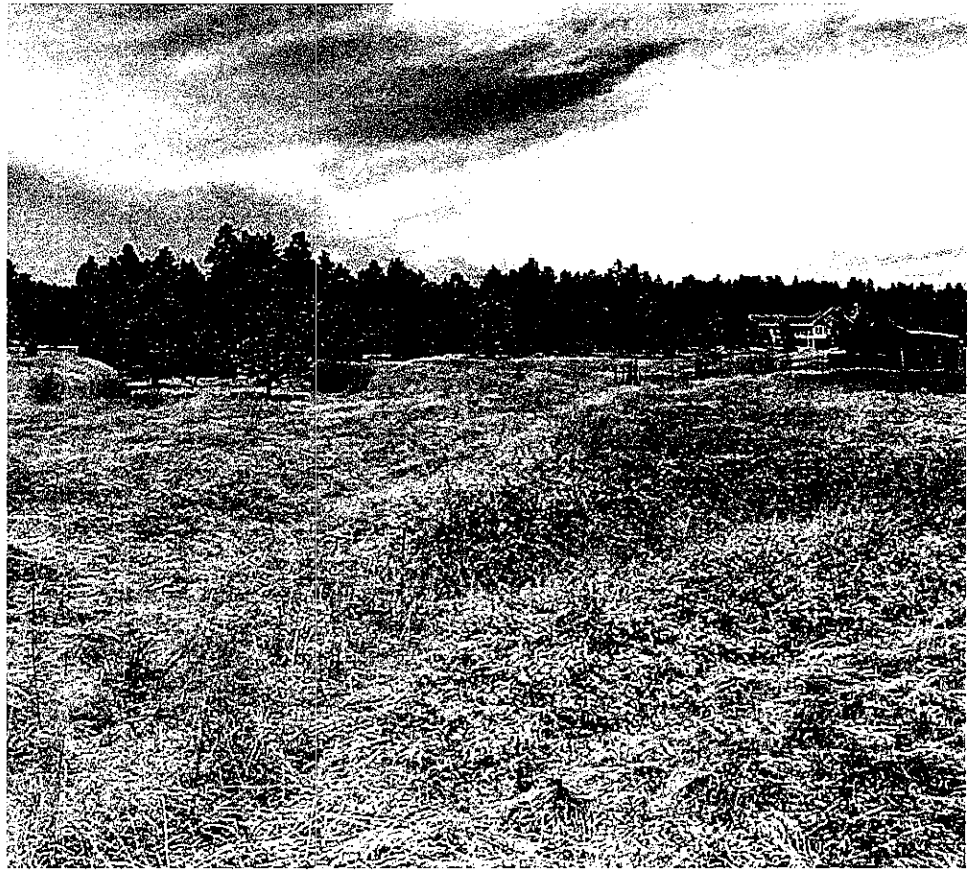
Pictorial Walk-Through

- Photo #42
- Tributary "B" north of Stella Drive
- Existing detention pond at "Limit of Study"



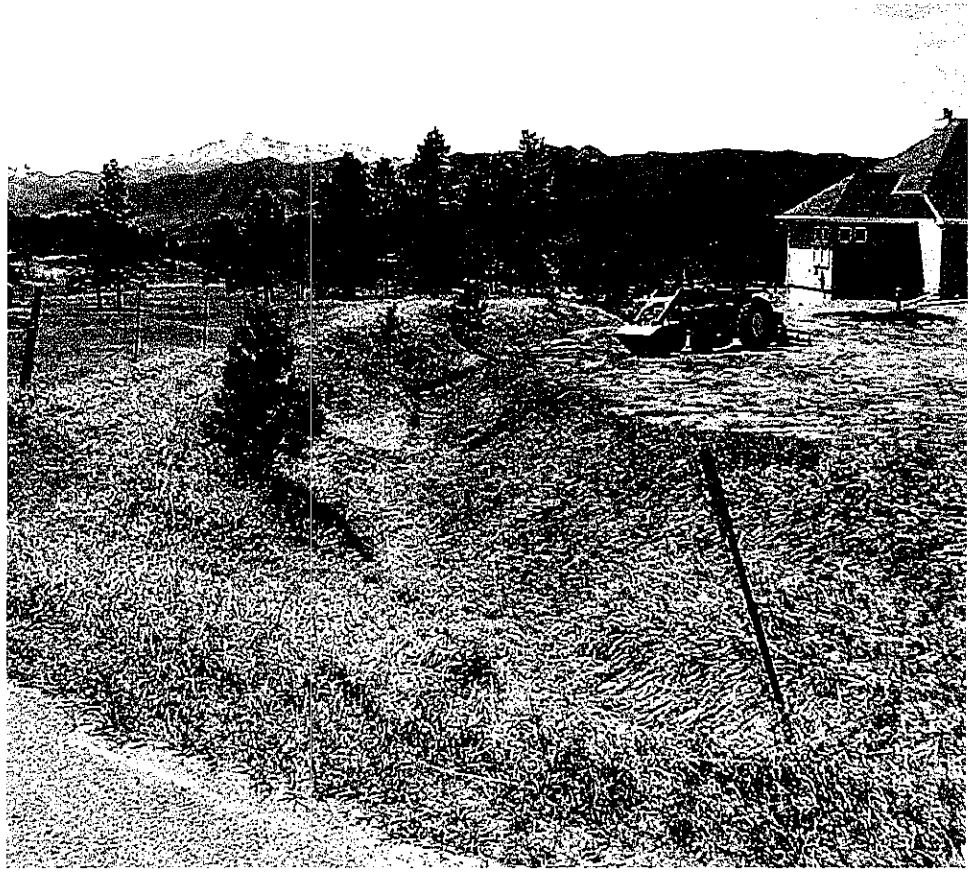
Pictorial Walk-Through

- Photo #43
- Confluence of Smith Creek and Tributary "C"
- Looking upstream on Tributary "C"



Pictorial Walk-Through

- Photo #44
- Tributary "C" west of Raton Road
- Looking downstream
- Existing 18" CMP



Pictorial Walk-Through

- Photo #45
- Confluence of Smith Creek and Tributary "D"
- Looking upstream on Tributary "D"

