Sensitive Habitat Inventory and Mapping (SHIM)
Bellevue Creek Inventory Summary — Segments 11-14

Segment	Primary	Length (m)	Hydraulic	Gradient (%)	Crown Closure	Spawning Habitat	Bars	Substrates (%) [a]						Channel (m)				Cover (%) [b]							
								O	F	G	C	B	R	Wetted Width	Bankfull Width	Wetted Depth	Bankfull Depth	Total Cover	B	DP	IV	LWD	OV	SWD	UC
11.0	Channelized	132	Riffle	5.0	21-40%	Unknown	None	0	1	4	45	50	0	5.00	8.00	0.07	0.95	30	100	0	0	0	0	0	0
12.0	Channelized	143	Riffle	4.0	0	Potential	Mid-channel	0	1	4	50	45	0	4.00	17.50	0.06	0.60	25	95	0	0	0	0	5	0
13.0	Channelized	224	Cascade	5.0	0	Unknown	Mid-channel	0	0	0	45	55	0	4.70	10.50	0.08	0.85	25	95	5	0	0	0	0	0
14.0	Channelized	418	Cascade	5.0	1-20%	Potential	None	0	1	1	33	65	0	3.30	8.80	0.08	0.90	40	90	10	0	0	0	0	0

a. Substrate codes: O=organics; F=silt/sand; G=gravel; C=cobble; B=boulder; R=bedrock

b. Cover codes: B=boulder; DP=deep pool; IV=instream vegetation; LWD=large woody debris; OV=overstream vegetation; SWD=small woody debris; UC=undercut bank

Segment	Left Bank Riparian					Right Bank Riparian					Level of Impact	Enhancement Opportunity
	Class	Qualifier	Stage	Shrub Cover	Bank Stability	Class	Qualifier	Stage	Shrub Cover	Bank Stability		
11.0	Broadleaf forest	Urban Residential	young forest	5-33%	Medium	Broadleaf forest	Urban Residential	young forest	34-66%	Medium	5	Low
12.0	Mixed forest	Urban Residential	young forest	5-33%	High	Mixed forest	Urban Residential	young forest	5-33%	High	5	Low
13.0	Mixed forest	Urban Residential	sapling >10m	<5%	Medium	Mixed forest	Urban Residential	sapling >10m	<5%	Medium	6	High
14.0	Mixed forest	Urban Residential	young forest	5-33%	High	Mixed forest	Urban Residential	young forest	5-33%	High	4	Low

c. Impact rating: 0=nil; 1 = 1-bank low; 2 = 1-bank moderate; 3 = 1-bank high; 4 = both banks low; 5 = both banks moderate; 6 = both banks high

Segment: 11

Higher gradient; riffle-cascade; boulders predominant. Sections of high bank instability attributed to over-steepening and removal of riparian vegetation.



Segment: 12

Diking more setback permitting wider channel and allowing development of mid channel bars. A spring occurs on left bank. Therefore deep pool development may provide refuge during low flows.



Segment: 13

Deep-cut channelization and poor riparian quality. Stream bed instability.



Segment: 14

Narrow riparian band naturalizing. Intermittent sections of bank instability from channelization. Boulder-pool complexes providing cover and associated shallow pools and small pockets of suitable spawning substrates.



Bellevue Creek
Sensitive Habitat Inventory and Mapping (SHIM) Segments 11-14



30 0 30 60 90 Meters

N
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Map:	3 of 7
Title:	Segments 11-14 of 25
Projection:	NAD 83, 11 North
Prepared for:	City of Kelowna
Prepared by:	Ecoscape Environmental Consultants
Drawn by:	KH
Date:	December, 2005

LEGEND

- Stream Centreline
- Top of Bank
- Segment break

Modification
- Bridge
- Channelization
- Garbage/Pollution
- PipeCrossing
- Retaining Wall/Bank Stability
- Water Withdrawal

