PROPOSED

Species at Risk Act
Recovery Strategy Series
Adopted under Section 44 of SARA

Recovery Strategy for the Rocky Mountain Tailed Frog (*Ascaphus montanus*) in Canada

Rocky Mountain Tailed Frog

2015

Government of Canada
Gouvernement du Canada

Canada

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For copies of the recovery strategy, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the SAR Public Registry[1].

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[1] http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

RECOVERY STRATEGY FOR THE ROCKY MOUNTAIN TAILED FROG (*Ascaphus montanus*) IN CANADA

2015

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the *Recovery Plan for the Rocky Mountain Tailed Frog (*Ascaphus montanus*) in British Columbia* (Part 2) under Section 44 of the *Species at Risk Act.* Environment Canada has included an addition which completes the SARA requirements for this recovery strategy.

The federal recovery strategy for the Rocky Mountain Tailed Frog in Canada consists of two parts:

Part 1 – Federal addition to the *Recovery Plan for the Rocky Mountain Tailed Frog (*Ascaphus montanus*) in British Columbia*, prepared by Environment Canada.

Part 2 - *Recovery Plan for the Rocky Mountain Tailed Frog (*Ascaphus montanus*) in British Columbia*, prepared by British Columbia Ministry of Environment.

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PART 1 - Federal Addition to the *Recovery Plan for the Rocky Mountain Tailed Frog (*Ascaphus montanus*) in British Columbia*, prepared by Environment Canada

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment is the competent minister for the recovery of the Rocky Mountain Tailed Frog and has prepared the federal component of this recovery strategy (Part 1), as per section 37 of SARA. It has been prepared in cooperation with the Province of British Columbia (B.C.). SARA section 44 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for content (sub-sections 41(1) or (2)). The Province of British Columbia provided the attached recovery plan for the Rocky Mountain Tailed Frog (Part 2) as science advice to the jurisdictions responsible for managing the species in British Columbia. It was prepared in cooperation with Environment Canada.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Rocky Mountain Tailed Frog and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=En&n=6B319869-1%20

ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT

The following sections have been included to address specific requirements of SARA that are not addressed in the "Recovery Plan for the Rocky Mountain Tailed Frog (*Ascaphus montanus*) in British Columbia" (Part 2 of this document, referred to henceforth as "the provincial recovery plan") and to provide updated or additional information.

Under SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Therefore, statements in the provincial recovery plan referring to protection of survival/recovery habitat may not directly correspond to federal requirements, and are not being adopted by Environment Canada as part of the federal recovery strategy. Whether particular measures or actions will result in protection of critical habitat under SARA will be assessed following publication of the federal recovery strategy.

1. Critical Habitat

1.1 Identification of the Species' Critical Habitat

Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Section 7.1.1 of the provincial recovery plan for this species describes biophysical attributes that are required by Rocky Mountain Tailed Frog. Environment Canada accepts the description of biophysical attributes as stated in the provincial recovery plan as the definition of biophysical attributes that comprise the critical habitat identification in the federal recovery strategy. The following text replaces section 7.1.2 of the provincial recovery plan, which describes the geospatial area containing survival/recovery habitat.

Critical habitat for Rocky Mountain Tailed Frog is identified for all habitable stream reaches and the associated riparian habitat within the species' known range in Canada as outlined by Figure 4 (A,B) in the provincial recovery plan, that meet the biophysical attributes described in section 7.1.1 in the provincial recovery plan. More precise or refined boundaries may be mapped, and/or additional critical habitat may be added in the future if ongoing research (e.g. through work by the province, stewardship and recovery groups, university projects, or related federal Interdepartmental Recovery Fund projects) supports the inclusion of areas beyond those identified in this document. A primary consideration in the identification of critical habitat is the amount, quality, and locations of habitat needed to achieve the population and distribution objectives. Detailed methods and decision-making processes relating to critical habitat identification are archived in a supporting document; these methods are summarized below.

The precautionary approach of applying the identification to all habitable stream reaches within the species' known range is considered appropriate considering the high likelihood of Rocky Mountain Tailed Frog being present in suitable habitat within this range. Current

data (e.g. Montana Fish, Wildlife & Parks unpubl. data 2013) suggests that Rocky Mountain Frog has a greater distribution within this area than previous sampling/sighting records have shown. Further, visual searches that have been used to detect Rocky Mountain Tailed Frog are not considered to be as accurate as other methods such as electroshocking (Cossel et. al 2012) and eDNA sampling, therefore false negative searches within the area are likely. Another factor influencing the approach to critical habitat identification is recognition that the Rocky Mountain Tailed Frog adults may move to colonize neighbouring streams, and that tadpoles in particular may be swept downstream from known inhabited reaches and persist in those lower reaches (i.e. distribution is not necessarily fixed to past stream sighting/confirmed location).

The species' known range is defined as the boundaries established by inventory efforts. Stream reaches were delineated using 1:20,000 scale maps (source: Government of British Columbia). The downstream limit of each stream reach was estimated; in most cases, these occur at confluences with larger reaches. Streams reaches that were deemed too cold to support Rocky Mountain Tailed Frog were excluded (data source: Dupuis and Friele 2004; see Dupuis and Friele 2005 Figure 7); Brown (1975) found that eggs only develop above 5°C, and Dupuis and Friele (2006) implied that creeks reaching less than or equal to 8.5°C by the afternoon in late summer have too short a growing season to support viable breeding. Riparian habitats were delineated using a 50 m critical function zone[3] on either side of the centre of each stream (total critical function zone width = 100 m). A 50 m radius was added to the ends of reaches.

All habitable stream reaches were used to ensure dispersal opportunities between streams are maintained; this is known to be important for gene transfer. Under natural disturbance regimes (wildfire), this movement is thought to take place via older forest stands that persist in patches of forest skipped by wildfire (Spear and Storfer 2010). However, Rocky Mountain Tailed Frog range in Canada is dominated by industrial forest management activities with extensive logging activity in the upland forest matrix between inhabited stream reaches. Under these conditions, Rocky Mountain Tailed Frog has been shown to be more reliant on intact riparian zone habitats with very little occurrence in the drier upland forests (Spear and Storfer 2010).

The 50 m critical function zone was deemed reasonable to capture the majority of the riparian zone immediately adjacent to inhabited streams. These areas are essential to Rocky Mountain Tailed Frog. *Ascaphus* frogs are more susceptible to desiccation than any other anuran in North America (Claussen 1973; Brown 1975). The relatively dry upland forest beyond the riparian zone can be too harsh for Rocky Mountain Tailed Frogs. Removal of riparian vegetation is well documented to increase stream temperature (Bury 2008; see reviews in Hauer et al. 2007 and Olson et al. 2007).

Riparian zones are not linear, but vary in width based on soils, terrain (slopes), aspect and other factors. However, detailed mapping of these zones is marginal. The best

[3] A "critical function zone" distance is defined as the threshold habitat fragment size required for ensuring the growth, survival, and successful reproduction of a species such that all life history stages are supported.

representation is Predictive Ecosystem Mapping (PEM) but this tool was deemed unsuitable, in part because it doesn't account for slope. Steep side-sloped reaches in PEM significantly underestimate the width of riparian buffer and would not offer sufficient suitable habitat. The 50 m critical function zone on each side is irrespective of slope and should capture the majority of riparian habitats used by Rocky Mountain Tailed Frog. This width is consistent with other habitat protection measures for Rocky Mountain Tailed Frog (Province of British Columbia 2005a; 2005b) and is toward the upper range of riparian buffer widths considered for conservation elsewhere (see Table 5 in Olson et al. 2007).

The total area within which critical habitat is found is 4464.8 ha, as shown by the detailed (yellow) polygons on Figure 1 and Figure 2 (see also Appendix A). The 1 km x 1 km UTM (red) grid overlay shown on these figures is a standardized national grid system that indicates the general geographic area containing critical habitat, for land use planning and/or environmental assessment purposes. Critical habitat can only be partially identified at this time. New records of Rocky Mountain Tailed Frog that expand the species range in Canada have been reported for the Flathead River watershed (Montana Fish, Wildlife & Parks unpubl. data 2013). A schedule of studies has been included to provide the information necessary to complete the identification of critical habitat. The identification of critical habitat will be updated when the information becomes available, either in a revised recovery strategy or action plan(s).

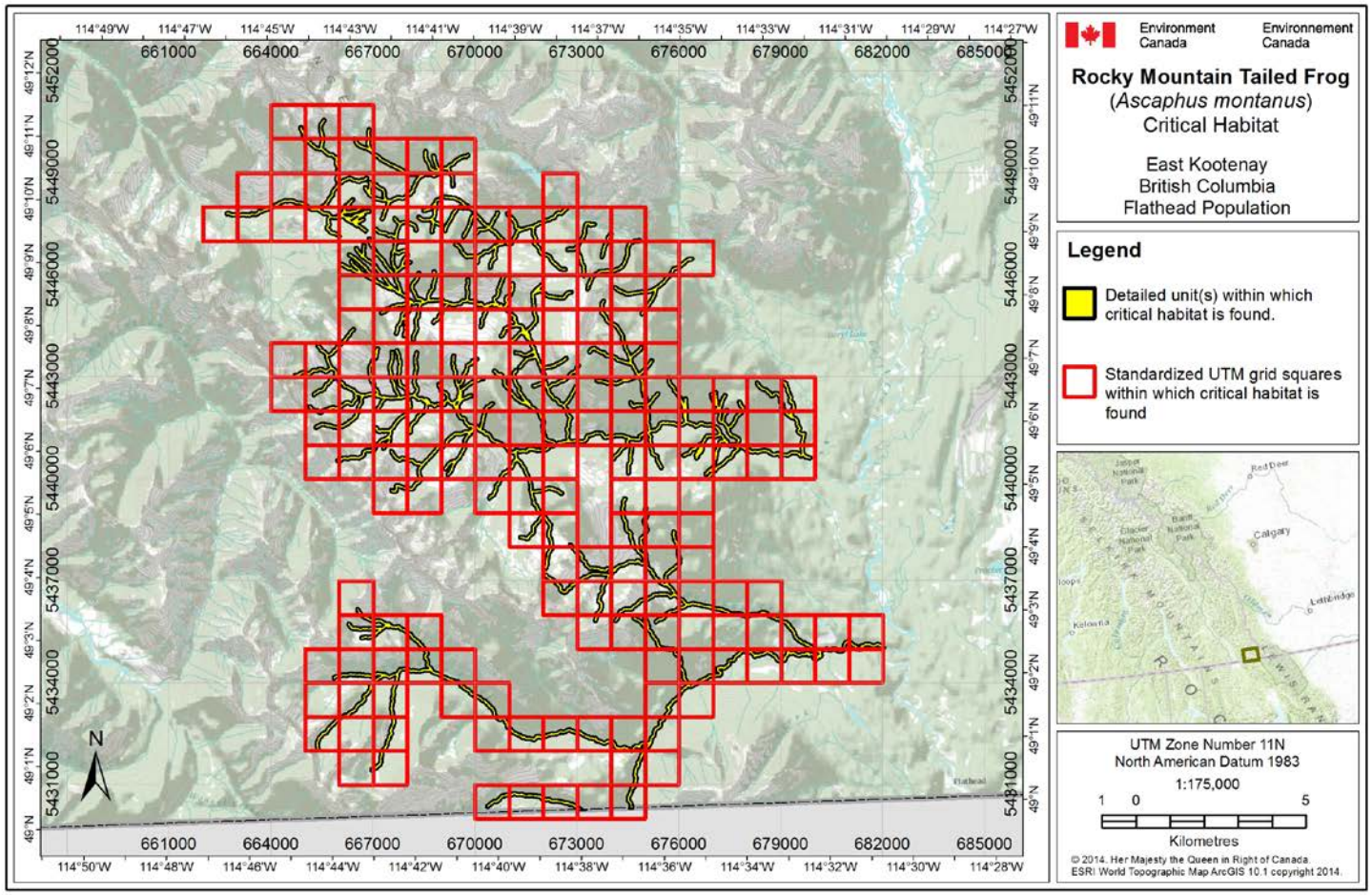

Figure 1: Critical habitat for Rocky Mountain Tailed Frog in the Flathead River watershed is represented by the yellow shaded polygons (units), where the the biophysical attributes described in section 7.1.1 in the provincial recovery plan are met.
The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area within which critical habitat is found in Canada; USA landbase (shaded grey) is excluded.

