Fish Habitat Design, Operation, Reclamation Requirements for Moderate–Low Habitat Suitability Watercourses (Includes Tributaries to Large Lakes)

Fish Habitat Design, Operation, Reclamation Requirements for Moderate – Low Habitat Suitability Watercourses (includes Tributaries to Large Lakes)

Moderate-low suitability habitats are defined as watercourses suitable for rearing juvenile Chinook salmon, although utilization may be limited at times due to environmental factors or conditions. These watercourses are typically highly suitable for non-anadromous resident fish species such as Arctic grayling.

Please use the following instructions and information to complete the worksheets relevant to your proposal (located in Appendix A to G). The completed worksheets will be submitted as part of your project description to Yukon Environmental and Socio Economic Assessment Board (YESAB) and your application to the Yukon Water Board (YWB).

Do you propose to undertake placer mining activities in or near a watercourse? Activities may include discharging effluent, constructing stream crossings, clearing riparian vegetation, constructing channel diversions, or withdrawing water.

NO – No further review pursuant to the *Fisheries Act* is required.

YES – Proceed to Step A, Identification of Project Location

A) Identification of Project Location

The first step in compiling a project proposal that involves activities proposed to occur in or around fish habitat areas involves completing the ***Project Location Worksheet*** (Appendix A).

A1. *On the* ***Project Location Worksheet*** *enter the stream name, the watershed name (as per* ***Yukon Placer Fish Habitat Suitability Maps),*** *identify the watershed sensitivity, and habitat suitability classification for the reaches you proposed to work in, if any reaches are designated as "prior development" a short description of the location, the proposed duration of activities and a copy of a map of the specific location of the site.*

Does the Previous Development designation apply to your project?

NO – Proceed to the next question.

YES – See below.

Historical Development, Current Development or Extensive Development

If your project falls within a "Historical Development", "Current Development" or "Extensive Development" zone, the requirements for settling pond discharge, riparian zones, seasonal or temporary diversions, watercourse crossings, water acquisition and in-stream works that normally apply to Low Habitat Suitability will apply to your operation. **Please note that permanent diversion channels and all reclamation work must conform to the requirements for Moderate-low suitability habitats**.

Once the sections noted above are complete in the ***Project Location Worksheet***, proceed to the next question.

Do you propose to discharge effluent from your mine site?

NO – Proceed to Step C, Riparian Zones.

YES - Proceed to Step B, Settling Pond Discharge.

B) Settling Pond Discharge (effluent concentration)

Point source sediment discharges from gold recovery processes are typically managed through the use of settling facilities. The action level approach is a key element of the risk-based approach to sediment management for Yukon placer mining. For more information on the action level approach or settling pond design, operation, recirculation systems, and settling pond reclamation refer to the *Guidebook of Mitigation Measures for Yukon Placer Mining*

Water quality objectives and sediment discharge standards for settling ponds in Moderate-low habitats are specified in the *Authorization for Placer Mining Works or Undertakings Affecting Fish Habitat* for the specific watershed you propose to work in (general requirements summarized below). Please ensure to verify your specific discharge standard in the respective watershed you plan to work in (specifically if any exemptions exist) prior to proceeding with your application.

Discharge Standard (Category A, Moderate-Low and Tributaries to Large Lakes)	**Requirement**
Design Target	0.2 ml/L
Action Level	0.8 ml/L
Compliance Level	1.2 ml/L

Discharge Standard (Category B, Moderate-Low)	**Requirement**
Design Target	0.2 ml/L
Action Level	1.0 ml/L
Compliance Level	2.0 ml/L

B1. *Record the Design Target, Action Level and Compliance Level on the* ***Project Location Worksheet*** *(Appendix A).*

Once the effluent discharge standards are recorded on the ***Project Location Worksheet*** proceed to the next question.

Do you propose to build a Seasonal, Temporary or Permanent diversion channel?

NO – Proceed to Step C, Riparian Zones.

YES – Proceed to Step D, Diversion Channels.

C) Riparian Zones

The Riparian Zone is defined as the portion of the stream bank (either vegetated or not) immediately adjacent to the stream channel.

The designated **Riparian Zone** in Moderate-low habitats is **5 metres,** measured from the ordinary high water mark of the watercourse and following the shape of the channel.

The Riparian Zone designation applies to original (un-modified) channels, previously reclaimed channels and Permanent Diversion Channels. The Riparian Zone provisions set out below are not required for Seasonal or Temporary Diversion Channels.

Activities proposed within the Riparian Zone must comply with the following provisions (requirements of the watershed *Authorization for Placer Mining Works or Undertakings Affecting Fish Habitat*), or a site-specific authorization issued by DFO. In absence of compliance with either authorization, the only activity authorized within the Riparian Zone is the clearing of surface vegetation within a corridor to provide access to the stream (typically for water acquisition purposes). The maximum width of the corridor is to be no more than 7 **metres**. Riparian Zones must be staked out by the operator prior to development.

Do you propose to conduct surface or subsurface works in the Riparian Zone?

NO – Proceed to Step D, Diversion Channels.

YES – Proceed to next question.

Do you propose to construct a new stream crossing (ford)?

NO – Proceed to next question.

YES – Review Step E, Watercourse Crossings, prior to proceeding to next question.

Do you propose to clear surface vegetation only?

YES – Proceed to Step C1, Surface Vegetation Clearing.

NO – The proposal includes both clearing of surface vegetation and subsurface works, proceed to Step C1, Surface Vegetation Clearing, followed by C2, Bank Modification.