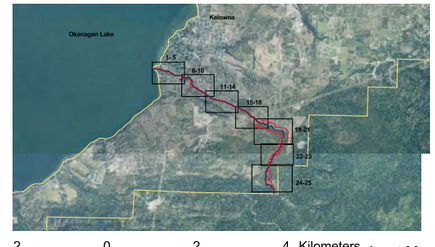
Waterbody
- Natural Springs
- Side Channel
- Tributary
- Wetland
- Wetland (polygon)

- Erosion
- Discharge

Obstruction
- Dam
- Falls
- Persistent Debris
- Velocity Barrier

Fish Habitat
- Boulder
- Deep Pool
- Instream Woody Debris
- Spawning Habitat

- Enhancement



2 0 2 4 Kilometers

Inset Map

Source Information

Base map:	82E.083 - 073 Kelowna
Orthophotos:	2003, provided by City of Kelowna
Stream information:	field inventory
Location information:	field, GPS (Trimble Geo XM)
Feature information:	field inventory
Date of inventory:	2005/11
Inventory management:	Kyle Hawes, R.P.Bio.

ECOSCAPE Environmental Consultants

City of Kelowna

Sensitive Habitat Inventory and Mapping (SHIM)
Bellevue Creek Inventory Summary — Segments 15-18

Segment	Primary	Length (m)	Hydraulic	Gradient (%)	Crown Closure	Spawning Habitat	Bars	Substrates (%) [a]						Channel (m)				Cover (%) [b]							
								O	F	G	C	B	R	Wetted Width	Bankfull Width	Wetted Depth	Bankfull Depth	Total Cover	B	DP	IV	LWD	OV	SWD	UC
15.0	Channelized	177	Cascade	6.0	0	Unknown	None	0	1	1	23	75	0	3.00	7.00	0.09	0.95	40	90	10	0	0	0	0	0
16.0	Channelized	217	Cascade	7.0	0	Unknown	None	0	1	1	33	65	0	4.00	9.00	0.08	0.85	35	90	10	0	0	0	0	0
17.0	Channelized	425	Cascade	7.0	1-20%	Potential	Diagonal	0	1	4	25	70	0	4.00	9.00	0.08	0.85	35	90	10	0	0	0	0	0
18.0	Natural	142	Cascade/Pool	7.0	21-40%	Resident		0	1	4	20	45	30	3.70	7.40	0.09	0.95	40	90	10	0	0	0	0	0

a. Substrate codes: O=organics; F=silt/sand; G=gravel; C=cobble; B=boulder; R=bedrock

b. Cover codes: B=boulder; DP=deep pool; IV=instream vegetation; LWD=large woody debris; OV=overstream vegetation; SWD=small woody debris; UC=undercut bank

Segment	Left Bank Riparian					Right Bank Riparian					Level of Impact	Enhancement Opportunity
	Class	Qualifier	Stage	Shrub Cover	Bank Stability	Class	Qualifier	Stage	Shrub Cover	Bank Stability		
15.0	Mixed forest	Disturbed	sapling >10m	5-33%	Medium	Mixed forest	Urban Residential	low shrubs <2m	<5%	Low	6	High
16.0	Mixed forest	Disturbed	young forest	5-33%	High	Mixed forest	Disturbed	mature forest	<5%	High	4	Low
17.0	Mixed forest	Agriculture	tall shrubs 2-10m	5-33%	Low	Mixed forest	Agriculture	sapling >10m	<5%	Medium	6	Very higH
18.0	Coniferous forest	Disturbed	young forest	<5%	High	Mixed forest	Disturbed	mature forest	34-66%	Medium	1	Nil

c. Impact rating: 0=nil; 1 = 1-bank low; 2 = 1-bank moderate; 3 = 1-bank high; 4 = both banks low; 5 = both banks moderate; 6 = both banks high

Segment: 15

Higher gradient; steep, unstable boulder banks; Recent enhancement works. Right bank nearly devoid of vegetation.



Segment: 16

Deep-cut channelization but with some meandering maintained. More stable bank sloping. Despite channelization diking is becoming naturalized with less overall encroachment to top of bank.