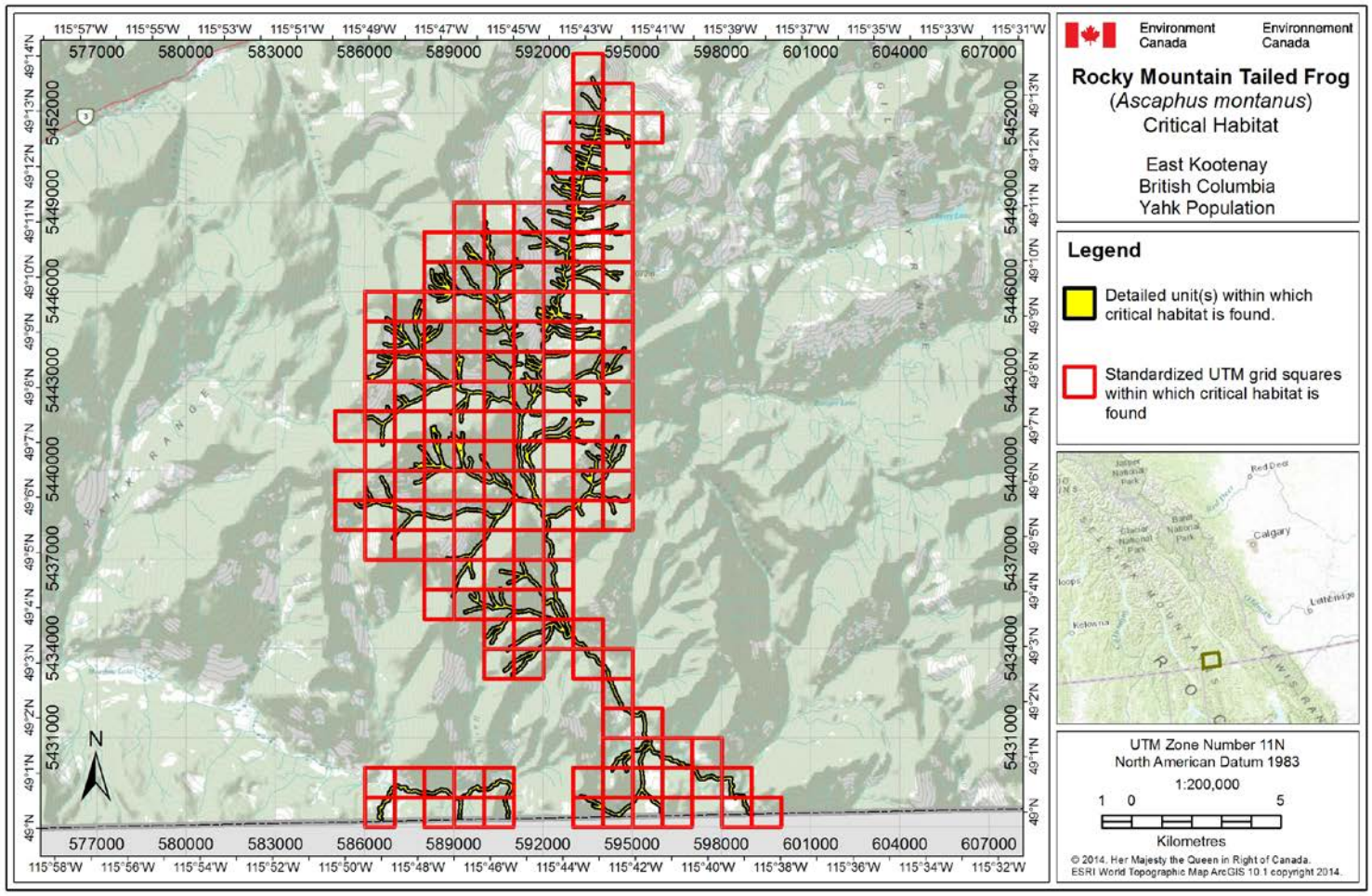

Figure 2: Critical habitat for Rocky Mountain Tailed Frog in the Yahk River watershed is represented by the yellow shaded polygons (units), where the the biophysical attributes described in section 7.1.1 in the provincial recovery plan are met. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area within which critical habitat is found in Canada; USA landbase (shaded grey) is excluded.

1.2 Schedule of Studies to Identify Critical Habitat

The following text replaces section 7.2 of the provincial recovery plan.

Sightings of Rocky Mountain Tailed Frog that expand the species range in Canada have been reported for the Flathead River watershed (Montana Fish, Wildlife & Parks unpubl. data 2013). These reports require verification such that all critical habitat for Rocky Mountain Tailed Frog is identified. Stream reaches where Rocky Mountain Tailed Frog is confirmed should be added as critical habitat following the methodology outlined in section 1.1. The suggested time frame for collecting this information and completing the critical habitat identification is 2014 – 2019 (i.e., 5 years).

1.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time. The provincial recovery plan provides a detailed description of limitations and potential threats to Rocky Mountain Tailed Frog. Activities described in Table 1 include those likely to cause destruction of critical habitat for the species; destructive activities are not limited to those listed.

Table 1. Examples of activities likely to result in destruction of critical habitat for Rocky Mountain Tailed Frog. IUCN Threat numbers are in accordance with the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system (CMP 2010).

Description of Activity	Description of Effect	Additional Information
Forest harvest in riparian zone	Loss of riparian forest cover alters hydrological regime and increases stream temperature, and may cause increased sediment input into streams. These effects can cause direct or indirect loss of critical habitat.	Related IUCN-CMP Threat # 5.3; 9.3; Area- or site – level threat, occurring inside or outside the bounds of CH; effects can be direct and/or cumulative
Forest harvest in upland zone	Logging surrounding upland forests can alter hydrological regimes such that critical habitat is destroyed.	Related IUCN-CMP Threat # 5.3; 9.3; Area- or site- level threat, occurring inside or outside the bounds of CH; effects can be direct and/or cumulative

Description of Activity	Description of Effect	Additional Information
Mining activities	Loss of riparian forest cover alters hydrological regime and increases stream temperature, and may cause increased sediment input into streams. Removal of surrounding upland forests can also alter hydrological regimes. Effluents may pollute streams such that critical habitat is destroyed.	Related IUCN-CMP Threat # 3.1; 3.2; 9.3; may occur inside or outside the bounds of critical habitat to cause destruction; direct and/or indirect loss, effects can be cumulative
Road Construction	New roads remove riparian habitat at stream crossings, increase sediment inputs into stream, alter hydrological regime, flow rates, water temperature.	Related IUCN-CMP Threat # 4.1; 9.3; may occur inside or outside the bounds of critical habitat to cause destruction; direct and/or indirect loss, effects can be cumulative
Improper road maintenance	Poorly maintained current roads increase sediment inputs into stream, alter hydrological regime, flow rates, water temperature.	Related IUCN-CMP Threat # 4.1; 9.3; may occur inside or outside the bounds of critical habitat to cause destruction; indirect loss, effects can be cumulative
Installation and use of hydroelectric generation in stream	Hydroelectric generation in stream would increase sediment inputs into stream, alter hydrological regime, flow rates, water temperature.	Related IUCN-CMP Threat # 3.3; 9.3; may occur inside or outside the bounds of critical habitat to cause destruction; direct and/or indirect loss, effects can be cumulative
Inappropriate livestock management (e.g., allowing livestock in stream and riparian areas)	Trampling by ranging livestock will increase sedimentation, reduce riparian vegetation (leading to altered hydrological regimes and raised water temperature) and pollute waterways.	Related IUCN-CMP Threat # 2.3; 9.3; may occur inside or outside the bounds of critical habitat to cause destruction; direct and/or indirect loss, effects can be cumulative
Sump installation and use in streams	Installation of sump pumps to draw water, usually for fire fighting purposes will reduce water volume, disturb riparian cover (leading to altered hydrological regimes and raised water temperature), increase sedimentation.	Related IUCN-CMP Threat # 7.1; 9.3; may occur inside or outside the bounds of critical habitat to cause destruction; direct and/or indirect loss, effects can be cumulative
Use of off-road motorized vehicles outside of established trails and roads	Motorized vehicles operating off-road in the riparian zone and/or the waterway will reduce riparian vegetation (leading to altered hydrological regimes and raised water temperature) and pollute waterways.	Related IUCN-CMP Threat # 6.1; 9.3; may occur inside or outside the bounds of critical habitat to cause destruction; direct and/or indirect loss, effects can be cumulative

2. Statement on Action Plans

An action plan for Rocky Mountain Tailed Frog will be posted on the Species at Risk Public Registry by 2019.

3. Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[4]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[5] (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

The provincial recovery plan for Rocky Mountain Tailed Frog contains a section describing the effects of recovery activities on other species (i.e., Section 9). Environment Canada adopts this section of the provincial recovery plan as the statement on effects of recovery activities on the environment and other species.

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Appendix A: Table of UTM grids encompassing Critical Habitat.

Table A1: List of 1 km x 1 km UTM grid squares (generated by the standardized national grid system) that indicates the general geographic areas containing critical habitat for Rocky Mountain Tailed Frog in Canada.