C1. Surface Vegetation Clearing

If works or undertakings are proposed to occur within the Riparian Zone, refer to the conditions identified in the tables below and use the information to fill out the ***Riparian Zone / Bank Modification Worksheet*** (Appendix B).

C1a – *On the **Riparian Zone / Bank Modification Worksheet** record the maximum duration the proposed Vegetation Clearing will be in place (see table below).*

Moderate–Low Habitat Suitability (Includes Tributaries to Large Lakes)

C1b – *Record the habitat suitability type where Vegetation Clearing in the Riparian Zone is proposed.*

C1c – *Record the length (in metres) of proposed Vegetation Clearing in the Riparian Zone (see table below for restrictions).*

C1d – *Record the width (in metres) of proposed Vegetation Clearing in the Riparian Zone (see table below for restrictions).*

C1e – *Record the width (in metres) of Vegetation Setback in the Riparian Zone (see table below).*

C1f – *Draw a diagram of the proposed location where clearing of the Riparian Zone is proposed (include north arrow, flow direction) (use symbols identified on worksheet to compose your diagram).*

C1g – *Record a description of the required reclamation works (see table below).*

Conditions and reclamation required when proposing surface Vegetation Clearing in Riparian Zones in Moderate-low suitability habitats

Design Component (Vegetation Clearing)	Requirement
Minimum Vegetated Setback from Stream	1.0 metre
Maximum Length of Clearing	300 metres
Minimum Space Between Cleared Areas	100 metres
Maximum Duration Prior to Reclamation	5 years
Reclamation Requirement (surface)	Full topsoil coverage
Reclamation Requirement (vegetation)	30% live staking

If proposing bank modification activities, proceed to step C2.

C2. Bank Modification

If works or undertakings are proposed to occur within the Riparian Zone, refer to the conditions identified in the tables below and use the information to further fill out the ***Riparian Zone / Bank Modification Worksheet*** (Appendix B).

Conditions related to subsurface **Bank Modification** in Riparian Zones authorized in Moderate-low habitats.

Note - If your proposal includes bank modification related to the construction of a ford, see step E for design conditions and requirements prior to proceeding to step C2a.

C2a – *On the* ***Riparian Zone / Bank Modification Worksheet*** *enter length (in metres) of the proposed Bank Modification in the Riparian Zone (see table below for restrictions).*

C2b – *Record the width (in metres) of proposed Bank Modification (see table below).*

C2c – *Record the width (in metres) of the Bank Setback (see table below).*

C2e – *Draw a diagram of the proposed location of the Bank Modification (use symbols identified on worksheet to compose your diagram).*

C2f – *Draw the location of any new fords proposed (see step E for restrictions)*

C2g – *Record a description of the required reclamation works (see table below).*

Conditions and reclamation requirements when proposing Bank Modification in Riparian Zones in Moderate-low Habitats

Design Component (Bank Modification)	Requirement
Minimum Bank Setback From Stream	3.0 metres
Maximum Width of Excavation	100 metres
Minimum Width Between Bank Modification Areas	300 metres
Maximum Duration Prior to Reclamation	5 years
Reclamation Requirement (grading)	To pre-excavation grade
Reclamation Requirement (surface)	Full topsoil coverage
Reclamation Requirement (vegetation)	30% live staking

Note – The "Minimum Bank Setback From Stream" provision identified above does not apply to the construction of watercourse crossings (fords). If your proposal includes the construction of a ford, please see step E.

Once the ***Riparian Zone / Bank Modification Worksheet*** is completed, proceed to the next question.

Do you propose a Seasonal, Temporary or Permanent relocation of a channel?

NO – Proceed to step E, Watercourse Crossings.
YES – Proceed to step D, Diversion Channels.

D) Diversion Channels

Design and construction of a diversion channel is required if the proposal includes *Seasonal*, *Temporary* or *Permanent* relocation of a water course or channel. It is the responsibility of the applicant to ensure that when transferring water into a diversion channel, it is completed in such a manner as to avoid stranding of fish in the dewatered channel. If it is likely that stranding of fish will occur in a dewatered channel, the applicant should retain a qualified professional to conduct fish salvage prior to dewatering the channel. More information on fish salvage requirements is available from Fisheries and Oceans Canada.

Moderate–Low Habitat Suitability (Includes Tributaries to Large Lakes)

Provided the diversion channel design proposal meets the conditions identified in the following sections, the diversion channel may be constructed pursuant to the respective watershed *Authorization for Placer Mining Works or Undertakings Affecting Fish Habitat.* Specific criteria related to channel design and restoration requirements are described in the following sections while general information regarding design, construction and reclamation of diversion channels is provided in the *Guidebook of Mitigation Measures for Yukon Placer Mining.*

In order for a diversion channel to meet the requirements of the watershed *Authorization for Placer Mining Works or Undertakings Affecting Fish Habitat*, you must ensure that your proposed channel design achieves a total risk score of less than or equal to the maximum risk score threshold identified on the following Risk Scoring Tables. If your design exceeds this score you may wish to redesign your proposed channel in order to meet the maximum risk score, thus meeting the requirements of the authorization. If you are unable to meet the maximum risk score you are required to submit your proposal to Fisheries and Oceans Canada for site-specific review and authorization prior to proceeding.

D1. Original Channel and Site Parameters Worksheet

On the ***Original Channel and Site Parameters Worksheet*** *(Appendix C), record the information for the original channel (pre-diversion conditions). Refer to* the *Guidebook of Mitigation Measures for Yukon Placer Mining reference sections identified on the worksheet to assist you with the data collection and entry process.*

Note – The above worksheet must be completed prior to proceeding with the following steps.