Segment: 17

Combined impacts from channelization, agriculture and lack of riparian vegetation, and 2003 forest fire. Siltation occurs over a ~40-m length at the top of the segment, from small tributary and landslide.



Segment: 18

Ravine slope (left bank) small bench below ravine slope (right bank). Boulder cascade with numerous shallow pools. Regular small pockets of gravels among boulders amounting ~4% representing potential spawning habitat for resident rainbow trout (observed).



Bellevue Creek
Sensitive Habitat Inventory and Mapping (SHIM) Segments 15-18

30 0 30 60 90 Meters

N
W E
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Map:	4 of 7
Title:	Segments 15-18 of 25
Projection:	NAD 83, 11 North
Prepared for:	City of Kelowna
Prepared by:	Ecoscape Environmental Consultants
Drawn by:	KH
Date:	December, 2005

LEGEND

- Stream Centreline
- Top of Bank
- Segment break

Modification
- Bridge
- Channelization
- Garbage/Pollution
- PipeCrossing
- Retaining Wall/Bank Stability
- Water Withdrawal

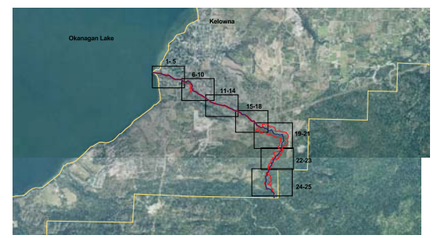
Waterbody
- Natural Springs
- Side Channel
- Tributary
- Wetland
- Wetland (polygon)

- Erosion
- Discharge

Fish Habitat
- Boulder
- Deep Pool
- Instream Woody Debris
- Spawning Habitat

Obstruction
- Dam
- Falls
- Persistent Debris
- Velocity Barrier

- Enhancement



2 0 2 4 Kilometers

Inset Map

Source Information

Base map:	82E.083 - 073 Kelowna
Orthophotos:	2003, provided by City of Kelowna
Stream information:	field inventory
Location information:	field, GPS (Trimble Geo XM)
Feature information:	field inventory
Date of inventory:	2005/11
Inventory management:	Kyle Hawes, R.P.Bio.

ECOSCAPE Environmental Consultants

City of Kelowna

Sensitive Habitat Inventory and Mapping (SHIM)
Bellevue Creek Inventory Summary — Segments 19-21

Segment	Primary	Length (m)	Hydraulic	Gradient (%)	Crown Closure	Spawning Habitat	Bars	Substrates (%) [a]						Channel (m)				Cover (%) [b]							
								O	F	G	C	B	R	Wetted Width	Bankfull Width	Wetted Depth	Bankfull Depth	Total Cover	B	DP	IV	LWD	OV	SWD	UC
19.0	Natural	610	Cascade/Pool	8.0	1-20%	Resident	Side	0	2	8	30	50	10	4.50	8.00	0.07	0.85	60	65	15	0	15	0	5	0
20.0	Modified	244	Cascade/Pool	7.0	0	Resident	Side	0	2	13	15	65	5	3.60	9.00	0.08	0.85	55	65	15	0	10	0	10	0
21.0	Natural	241	Falls	45.0	1-20%	Unknown	None	0	0	5	10	45	40	3.20	8.00	0.07	0.70	20	80	20	0	0	0	0	0

a. Substrate codes: O=organics; F=silt/sand; G=gravel; C=cobble; B=boulder; R=bedrock
b. Cover codes: B=boulder; DP=deep pool; IV=instream vegetation; LWD=large woody debris; OV=overstream vegetation; SWD=small woody debris; UC=undercut bank