HYDROLOGIC DATA

MANNING'S N CALCULATIONS
CURVE NUMBER DETERMINATION
LAG TIME CALCULATION
PRUDENT LINE CALCULATION

Curve Number Determination
Table II-1
Existing Land Use

Basin Number		Residential < 1/4 Ac.	Residential 1/2 Ac.	Residential > 5 Ac.	Pasture Area	Parks	Roads	Commercial & Business	Agriculture	% & Final CN Value
SC705	Percent				100					100
	CNumber				69					69
SC703	Percent				50		50			100
	CNumber				69		84			77
SC701	Percent	95*					5			100
	CNumber	92					84			92
SC617A	Percent				100					100
	CNumber				69					69
SC617B	Percent				100					100
	CNumber				69					69
SC615A	Percent	2			98					100
	CNumber	92			69					69
SC615B	Percent	100								100
	CNumber	78								78
SC613	Percent				100					100
	CNumber				69					69
SC611	Percent		15		85					100
	CNumber		70		69					69
SC609	Percent	5		50	45					100
	CNumber	75		68	69					69
SC607	Percent				100					100
	CNumber				69					69
SC605	Percent				100					100
	CNumber				69					69
SC603	Percent		15	80	5					100
	CNumber		70	68	69					68

* Area appears to be under construction

Curve Number Determination
Table II-1
Existing Land Use

Basin Number		Residential < 1/4 Ac.	Residential 1/2 Ac.	Residential > 5 Ac.	Pasture Area	Parks	Roads	Commercial & Business	Agriculture	% & Final CN Value
SC601	Percent			10	90					100
	CNumber			68	69					69
SC511	Percent			100						100
	CNumber			68						68
SC509	Percent			50	50					100
	CNumber			68	69					69
SC507	Percent			100						100
	CNumber			68						68
SC505	Percent			100						100
	CNumber			65						65
SC503	Percent			100						100
	CNumber			64						64
SC501	Percent			100						100
	CNumber			65						65
SC407	Percent			100						100
	CNumber			65						65
SC405	Percent			100						100
	CNumber			64						64
SC403	Percent			95		5				100
	CNumber			66		61				66
SC401	Percent			100						100
	CNumber			65						65
SC315	Percent			100						100
	CNumber			64						64
SC313	Percent			100						100
	CNumber			64						64
SC311	Percent			100						100
	CNumber			64						64

* Area appears to be under construction

Curve Number Determination
Table II-1
Existing Land Use

Basin Number		Residential < 1/4 Ac.	Residential 1/2 Ac.	Residential > 5 Ac.	Pasture Area	Parks	Roads	Commercial & Business	Agriculture	% & Final CN Value
SC309	Percent			100						100
	CNumber			64						64
SC307	Percent			100						100
	CNumber			64						64
SC305	Percent			100						100
	CNumber			64						64
SC303	Percent			95					5	100
	CNumber			64					71	64
SC301	Percent			100						100
	CNumber			64						64
SC219	Percent			10		90				100
	CNumber			64		61				61
SC217	Percent			10		90				100
	CNumber			64		61				61
SC215	Percent			25		75				100
	CNumber			64		61				62
SC213	Percent			40		20			40	100
	CNumber			64		61			71	66
SC211	Percent			20		80				100
	CNumber			64		61				62
SC209	Percent			10		90				100
	CNumber			64		61				61
SC207	Percent			85		5			10	100
	CNumber			64		61			71	65
SC205	Percent			100						100
	CNumber			64						64
SC203	Percent					100				100
	CNumber					61				61

* Area appears to be under construction

Curve Number Determination
Table II-1
Existing Land Use

Basin Number		Residential < 1/4 Ac.	Residential 1/2 Ac.	Residential > 5 Ac.	Pasture Area	Parks	Roads	Commercial & Business	Agriculture	% & Final CN Value
SC201	Percent			25		75				100
	CNumber			64		61				62
SC111	Percent			40	20	40				100
	CNumber			70	68	69				69
SC109	Percent		50	40		10				100
	CNumber		70	66		61				68
SC107A	Percent		70	30						100
	CNumber		70	64						68
SC107B	Percent		70	30						100
	CNumber		70	64						68
SC105A	Percent		90	5		5				100
	CNumber		70	64		61				69
SC105B	Percent		80	20						100
	CNumber		70	64						69
SC103	Percent		20	77		3				100
	CNumber		70	64		61				65
SC101	Percent			100						100
	CNumber			64						64

/kd/8896.90/spreadsheets/Future Land Use

* Area appears to be under construction

Curve Number Determination
Table II-1
Future Land Use

Basin Number		Residential < 1/4 Ac.	Residential 1/2 Ac.	Residential > 5 Ac.	Pasture Area	Parks	Roads	Commercial & Business	Agriculture	% & Final CN Value
SC705	Percent				100					100
	CNumber				69					69
SC703	Percent				50		50			100
	CNumber				69		84			77
SC701	Percent	95*					5			100
	CNumber	92					84			92
SC617A	Percent					60	10	30		100
	CNumber					61	84	92		73
SC617B	Percent				100					100
	CNumber				69					69
SC617C	Percent					90	10			100
	CNumber					62	95			65
SC618	Percent							100		100
	CNumber							73		73
SC615A	Percent	90				10				100
	CNumber	75				61				74
SC615B	Percent	100								100
	CNumber	78								78
SC613	Percent	100								100
	CNumber	75								75
SC611	Percent	5	15			80				100
	CNumber	75	70			69				69
SC609	Percent	5		50	45					100
	CNumber	75		68	69					69
SC607	Percent	20		80						100
	CNumber	75		68						69
SC605A	Percent			100						100
	CNumber			68						68