Grid Number	EASTING[a]	NORTHING[a]	CH Area (ha)[b] within Grid	Land Tenure[c]
1	593000	5453000	2.20	Provincial
2	593000	5452000	17.98	Provincial
3	594000	5452000	2.00	Provincial
4	592000	5451000	1.06	Provincial
5	593000	5451000	28.61	Provincial
6	594000	5451000	15.57	Provincial
7	595000	5451000	0.01	Provincial
8	592000	5450000	5.02	Provincial
9	593000	5450000	39.96	Provincial
10	594000	5450000	2.75	Provincial
11	664000	5450000	3.77	Provincial
12	665000	5450000	6.74	Provincial
13	666000	5450000	3.68	Provincial
14	592000	5449000	25.71	Provincial
15	593000	5449000	32.77	Provincial
16	594000	5449000	4.99	Provincial
17	664000	5449000	0.37	Provincial
18	665000	5449000	18.17	Provincial
19	666000	5449000	10.13	Provincial
20	667000	5449000	11.45	Provincial
21	668000	5449000	15.88	Provincial
22	669000	5449000	11.09	Provincial, Private
23	589000	5448000	0.54	Provincial
24	590000	5448000	4.29	Provincial
25	591000	5448000	7.69	Provincial
26	592000	5448000	23.02	Provincial
27	593000	5448000	31.24	Provincial
28	594000	5448000	12.75	Provincial
29	663000	5448000	0.15	Provincial
30	664000	5448000	10.45	Provincial
31	665000	5448000	13.08	Provincial
32	666000	5448000	20.70	Provincial
33	667000	5448000	18.41	Provincial
34	668000	5448000	20.14	Provincial
35	669000	5448000	14.35	Provincial
36	672000	5448000	0.04	Provincial
37	588000	5447000	0.04	Provincial
38	589000	5447000	18.11	Provincial

Grid Number	EASTING[a]	NORTHING[a]	CH Area (ha)[b] within Grid	Land Tenure[c]
39	590000	5447000	13.43	Provincial
40	591000	5447000	14.29	Provincial
41	592000	5447000	29.16	Provincial
42	593000	5447000	15.51	Provincial
43	594000	5447000	6.79	Provincial
44	662000	5447000	3.50	Provincial
45	663000	5447000	10.76	Provincial
46	664000	5447000	0.49	Provincial
47	665000	5447000	19.32	Provincial
48	666000	5447000	32.19	Provincial
49	667000	5447000	21.48	Provincial
50	668000	5447000	22.06	Provincial
51	669000	5447000	21.36	Provincial
52	670000	5447000	22.76	Provincial
53	671000	5447000	20.88	Provincial
54	672000	5447000	8.96	Provincial
55	673000	5447000	10.92	Provincial
56	674000	5447000	1.88	Provincial
57	588000	5446000	36.96	Provincial
58	589000	5446000	15.22	Provincial
59	590000	5446000	19.94	Provincial
60	591000	5446000	3.99	Provincial
61	592000	5446000	27.18	Provincial
62	593000	5446000	24.44	Provincial
63	594000	5446000	11.73	Provincial
64	666000	5446000	35.21	Provincial
65	667000	5446000	37.31	Provincial
66	668000	5446000	4.96	Provincial
67	669000	5446000	7.92	Provincial
68	670000	5446000	20.05	Provincial
69	671000	5446000	6.34	Provincial
70	672000	5446000	12.54	Provincial
71	673000	5446000	20.38	Provincial
72	674000	5446000	12.96	Provincial
73	675000	5446000	3.82	Provincial
74	676000	5446000	4.93	Provincial
75	586000	5445000	2.28	Provincial
76	587000	5445000	11.62	Provincial
77	588000	5445000	15.94	Provincial
78	589000	5445000	11.26	Provincial
79	590000	5445000	21.65	Provincial
80	591000	5445000	7.15	Provincial
81	592000	5445000	37.03	Provincial
82	593000	5445000	5.32	Provincial
83	594000	5445000	0.88	Provincial
84	666000	5445000	2.94	Provincial
85	667000	5445000	28.46	Provincial
86	668000	5445000	32.50	Provincial

Grid Number	EASTING[a]	NORTHING[a]	CH Area (ha)[b] within Grid	Land Tenure[c]
87	669000	5445000	19.26	Provincial
88	670000	5445000	25.56	Provincial
89	671000	5445000	15.13	Provincial
90	672000	5445000	9.85	Provincial
91	673000	5445000	8.67	Provincial
92	674000	5445000	9.88	Provincial
93	675000	5445000	15.42	Provincial
94	586000	5444000	9.73	Provincial
95	587000	5444000	36.34	Provincial
96	588000	5444000	17.29	Provincial
97	589000	5444000	1.64	Provincial
98	590000	5444000	22.37	Provincial
99	591000	5444000	12.59	Provincial
100	592000	5444000	29.85	Provincial
101	593000	5444000	21.91	Provincial
102	594000	5444000	2.16	Provincial
103	666000	5444000	5.75	Provincial
104	667000	5444000	17.82	Provincial
105	668000	5444000	16.40	Provincial
106	669000	5444000	1.22	Provincial
107	670000	5444000	11.75	Provincial
108	671000	5444000	29.78	Provincial
109	673000	5444000	5.71	Provincial
110	674000	5444000	9.07	Provincial
111	675000	5444000	0.58	Provincial
112	586000	5443000	25.63	Provincial
113	587000	5443000	14.08	Provincial
114	588000	5443000	10.72	Provincial
115	589000	5443000	14.45	Provincial
116	590000	5443000	18.41	Provincial
117	591000	5443000	39.34	Provincial
118	592000	5443000	10.70	Provincial
119	593000	5443000	19.78	Provincial
120	594000	5443000	18.40	Provincial
121	664000	5443000	3.53	Provincial
122	665000	5443000	24.81	Provincial
123	666000	5443000	6.23	Provincial
124	667000	5443000	20.70	Provincial
125	668000	5443000	7.73	Provincial
126	669000	5443000	13.54	Provincial
127	670000	5443000	4.68	Provincial
128	671000	5443000	24.96	Provincial
129	672000	5443000	13.09	Provincial
130	673000	5443000	9.27	Provincial
131	674000	5443000	24.69	Provincial
132	675000	5443000	3.91	Provincial
133	586000	5442000	2.56	Provincial
134	587000	5442000	23.07	Provincial

Grid Number	EASTING[a]	NORTHING[a]	CH Area (ha)[b] within Grid	Land Tenure[c]
135	588000	5442000	13.84	Provincial
136	589000	5442000	24.01	Provincial
137	590000	5442000	22.49	Provincial
138	591000	5442000	28.06	Provincial
139	592000	5442000	14.04	Provincial
140	593000	5442000	9.20	Provincial
141	594000	5442000	3.57	Provincial
142	664000	5442000	0.01	Provincial
143	665000	5442000	17.85	Provincial
144	666000	5442000	26.56	Provincial
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148	670000	5442000	11.05	Provincial
149	671000	5442000	23.68	Provincial
150	672000	5442000	26.65	Provincial
151	673000	5442000	4.75	Provincial
152	674000	5442000	19.49	Provincial
153	675000	5442000	15.80	Provincial
154	676000	5442000	10.66	Provincial
155	677000	5442000	17.38	Provincial
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165	593000	5441000	11.61	Provincial
166	594000	5441000	1.70	Provincial
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170	668000	5441000	9.07	Provincial
171	669000	5441000	23.11	Provincial
172	670000	5441000	16.47	Provincial
173	671000	5441000	5.26	Provincial
174	672000	5441000	23.41	Provincial
175	673000	5441000	12.01	Provincial
176	674000	5441000	13.64	Provincial
177	675000	5441000	20.63	Provincial
178	676000	5441000	20.62	Provincial
179	677000	5441000	36.27	Provincial
180	679000	5441000	14.99	Provincial
181	586000	5440000	1.75	Provincial
182	587000	5440000	10.05	Provincial

Grid Number	EASTING[a]	NORTHING[a]	CH Area (ha)[b] within Grid	Land Tenure[c]
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185	590000	5440000	3.73	Provincial
186	591000	5440000	29.89	Provincial
187	592000	5440000	0.11	Provincial
188	593000	5440000	15.97	Provincial
189	594000	5440000	23.66	Provincial
190	665000	5440000	0.78	Provincial
191	666000	5440000	11.60	Provincial
192	667000	5440000	10.25	Provincial
193	668000	5440000	17.11	Provincial
194	669000	5440000	15.95	Provincial
195	670000	5440000	6.64	Provincial
196	671000	5440000	23.65	Provincial
197	672000	5440000	3.87	Provincial
198	674000	5440000	15.05	Provincial
199	675000	5440000	8.21	Provincial
200	676000	5440000	18.96	Provincial
201	677000	5440000	22.71	Provincial
202	678000	5440000	11.15	Provincial
203	679000	5440000	12.55	Provincial
204	585000	5439000	0.49	Provincial
205	586000	5439000	14.15	Provincial
206	587000	5439000	4.46	Provincial
207	588000	5439000	5.96	Provincial
208	589000	5439000	8.16	Provincial
209	590000	5439000	23.23	Provincial
210	591000	5439000	23.71	Provincial
211	593000	5439000	25.50	Provincial
212	594000	5439000	11.95	Provincial
213	667000	5439000	6.61	Provincial
214	668000	5439000	5.47	Provincial
215	670000	5439000	7.39	Provincial
216	671000	5439000	14.17	Provincial
217	672000	5439000	6.39	Provincial
218	674000	5439000	5.75	Provincial
219	675000	5439000	1.14	Provincial
220	676000	5439000	0.01	Provincial
221	585000	5438000	4.01	Provincial
222	586000	5438000	12.95	Provincial
223	587000	5438000	17.35	Provincial
224	588000	5438000	10.69	Provincial
225	589000	5438000	10.83	Provincial
226	590000	5438000	18.46	Provincial
227	591000	5438000	10.45	Provincial
228	592000	5438000	15.84	Provincial
229	593000	5438000	8.42	Provincial
230	594000	5438000	7.66	Provincial

Grid Number	EASTING[a]	NORTHING[a]	CH Area (ha)[b] within Grid	Land Tenure[c]
231	671000	5438000	11.74	Provincial
232	672000	5438000	11.67	Provincial
233	674000	5438000	17.66	Provincial
234	675000	5438000	9.93	Provincial
235	676000	5438000	0.05	Provincial
236	586000	5437000	1.34	Provincial
237	587000	5437000	2.70	Provincial
238	588000	5437000	2.14	Provincial
239	589000	5437000	13.25	Provincial
240	590000	5437000	4.36	Provincial
241	591000	5437000	0.31	Provincial
242	592000	5437000	11.56	Provincial
243	672000	5437000	12.68	Provincial
244	673000	5437000	25.02	Provincial
245	674000	5437000	19.71	Provincial
246	675000	5437000	19.20	Provincial
247	676000	5437000	2.21	Provincial
248	588000	5436000	0.66	Provincial
249	589000	5436000	16.74	Provincial
250	590000	5436000	7.72	Provincial
251	591000	5436000	19.45	Provincial
252	592000	5436000	11.06	Provincial
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256	674000	5436000	9.65	Provincial
257	675000	5436000	22.41	Provincial
258	676000	5436000	13.18	Provincial
259	677000	5436000	9.01	Provincial
260	678000	5436000	5.08	Provincial
261	588000	5435000	1.47	Provincial
262	589000	5435000	17.52	Provincial
263	590000	5435000	25.81	Provincial
264	591000	5435000	14.52	Provincial
265	592000	5435000	27.18	Provincial
266	666000	5435000	16.16	Provincial
267	667000	5435000	18.92	Provincial
268	668000	5435000	7.32	Provincial
269	673000	5435000	2.08	Provincial
270	674000	5435000	7.79	Provincial
271	675000	5435000	17.13	Provincial
272	677000	5435000	1.60	Provincial
273	678000	5435000	6.19	Provincial
274	679000	5435000	13.68	Provincial
275	680000	5435000	4.70	Provincial
276	681000	5435000	11.72	Provincial
277	590000	5434000	19.16	Provincial
278	591000	5434000	13.64	Provincial