Segment	Left Bank Riparian					Right Bank Riparian					Level of Impact	Enhancement Opportunity
	Class	Qualifier	Stage	Shrub Cover	Bank Stability	Class	Qualifier	Stage	Shrub Cover	Bank Stability		
19.0	Mixed forest	Disturbed	young forest	<5%	High	Mixed forest	Disturbed	young forest	5-33%	Medium	0	Nil
20.0	Rock	Disturbed	low shrubs <2m	34-66%	High	Herbs/grasses	Disturbed	low shrubs <2m	<5%	High	5	Nil
21.0	Coniferous forest	Disturbed	mature forest	5-33%	High	Coniferous forest	Disturbed	mature forest	5-33%	High	0	Nil

c. Impact rating: 0=nil; 1 = 1-bank low; 2 = 1-bank moderate; 3 = 1-bank high; 4 = both banks low; 5 = both banks moderate; 6 = both banks high

Segment: 19

Creek meanders through bedrock ravine. Small alluvial floodplain communities occur on inside bends. Suitable pockets of spawning substrates associated with instream structures (LWD and Boulders). Forest fire disturbance.



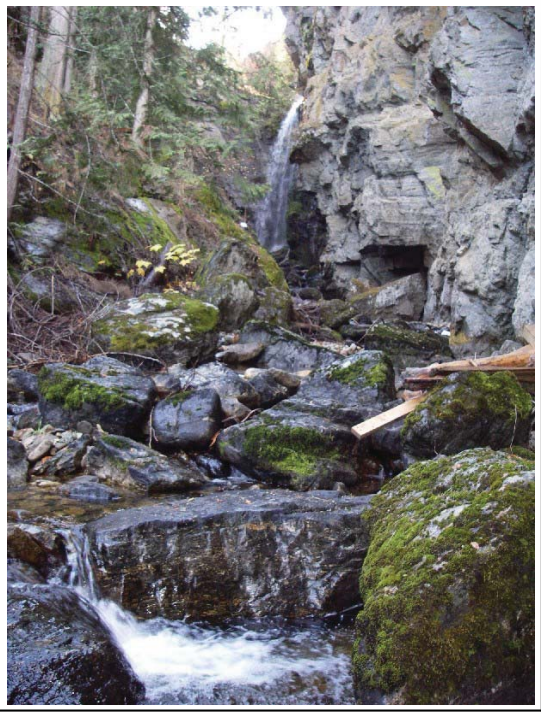
Segment: 20

Modified canyon/ ravine by forest fire with subsequent salvage logging. Rainbow trout (juveniles) observed to Crawford Falls.



Segment: 21

Steep cascade and waterfall complex through canyon.



Bellevue Creek
Sensitive Habitat Inventory and Mapping (SHIM) Segments 19-21



30 0 30 60 90 Meters

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Map:	5 of 7
Title:	Segments 19-21 of 25
Projection:	NAD 83, 11 North
Prepared for:	City of Kelowna
Prepared by:	Ecoscape Environmental Consultants
Drawn by:	KH
Date:	December, 2005

LEGEND

- Stream Centreline
- Top of Bank
- Segment break

Modification
- Bridge
- Channelization
- Garbage/Pollution
- PipeCrossing
- Retaining Wall/Bank Stability
- Water Withdrawal

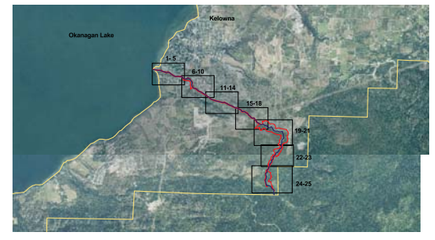
Waterbody
- Natural Springs
- Side Channel
- Tributary
- Wetland
- Wetland (polygon)

- Erosion
- Discharge

Obstruction
- Dam
- Falls
- Persistent Debris
- Velocity Barrier

Fish Habitat
- Boulder
- Deep Pool
- Instream Woody Debris
- Spawning Habitat

- Enhancement



2 0 2 4 Kilometers

Inset Map

Source Information

Base map:	82E.083 - 073 Kelowna
Orthophotos:	2003, provided by City of Kelowna
Stream information:	field inventory
Location information:	field, GPS (Trimble Geo XM)
Feature information:	field inventory
Date of inventory:	2005/11
Inventory management:	Kyle Hawes, R.P.Bio.