* Apartment/Townhouse

** Modified to reflect furture on-site detention as required by FDR for the Ridge at Fox Run Filings 2, 3 4

Curve Number Determination
Table II-1
Future Land Use

Basin Number		Residential < 1/4 Ac.	Residential 1/2 Ac.	Residential > 5 Ac.	Pasture Area	Parks	Roads	Commercial & Business	Agriculture	% & Final CN Value
SC605B	Percent	100								100
	CNumber	75								75
SC603	Percent		20	80						100
	CNumber		70	68						68
SC601	Percent			100						100
	CNumber			69						69
SC511	Percent			100						100
	CNumber			68						68
SC509	Percent			100						100
	CNumber			68						68
SC507	Percent			100						100
	CNumber			68						68
SC505	Percent			100						100
	CNumber			68						68
SC503	Percent			100						100
	CNumber			68						68
SC501	Percent			100						100
	CNumber			68						68
SC407	Percent			100						100
	CNumber			68						68
SC405	Percent			100						100
	CNumber			68						68
SC403	Percent			95		5				100
	CNumber			68		61				68
SC401	Percent			100						100
	CNumber			68						68
SC315	Percent			100						100
	CNumber			68						68

* Apartment/Townhouse

** Modified to reflect furture on-site detention as required by FDR for the Ridge at Fox Run Filings 2, 3 4

Curve Number Determination
Table II-1
Future Land Use

Basin Number		Residential < 1/4 Ac.	Residential 1/2 Ac.	Residential > 5 Ac.	Pasture Area	Parks	Roads	Commercial & Business	Agriculture	% & Final CN Value
SC313	Percent			80		20				100
	CNumber			68		61				67
SC311	Percent			100						100
	CNumber			68						68
SC309	Percent			100						100
	CNumber			68						68
SC307	Percent			100						100
	CNumber			68						68
SC305	Percent			100						100
	CNumber			68						68
SC303	Percent			100						100
	CNumber			68						68
SC301	Percent			100						100
	CNumber			68						68
SC219	Percent			10		90				100
	CNumber			68		61				62
SC217	Percent			10		90				100
	CNumber			68		61				62
SC215	Percent			100						100
	CNumber			68						68
SC213	Percent			80		20				100
	CNumber			68		61				67
SC211	Percent			20		80				100
	CNumber			68		61				62
SC209	Percent			30		70				100
	CNumber			68		61				63
SC207	Percent			100						100
	CNumber			68						68

* Apartment/Townhouse

** Modified to reflect furture on-site detention as required by FDR for the Ridge at Fox Run Filings 2, 3 4

Curve Number Determination
Table II-1
Future Land Use

Basin Number		Residential < 1/4 Ac.	Residential 1/2 Ac.	Residential > 5 Ac.	Pasture Area	Parks	Roads	Commercial & Business	Agriculture	% & Final CN Value
SC205	Percent			100						100
	CNumber			68						68
SC203	Percent					100				100
	CNumber					61				61
SC201	Percent	10		15		75				100
	CNumber	25		68		61				63
SC111	Percent		40	60						100
	CNumber		70	68						69
SC109	Percent		70	30						100
	CNumber		70	68						69
SC107A	Percent		70	30						100
	CNumber		70	68						69
SC107B	Percent		70	30						100
	CNumber		70	64						68
SC105A	Percent		95			5				100
	CNumber		70			61				70
SC105B	Percent		80	20						100
	CNumber		70	64						69
SC103	Percent		100							100
	CNumber		65							65**
SC101	Percent		100							100
	CNumber		64							64**