Do you propose a Seasonal relocation of a channel? *(A Seasonal Channel is in place for a period of less than one year and is replaced before winter).*

YES – Proceed to Step D2, Seasonal Diversion Channels.

NO – Proceed to next question.

Do you propose a *Temporary* relocation of a channel? *(A Temporary Channel is in place for a period of less than five years).*

YES – Proceed to Step D3, Temporary Diversion Channels.

NO – Proceed to next question.

Do you propose a *Permanent* relocation of a channel? *(A Permanent Channel is in place for a period of five years or more).*

NO – Proceed to next question.

YES – Proceed to Step D4, Permanent Diversion Channels.

D2. Seasonal Diversion Channels

Seasonal diversion channels are defined as a constructed channel that will convey stream flow for no more than one operating season. This diversion channel type may not be used to convey stream flow between late fall and the following spring of any given year. Refer to the channel design considerations in the guidebook for more information on seasonal diversion channels. You will need to complete and submit the ***Channel Design Flood Estimate Worksheet*** (Appendix D3) and the ***Channel Design Method Worksheet*** (Appendix E) for your Seasonal Diversion Channel to YESAB and the YWB.

Note – Riparian Zone provisions do not apply to Seasonal Diversion Channels.

Note – Flood design interval for Seasonal Diversion Channels in Moderate-low is 1:1.

D2a. O*n the* ***Channel Design Flood Estimate Worksheet*** *(Appendix D3), enter the flood design interval (line 1).*
The following table is to be used to asses the total risk when designing a seasonal diversion channel. The channel design proposed must achieve a risk score of no higher than the maximum risk score identified.

Severity of Effect Assessment for Seasonal Diversion Channels

Design Component (Seasonal Diversion)	Range	Risk Score
Channel Gradient	3.51% to 5.0%	3
	1.51% to 3.5%	2
	0 to 1.5%	1
Length of diversion channel	1000 m to 2000 m	2
	<1000 m	1
Relative length of diversion channel	Shorter than original	1
	Equal or Longer than original	0
Permafrost in diversion channel	Present	3
	Absent	0
Primary material in diversion channel	Silt / Sand	2
	Gravel / Cobble / Bedrock	1
Location of diversion channel	Perched (valley wall)	4
	Confined (valley floor)	2
	Incised (valley floor)	1
Total Maximum Permitted Score for Seasonal Diversion Channels		**11**

D2b. *Calculate your total score and maximum permitted score on the* ***Severity of Effects Assessment for Seasonal Diversion Channel Worksheet (****Appendix D1), and* record your total score on line 2 of the **Channel** ***Design Flood Estimate Worksheet*** *(Appendix D3).*

D2c. *On the* ***Design Flood Estimate Worksheet*** *(Appendix D3), enter the information required and complete the calculations. Refer to the guidebook reference sections identified on the worksheet to assist with the data collection, entry and calculation process. Please ensure to include the completed* ***Design Flood Estimate Worksheet*** *with your submission to the YESAB and the YWB.*

Note – The Design Flood Estimate Worksheet must be completed prior to proceeding with the following steps.

D2d. Selecting a Channel Design Method

The selection of a channel design method for channel construction is dependent upon the site geography, channel conditions and channel type. The design method selected is used to define the diversion channel dimensions and drop structure requirements.

The Channel Design Method table provides a list of recommendations to guide the selection of a suitable channel design method.

Design Method	Parameter	Condition
Channel Replication	Channel Duration	Seasonal or Temporary or Permanent
	Channel Gradient	> 2%
	Channel Material in Diversion	Similar or Coarser than Original (not in seasonal channel)
	Diversion Channel Length	Any
	Floodplain	Limited to none
	Valley Type	Incised or entrenched
	Channel Stability	Stable (if original channel is diversion it must have been in place for >10 Years)
	Notes	*Optional when channel gradient is < 2%*
Floodplain Design	Channel Duration	Permanent
	Channel Gradient	< 2%
	Channel Material in Diversion	All
	Diversion Channel Length	At least 2/3 length of original channel
	Floodplain	Narrow to Wide
	Valley Type	Narrow to Wide
	Channel Stability	Any
	Notes	*Can be used in areas with no floodplain when relocation site has space to support floodplain*
Regime Channel	Channel Duration	Seasonal or Temporary or Permanent
	Channel Gradient	All
	Channel Material in Diversion	Similar or Coarser than Original (not in seasonal channel)
	Diversion Channel Length	Any
	Floodplain	Narrow to Wide
	Valley Type	Narrow to Wide
	Channel Stability	Any
	Notes	*Use when site data is insufficient to use other methods*

Select a Channel Design Method based on the criteria listed in the table above.

Moderate–Low Habitat Suitability (Includes Tributaries to Large Lakes)

In the following steps you will need to use a specific worksheet for the Channel Design Method you have selected (Channel Replication Worksheet (Appendix E1), Floodplain Design Worksheet (Appendix E2) or Regime Channel Worksheet (Appendix E3)). Do not proceed until you have selected a Channel Design Method.

Note – The Design Flood Estimate Worksheet must be completed prior to proceeding with the following sections.

D2e. On the ***Channel Design Method Worksheet*** you have selected, e*nter the information required and complete the design calculations. Refer to the guidebook reference sections identified on the worksheets to assist with the data collection, entry and calculation process. Please ensure to include the completed* ***Channel Design Method Worksheet*** *with your submission to the YESAB and the YWB.*

Note – A plan for a Seasonal Diversion Channel must be accompanied by plans for a Temporary and / or Permanent Diversion Channel (See sections D3 and / or D4).

Once the ***Channel Design Method Worksheet*** is completed, proceed to Step D3, Temporary Diversion Channels or D4, Permanent Diversion Channels.