Grid Number	EASTING[a]	NORTHING[a]	CH Area (ha)[b] within Grid	Land Tenure[c]
279	592000	5434000	33.29	Provincial
280	593000	5434000	6.25	Provincial
281	665000	5434000	2.07	Provincial
282	666000	5434000	10.66	Provincial
283	667000	5434000	16.74	Provincial
284	668000	5434000	17.63	Provincial
285	669000	5434000	5.84	Provincial
286	675000	5434000	4.71	Provincial
287	676000	5434000	13.49	Provincial
288	677000	5434000	16.26	Provincial
289	678000	5434000	12.54	Provincial
290	679000	5434000	14.44	Provincial
291	680000	5434000	11.11	Provincial
292	681000	5434000	1.21	Provincial
293	590000	5433000	6.66	Provincial
294	591000	5433000	19.96	Provincial
295	593000	5433000	8.81	Provincial
296	594000	5433000	5.21	Provincial
297	665000	5433000	0.01	Provincial
298	666000	5433000	14.54	Provincial
299	667000	5433000	10.58	Provincial
300	669000	5433000	6.50	Provincial
301	670000	5433000	9.42	Provincial
302	675000	5433000	8.63	Provincial
303	676000	5433000	7.64	Provincial
304	594000	5432000	11.75	Provincial
305	665000	5432000	12.07	Provincial
306	666000	5432000	1.03	Provincial
307	667000	5432000	11.15	Provincial
308	670000	5432000	5.99	Provincial
309	671000	5432000	11.78	Provincial
310	672000	5432000	10.71	Provincial
311	673000	5432000	11.49	Provincial
312	674000	5432000	13.55	Provincial
313	675000	5432000	12.66	Provincial
314	594000	5431000	3.77	Provincial
315	595000	5431000	12.62	Provincial
316	666000	5431000	0.91	Provincial
317	667000	5431000	6.78	Provincial
318	674000	5431000	11.35	Provincial
319	675000	5431000	0.00	Provincial
320	594000	5430000	15.43	Provincial
321	595000	5430000	24.61	Provincial
322	596000	5430000	11.32	Provincial
323	597000	5430000	0.55	Provincial
324	670000	5430000	7.92	Provincial
325	671000	5430000	10.62	Provincial
326	672000	5430000	10.75	Provincial

Grid Number	EASTING[a]	NORTHING[a]	CH Area (ha)[b] within Grid	Land Tenure[c]
327	673000	5430000	3.78	Provincial
328	674000	5430000	9.48	Provincial
329	586000	5429000	4.80	Provincial
330	587000	5429000	12.25	Provincial
331	588000	5429000	11.12	Provincial
332	589000	5429000	10.38	Provincial
333	590000	5429000	15.72	Provincial
334	593000	5429000	1.68	Provincial
335	594000	5429000	2.77	Provincial
336	595000	5429000	14.22	Provincial
337	596000	5429000	0.74	Provincial
338	597000	5429000	12.29	Provincial
339	598000	5429000	14.41	Provincial
340	586000	5428000	11.93	Provincial
341	588000	5428000	0.08	Provincial
342	589000	5428000	9.85	Provincial
343	590000	5428000	8.59	Provincial
344	593000	5428000	10.23	Provincial
345	594000	5428000	13.99	Provincial
346	595000	5428000	9.29	Provincial
347	596000	5428000	0.12	Provincial
348	598000	5428000	7.70	Provincial
349	599000	5428000	2.24	Provincial

[a] The listed coordinates represent the southwest corner of the Universal Transverse Mercator (UTM) Military Grid Reference System square containing CH (see http://maps.nrcan.gc.ca/topo101/mil_ref_e.php for more information on the reference system). The coordinates may not fall within CH and are provided as a general location only.

[b] The area presented is of the site boundary containing areas of CH and not necessarily the area of CH itself.

[c] Land Tenure is provided as an approximation of land ownership of the site containing CH and should be used for guidance purposes only. Accurate land tenure will require cross referencing CH boundaries with surveyed land parcel information

PART 2 - *Recovery Plan for the Rocky Mountain Tailed Frog (*Ascaphus montanus*) in British Columbia*, prepared by the British Columbia Ministry of Environment

Recovery Plan for the Rocky Mountain Tailed Frog (*Ascaphus montanus*) in British Columbia

Prepared by B.C. Ministry of Environment

BRITISH COLUMBIA | Ministry of Environment

August 2014

About the British Columbia Recovery Strategy Series

This series presents the recovery documents that are prepared as advice to the Province of British Columbia on the general approach required to recover species at risk. The Province prepares recovery documents to ensure coordinated conservation actions and to meet its commitments to recover species at risk under the *Accord for the Protection of Species at Risk in Canada* and the *Canada–British Columbia Agreement on Species at Risk*.

What is recovery?

Species at risk recovery is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a provincial recovery document?

Recovery documents summarize the best available scientific and traditional information of a species or ecosystem to identify goals, objectives, and strategic approaches that provide a coordinated direction for recovery. These documents outline what is and what is not known about a species or ecosystem, identify threats to the species or ecosystem, and explain what should be done to mitigate those threats, as well as provide information on habitat needed for survival and recovery of the species. This information may be summarized in a recovery strategy followed by one or more action plans. The purpose of an action plan is to offer more detailed information to guide implementation of the recovery of a species or ecosystem. When sufficient information to guide implementation can be included from the onset, all of the information is presented together in a recovery plan.

Information provided in provincial recovery documents may be adopted by Environment Canada for inclusion in federal recovery documents that the federal agencies prepare to meet their commitments to recover species at risk under the *Species at Risk Act*.

What's next?

The Province of British Columbia accepts the information in these documents as advice to inform implementation of recovery measures, including decisions regarding measures to protect habitat for the species.

Success in the recovery of a species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this document. All British Columbians are encouraged to participate in these efforts.

For more information

To learn more about species at risk recovery in British Columbia, please visit the B.C. Ministry of Environment Recovery Planning webpage at:
<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

Recovery Plan for the Rocky Mountain Tailed Frog (*Ascaphus montanus*) in British Columbia

Prepared by the B.C. Ministry of Environment

August 2014

Recommended citation

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Cover illustration/photograph

Photograph by Purnima Govindarajulu. Rocky Mountain Tailed Frog showing colours that blend in with the cobble/rock stream edges they are often found in. Note the “tail” that gives the Tailed Frog its common name.

Additional copies

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

Publication information

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Disclaimer

This recovery plan has been prepared by the B.C. Ministry of Environment, as advice to the responsible jurisdictions and organizations that may be involved in recovering the species. The British Columbia Ministry of Environment has received this advice as part of fulfilling its commitments under the *Accord for the Protection of Species at Risk in Canada* and the *Canada–British Columbia Agreement on Species at Risk*.

This document identifies the recovery strategies that are deemed necessary, based on the best available scientific and traditional information, to recover Rocky Mountain Tailed Frog populations in British Columbia. Recovery actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and recovery approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions and all members of the Rocky Mountain Tailed Frog Recovery Team have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all individuals on the recovery team.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this plan. The B.C. Ministry of Environment encourages all British Columbians to participate in the recovery of Rocky Mountain Tailed Frog.

ACKNOWLEDGEMENTS

Ian Adams (Vast Resource Solutions) updated this recovery plan to its current state with funding support by Environment Canada – Canadian Wildlife Service and B.C. Ministry of Environment (B.C. MoE). An earlier draft version of the plan in 2007 was funded by the Forest Investment Account of British Columbia and B.C. MoE. Linda Friele (Ascaphus Consulting) wrote an earlier version with input and collaboration from other members of the Rocky Mountain Tailed Frog Recovery Team: Ted Antifeau (Co-chair, B.C. Ministry of Forests, Lands and Natural Resource Operations [B.C. FLNRO]); Larry Halverson (retired, Co-chair, Parks Canada); Colin Campbell (BC Environmental Network); Paul Chalifour (retired, B.C. Ministry of Forests); Al Pollard (retired, B.C. Timber Sales, B.C. Ministry of Forests); John Richardson (University of British Columbia); and Kari Stuart-Smith (Canfor, BC Division). Many sections of this plan are directly taken from that work.

This plan has benefited greatly from discussions and review from Purnima Govindarajulu (B.C. MoE), Ted Antifeau, Linda Dupuis, Leah Westereng (B.C. MoE), and Kathy Paige (B.C. MoE). Purnima Govindarajulu, David Fraser (B.C. MoE), Ted Antifeau, Melissa Todd (B.C. FLNRO), David Green (McGill University), Lea Gelling (B.C. MoE), Kristiina Ovaska (Biolinx Environmental Research Ltd.), and Ian Adams completed the threat assessment. Jared Hobbs (Hobbs Photo Images Co.) and Purnima Govindarajulu provided use of their photos and David Green use of the range map.

EXECUTIVE SUMMARY

The Rocky Mountain Tailed Frog (*Ascaphus montanus*) is a unique amphibian endemic to the mountainous inland Pacific Northwest. In Canada, the species occurs only in southeast British Columbia (B.C.) in two separate, unconnected watersheds – the Flathead and Yahk. The relatively small frog is sexually dimorphic with males exhibiting a "tail" that is a copulatory organ. The species inhabits cool, mid-elevation montane streams and surrounding riparian habitat. The larval tadpoles have a modified mouth that acts as a sucker to help maintain the tadpole's location within often swift-moving small streams. The Rocky Mountain Tailed Frog is relatively unique among anurans in being slow developing and long-lived. Metamorphosis usually occurs after 3 years in the larval stage and the frogs are not reproductively active until age 7 or 8 post-hatching.

The status of the Rocky Mountain Tailed Frog was recently re-examined and designated as Threatened (Nov. 2013) by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) based on its small number of mature individuals, unusual habitat use, and sensitivity to changes. The change of status from Endangered was due to the increased habitat protection and a moratorium on mining in the Flathead River portion of the range. It is currently listed as Endangered in Canada on Schedule 1 of the *Species at Risk Act* (SARA). In B.C., the Rocky Mountain Tailed Frog is ranked S2 (imperiled) by the Conservation Data Centre and is on the provincial Red list. The B.C. Conservation Framework ranks the Rocky Mountain Tailed Frog as a priority 2 under goal 3 (maintain the diversity of native species and ecosystems). It is protected from capture and killing, under the B.C. *Wildlife Act.* It is also listed as a species that requires special management attention to address the impacts of forest and range activities under the *Forest and Range Practices Act* (FRPA) on Crown land (as described in the Identified Wildlife Management Strategy). Recovery is considered to be biologically and technically feasible.

The greatest threat to Rocky Mountain Tailed Frog populations in B.C. is pollution from agricultural and forestry effluents that cause increased sedimentation of streams, followed by fire and fire suppression.

The recovery (population and distribution) goal is to maintain stable or increasing populations of Rocky Mountain Tailed Frog distributed throughout the species' range in British Columbia, including any additional populations that may be discovered.

The achievement of this recovery goal is supported by the following recovery objectives:

1. Update distribution of Rocky Mountain Tailed Frog in B.C. by attempting to confirm anecdotal reports in the Flathead and conducting similar searches in other watersheds currently considered unoccupied.
2. Implement habitat protection measures, assess effectiveness by regular monitoring, and implement adaptive management as necessary to ensure habitat protection measures are effective over the long term.
3. Assess if populations are stable by monitoring and reporting on population size and trends at nested spatial scales, and initiate recovery actions as necessary and appropriate.