/kd/8896.90/spreadsheets/Future Land Use

* Apartment/Townhouse

** Modified to reflect furture on-site detention as required by FDR for the Ridge at Fox Run Filings 2, 3 4

NOTE: SEE ATTACHED SHEET FOR REVISED BASIN AREAS

* UPDATE & REVISED 5/29/01 FOR REVISED STUDY BY JR ENGINEERING - SEE ATTACHED CALC

Lag Time Calculations for HEC-1 Input

Table II-2

Basin	Area Basin	Type of Flow	Length		Change in Elevation		C Value		Velocity (ft/s)		Slope %		Te (hrs.)		Tlag (hrs.)		Summation of Tlag	
			Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future
SC705	0.0882	Overland (1)	600	600	23	23	0.35	0.35			3.833	3.833	0.367	0.367	0.220	0.220		
		Overland (2)	260	260	14	14			3.5	3.50	5.38	5.385	0.021	0.021	0.012	0.012	0.329	0.329
		Flow Channel(sc)	2300	2300	60	60			4.00	4.00	2.609	2.609	0.160	0.160	0.096	0.096		
SC703	0.1182	Overland	1000	1000	23	23			2.30	2.30	2.300	2.300	0.121	0.121	0.072	0.072		
		Storm Sewer	1260	1260	53	53			18.04	18.04	4.206	4.206	0.019	0.019	0.012	0.012	0.092	0.092
		Flow Channel(sc)	200	200	4	4			4.00	4.00	2.000	2.000	0.014	0.014	0.008	0.008		
SC701 *	0.0758	Overland (1)	500	300	17	10	0.35	0.9			3.400	3.333	0.349	0.073	0.209	0.044		
		Overland (2)	500	0	17	0			2.80	0.00	3.400		0.050		0.030		0.407	0.247
		Int. Stream	2050	2750	56	80			2.04	2.25	2.732	2.909	0.279	0.340	0.167	0.204		
SC617 *	0.1117	Overland	400	300	15	11	0.35	0.9			3.750	3.667	0.302	0.070	0.181	0.042		
		Flow Channel(sc)	1350	1350	31	31			4.20	4.20		2.296	0.089	0.089	0.054	0.054	0.470	0.335
		Int. Stream	1850	1950	62	66			2.51	2.55	3.351	3.385	0.205	0.212	0.123	0.127		
		St./Gutter Flow	2450	2450	83	83			3.65	3.65	3.388	3.388	0.186	0.186	0.112	0.112		
SC615 *	0.0977	Overland (1)	600	300	18	9	0.35	0.65			3.000	3.000	0.398	0.169	0.239	0.101		
		Overland (2)	400	0	19	0			3.25	0.00	4.750		0.034		0.021		0.394	0.273
		Int. Stream	1400	2100	108	136			3.93	3.63	7.714	6.476	0.099	0.161	0.059	0.096		
		Flow Channel(sc)	1350	1350	31	31			3.01	3.01	2.296	2.296	0.125	0.125	0.075	0.075		
SC611	0.1126	Overland (1)	450	300	36	26	0.35	0.65			8.000	8.667	0.250	0.119	0.150	0.071		
		Overland (2)	450	0	54	0			5.30	0.00	12.000		0.024		0.014		0.229	0.149
		Int. Stream	1060	1660	38	102			2.70	3.55	3.585	6.145	0.109	0.130	0.065	0.078		
		Pond	250	250	0	0						0.000						
SC613 *	0.1069	Overland (1)	500	300	15	8	0.65	0.65			3.000	2.667	0.218	0.176	0.131	0.105		
		Overland (2)	470	0	13	0			2.50	0.00	2.766		0.052		0.031		0.423	0.396
		St./Gutter Flow	5000	5670	124	144			3.20	3.25	2.480	2.540	0.434	0.485	0.260	0.291		
SC609	0.1009	Overland (1)	500	300	32	19	0.35	0.35			6.400	6.333	0.283	0.220	0.170	0.132		
		Overland (2)	500	0	44	0			4.50	0.00	8.800		0.031		0.019		0.342	0.326
		Int. Stream	2300	3000	154	167			3.68	3.45	6.696	5.567	0.174	0.242	0.104	0.145		
		Flow Channel(sc)	880	880	13	13			3.00	3.00	1.477	1.477	0.081	0.081	0.049	0.049		
		Pond	570	570	0	0												
SC607	0.0937	Overland (1)	450	450	70	70	0.35	0.35			15.556	15.556	0.200	0.200	0.120	0.120		
		Overland (2)	450	450	59	59			5.50	5.50	13.111	13.111	0.023	0.023	0.014	0.014	0.270	0.270
		Flow Channel(sc)	2860	2860	72	72			3.50	3.50	2.517	2.517	0.227	0.227	0.136	0.136		
		Pond	570	570	0	0						0.000						
SC605 *	0.15	Overland (1)	720	720	26	26	0.35	0.35			3.611	3.611	0.411	0.411	0.246	0.246		
		Int. Stream	4500	4500	184	184			3.03	3.03	4.089	4.089	0.413	0.413	0.248	0.248	0.494	0.494
			0															
SC603	0.2546	Overland (1)	500	300	78	48	0.35	0.45			15.600	16.000	0.211	0.141	0.127	0.084		
		Overland (2)	500	0	46	0			4.60	0.00	9.200		0.030		0.018		0.325	0.289
		Int. Stream	1700	2400	124	200			3.83	4.05	7.294	8.333	0.123	0.165	0.074	0.099		
		Flow Channel(sc)	3460	3460	182	182			5.42	5.42	5.260	5.260	0.177	0.177	0.106	0.106		
SC601	0.0645	Overland (1)	700	300	47	20	0.35	0.35			6.714	6.667	0.330	0.216	0.198	0.130		
		Overland (2)	300	0	20	0			4.00	0.00	6.667		0.021		0.013		0.302	0.210
		St./Gutter Flow	500	500	42	42			5.80	5.80	8.400	8.400	0.024	0.024	0.014	0.014		
		Int. Stream	1800	1800	136	183			3.90	4.55	7.556	10.167	0.128	0.110	0.077	0.066		

Lag Time Calculations for HEC-1 Input Cont...