ECOSCAPE Environmental Consultants

City of Kelowna

Sensitive Habitat Inventory and Mapping (SHIM)
Bellevue Creek Inventory Summary — Segments 22-23

Segment	Primary	Length (m)	Hydraulic	Gradient (%)	Crown Closure	Spawning Habitat	Bars	Substrates (%) [a]						Channel (m)				Cover (%) [b]							
								O	F	G	C	B	R	Wetted Width	Bankfull Width	Wetted Depth	Bankfull Depth	Total Cover	B	DP	IV	LWD	OV	SWD	UC
22.0	Natural	172	Cascade/Pool	8.0	1-20%	Unknown	None	0	1	4	15	30	50	3.20	8.00	0.07	0.80	40	70	30	0	0	0	0	0
23.0	Modified	583	Riffle/Pool	5.0	1-20%	Unknown	Mid-channel	1	1	3	25	45	10	4.50	16.50	0.07	0.85	30	80	10	0	5	0	5	0

a. Substrate codes: O=organics; F=silt/sand; G=gravel; C=cobble; B=boulder; R=bedrock

b. Cover codes: B=boulder; DP=deep pool; IV=instream vegetation; LWD=large woody debris; OV=overstream vegetation; SWD=small woody debris; UC=undercut bank

Segment	Left Bank Riparian					Right Bank Riparian					Level of Impact	Enhancement Opportunity
	Class	Qualifier	Stage	Shrub Cover	Bank Stability	Class	Qualifier	Stage	Shrub Cover	Bank Stability		
22.0	Coniferous forest	Disturbed	mature forest	5-33%	High	Coniferous forest	Disturbed	mature forest	5-33%	High	0	Nil
23.0	Mixed forest	Disturbed	low shrubs <2m	5-33%	Medium	Mixed forest	Disturbed	mature forest	5-33%	Medium	4	Very high

c. Impact rating: 0=nil; 1 = 1-bank low; 2 = 1-bank moderate; 3 = 1-bank high; 4 = both banks low; 5 = both banks moderate; 6 = both banks high

Segment: 22

Predominant bedrock substrate over cascade-pool with regular bedrock outcrops within the stream channel.



Segment: 23

Wide floodplain (cottonwood riparian/floodplain association) area flanked by ravine slope and bedrock. Salvage logged to current stream channel. Prominent active floodplain (up to ~50-m wide) with numerous relic and active side channels (some still wetted).



Bellevue Creek

Sensitive Habitat Inventory and Mapping (SHIM) Segments 22-23

30 0 30 60 90 Meters

N W E S

Map:	6 of 7
Title:	Segments 22-23 of 25
Projection:	NAD 83, 11 North
Prepared for:	City of Kelowna
Prepared by:	Ecoscape Environmental Consultants
Drawn by:	KH
Date:	December, 2005

LEGEND

Stream Centreline
Top of Bank
Segment break

Modification
- Bridge
- Channelization
- Garbage/Pollution
- PipeCrossing
- Retaining Wall/Bank Stability
- Water Withdrawal

Waterbody
- Natural Springs
- Side Channel
- Tributary
- Wetland
- Wetland (polygon)

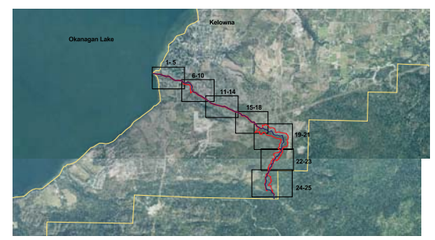
Erosion

Discharge

Obstruction
- Dam
- Falls
- Persistent Debris
- Velocity Barrier

Fish Habitat
- Boulder
- Deep Pool
- Instream Woody Debris
- Spawning Habitat

Enhancement



2 0 2 4 Kilometers

Inset Map

Source Information

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Orthophotos:	2003, provided by City of Kelowna
Stream information:	field inventory
Location information:	field, GPS (Trimble Geo XM)
Feature information:	field inventory
Date of inventory:	2005/11
Inventory management:	Kyle Hawes, R.P.Bio.