4. Monitor and report on habitat quality trends at nested spatial scales to evaluate continuing and emerging impacts of anthropogenic and natural habitat change (e.g., climate change) that may occur even in protected areas, and initiate mitigation as appropriate.

RECOVERY FEASIBILITY SUMMARY

The recovery of Rocky Mountain Tailed Frog in B.C. is considered technically and biologically feasible based on the criteria outlined by the Government of Canada (2009):

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

   Yes. In 2002, the Yahk population was estimated to have 1230 adult females. In 2004 the Flathead population was estimated to have 250 adult females.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

   Yes. The vast majority of Rocky Mountain Tailed Frog range within Canada occurs within approved Wildlife Habitat Areas (WHA), under the B.C. *Forest and Range Practices Act*. These WHAs are proposed at this time to be sufficient habitat to protect Rocky Mountain Tailed Frog habitat, although activities outside these WHAs may affect the effectiveness of this protection.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

   Yes. A variety of human activities resulting in increased agricultural and forestry effluents are the primary concern. Careful land management can avoid or minimize the impacts of these threats.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

   Yes. Management options are available or already implemented to help achieve recovery objectives.

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1 COSEWIC* SPECIES ASSESSMENT INFORMATION

Assessment Summary - November 2013
Common name (population): Rocky Mountain Tailed Frog**
Scientific name:** *Ascaphus montanus*
Status: Threatened
Reason for designation: In Canada, this unusual stream-breeding frog is restricted to two unconnected watersheds, where it relies on small, forested fast-flowing streams. Habitat damage from sedimentation due primarily to roads, logging, and fires, and loss of terrestrial dispersal habitat from logging and wood harvesting are key threats. The total population is small, consisting of approximately 3000 adults, which increases the vulnerability of the population to environmental perturbations. Increases in habitat protection and a moratorium on mining in the Flathead River portion of the range resulted in a change of status from Endangered.
Occurrence: B.C.
Status history: Designated Endangered in May 2000. Status re-examined and designated Threatened in November 2013.

* Committee on the Status of Endangered Wildlife in Canada.
** Common and scientific names reported in this recovery plan follow the naming conventions of the British Columbia Conservation Data Centre, which may be different from names reported by COSEWIC.

2 SPECIES STATUS INFORMATION

Rocky Mountain Tailed Frog [a]		
Legal Designation:		
FRPA:[b] Species at Risk OGAA:[b] Species at Risk	B.C. *Wildlife Act:*[c] Schedule A	SARA: Schedule 1 - Endangered (2003)[d]
Conservation Status[e]		
B.C. List: Red	B.C. Rank: S2 (2010)	National Rank: N2 (2011) Global Rank: G4 (2004)
Other Subnational Ranks:[f]		
Idaho: S3; Montana: S4; Oregon: S2; Washington: S2?		
B.C. Conservation Framework (CF)[g]		
Goal 1: Contribute to global efforts for species and ecosystem conservation.		Priority:[h] 5 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk.		Priority: 6 (2009)
Goal 3: Maintain the diversity of native species and ecosystems.		Priority: 2 (2009)
CF Action Groups:	Compile Status Report; Planning; List under *Wildlife Act*; Send to COSEWIC; Habitat Protection; Habitat Restoration; Private Land Stewardship; Species and Population Management	

[a] Data source: B.C. Conservation Data Centre (2014a) unless otherwise noted.
[b] Species at Risk = a listed species that requires special management attention to address the impacts of forest and range activities on Crown land under the *Forest and Range Practices Act* (FRPA; Province of British Columbia 2002) and/or the impacts of oil and gas activities on Crown land under the *Oil and Gas Activities Act* (OGAA; Province of British Columbia 2008) as described in the Identified Wildlife Management Strategy (Province of British Columbia 2004).
[c] Schedule A = designated as wildlife under the B.C. *Wildlife Act*, which offers it protection from direct persecution and mortality (Province of British Columbia 1982).
[d] Schedule 1 = found on the List of Wildlife Species at Risk under the *Species at Risk Act* (SARA). This species was recently reassessed by COSEWIC as Threatened. This assessment will be reviewed by the Governor in Council (GIC) who will make a decision as to whether to amend the List to reclassify this species as Threatened. If the GIC does not make a decision within nine months of receiving the COSEWIC assessment, the Minister shall by order amend the List according to COSEWIC's assessment.
[e] S = subnational; N = national; G = global; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure.
[f] Data source: NatureServe (2013).
[g] Data source: B.C. Ministry of Environment (2010).
[h] Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3 SPECIES INFORMATION

3.1 Species Description

The Rocky Mountain Tailed Frog (*Ascaphus montanus*) is a small anuran amphibian that inhabits mid- to high-elevation mountain streams. Adults are 2 to 5 cm long and coloured gray, brown, or olive or a combination, with bumpy skin (Figure 1). The “tail” is actually a copulatory organ, found only on males. Unlike most other anurans, fertilization is internal. Females lay up to 50 eggs in a single strand that is attached to the underside of rocks submerged in the stream. Tadpoles have a modified mouth that not only enables feeding on periphyton but also acts as a sucker to provide stability against the stream current (Dupuis and Friele 2005). Metamorphosis usually occurs after 3 years in the tadpole stage, although the length of the larval period depends on water temperature and food availability (Daugherty and Sheldon 1982a). Adults do not reach sexual maturity until 7 or 8 years of age post-hatching (Daugherty and Sheldon 1982a).

Until 2001, the Rocky Mountain Tailed Frog was previously recognized as a subspecies of the Coastal Tailed Frog (*Ascaphus truei*). Mitochondrial divergence as well as allozyme and morphology differences led to inland tailed frog populations being recognized as a distinct species, *Ascaphus montanus* (Nielson *et al.* 2001, 2006; Conlon *et al.* 2007).

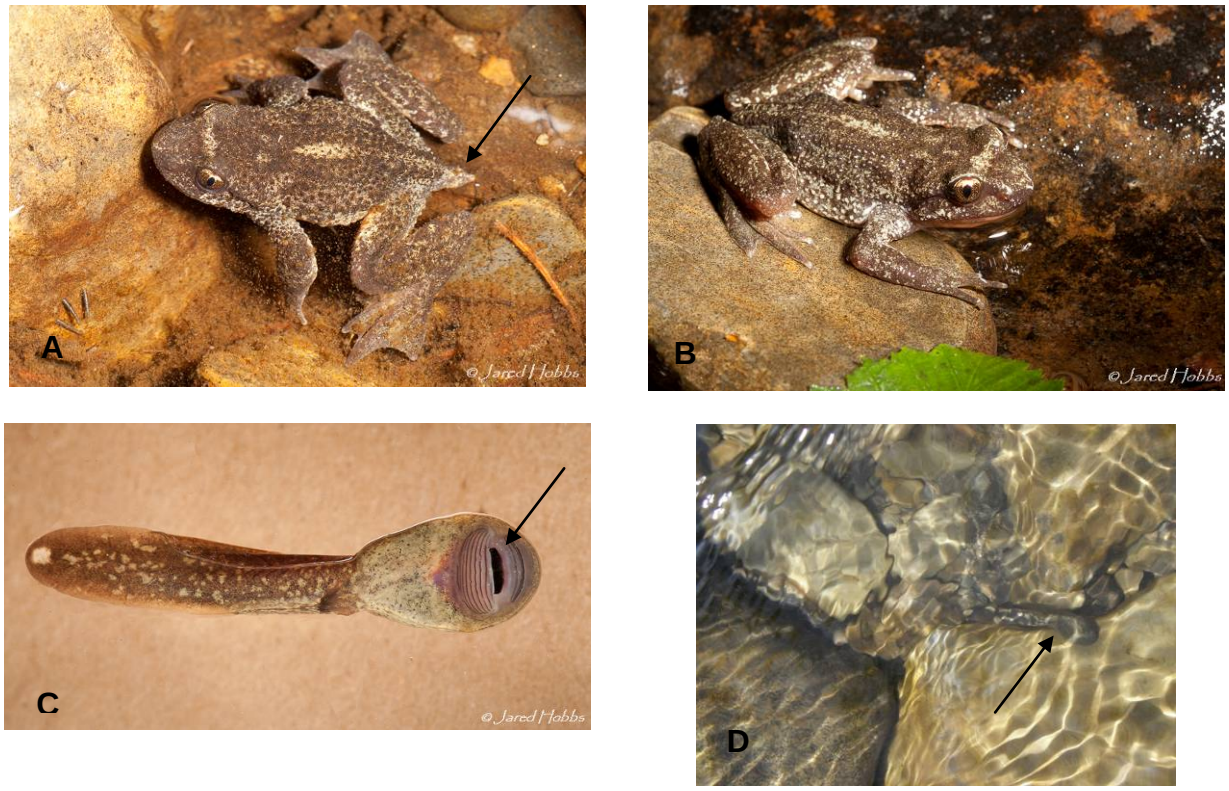

Figure 1. Photographs of Rocky Mountain Tailed Frog. A: adult male; B: adult female; C: tadpole (ventral view showing modified "sucker" mouth); D: tadpole in high flow stream.
Photos A-C: © Jared Hobbs. Photo D: Purnima Govindarajulu.

3.2 Populations and Distribution

3.2.1 Global Range

Rocky Mountain Tailed Frogs are endemic to the Intermountain northwest of the United States and Canada. The core range of Rocky Mountain Tailed Frog is found from the Flathead River drainage in southeastern British Columbia (B.C.), through western Montana and northern Idaho. There are isolated populations in the Yahk River (Yaak River in the United States) drainage of southern B.C. and northwest Montana, western Idaho, southeastern Washington, and northeastern Oregon (Figure 2).