Table II-2

Basin	Area Basin	Type of Flow	Length		Change in Elevation		C Value		Velocity (ft/s)		Slope %		To (hrs.)		Tlag (hrs.)		Summation of Tlag	
			Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future
SC511	0.1028	Overland	510	220	44	10	0.35	0.35			8.627	4.545	0.259	0.210	0.156	0.126		
		Int. Stream	1250	1540	106	140			4.45	3.80	8.480	9.091	0.078	0.113	0.047	0.068	0.313	0.305
		Flow Channel(sc)	2330	2330	39	39			3.50	3.50	1.674	1.674	0.185	0.185	0.111	0.111		
SC509	0.1738	Overland (1)	500	500	19	19	0.35	0.35			3.800	3.800	0.336	0.336	0.202	0.202		
		Overland (2)	500	500	35	35			4.00	5.30	7.000	7.000	0.035	0.026	0.021	0.016	0.411	0.405
		Int. Stream	2400	2400	180	180			3.88	3.88	7.500	7.500	0.172	0.172	0.103	0.103		
		Flow Channel(sc)	1780	1780	41	41			3.50	3.50	2.303	2.303	0.141	0.141	0.085	0.085		
SC507	0.0965	Overland	650	300	78	44	0.45	0.45			12.000	14.667	0.227	0.145	0.136	0.087		
		St./Gutter Flow	1450	1450	100	100			5.20	5.20	6.897	6.897	0.077	0.077	0.046	0.046	0.267	0.229
		Int. Stream	1600	1950	75	109			3.17	3.40	4.688	5.590	0.140	0.159	0.084	0.096		
SC505	0.1948	Overland (1)	300	300	30	30	0.35	0.35			10.000	10.000	0.189	0.189	0.114	0.114		
		Overland (2)	700	0	55	0			4.25	0.00	7.857		0.046		0.027		0.380	0.379
		Int. Stream	5600	6300	366	421			3.90	3.95	6.536	6.683	0.399	0.443	0.239	0.266		
SC503	0.1244	Overland	500	300	15	11	0.35	0.35			3.000	3.667	0.364	0.264	0.218	0.158		
		Overland (2)	500	0	31	0			3.75	0.00	6.200		0.037		0.022		0.382	0.334
		Int. Stream	3100	3800	204	239			3.64	3.60	6.581	6.289	0.237	0.293	0.142	0.176		
SC501	0.1228	Overland (1)	300	300	24	24	0.35	0.35			8.000	8.000	0.204	0.204	0.122	0.122		
		Overland (2)	300	0	26	0			4.5	0.00	8.667		0.019		0.011		0.313	0.312
		Int. Stream	4300	4600	297	323			4.00	4.05	6.907	7.022	0.299	0.316	0.179	0.189		
SC407	0.1702	Overland (1)	300	300	29	29	0.15	0.35			9.667	9.667	0.243	0.192	0.146	0.115		
		Overland (2)	300	0	28	0			4.65	0.00	9.333		0.018		0.011		0.455	0.423
		Int. Stream	4450	4750	346	374			3.94	4.00	7.775	7.874	0.314	0.330	0.188	0.198		
		Flow Channel(sc)	1490	1490	32	32			2.25	2.25	2.148	2.148	0.184	0.184	0.110	0.110		
SC405	0.0672	Overland (1)	450	300	42	28	0.15	0.35			9.333	9.333	0.301	0.194	0.180	0.116		
		Overland (2)	450	0	46	0			4.90	0.00	10.222		0.026		0.015		0.356	0.263
		Int. Stream	3150	3150	256	316			4.03	4.50	8.127	10.032	0.217	0.194	0.130	0.117		
		Flow Channel(sc)	500	500	17	17			2.80	2.80	3.400	3.400	0.050	0.050	0.030	0.030		
SC403	0.0998	Overland (1)	300	300	41	41	0.15	0.15			13.667	13.667	0.216	0.216	0.130	0.130		
		Overland (2)	700	0	89	0			5.40	0.00	12.714		0.036		0.022		0.333	0.332
		Int. Stream	1700	2400	111	200			3.63	4.05	6.529	8.333	0.130	0.165	0.078	0.099		
		Flow Channel(sc)	1900	1900	76	76			3.05	3.05	4.000	4.000	0.173	0.173	0.104	0.104		
SC401	0.1533	Overland	450	300	43	28	0.15	0.35			9.556	9.333	0.298	0.194	0.179	0.116		
		Int. Stream	4200	4350	248	263			3.48	3.55	5.905	6.046	0.335	0.340	0.201	0.204	0.437	0.377
		Flow Channel(sc)	1600	1600	151	151			4.70	4.70	9.438	9.438	0.095	0.095	0.057	0.057		
SC315	0.0905	Overland (1)	400	300	42	36	0.15	0.35			10.500	12.000	0.273	0.178	0.164	0.107		
		Overland (2)	600	0	44	0			4.15	0.00	7.333		0.040		0.024		0.350	0.297
		Int. Stream	3400	4100	202	252			3.49	3.60	5.941	6.146	0.271	0.316	0.162	0.190		
SC313	0.1566	Overland	150	150	18	18	0.15	0.35			12.000	12.000	0.160	0.126	0.096	0.076		
		Int. Stream	3250	3250	196	196			3.50	3.50	6.031	6.031	0.258	0.258	0.155	0.155	0.373	0.352
		Flow Channel(tc)	2050	2050	88	88			2.80	2.80	4.293	4.293	0.203	0.203	0.122	0.122		
SC311	0.1075	Overland (1)	500	300	58	40	0.15	0.35			11.600	13.333	0.295	0.172	0.177	0.103		
		Overland (2)	500	0	34	0			4.00	4.00	6.800		0.035		0.021		0.295	0.234
		Flow Channel(tca)	2050	2750	108	160			3.50	3.50	5.268	5.818	0.163	0.218	0.098	0.131		
SC309	0.1211	Overland (1)	400	400	34	34	0.15	0.15			8.500	8.500	0.292	0.292	0.175	0.175		
		Overland (2)	600	600	42	42			4.05	5.30	7.000	7.000	0.041	0.031	0.025	0.019	0.383	0.366
		Int. Stream	2400	2400	114	114			3.19	3.50	4.750	4.750	0.209	0.190	0.125	0.114		
		Flow Channel(tc)	1140	1140	54	54			3.30	3.30	4.737	4.737	0.096	0.096	0.058	0.058		

Lag Time Calculations for HEC-1 Input Cont...