D3. ***Temporary Diversion Channels***

Temporary diversion channels are defined as a constructed channel that will convey stream flow for a period of one to five years. Although not required, construction of fish habitat features may be incorporated in the channel design to reduce the overall risk score. To achieve this condition the channel must incorporate the required fish habitat features (based on channel configuration). Refer to the channel design considerations in the guidebook for more information on temporary diversion channels.

You will need to complete and submit the ***Channel Design Flood Estimate Worksheet*** (Appendix D3) and the ***Channel Design Method Worksheet*** (Appendix E) for your Temporary Diversion Channel to YESAB and the YWB.

Note – The Riparian Zone provisions do not apply to Temporary Diversion Channels.

Note – Flood design interval for Temporary Diversion Channels in Moderate Low is 1:5.

D3a. O*n the* ***Channel Design Flood Estimate Worksheet*** *(Appendix D3), enter the flood design interval (line 1).*

The following table is to be used when designing Temporary Diversion Channels. The channel design proposed must achieve a risk score of no higher than the maximum risk score identified to be in compliance with the respective watershed *Authorization for Placer Mining Works or Undertakings Affecting Fish Habitat*.

Severity of Effects Assessment for Temporary Diversion Channels

Design Component (Temporary Diversion)	Range	Risk Score
Channel Gradient	3.51% to 5.0%	3
	1.51% to 3.5%	2
	0 to 1.5%	1
Length of diversion channel	2000 m to 5000 m	3
	500m to 2000 m	2
	<500 m	1
Relative length of diversion channel	Shorter than original	1
	Equal or Longer than original	0
Permafrost in diversion channel	Present	2
	Absent	0
Primary material in diversion channel	Silt / Sand	2
	Gravel / Cobble / Bedrock	1
Location of diversion channel	Perched (valley wall)	4
	Confined (valley floor)	2
	Incised (valley floor)	1
Fish habitat features (rock islands / boulder groupings only)	30% of total required for permanent channel	-1
Maximum Permitted Score for Temporary Diversion Channels		**10**

D3b. *Calculate your total score and maximum permitted score on the* ***Severity of Effects Assessment for Temporary Diversion Channel Worksheet (****Appendix D2), and* record your total score on line 2 of the **Channel** ***Design Flood Estimate Worksheet*** *(Appendix D3).*

D3c. *On the* ***Channel Design Flood Estimate Worksheet*** *(Appendix D3), enter the information required and complete the calculations. Refer to the guidebook reference sections identified on the worksheet to assist with the data collection, entry and calculation process. Please ensure to include the completed* ***Design Flood Estimate Worksheet*** *with your submission to the YESAB or YWB.*

Note – The Design Flood Estimate Worksheet must be completed prior to proceeding with the following sections.

Have you selected Fish Habitat Features to generate the total risk score for your proposed Temporary Diversion Channel (in step D3b)?

NO – Proceed to Step E, Watercourse Crossings.

YES – Proceed to Step D3d, Selecting a Channel Design Method.

Moderate–Low Habitat Suitability (Includes Tributaries to Large Lakes)

D3d. Selecting a Channel Design Method

The selection of a channel design method for channel construction is dependent upon the site geography, channel conditions and channel type. The design method selected is used to define the diversion channel dimensions and drop structure requirements.

The Channel Design Method table provides a list of recommendations to guide the selection of a suitable channel design method.

Design Method	Parameter	Condition
Channel Replication	Channel Duration	Seasonal or Temporary or Permanent
	Channel Gradient	> 2%
	Channel Material in Diversion	Similar or Coarser than Original (not in seasonal channel)
	Diversion Channel Length	Any
	Floodplain	Limited to none
	Valley Type	Incised or entrenched
	Channel Stability	Stable (if original channel is diversion it must have been in place for >10 Years)
	Notes	*Optional when channel gradient is < 2%*
Floodplain Design	Channel Duration	Permanent
	Channel Gradient	< 2%
	Channel Material in Diversion	All
	Diversion Channel Length	At least 2/3 length of original channel
	Floodplain	Narrow to Wide
	Valley Type	Narrow to Wide
	Channel Stability	Any
	Notes	*Can be used in areas with no floodplain when relocation site has space to support floodplain*
Regime Channel	Channel Duration	Seasonal or Temporary or Permanent
	Channel Gradient	All
	Channel Material in Diversion	Similar or Coarser than Original (not in seasonal channel)
	Diversion Channel Length	Any
	Floodplain	Narrow to Wide
	Valley Type	Narrow to Wide
	Channel Stability	Any
	Notes	*Use when site data is insufficient to use other methods*

Select a Channel Design Method based on the criteria listed in the table above.

In the following steps you will need to use a specific worksheet for the Channel Design Method you have selected (Channel Replication Worksheet (Appendix E1), Floodplain Design Worksheet (Appendix E2) or Regime Channel Worksheet (Appendix E3)). Do not proceed until you have selected a Channel Design Method.

D3e. Fish Habitat Features

If you have included Fish Habitat Features in your proposed Temporary Diversion Channel you must select the appropriate spacing of features based on the Channel Type identified on the ***Original Channel and Site Parameters Worksheet***. Refer to the fish habitat feature considerations in the guidebook for more information. Use the following tables as a guide to fill out information requirements in the ***Fish Habitat Feature Worksheet*** (Appendix F).