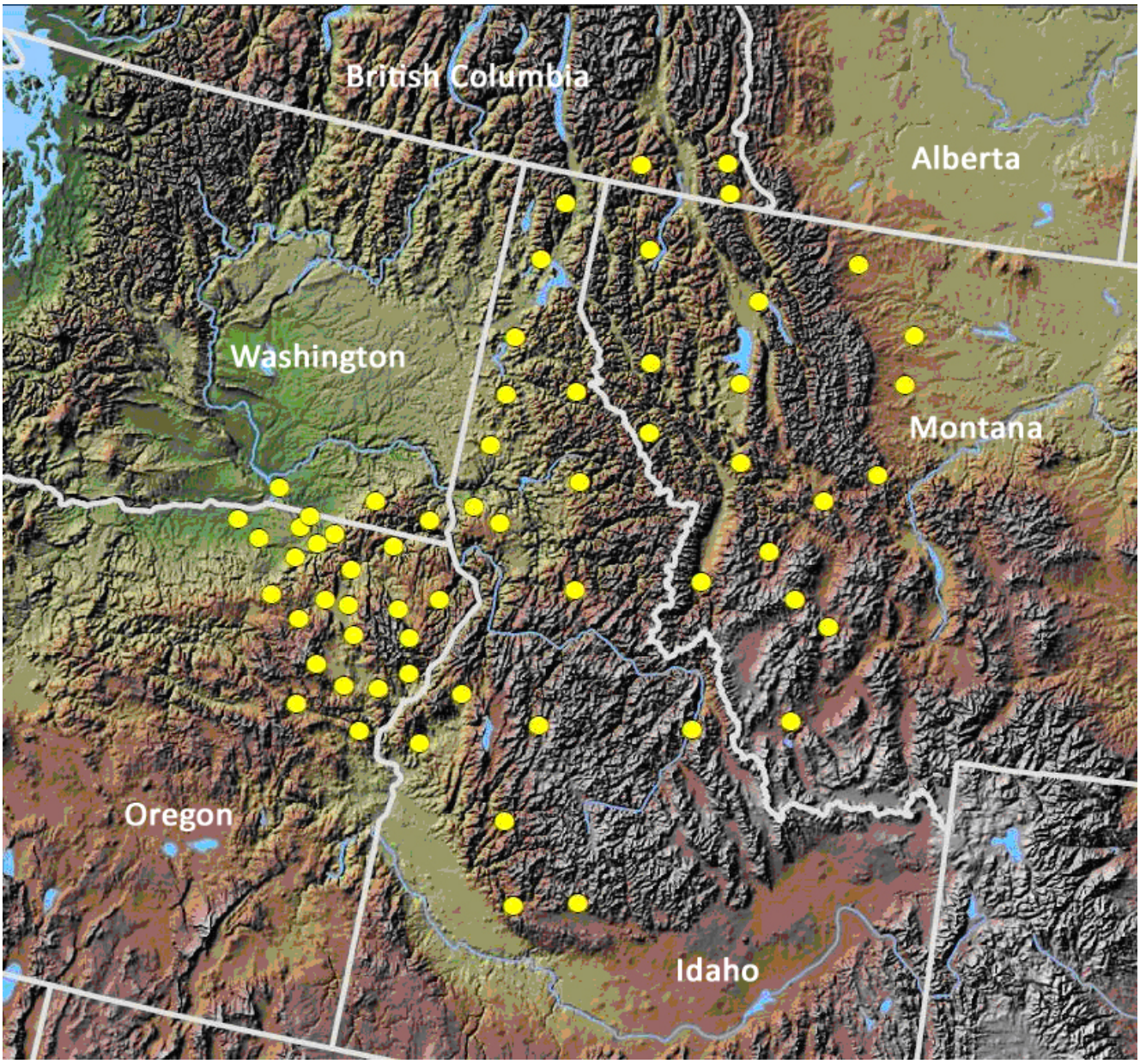

Figure 2. Global distribution of known Rocky Mountain Tailed Frog (*Ascaphus montanus*) occurrences. Source: with permission by COSEWIC (in press); adapted from Green *et al.*, in press.

3.2.2 British Columbia Range

In Canada, the Rocky Mountain Tailed Frog occurs only within B.C. It has a disjunct distribution along the B.C.–Montana border (Figure 33). One population (hereafter "Flathead") is found in the Border Ranges of the Rocky Mountains; the other (hereafter "Yahk") is farther west in the McGillivray Range of the Columbia Mountains.

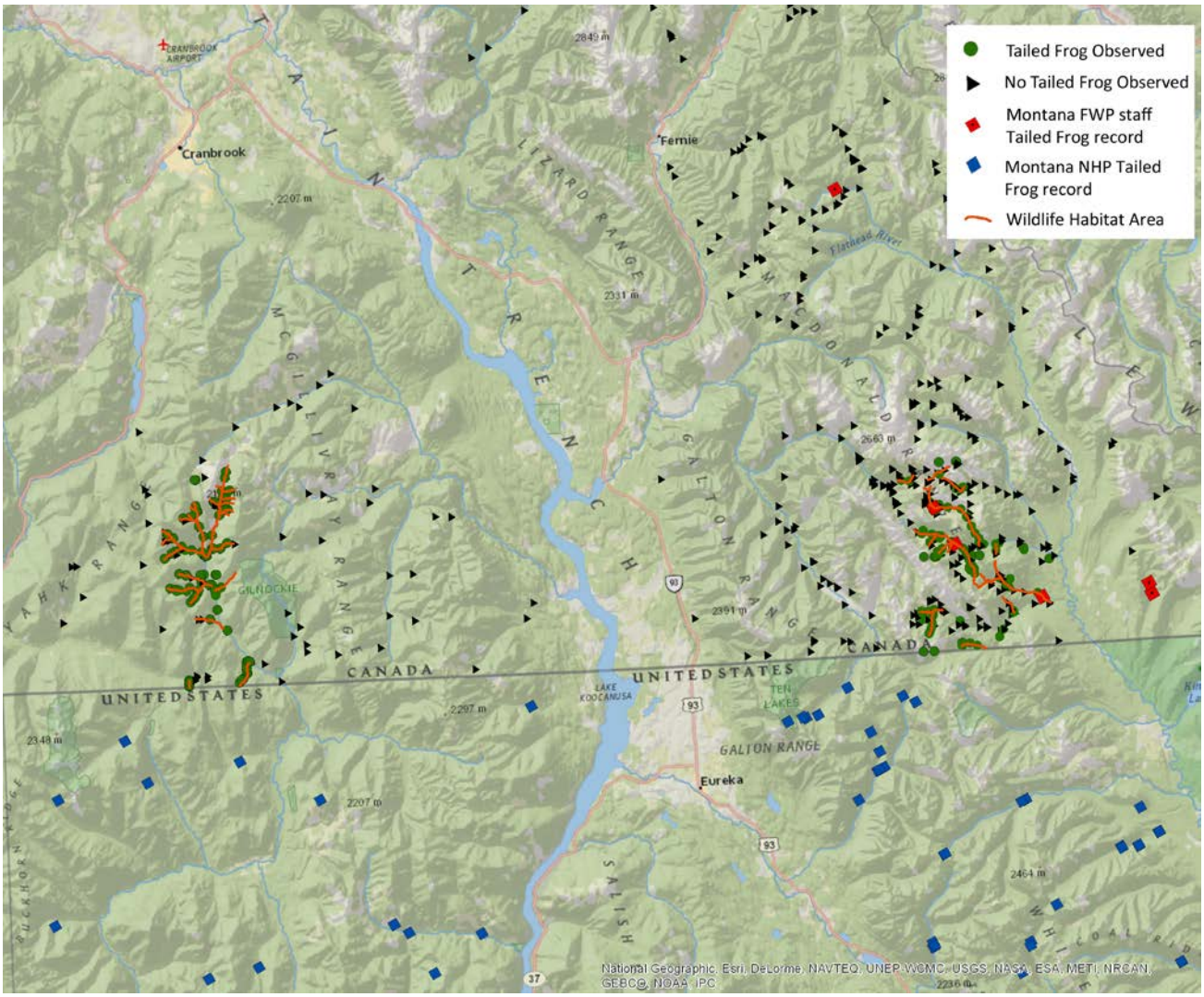

Figure 3. Distribution of Rocky Mountain Tailed Frog in British Columbia.
Confirmed observations (green circles) and approved Wildlife Habitat Areas (orange lines) in the Yahk drainage (left side of map) and Flathead drainage (right side of map). See Figure 4 for detailed range for each population. Black triangles indicate search location between 1996 and 2004 with no Rocky Mountain Tailed Frog observed. Blue diamonds are recorded observations in Montana (source: Montana Natural Heritage Program [NHP]). Red diamonds are reported Rocky Mountain Tailed Frog observations in B.C. by Montana Fish, Wildlife & Parks (FWP) staff while conducting electrofishing searches for Bull Trout in the B.C. Flathead River watershed (see Appendix 1).

Yahk population

The Yahk population (Figure 4A) occupies an area of roughly 120 km^2 and includes all perennial streams within this range (Dupuis and Friele 2002). The bulk of individuals occur along mid to upper portions of the Yahk River in Canada. Within the Yahk population there are two separate, smaller subpopulations: one in Boyd Creek, which drains into the lower Yahk River near the U.S. border; the other in Screw Creek, which flows into the West Yahk River as it loops over the U.S. border into B.C. for 1.5 km, before it joins the Yahk River in Montana (spelled “Yaak” in

Montana). Range information is based on 295 surveys (Dupuis and Bunnell 1997; Dupuis and Friele 2002) of the Yahk and neighbouring river watersheds.

Flathead population

Based on roughly 460 surveys over four summers within the Flathead and adjacent watersheds (Dupuis and Bunnell 1997; Dupuis and Wilson 1999; Dupuis and Friele 2004a, 2004b, 2006), the Flathead population (Figure 4B) of Rocky Mountain Tailed Frog was thought to be limited to an area of roughly 303 km^2 primarily within two large watersheds (Cabin and Couldrey creeks) that flow eastward into the Flathead River. Small satellite populations exist in Leslie Creek, also a Flathead tributary, and in the Bighorn, a tributary to Wigwam Creek (which ultimately flows into the Kootenay River). This Flathead population is restricted to specific reaches of American Couldrey, Canadian Couldrey, Burnham, Cabin, Storm, Leslie, and Bighorn creeks (Dupuis and Friele 2004a) where cold creeks associated with steep relief or ground water springs are relatively common.

Montana Fish, Wildlife & Parks staff (A. Steed, pers. comm., 2013) reported several Rocky Mountain Tailed Frogs within the Canadian Flathead River watershed. These observations were made during electrofishing efforts between 2008 and 2012 (see Appendix 1). Most of these observations occurred within previously accepted range of the Rocky Mountain Tailed Frog; however, two observations occurred east of the Flathead River mainstem, in Elder Creek and one observation at the north end of the watershed in McEvoy Creek (Figure 3).

There are also several records of *A. montanus* from the Wigwam River headwaters in Montana as reported by the Montana Natural Heritage Program (2014). Searches in the B.C. reaches of the Wigwam River and its tributaries were conducted in 1996 with no positive observations. Revisiting Wigwam tributaries of the Flathead River watershed may be justified given the recent records outside of its previously known range and emergence of eDNA and electroshocking techniques.