Table II-2

Basin	Area Basin	Type of Flow	Length		Change in Elevation		C Value		Velocity (ft/s)		Slope %		To (hrs.)		Tlag (hrs.)		Summation of Tlag	
			Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future
SC307	0.1104	Overland	400	300	12	5	0.15	0.15			3.000	1.667	0.412	0.433	0.247	0.260		
		Int. Stream	2850	2950	146	153			3.28	3.30	5.123	5.186	0.241	0.248	0.145	0.149	0.455	0.472
		Flow Channel(tc)	1230	1230	56	56			3.25	3.25	4.553	4.553	0.105	0.105	0.063	0.063		
SC305	0.0588	Overland (1)	450	300	30	24	0.15	0.35			6.667	8.000	0.336	0.204	0.202	0.122		
		Overland (2)	450	0	30	0			4.00	0.00	6.667		0.031		0.019		0.331	0.261
		Int. Stream	1800	2400	92	128			3.28	3.35	5.111	5.333	0.152	0.199	0.091	0.119		
		Flow Channel(tc)	350	350	13	13			2.95	2.95	3.714	3.714	0.033	0.033	0.020	0.020		
SC303	0.1152	Overland (1)	300	300	22	22	0.15	0.15			7.333	7.333	0.266	0.266	0.159	0.159		
		Overland (2)	700	700	32	32			3.3	4.30	4.571	4.571	0.059	0.045	0.035	0.027	0.322	0.314
		Flow Channel(tc)	2450	2450	110	110			3.20	3.20	4.490	4.490	0.213	0.213	0.128	0.128		
SC301	0.1062	Overland	250	250	30	30	0.15	0.15			12.000	12.000	0.206	0.206	0.124	0.124		
		Flow Channel(tcb)	2800	2800	134	134			3.30	3.00	4.786	4.786	0.236	0.259	0.141	0.156	0.265	0.279
SC219	0.1813	Overland (1)	250	250	12	12	0.15	0.15			4.800	4.800	0.279	0.279	0.167	0.167		
		Overland (2)	750	750	104	104			5.55	5.55	13.867	13.867	0.038	0.038	0.023	0.023	0.362	0.362
		Int. Stream	2000	2000	86	86			3.08	3.08	4.300	4.300	0.180	0.180	0.108	0.108		
		Flow Channel(sc)	1210	1210	53	53			3.15	3.15	4.380	4.380	0.107	0.107	0.064	0.064		
SC217	0.0553	Overland (1)	500	500	64	64	0.55	0.55			12.800	12.800	0.165	0.165	0.099	0.099		
		Overland (2)	500	500	40	40			4.35	4.35	8.000	8.000	0.032	0.032	0.019	0.019	0.211	0.211
		Flow Channel(td)	1900	1900	93	93			3.40	3.40	4.895	4.895	0.155	0.155	0.093	0.093		
SC215	0.0584	Overland	250	250	40	40	0.15	0.15			16.000	16.000	0.188	0.188	0.113	0.113		
		Int. Stream	2400	2400	143	143			3.50	3.50	5.958	5.958	0.190	0.190	0.114	0.114	0.227	0.227
SC213	0.1277	Overland (1)	500	500	50	50	0.15	0.15			10.000	10.000	0.310	0.310	0.186	0.186		
		Overland (2)	500	500	38	38			4.20	5.50	7.600	7.600	0.033	0.025	0.020	0.015	0.382	0.361
		Int. Stream	2800	2800	124	124			3.11	3.50	4.429	4.429	0.250	0.222	0.150	0.133		
		St./Gutter Flow	600	600	22	22			3.80	3.80	3.667	3.667	0.044	0.044	0.026	0.026		
SC211	0.0831	Overland	520	520	52	52	0.15	0.15			10.000	10.000	0.316	0.316	0.189	0.189		
		Int. Stream	3300	3300	162	162			3.32	3.32	4.909	4.909	0.276	0.276	0.166	0.166	0.418	0.418
		Flow Channel(sc)	1280	1280	61	61			3.40	3.40	4.766	4.766	0.105	0.105	0.063	0.063		
SC209	0.1229	Overland (1)	200	200	25	25	0.15	0.15			12.500	12.500	0.182	0.182	0.109	0.109		
		Overland (2)	600	600	46	46			4.25	4.25	7.667	7.667	0.039	0.039	0.024	0.024	0.336	0.336
		Flow Channel(tc)	4200	4200	213	213			3.45	3.45	5.071	5.071	0.338	0.338	0.203	0.203		
SC207	0.121	Overland (1)	400	400	48	48	0.15	0.15			12.000	12.000	0.261	0.261	0.156	0.156		
		Overland (2)	600	600	34	34			3.65	3.65	5.667	5.667	0.046	0.046	0.027	0.027	0.367	0.367
		Int. Stream	2600	2600	124	124			3.19	3.19	4.769	4.769	0.226	0.226	0.136	0.136		
		Flow Channel(sc)	900	900	40	40			3.20	3.20	4.444	4.444	0.078	0.078	0.047	0.047		
SC205	0.0877	Overland (1)	250	250	32	32	0.15	0.15			12.800	12.800	0.202	0.202	0.121	0.121		
		Overland (2)	650	650	42	42			3.90	3.90	6.462	6.462	0.046	0.046	0.028	0.028	0.257	0.257
		Flow Channel(sc)	2270	2270	102	102			3.50	3.50	4.493	4.493	0.180	0.180	0.108	0.108		
SC203	0.1042	Overland (1)	300	300	38	38	0.15	0.15			12.667	12.667	0.222	0.222	0.133	0.133		
		Overland (2)	700	700	62	62			4.50	4.50	8.857	8.857	0.043	0.043	0.026	0.026	0.223	0.223
		Int. Stream	500	500	40	40			4.00	4.00	8.000	8.000	0.035	0.035	0.021	0.021		
		Flow Channel(td)	850	850	39	39			3.25	3.25	4.588	4.588	0.073	0.073	0.044	0.044		
SC201	0.1219	Overland	650	650	33	33	0.15	0.15			5.077	5.077	0.442	0.442	0.265	0.265		
		Flow Channel(td)	2250	2250	233	233			5.00	5.00	10.356	10.356	0.125	0.125	0.075	0.075	0.340	0.340

Lag Time Calculations for HEC-1 Input Cont...

Table II-2

Basin	Area Basin	Type of Flow	Length Existing	Length Future	Change in Elevation Existing	Change in Elevation Future	C Value Existing	C Value Future	Velocity (ft/s) Existing	Velocity (ft/s) Future	Slope % Existing	Slope % Future	To (hrs.) Existing	To (hrs.) Future	Tlag (hrs.) Existing	Tlag (hrs.) Future	Summation of Tlag Existing	Summation of Tlag Future
SC111	0.1747	Overland	300	300	24	24	0.45	0.45			8.000	8.000	0.177	0.177	0.106	0.106		
		SL/Gutter Flow	2850	2850	140	140			4.40	4.40	4.912	4.912	0.180	0.180	0.108	0.108	0.382	0.382
		Int. Stream	1800	1800	150	150			4.08	4.08	8.333	8.333	0.123	0.123	0.074	0.074		
		Flow Channel(tb)	1580	1580	54	54			2.80	2.80	3.418	3.418	0.157	0.157	0.094	0.094		
SC109	0.1212	Overland	300	300	26	26	0.15	0.45			8.667	8.667	0.251	0.172	0.151	0.103		
		SL/Gutter Flow	1000	1000	28	28			3.35	3.35	2.800	2.800	0.083	0.083	0.050	0.050	0.398	0.350
		Int. Stream	2300	2300	114	114			3.24	3.24	4.957	4.957	0.197	0.197	0.118	0.118		
		Flow Channel(tb)	1320	1320	44	44			2.80	2.80	3.333	3.333	0.131	0.131	0.079	0.079		
SC107 *	0.1793	Overland	210	210	42	42	0.15	0.15			20.000	20.000	0.160	0.160	0.096	0.096		
		Int. Stream	1900	1900	132	132			3.74	4.50	6.947	6.947	0.141	0.117	0.085	0.070	0.287	0.273
		Flow Channel(tb)	1700	1700	51	51			2.65	2.65	3.000	3.000	0.178	0.178	0.107	0.107		
SC105 *	0.139	Overland (1)	400	400	40	40	0.15	0.15			10.000	10.000	0.277	0.277	0.166	0.166		
		Overland (2)	600	600	22	22			3.00	3.80	3.667	3.667	0.056	0.044	0.033	0.026	0.345	0.330
		Int. Stream	2450	2450	125	125			3.28	3.50	5.102	5.102	0.207	0.194	0.124	0.117		
		Flow Channel(tb)	450	450	25	25			3.60	3.60	5.556	5.556	0.035	0.035	0.021	0.021		
SC103	0.1612	Overland	330	330	26	26	0.15	0.15			7.879	7.879	0.272	0.272	0.163	0.163		
		Int. Stream	2050	2050	84	84			3.03	3.03	4.098	4.098	0.188	0.188	0.113	0.113	0.348	0.348
		Flow Channel(tb)	1400	1400	65	65			3.25	3.25	4.643	4.643	0.120	0.120	0.072	0.072		
SC101	0.0913	Overland	470	470	18	18	0.15	0.15			3.830	3.830	0.412	0.412	0.247	0.247		
		Flow Channel(tb)	2050	2050	82	82			3.23	3.23	4.000	4.000	0.176	0.176	0.106	0.106	0.353	0.353
SC617A	0.01489	overland channel	600		16		From Drainage Report						0.43	0.27				
SC617B	0.0209	overland channel															0.258	0.162
SC615A	0.0972	overland channel	500 1100	15 47													0.228	0.228
SC615B	0.0315	overland channel		FROM DRAINAGE Report									0.30	0.3			0.180	0.18
SC105A	0.0164	overland channel		From Drainage Report									.2667	.2667			0.160	0.160
SC105B	0.0095	overland channel											.58	.58			0.345	.345
SC107A	0.1916	overland channel															0.345	.345
SC107B	0.0777	overland channel															0.287	0.273
SC605A	0.06	overland channel															0.287	0.273
SC605B	0.093	overland channel			From Drainage Report									.42			N/A	0.252
SC618	0.007	overland channel			From Drainage Report									.42			N/A	0.252
SC613	0.1234					From Drainage Report								.25			N/A	0.150
SC701	0.0721	overland	1000 (120')	30				32					0.45	0.45			0.30	0.270
SC617C	0.0118 21												.16hr	.16hr			0.360	0.360
																	NA	0.17