Fish Habitat Reclamation Requirements for Temporary Diversion Channels

Pool-riffle / Dune-riffle and **Plane-bed** channel type

Select Fish Habitat Feature Based on Diversion Channel Width	Spacing Requirements (place feature every X channel width)
Rock Island (channel width < 5m)	18
Boulder Grouping (channel width > 5m)	16
Rip-rap	Based on channel design method

Step-pool and **Cascade** channel type

Select Fish Habitat Feature Based on Diversion Channel Width	Spacing Requirements (place feature every X channel width)
Rock Island (channel width < 5m)	15
Boulder Grouping (channel width > 5m)	9
Rip-rap	Based on channel design method

D3f. *Enter the required information on the* ***Fish Habitat Feature Worksheet*** *(Appendix F) to identify the type, spacing and relative location of the fish habitat features. Draw a diagram of the diversion channel (include north arrow, flow direction) (use symbols identified on worksheet to compose your diagram).*

Note – If your Temporary Diversion Channel includes fish habitat features, and you propose to construct a crossing (new ford) be sure to identify the location of the ford on the *Fish Habitat Features Worksheet* (see step E2).

Proceed to following steps if: D4, constructing a Permanent Diversion Channel.
E, proposing to construct a new stream crossing.
F, proposing to acquire water.

D4. Permanent Diversion Channels

Permanent diversion channels are defined as a constructed channel that will convey stream flow for a period of over five years. All permanent diversion channels must include provisions for construction of fish habitat features. Refer to the channel design considerations in the guidebook for more information on permanent diversion channels. You will need to complete and submit the ***Channel Design Flood Estimate Worksheet*** (Appendix D3), the ***Channel Design Method Worksheet*** (Appendix E) and the ***Fish Habitat Features Worksheet*** (Appendix F) for your Permanent Diversion Channel to YESAB and the YWB.

Note – Flood design interval for Permanent Diversion Channels in Moderate Low Habitat is 1:10.

D4a. *On the* ***Channel Design Flood Estimate Worksheet*** *(Appendix D3), enter the flood design interval (line 1).*

D4b. *On the* ***Design Flood Estimate Worksheet*** *(Appendix D3), enter the information required and complete the calculations. Refer to the guidebook reference sections identified on the worksheet to assist with the data collection, entry and calculation process. Please ensure to include the completed* ***Design Flood Estimate Worksheet*** *with your submission to the YESAB and the YWB.*

Note – The Design Flood Estimate Worksheet must be completed prior to proceeding with the following steps.

D4c. Selecting a Channel Design Method

The selection of a channel design method for channel construction is dependent upon the site geography, channel conditions and channel type. The design method selected is used to define the diversion channel dimensions and drop structure requirements.

The Channel Design Method table provides a list of recommendations to guide the selection of a suitable channel design method.

Design Method	**Parameter**	**Condition**
Channel Replication	Channel Duration	Seasonal or Temporary or Permanent
	Channel Gradient	> 2%
	Channel Material in Diversion	Similar or Coarser than Original (not in seasonal channel)
	Diversion Channel Length	Any
	Floodplain	Limited to none
	Valley Type	Incised or entrenched
	Channel Stability	Stable (if original channel is diversion it must have been in place for >10 Years)
	Notes	*Optional when channel gradient is < 2%*
Floodplain Design	Channel Duration	Permanent
	Channel Gradient	< 2%
	Channel Material in Diversion	All
	Diversion Channel Length	At least 2/3 length of original channel
	Floodplain	Narrow to Wide
	Valley Type	Narrow to Wide
	Channel Stability	Any
	Notes	*Can be used in areas with no floodplain when relocation site has space to support floodplain*
	Channel Duration	Seasonal or Temporary or Permanent

	Channel Gradient	All
	Channel Material in Diversion	Similar or Coarser than Original (not in seasonal channel)
Regime Channel	Diversion Channel Length	Any
	Floodplain	Narrow to Wide
	Valley Type	Narrow to Wide
	Channel Stability	Any
	Notes	*Use when site data is insufficient to use other methods*

Select a Channel Design Method based on the criteria listed in the table above.

In the following steps you will need to use a specific worksheet for the Channel Design Method you have selected (Channel Replication Worksheet (Appendix E1), Floodplain Design Worksheet (Appendix E2) or Regime Channel Worksheet (Appendix E3)). Do not proceed until you have selected a Channel Design Method.

Note – The Design Flood Estimate Worksheet must be completed prior to proceeding with the following sections.

D4d. On the ***Channel Design Method Worksheet*** you have selected, e*nter the information required and complete the design calculations. Refer to the guidebook reference sections identified on the worksheets to assist with the data collection, entry and calculation process. Please ensure to include the completed* ***Channel Design Method Worksheet*** *with your submission to the YESAB and the YWB.*

The following tables identify design restrictions and fish habitat reclamation requirements for Permanent Diversion Channels which must be incorporated to be in compliance with the respective watershed *Authorization for Placer Mining Works or Undertakings Affecting Fish Habitat*.

Design Restrictions for Permanent Diversion Channels

Design Component (Permanent Diversion)	**Criteria**
Overall length of diversion channel	< 5000 m
Conveyance (flood design) capacity	1:10
Channel design	As per channel design worksheets
Fish Habitat Features	As per reclamation tables

Note – in the next step you will need to refer to the *Original Channel and Site Parameters Worksheet (Appendix C)* in order to select the appropriate category of the original channel type (Pool-riffle, Dune-riffle, Plane-bed, Step-pool or Cascade Channel). For more information on channel types see the *Guidebook of Mitigation Measures for Yukon Placer Mining.*

Construction and Reclamation Requirements for Permanent Diversion Channels
Pool-riffle / **Dune-riffle** and **Plane-bed** channel type.