ECOSCAPE Environmental Consultants

City of Kelowna

Sensitive Habitat Inventory and Mapping (SHIM)
Bellevue Creek Inventory Summary — Segments 24-25

								Substrates (%) [a]						Channel (m)				Cover (%) [b]							
Segment	Primary	Length (m)	Hydraulic	Gradient (%)	Crown Closure	Spawning Habitat	Bars	O	F	G	C	B	R	Wetted Width	Bankfull Width	Wetted Depth	Bankfull Depth	Total Cover	B	DP	IV	LWD	OV	SWD	UC
24.0	Natural	344	Riffle/Pool	6.0	21-40%	Unknown	Mid-channel	1	1	3	20	75	0	4.50	10.00	0.08	0.85	30	80	10	0	5	0	5	0
25.0	Natural	692	Riffle/Pool	7.0	1-20%	Unknown	Mid-channel	1	1	3	10	83	2	4.50	20.00	0.08	0.85	40	65	15	0	15	0	5	0

a. Substrate codes: O=organics; F=silt/sand; G=gravel; C=cobble; B=boulder; R=bedrock

b. Cover codes: B=boulder; DP=deep pool; IV=instream vegetation; LWD=large woody debris; OV=overstream vegetation; SWD=small woody debris; UC=undercut bank

	Left Bank Riparian					Right Bank Riparian						
Segment	Class	Qualifier	Stage	Shrub Cover	Bank Stability	Class	Qualifier	Stage	Shrub Cover	Bank Stability	Level of Impact [c]	Enhancement Opportunity
24.0	Mixed forest	Disturbed	mature forest	5-33%	Medium	Mixed forest	Disturbed	mature forest	5-33%	Low	0	Nil
25.0	Mixed forest	Disturbed	mature forest	5-33%	Low	Mixed forest	Disturbed	mature forest	5-33%	Low	1	Nil

c. Impact rating: 0=nil; 1 = 1-bank low; 2 = 1-bank moderate; 3 = 1-bank high; 4 = both banks low; 5 = both banks moderate; 6 = both banks high