Smith Creek Drainage Basin Planning Study

Job Number 8896.90
June 22, 2001

J·R ENGINEERING
A Subsidiary of Westrian

PRUDENT LINE CALCULATOR for DESIGN POINT No. 604

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	1989	2.50	29835	7459	1106	1847	0	5	2
50	1301	2.50	19515	4879					
25	892	2.50	13380	3345					
10	514	2.75	8481	2120					
5	270	4.25	6885	1721					
2	70	6.50	2730	683					

24' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

$PLM_{LT} = Y_m$ x 1.67 x bank height/500

$PLM_{ST} = Y_m$ x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 0' - 100 year flood contained within top of bank
(2) 5'
(3) 2'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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J·R ENGINEERING
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PRUDENT LINE CALCULATOR for DESIGN POINT No.603

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	241	1.50	2169	542	97	162	0	1	1
50	176	1.50	1584	396					
25	127	1.50	1143	286					
10	83	1.50	747	187					
5	52	1.50	468	117					
2	17	3.25	332	83					

14' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

PLM_{LT} = Y_m x 1.67 x bank height/500

PLM_{ST} = Y_m x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 0' - 100 year flood contained within top of bank
(2) 1'
(3) 1'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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Job Number 8896.90
June 22, 2001

J-R ENGINEERING
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PRUDENT LINE CALCULATOR for DESIGN POINT No. 511

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	1891	2.25	25529	6382	1047	1748	0	7	2
50	1250	2.50	18750	4688					
25	858	2.50	12870	3218					
10	495	2.75	8168	2042					
5	260	4.25	6630	1658					
2	66	6.50	2574	644					

15' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

PLM_{LT} = Y_m x 1.67 x bank height/500

PLM_{ST} = Y_m x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 45'
(2) 7'
(3) 2'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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J·R ENGINEERING
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PRUDENT LINE CALCULATOR for DESIGN POINT No. 509

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	2019	2.25	27257	6814	1008	1684	1	16	4
50	1240	2.50	18600	4650					
25	868	2.25	11718	2930					
10	504	2.50	7560	1890					
5	270	4.00	6480	1620					
2	65	6.25	2438	609					

6.5' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

PLM_{LT} = Y_m x 1.67 x bank height/500

PLM_{ST} = Y_m x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 0' - 100 year flood contained within top of bank
(2) 16'
(3) 4'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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J·R ENGINEERING
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PRUDENT LINE CALCULATOR for DESIGN POINT No. 507

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	2036	2.00	24432	6108	931	1555	0	8	2
50	1219	2.25	16457	4114					
25	846	2.25	11421	2855					
10	513	2.25	6926	1731					
5	265	3.75	5963	1491					
2	63	6.00	2268	567					

12' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

$PLM_{LT} = Y_m$ x 1.67 x bank height/500

$PLM_{ST} = Y_m$ x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 60'
(2) 8'
(3) 2'
(4) 50'

Therefore, the prudent line setback at this design point is 60 feet.

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PRUDENT LINE CALCULATOR for DESIGN POINT No. 506

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	2065	1.75	21683	5421	924	1543	0	12	3
50	1293	2.25	17456	4364					
25	850	2.25	11475	2869					
10	522	2.25	7047	1762					
5	265	3.75	5963	1491					
2	62	6.00	2232	558					

8' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

PLM_{LT} = Y_m x 1.67 x bank height/500

PLM_{ST} = Y_m x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):
(1) 0' - 100 year flood contained within top of bank
(2) 12'
(3) 3'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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PRUDENT LINE CALCULATOR for DESIGN POINT No. 505

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	317	1.50	2853	713	125	208	0	3	1
50	229	1.50	2061	515					
25	163	1.75	1712	428					
10	105	1.75	1103	276					
5	65	1.75	683	171					
2	20	2.75	330	83					

5' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

PLM_{LT} = Y_m x 1.67 x bank height/500

PLM_{ST} = Y_m x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 14'
(2) 3'
(3) 1'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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PRUDENT LINE CALCULATOR for DESIGN POINT No. 407

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	1718	2.00	20616	5154	816	1363	1	17	4
50	1221	2.00	14652	3663					
25	826	2.00	9912	2478					
10	466	2.00	5592	1398					
5	248	3.75	5580	1395					
2	76	4.25	1938	485					

5' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

$PLM_{LT} = Y_m$ x 1.67 x bank height/500

$PLM_{ST} = Y_m$ x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 0' - 100 year flood contained within top of bank
(2) 17'
(3) 4'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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PRUDENT LINE CALCULATOR for DESIGN POINT No. 405

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	1177	2.00	14124	3531	533	890	0	4	1
50	837	2.00	10044	2511					
25	582	2.00	6984	1746					
10	310	2.00	3720	930					
5	156	3.75	3510	878					
2	48	4.25	1224	306					

17' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

$PLM_{LT} = Y_m$ x 1.67 x bank height/500

$PLM_{ST} = Y_m$ x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 0' - 100 year flood contained within top of bank
(2) 4'
(3) 1'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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PRUDENT LINE CALCULATOR for DESIGN POINT No. 401

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	1095	2.00	13140	3285	492	822	0	5	1
50	789	2.00	9468	2367					
25	558	2.00	6696	1674					
10	294	2.00	3528	882					
5	148	3.50	3108	777					
2	45	4.25	1148	287					

11' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

PLM_{LT} = Y_m x 1.67 x bank height/500

PLM_{ST} = Y_m x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 0' - 100 year flood contained within top of bank
(2) 5'
(3) 1'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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PRUDENT LINE CALCULATOR for DESIGN POINT No. 316

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	1158	2.00	13896	3474	429	716	0	11	3
50	811	1.75	8516	2129					
25	555	1.75	5828	1457					
10	335	1.75	3518	879					
5	192	1.75	2016	504					
2	55	3.50	1155	289					

4 assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

$PLM_{LT} = Y_m$ x 1.67 x bank height/500

$PLM_{ST} = Y_m$ x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 85'
(2) 11'
(3) 3'
(4) 50'

Therefore, the prudent line setback at this design point is 85 feet.

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PRUDENT LINE CALCULATOR for DESIGN POINT No. 315

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	599	1.75	6290	1572	233	389	0	12	3
50	427	1.75	4484	1121					
25	298	1.75	3129	782					
10	187	1.75	1964	491					
5	112	1.75	1176	294					
2	35	3.00	630	158					

2' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

$PLM_{LT} = Y_m$ x 1.67 x bank height/500

$PLM_{ST} = Y_m$ x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 125'
(2) 12'
(3) 3'
(4) 50'

Therefore, the prudent line setback at this design point is 125 feet.

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PRUDENT LINE CALCULATOR for DESIGN POINT No. 311

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	458	1.75	4809	1202	186	311	1	19	5
50	330	1.75	3465	866					
25	235	1.75	2468	617					
10	150	1.75	1575	394					
5	93	1.75	977	244					
2	28	3.00	504	126					

1' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

PLM_{LT} = Y_m x 1.67 x bank height/500

PLM_{ST} = Y_m x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 26'
(2) 19'
(3) 5'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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J-R ENGINEERING
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PRUDENT LINE CALCULATOR for DESIGN POINT No. 305

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	235	1.75	2468	617	83	138	0	2	1
50	171	1.50	1539	385					
25	122	1.50	1098	275					
10	79	1.50	711	178					
5	49	1.50	441	110					
2	15	2.25	203	51					

5.5' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

PLM_{LT} = Y_m x 1.67 x bank height/500

PLM_{ST} = Y_m x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 61'
(2) 2'
(3) 1'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

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PRUDENT LINE CALCULATOR for DESIGN POINT No. 220

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	570	2.00	6840	1710	205	342	0	3	1
50	394	2.00	4728	1182					
25	264	2.00	3168	792					
10	154	1.75	1617	404					
5	84	1.75	882	221					
2	21	4.25	536	134					

9' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

$PLM_{LT} = Y_m$ x 1.67 x bank height/500

$PLM_{ST} = Y_m$ x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):
(1) 0' - 100 year flood contained within top of bank
(2) 3'
(3) 1'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

Smith Creek Drainage Basin Planning Study

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June 22, 2001

J·R ENGINEERING
A Subsidiary of Westrian

PRUDENT LINE CALCULATOR for DESIGN POINT No. 219

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	432	2.00	5184	1296	165	276	0	2	1
50	301	2.00	3612	903					
25	204	2.00	2448	612					
10	122	1.75	1281	320					
5	69	1.75	725	181					
2	18	4.25	459	115					

9' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

$PLM_{LT} = Y_m$ x 1.67 x bank height/500

$PLM_{ST} = Y_m$ x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 0' - 100 year flood contained within top of bank
(2) 2'
(3) 1'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.

Smith Creek Drainage Basin Planning Study

Job Number 8896.90
June 22, 2001

J·R ENGINEERING
A Subsidiary of Westrian

PRUDENT LINE CALCULATOR for DESIGN POINT No. 217

Storm	Q_p	d	$Vol_i=6Q_pd$	$Y_i=0.25Vol_i$	Y_m	Y_m x 1.67	Long Term Potential Lateral Migration PLM_{LT}	PLM_{LT}*30	Short Term Potential Lateral Migration PLM_{ST}
	cfs	hr.	cubic feet			cubic feet	feet	feet	feet
100	139	2.00	1668	417	39	65	0	1	1
50	93	1.75	977	244					
25	60	1.75	630	158					
10	32	1.75	336	84					
5	16	1.75	168	42					
2	3	4.25	77	19					

9' assumed bank height for channel erosion

$Y_m=0.015Y_{100}+0.015Y_{50}+0.04Y_{25}+0.08Y_{10}+0.2Y_5+0.4Y_2$

$PLM_{LT} = Y_m$ x 1.67 x bank height/500

$PLM_{ST} = Y_m$ x 1.67 x bank height/150

d=hydrograph duration (hrs)

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100 year flood plain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

Long term potential lateral migration is based on a 500' length.
Short term potential lateral migration is based on a 150' length.
The lateral migration numbers are estimates.

Setback from the low flow channel top of bank (or the 10-year water surface when a low flow channel is not apparent):

(1) 0' - 100 year flood contained within top of bank
(2) 1'
(3) 1'
(4) 50'

Therefore, the prudent line setback at this design point is 50 feet.