Fish Habitat Features	**Spacing Requirements** (multiply the number in this column by the width of the channel in metres)
Rock Island (channel width < 5m)	6
Boulder Grouping (channel width > 5m)	4
Anchored or Buried trees	20
Top Soil Spreading	Continuous (both banks)
Willow staking	Inside bank, alternating meander bends
Transplanting	At sharp bends
Rip-rap	Based on channel design method

Step-pool and **Cascade Channel** type

Fish Habitat Feature	**Spacing Requirements** (multiply the number in this column by the width of the channel in metres)
Rock Island (channel width < 5m)	5
Boulder Grouping (channel width > 5m)	3
Anchored or Buried trees	14
Top Soil Spreading	Continuous (both banks)
Willow staking	Inside bank, alternating meander bends
Transplanting	At sharp bends only
Rip-rap	Based on channel design method

Note - Topsoil spreading is to occur for the full width of the Riparian Zone (5 metres), willow planting is to be completed to a width of 3 metres from the bank, Willow staking / Transplanting is not required for the floodplain design method.

D4e. *Use the information above to complete the* ***Fish Habitat Feature Worksheet*** *(Appendix G) to identify the type, spacing and relative location of the fish habitat features. Draw a diagram of the diversion channel (include north arrow, flow direction and reclaimed Riparian Zone) (use symbols identified on worksheet to compose your diagram).*

Note – If you propose to construct a crossing (new ford) be sure to identify the location of the ford on the *Fish Habitat Feature Worksheet* (see section E2).

Once the ***Fish Habitat Feature Worksheet*** is completed, proceed to the next question.

Do you propose to use an Existing Ford?

NO – Proceed to next question.

YES – Proceed to Step E, Watercourse Crossings, then E1, Use of Existing Ford.

Moderate–Low Habitat Suitability (Includes Tributaries to Large Lakes)

Do you propose to construct a New Ford?

NO – Proceed to Step F, Water Acquisition.

YES – Proceed to Step E, Watercourse Crossings.

E. Watercourse Crossings (Fords)

Fording is defined as the crossing of creeks, streams and / or rivers at locations where a bridge, causeway or elevated embankment does not exist or is not utilized by a vehicle or equipment. Fording typically involves driving directly through a watercourse, across the banks and bed. In some instances, Fording locations (*Fords*) have been "improved" or constructed through watercourses by way of adding materials such as rocks or gravel, the modification of approaches, or the modification of the bed of a watercourse.

E1. Use of Existing Ford

Use of existing Fords is often the least preferred option for crossing watercourses however it is recognized that there are instances where it is the only viable option. Refer to the *Guidebook of Mitigation Measures for Yukon Placer Mining* for additional information on Fords. The following measures should be adhered to when utilizing existing Fords.

NOTE – Please identify if you intend to use Existing Fords on the Project Location Worksheet (Appendix A).

- Ensure water depth is sufficiently shallow to allow passage of vehicle / equipment.
- Plan your activities in advance to minimize the number of crossings required.
- Avoid crossing during extreme rain or flood events.
- Access approaches at 90° to the bank, when entering or exiting the ford.
- Maintain speed at a very slow and steady pace throughout the crossing.
- Avoid rapid acceleration while on approaches or while in the water.

E2. Construction of New Fords

Construction of new Fords should be limited to locations or applications where deemed to be absolutely necessary. More permanent or high use locations should employ the construction and use of a bridge as the primary crossing structure where possible. For more information on construction of stream crossings refer to the *Guidebook of Mitigation Measures for Yukon Placer Mining.*

The location of new Fords must be identified when proposed for original channels, Temporary Channels (with Fish Habitat Features), and Permanent Diversion Channels. The new ford proposed must achieve the design, construction and reclamation requirements identified in the table below to be in compliance with the respective watershed *Authorization for Placer Mining Works or Undertakings Affecting Fish Habitat*.

Design and Construction Restrictions and Reclamation Requirements for New Fords

Design Component (Construction of new Ford)	Requirement
Approach angle	90° to bank
Maximum width of approach zone clearing (surface)	10 metres
Minimum watercourse distance between Ford sites or Not to exceed more than	800 metres 3 fords / 2000 metres
Site Selection (Watercourse)	Shallow Water Depth
Site Selection (Approach / Bank Composition)	Gravel / Cobble
Construction	Equipment to Work from Bank
Maximum width of bank grading (subsurface)	10 metres
Approach surface ground coverage	Gravel / Cobble
Construction timing	Low Water Period
Reclamation	Full Topsoil Coverage

Note – The above design considerations are not required for Construction of Fords in Seasonal Diversion Channels.

E2a. *If the construction of a new ford is proposed for an original channel or previously restored channel, identify the location of the new ford(s) on the* ***Riparian Zone / Bank Modification Worksheet*** *(see step C, Riparian Zones and Appendix B).*

E2b. *If the construction of a new ford is proposed for a Temporary Diversion Channel (with fish habitat features) or a Permanent Diversion Channel, identify the location of the new ford(s) on the* ***Fish Habitat Feature Worksheet*** *(see step D3d or D4b and Appendix F).*

Once the location and specification of the new ford is identified on either the completed ***Riparian Zone / Bank Modification Worksheet*** *or the* ***Fish Habitat Feature Worksheet*** proceed to the next question.

Do you propose to withdraw water from a Moderate-low habitat suitability watercourse?

NO – Proceed to Step G, In-stream Works.

YES – Proceed to Step F, Water Acquisition.

F. Water Acquisition

Acquisition of water is required for processing materials during placer mining. Effective water management is a key consideration at all placer mine sites. The following requirements must be achieved to meet compliance with the respective watershed *Authorization for Placer Mining Works or Undertakings Affecting Fish Habitat*.