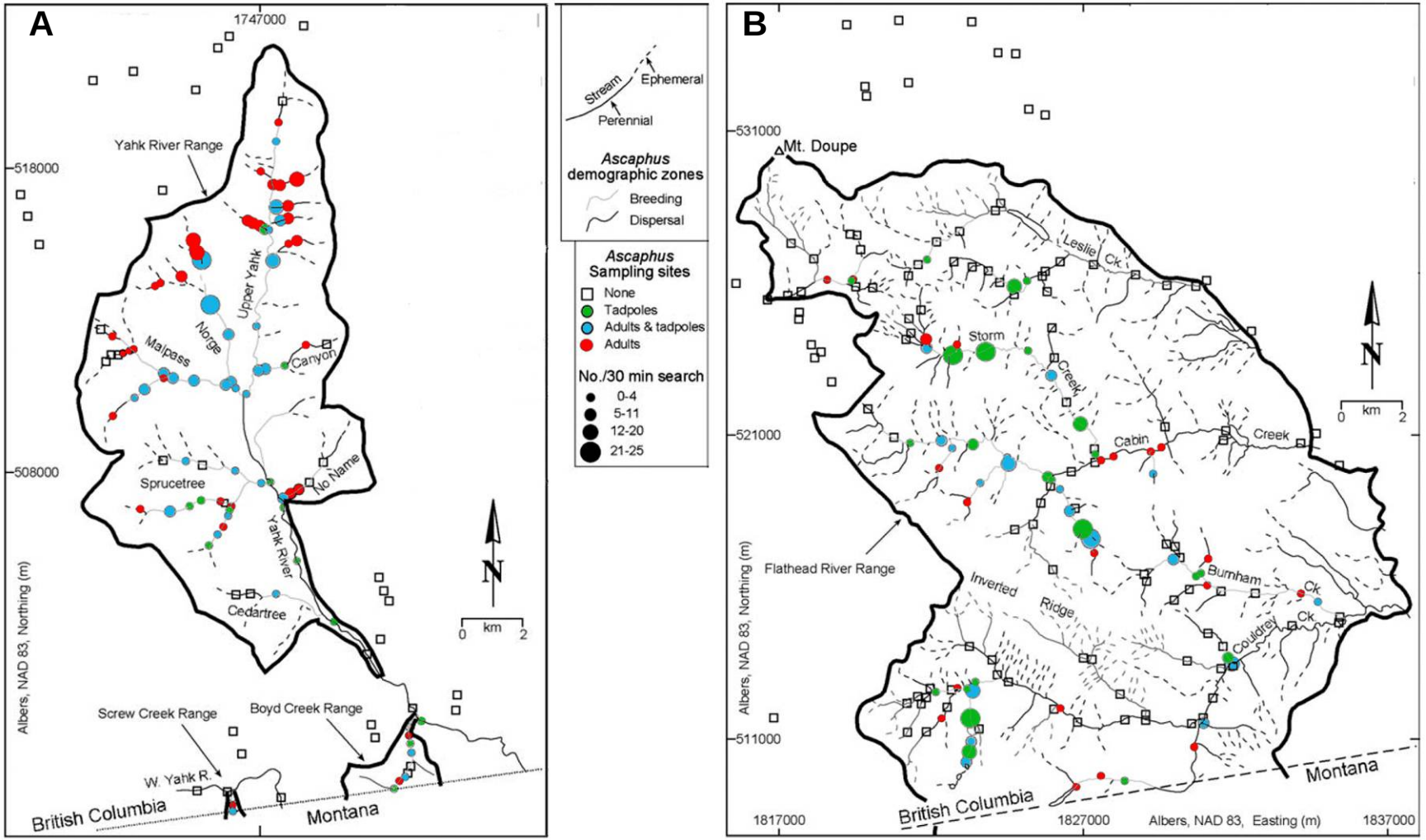

Figure 4. Distribution of Rocky Mountain Tailed Frog tadpoles and adults in the Yahk River (A) and the Flathead River (B) watersheds. Source: adapted from Dupuis and Friele (2006).

Abundance in B.C.

Abundance of Rocky Mountain Tailed Frogs can vary greatly year to year (e.g., Cordilleran Geoscience and ESSA Technologies 2010). Previous estimates of adult female abundance (Table 1) suggested over 4 times as many breeding females in the Yahk population compared to the Flathead population.

Table 1. Status and description of Rocky Mountain Tailed Frog populations in B.C.

Population	Status and description	Land tenure
Yahk	Dupuis and Friele (2002) sampled the entire extent of the Yahk Rocky Mountain Tailed Frog population and determined the total length of perennial creek habitat in this watershed to be 59 km; roughly 65% of this estimate coincides with breeding reaches (total = 38 km of breeding habitat). A mean of 0.8 females was encountered per 30-minute search of an average creek length of 25 m in 2002. This leads to an estimated 1230 adult females in the Yahk River watershed. Total population size is unknown.	Crown land
Flathead	The total length of breeding habitat in the Flathead watershed is roughly 50 km (Dupuis and Friele 2004a, 2005). Given the mean of 0.124 females encountered in an average creek length of 25 m in 2004, there were an estimated 250 adult females in the Flathead watershed at that time. Total population size is unknown.	Crown land

Land tenure

The Rocky Mountain Tailed Frog occurs exclusively on provincial Crown land (Table 1). There is one parcel of private land in the Flathead drainage; however, no tadpoles or frogs have been observed during surveys on this property (Dupuis and Friele 2004a). The reach of Leslie Creek that runs through this property into Hunger Lake is considered too cold to support Rocky Mountain Tailed Frog (Dupuis and Friele 2005). Two other parcels of private land occur in the same area, but are likely outside Rocky Mountain Tailed Frog range. The parcel on the Flathead River mainstem along the U.S.–Canada border may have very occasional tadpole occurrences as a result of drift from core reaches. There is no private land in the Yahk watershed in the proximity of Rocky Mountain Tailed Frog occurrence.

3.3 Habitat and Biological Needs of the Rocky Mountain Tailed Frog

The Rocky Mountain Tailed Frog occurs in several biogeoclimatic subzones[1] within its limited Canadian range. Most inhabited streams and adjacent riparian zones in the Yahk population occur within the Interior Cedar–Hemlock dry, mild (ICHdm), and Montane Spruce dry, cool (MSdk1) subzones. Upper reaches of many streams are in the Engelmann Spruce–Subalpine Fir dry, cool (ESSFdk1), and a small portion of the Screw Creek occurrence is in the Interior Cedar–Hemlock moist, cool (ICHmk4). In the Flathead population, the lower reaches of occupied

[1] Meidinger and Pojar (1991).

streams are in the MSdk1, while the upper reaches are in the ESSFdk1 (B.C. Conservation Data Centre 2014b).

The Rocky Mountain Tailed Frog occupies water basins with a contributing area of up to 80 km^2, though their numbers peak in basins of roughly 1.5–30 km^2 (Dupuis and Friele 2006). These basins are characterized by:

- minimal channel sedimentation;
- streams with good perennial flows (bankfull discharge rates of 0.3–1.0 m^3/s);
- overall channel gradients of 10–30%;
- presence of cascade and step-pool morphologies (see Montgomery and Buffington [1997] for a discussion of channel morphologies);
- modulated summer freshet (high stream flow resulting from spring thaw of winter snow accumulation);
- suitable water temperatures: survival of eggs require temperatures between 5 and 18.5°C (Brown 1975); tadpoles exist optimally between 9 and 16°C (Dupuis and Friele 2002). Lethal maximum water temperatures for adults range from 22 (Metter 1966) to 24.1°C (Claussen 1973); and
- presence of appropriate upland (terrestrial) habitats: mature (100- to 140-year-old) or old growth (> 140 years of age) forest stands adjacent to riparian zones and at seepage sites; where this habitat is absent, younger forests should be maintained for long-term restoration and recovery. Upland habitat is needed help maintain present and future riparian microhabitat conditions, and increase the availability of terrestrial foraging and dispersal habitats for juveniles and adults. Older forests are also needed along ephemeral headwaters to provide key linkages between occurrences.

Basins occupied by Rocky Mountain Tailed Frog can be classified into three zones: frontier, core, and transition. First-order headwaters are referred to as “frontier” zones and are used as mating sites (Dupuis and Friele 2006). In this zone, tadpole distribution is patchy and maybe scarce as streams are steeper, with fewer refuge spaces between rocks, and are subject to late summer flow contraction (Dupuis and Friele 2002, 2004a). Core zones contain an abundance of tadpoles, although all life stages are present (Dupuis and Friele 2002, 2006). Mainstem reaches with larger contributing areas, between 50 and 80 km^2, are referred to as transition zones. These larger mainstems, with plane bed to pool riffle channel morphologies, and bankfull discharge rates that exceed 10 m^3/s, are not considered suitable breeding habitat because these physical conditions are unsuited to egg survival. Tadpoles are occasionally encountered in them but probably due to downstream drift. Frontier and transition zones may contain a large segment of the adult population as these areas are possibly used by frogs to disperse into adjacent watersheds (Dupuis and Friele 2002).

Tadpole habitat

Tailed frogs are strongly adapted to the drop-pool (cascade and step-pool) sequences of hillslope channels (Dupuis and Friele 2002, 2004a), which are made up of coarse substrates and provide channel stability. Coarse substrates provide more space between rocks (pore space), which serve as refugia from high-flow events. This microhabitat is particularly important for tadpole and metamorph life stages and may be destroyed by extreme events (Chin 1998). However, as long

as return intervals are a greater duration than the in-stream larval residence period (i.e., at least 3 years, from egg laying to metamorphosis), then long-term habitat quality can be considered good for the species. Tailed frogs may move seasonally to avoid temperature extremes. Adams and Frissell (2001) observed individuals moving downstream from lake outlets in Montana where temperatures reached 21°C, presumably to access lower water temperatures.

Adult and juvenile habitat

Juveniles and adults are regularly found both above and below the breeding reaches (i.e., core zone) because these life stages are more terrestrial and their distribution is not as strongly tied to in-stream conditions. For example, 50% of the adults encountered in the Yahk River watershed in 2001 (n = 208 frogs) were on first-order streams (Dupuis and Friele 2002). This pattern is perhaps explained by headwater dispersal. In the Flathead River watershed in 2003, 19% of the juveniles and adults (13 of 67 frogs) were encountered in stream reaches draining large basin areas where breeding activity was not detected (Dupuis and Friele 2004a).

Juveniles and adults appear to be governed by forest structure attributes including forest age and riparian vegetation cover (Dupuis and Friele 2002; Stoddard 2002; Welsh and Lind 2002), and by the percentage of undisturbed (mature and old-growth) forest within a watershed (Corn and Bury 1989; Dupuis and Friele 2002; Stoddard 2002). The extreme site fidelity of Rocky Mountain Tailed Frog to riparian zones and its dependence on older forest is likely a function of the continental climate in southeastern B.C., and of the species' intolerance to high temperatures and xeric conditions. In drought periods, adults have been found congregating in nearby seepage areas and springs, or adjacent to dry first-order streams (P. Friele, pers. observation 2004; L. Dupuis, pers. observation 2004; T. Antifeau, pers. observation, 2004). Thus, seepage sites represent sites of special interest to the juvenile and adult life stages.

Although the upland forest matrix may be hot and dry, and therefore not conducive to Rocky Mountain Tailed Frog movements during some parts of the year, it may be used when conditions are more favourable to movement (i.e., milder and moister conditions in spring and late summer/early fall). Unfavourable conditions may be exacerbated by forest harvest that generally reduces cover and results in drier conditions. Spear and Storfer (2010) found that, in harvested landscapes, tailed frogs dispersal shifted more to using riparian buffers instead of dispersing through the broader landscape. More research is required, but these findings suggest the importance of providing upland forested areas to serve as dispersal habitat to facilitate maintaining genetic diversity of Rocky Mountain Tailed Frog populations (Wahbe *et al.* 2012).

3.4 Ecological Role

The Rocky Mountain Tailed Frog is the largest vertebrate in non-fish-bearing tributaries within its range. Tailed frogs have a significant role in the mountain stream ecosystem as a dominant grazer (see Rosenfeld 1997) and adults may play a significant role in the food chain of adjacent riparian zones, feeding on terrestrial invertebrates. Their slow metabolism enables them to use prey with low food value, which they convert into biomass that is more available to birds and mammals (Pough 1983). American Dippers (*Cinclus mexicanus*) are known to prey on tailed

frog tadpoles (Morrissey and Olenick 2004). Other predators include Cutthroat Trout (*Salmo clarki*) and garter snakes (*Thamnophis* spp.) (Daugherty and Sheldon 1982a; COSEWIC 2000).