Segment: 24

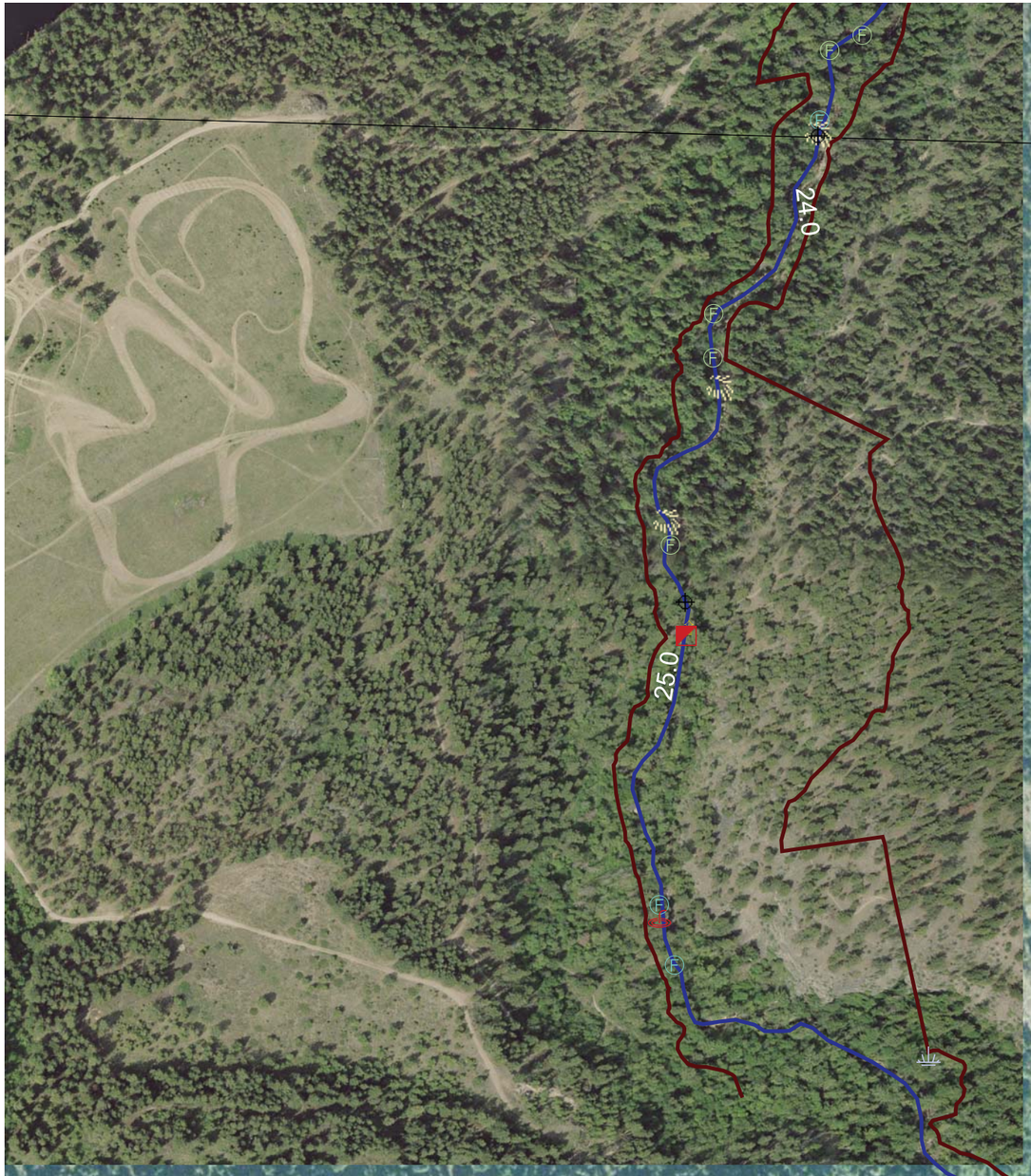
Wide floodplain area flanked by ravine slope and bedrock. No salvage logging has occurred. Mid channel bars/ islands; side channels; very dynamic/unstable character over floodplain.