Moderate–Low Habitat Suitability (Includes Tributaries to Large Lakes)

F1. Water Intake Screens

In order to meet the requirement of the *Fisheries Act*, all water intakes must be screened in accordance with requirements identified in the Fisheries and Oceans Canada Intake End-of-Pipe Fish Screen Guidelines. A general summary of the guideline requirements are provided in the following table. For more information regarding fish screens, please refer to the guidebook or for more specialized applications please refer to the Fisheries and Oceans Canada Intake End-of-Pipe Fish Screen Guidelines (available online or through Fisheries and Oceans Canada).

General Guidelines for Intake Screens

Design Component (Fish Screens)	Requirement
Screen Openings (Imperial)	No less than 8 openings per lineal inch, with openings no greater than 1/8 inch along any given side of the screen. If a punch plate or similar material is used, openings no greater than 1/8 inches in length or width are permitted.
Screen Openings (Metric)	No less than 3.5 openings per lineal cm, with openings no greater than 3.2 mm along any given side of the screen. If a punch plate or similar material is used, openings no greater than 3.2 mm in length or width are permitted.
Screen Area (Imperial)	1 ft^2 of open screen area per 45 imperial / 55 US gallons per minute of water withdrawn is required.
Screen Area (Metric)	929 cm^2 of open screen area per 205 litres per minute of water withdrawn is required.

Note: the objective behind the installation of intake screens is to prevent the destruction of fish through the acquisition of water. If screens of the correct mesh size are deployed between a watercourse and the intake to a water reservoir or gravity feed ditch, it is not necessary to screen the pump intake that removes water from within these structures provided these structures do not already contain fish. In the case of total recirculation systems, the operator shall ensure that any areas where fish could enter the system have barriers to prevent the entry of fish (unless the pump intake is appropriately screened).

Do you propose to carry out in-stream works within a watercourse? In-stream works may include small dugouts or wing dams to facilitate water acquisition, in-stream settling facilities, in-stream reservoirs, and use of a stream channel as a conduit to transport process water to out-of-stream settling ponds.

NO – Proceed to next question.

YES – Proceed to Step G, In-stream Works.

Moderate–Low Habitat Suitability (Includes Tributaries to Large Lakes)

G. In-stream Works

In-stream works are defined as works that occur within the high water mark of a watercourse, but do not include diversion channels or fords. Some in-stream works can lead to effects on fish and fish habitat such as erosion/scouring, sediment inputs, loss of habitat area, changes in channel morphology, blockages to passage, and reduced productivity.

Do you propose to carry out in-stream works within a watercourse? In-stream works may include small dugouts or wing dams to facilitate water acquisition, in-stream settling facilities, in-stream reservoirs, and use of a stream channel as a conduit to transport process water to out-of-stream settling ponds.

NO – Review complete – proceed with submission of all completed worksheets along with your project description to YESAB and your application for water use license to YWB.

YES – Proceed to Step G1, Severity of Effects Assessment.

Habitats of Moderate-Low Suitability

In-stream settling facilities and use of a stream channel as a conduit to transport process water to out-of-stream settling ponds may be authorized under the auspices of a watershed-based authorization in habitats of Moderate-low suitability under strictly specified conditions. In order to determine whether your site qualifies, please complete the worksheet found in Section I.

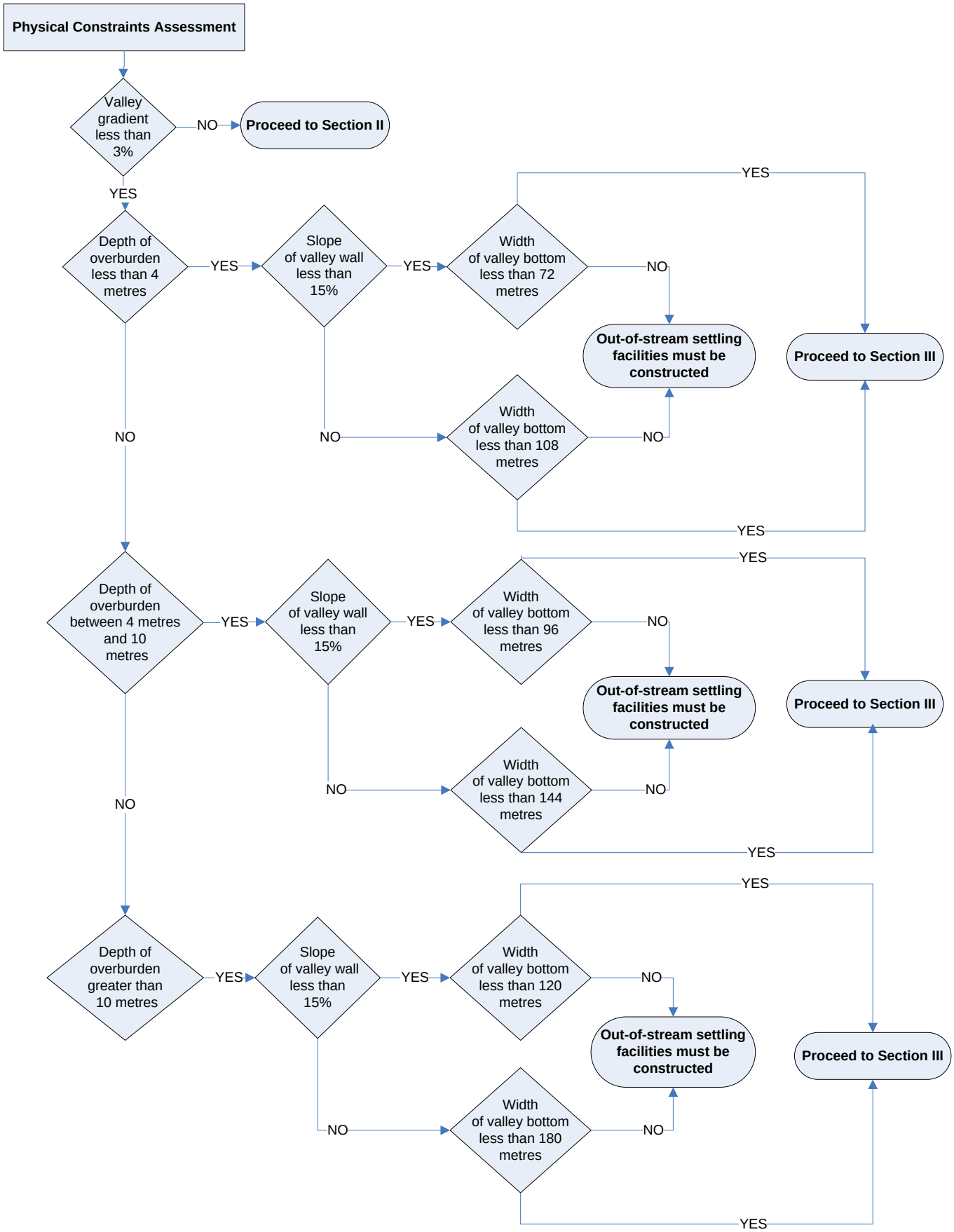
In-stream reservoirs constructed with cross-channel dams are not authorized under watershed-based authorizations in habitats of Moderate-low suitability, unless a previously authorized in-stream settling pond is used for this purpose prior to stream channel restoration. Operators may apply to Fisheries and Oceans Canada for a site-specific review of plans to construct in-stream reservoirs using cross-channel dams.

Section I

Use the following flowchart to evaluate whether your site is suitable for construction of in-stream settling facilities or the use of a stream channel as a conduit.

Please note that authorization to construct in-stream settling facilities or to use a stream channel as a conduit is conditional and that these works may not be permitted. Depending upon the scale of operation or size of earth-moving equipment out-of-stream settling facilities may be required in proximity to working areas.

Worksheet for Instream Settling Ponds and Use of Stream Channel as Conduit



Section II

The valley bottom you intend to mine is not ideal for the construction of settling ponds, due to its steep gradient. Use of the stream channel as a conduit for transporting process water to the nearest suitable site for out-of-stream settling ponds may be permitted.

Do you have the right to construct settling facilities on placer claims immediately below your working area where the valley gradient is less than or equal to 3%, and the habitat classification remains Moderate-low?

YES - Use the flowchart above to evaluate whether your site is suitable for construction of out-of stream settling facilities.
NO – Prior to proceeding with this proposal you must apply to Fisheries and Oceans Canada for a site-specific review of your project.

Section III

The valley bottom you intend to mine can not accommodate an out-of-stream settling facility, due to its narrow width. If you have the right to construct out-of stream settling facilities on placer claims immediately below your working area, and the habitat classification remains Moderate-low, use of the stream as a conduit for transporting process water to this downstream location may be permitted. If not, construction of in-stream settling ponds may be permitted. The following conditions apply to construction of these in-stream works:

- Construction and maintenance of a pre-settling pond is mandatory;
- If it is likely that stranding of fish will occur in a dewatered channel, the applicant should retain a qualified professional to conduct a fish salvage prior to dewatering the channel. More information on fish salvage requirements is available from Fisheries and Oceans Canada;
- Only compactable material (fine gravel and sand) may be used as core material in dam construction, while coarse material should be used on the surfaces to prevent erosion;
- Material must be placed in shallow (< 0.3 metre) lifts and compacted when dams are constructed;
- Sluicing must be terminated if stream flows increase to bank-full width in response to rainfall events;
- Settling ponds must be mechanically cleaned and equipped with well–armoured spillways in order to maintain stability during spring freshet; or
- A stable bypass channel must be constructed to protect the settling pond cells from high flows during spring freshet; and
- Stream channel restoration must commence once these in-stream works are no longer required for current mining activities.

The following table is to be used to evaluate the risk of proposed in-stream works in Moderate-low suitability habitats. The design elements of the proposed works must achieve a risk score of no higher than the maximum risk score identified to be in compliance with the respective watershed *Authorization for Placer Mining Works or Undertakings Affecting Fish Habitat*.

Please note that in-stream settling ponds must be constructed from compactable material that is placed and compacted in shallow lifts.

Design Component	Range	Risk Score
Channel Width Construction	>30% channel constriction 5% - 30% of the channel < 5%	3 2 1
Above and Below the Structure – Difference in Water Surface	>2.0 m 0.3 – 2.0 m < 0.3 m	3 2 1
Material Type	Fine (silt-sand) Coarse (fine gravel and sand) Metal/ riprap/ structure	N/A 2 1
Construction Method	Non-compaction/ dumped Moderately compacted/ placement Compacted shallow lift	3 2 1
Amount of In-water Work	Completely in water Partially in water (more than ½) In dry	3 2 1
Structure Height	Above bank full Between bank full and channel bed Below channel bed	3 2 1
MAXIMUM PERMITTED SCORE FOR IN-STREAM WORKS		**14**

G1. *Calculate your total score and maximum permitted score on the* ***Severity of Effects Assessment for In-stream Works Worksheet (****Appendix G1), and record details of proposed in-stream works on the* ***In-stream Works Worksheet*** *(Appendix G2). Proceed with submission of proposal.*