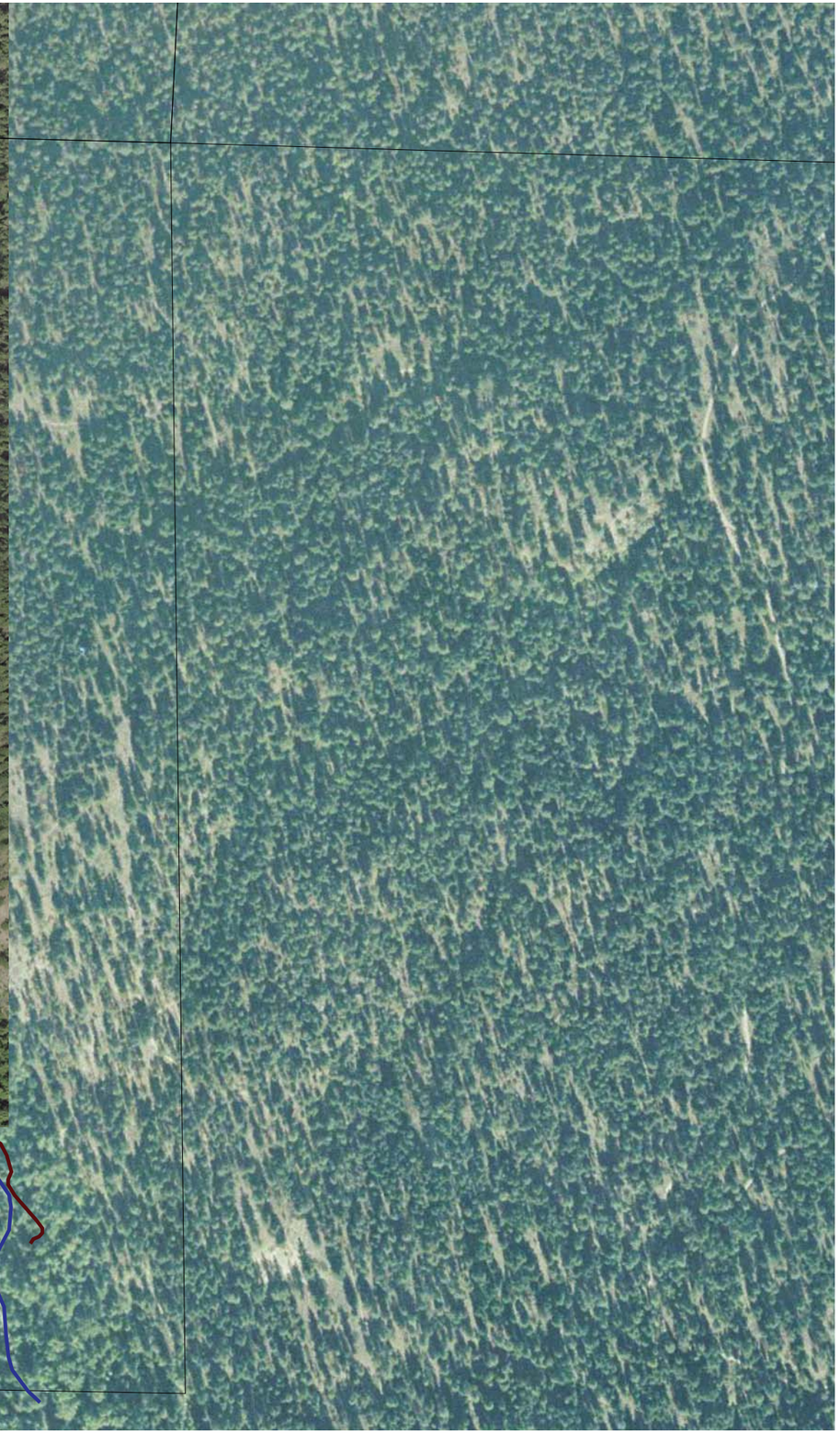


Segment: 25

Some historic channelization to maintain alignment to dam and withdrawal. Occasionally flows adjacent ravine slope toe then meanders to centre of wide floodplain. Entire ravine valley is broad floodplain with predominance of boulders and cobble substrates.







Bellevue Creek

Sensitive Habitat Inventory and Mapping (SHIM) Segments 24-25

30 0 30 60 90 Meters

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Map:	7 of 7
Title:	Segments 24-25 of 25
Projection:	NAD 83, 11 North
Prepared for:	City of Kelowna
Prepared by:	Ecoscape Environmental Consultants
Drawn by:	KH
Date:	December, 2005

LEGEND

Stream Centreline
Top of Bank
Segment break

Modification
- Bridge
- Channelization
- Garbage/Pollution
- PipeCrossing
- Retaining Wall/Bank Stability
- Water Withdrawal

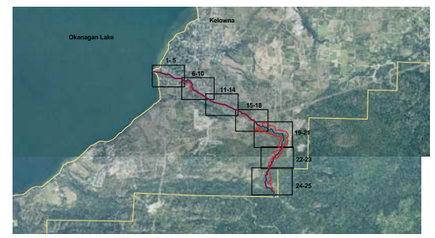
Waterbody
- Natural Springs
- Side Channel
- Tributary
- Wetland
- Wetland (polygon)

Erosion
Discharge

Obstruction
- Dam
- Falls
- Persistent Debris
- Velocity Barrier

Fish Habitat
- Boulder
- Deep Pool
- Instream Woody Debris
- Spawning Habitat

Enhancement



2 0 2 4 Kilometers

Inset Map

Source Information

Base map:	82E.083 - 073 Kelowna
Orthophotos:	2003, provided by City of Kelowna
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Feature information:	field inventory
Date of inventory:	2005/11
Inventory management:	Kyle Hawes, R.P.Bio.

ECOSCAPE Environmental Consultants

City of Kelowna