3.5 Limiting Factors

Specific habitat

Rocky Mountain Tailed Frog adults are restricted by the availability of moist terrestrial foraging habitat. Tadpole rearing habitat is primarily limited by the availability of perennial streams with good summer flows (i.e., bankfull discharge of 0.5–6.0 m^3/s is ideal), moderate stream temperatures (ideally 9–16°C in August), and cascade or step-pool morphologies. Rocky Mountain Tailed Frog is subject to natural flooding events, debris flows, and channel drying during its aquatic life stage. Tadpoles have an in-stream residency of 3.5 years from egg laying to metamorphosis (Dupuis and Friele 2002). If channel disturbances rework the channel bed that they occupy, and interstitial spaces amongst anchored substrates are unavailable, tadpoles risk displacement and mortality (Metter 1968; Welsh and Ollivier 1998).

Low reproductive rate

Ascaphus spp. have one of the smallest clutch sizes and the longest larval developmental stage of all anurans (Duellman and Trueb 1994). Metamorphosis occurs after at least 3 years in the tadpole stage (Daugherty and Sheldon 1982a). Individuals do not reach reproductive maturity until 7–8 years of age, but may live up to 14 years, occasionally longer (Daugherty and Sheldon 1982b; Brown 1990). Generation length is estimated at 9–11 years.

Stream temperature

Rocky Mountain Tailed Frogs are thought to be limited by stream temperature. Coastal Tailed Frog (*A. truei*) tadpoles died within 24–28 hours in waters held at 22°C (Metter 1966), while adults rarely occur in streams with maximum temperatures above 16.8°C (Pilliod *et al.* 2003). Dunham *et al.* (2007) found Rocky Mountain Tailed Frog tadpoles in post-fire streams in central Idaho with maximum daily temperatures as high as 26.6°C. However, most waters were cooler (< 20°C) and Rocky Mountain Tailed Frog are thought to be able to persist in generally warmer waters by finding pockets of cooler water (Adams and Frissell 2001; Bury 2008). Rocky Mountain Tailed Frog eggs require temperatures between 5 and 18.5°C (Brown 1975) and tadpoles exist optimally between 9 and 16°C (Dupuis and Friele 2002).

Predation

Predation by fish (in particular, sculpins [*Cottus* sp.]) in larger streams may partly explain the tailed frog's tendency to select smaller, steeper channels (Feminella and Hawkins 1994). Tailed frog numbers were higher above fish barriers (Dupuis and Friele 2002), but this observation is confounded by the fact that those same sites were the least impacted by forestry operations.

Dispersal

Movements by adults are very limited; Daugherty and Sheldon (1982b) reported a maximum movement of 20 m/yr for Rocky Mountain Tailed Frog adults in the Missoula Valley of Montana. Tadpoles likely drift downstream with water currents; whether these tadpoles survive to metamorphosis and then to adulthood are unknown.

4 THREATS

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (Salafsky *et al.* 2008). For purposes of threat assessment, only present and future threats are considered.[2] Threats presented here do not include biological features of the species or population such as inbreeding depression, small population size, and genetic isolation; or likelihood of regeneration or recolonization for ecosystems, which are considered limiting factors (Table 2).[3]

For the most part, threats are related to human activities, but they can be natural. The impact of human activity may be direct (e.g., destruction of habitat) or indirect (e.g., invasive species introduction). Effects of natural phenomena (e.g., fire, hurricane, flooding) may be especially important when the species or ecosystem is concentrated in one location or has few occurrences, which may be a result of human activity (Master *et al.* 2009). As such, natural phenomena are included in the definition of a threat, though should be applied cautiously. These stochastic events should only be considered a threat if a species or habitat is damaged from other threats and has lost its resilience, and is thus vulnerable to the disturbance (Salafsky *et al.* 2008) so that these types of events would have a disproportionately large effect on the population/ecosystem compared to the effect they would have had historically.

[2] Past threats may be recorded but are not used in the calculation of Threat Impact. Effects of past threats (if not continuing) are considered when determining long-term and/or short-term trend factors (Master *et al.* 2009).

[3] It is important to distinguish between limiting factors and threats. Limiting factors are generally not human induced and include characteristics that make the species or ecosystem less likely to respond to recovery/conservation efforts.

4.1 Threat Assessment

The threat classification below is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre and the B.C. Conservation Framework. For a detailed description of the threat classification system, see the CMP website (CMP 2010). Threats may be observed, inferred, or projected to occur in the near term. Threats are characterized here in terms of scope, severity, and timing. Threat "impact" is calculated from scope and severity. For information on how the values are assigned, see Master *et al.* (2009) and table footnotes for details. Threats for the Rocky Mountain Tailed Frog were assessed for the entire province (Table 2).

Table 2. Threat classification table for Rocky Mountain Tailed Frog.

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
2	**Agriculture & aquaculture**	Negligible	Negligible (< 1%)	Slight (1–10%)	High (Continuing)
2.3	Livestock farming & ranching	Negligible	Negligible (< 1%)	Slight (1–10%)	High (Continuing)
3	**Energy production & mining**	Not Calculated			Low
3.1	Oil & gas drilling	Not Calculated			Low
3.2	Mining & quarrying	Not Calculated			Low
3.3	Renewable energy	Not Calculated			Low
4	**Transportation & service corridors**	Negligible	Large (31–70%)	Negligible (< 1%)	High (Continuing)
4.1	Roads & railroads	Negligible	Large (31–70%)	Negligible (< 1%)	High (Continuing)
5	**Biological resource use**	Low	Restricted - Small (1–30%)	Moderate - Slight (1–30%)	High (Continuing)
5.3	Logging & wood harvesting	Low	Restricted - Small (1–30%)	Moderate - Slight (1–30%)	High (Continuing)
6	**Human intrusions & disturbance**	Low	Large (31–70%)	Slight (1–10%)	High (Continuing)
6.1	Recreational activities	Low	Large (31–70%)	Slight (1–10%)	High (Continuing)
6.3	Work & other activities	Unknown	Unknown	Unknown	High (Continuing)

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
7	**Natural system modifications**	Med.- Low	Restricted (11–30%)	Moderate - Slight (1–30%)	High (Continuing)
7.1	Fire & fire suppression	Med.- Low	Restricted (11–30%)	Moderate - Slight (1–30%)	High (Continuing)
8	**Invasive & other problematic species & genes**	Unknown	Unknown	Unknown	Unknown
8.1	Invasive non-native/alien species	Unknown	Unknown	Unknown	Unknown
9	**Pollution**	High - Med.	Large (31–70%)	Serious - Moderate (11–70%)	High (Continuing)
9.3	Agricultural & forestry effluents	High - Med.	Large (31–70%)	Serious - Moderate (11–70%)	High (Continuing)
10	**Geological events**	Low	Small (1–10%)	Serious (31–70%)	High (Continuing)
10.3	Avalanches/landslides	Low	Small (1–10%)	Serious (31–70%)	High (Continuing)
11	**Climate change & severe weather**	Low	Small (1–10%)	Moderate (11–30%)	High - Moderate
11.2	Droughts	Low	Small (1–10%)	Moderate (11–30%)	High - Moderate
11.3	Temperature extremes	Unknown	Unknown	Unknown	High - Moderate
11.4	Storms & flooding	Low	Small (1–10%)	Moderate (11–30%)	High - Moderate

[a] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on severity and scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

[b] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

[c] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. For this species a generation time of 9–11 years (COSEWIC, in press) was used resulting in severity being scored over a 27- to 33-year timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

[d] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of Threats

The overall province-wide Threat Impact for this species is High.[4] The greatest threat is "Agricultural & forestry effluents" (sedimentation of stream habitats scored as having a High-Medium impact) (Table 2). Details are discussed below under the Threat Level 1 headings.

IUCN-CMP Threat 2. Agriculture & aquaculture (2.3 Livestock farming & ranching)

Cattle (*Bos taurus)* can trample streambanks and destroy riparian vegetation, thereby increasing bank erosion and stream sedimentation. This bank destabilization causes creeks to fill in and become braided (Miles 1995). Resulting sand/pebble dominated stream reaches would support few tadpoles.

The high methane content of cow manure in or near water leads to raised water temperatures during the summer. High temperatures further accelerate stream productivity, oxygen depletion, and contamination rates. Tailed frogs require cool, highly oxygenated water for survival (Metter 1966; Claussen 1973; Brown 1975). Although aspect, flow rate, lake sources, and the availability of shade from mature forest canopies can all affect water temperature, the potential influence of methane from cow manure is noteworthy.

There are no range tenures in the main Yahk population distribution. The only range tenure occurs in the isolated Screw Creek as part of the West Yahk drainage. In the Flathead population, the only tenures that permit grazing are guide-outfitter areas that allow horse grazing. Although this could include horses crossing and stepping in Rocky Mountain Tailed Frog streams, this is likely no more of a threat than native ungulates doing the same thing.

IUCN-CMP Threat 3. Energy production & mining

Threat impact is not calculated for this threat because it is considered a past threat (now ceased) or the threat could happen in the future but not likely within assessment timeframe of 27–33 years.

3.1 Oil & gas drilling and 3.2 Mining & quarrying

Mining activities have the ability to seriously degrade stream habitats, and consequently Rocky Mountain Tailed Frog habitat (among other species). Mines may either completely remove some creeks, or alter them sufficiently to render then ineffective as Rocky Mountain Tailed Frog habitat.

However, subsurface exploration and development are not a threat to Rocky Mountain Tailed Frog in the near term because a ban on subsurface activity in the Flathead was legally

[4] The overall threat impact was calculated following Master *et al.* (2009) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate. This includes 0 Very High, 1 High-Medium, 1 Medium-Low, 4 Low, and 2 Negligible (Table 2).The overall threat considers the cumulative impacts of multiple threats.

implemented under the *Flathead Watershed Area Conservation Act* (Province of British Columbia 2011). There are no known petroleum reserves overlapping Rocky Mountain Tailed Frog range in the Yahk drainage (Province of British Columbia 2014). A small portion of the upper reaches of the Yahk River and three of its side drainages that occur within known Rocky Mountain Tailed Frog range overlap with active mineral tenures. Likelihood of any significant exploration on these tenures is very low and the probability of development into an active mine site even lower.

3.3 Renewable energy

Independent power projects (IPPs) that divert stream flows (e.g., "run-of-the-river" hydroelectric generation) have the potential to significantly degrade tailed frog habitat (COSEWIC 2011). There are no known IPPs planned within Rocky Mountain Tailed Frog's B.C. distribution for this area, so this threat was not scored. Streams inhabited by Rocky Mountain Tailed Frogs are generally the smaller reaches of relatively isolated streams, which are unlikely to be suitable for industrial IPPs and no IPP applications are currently in process where Rocky Mountain Tailed Frogs have been found (T. Antifeau, pers. comm., 2013).

IUCN-CMP Threat 4. Transportation & service corridors (4.1 Roads & railroads)

This category records impacts to Rocky Mountain Tailed Frogs from new road construction (habitat loss) and roadkill, and not sedimentation, which is captured under Threat 9.3. The risk of road mortality is low because of Rocky Mountain Tailed Frog's nocturnal habits and low traffic volumes at night. Barrier effects of culverts are unknown. Full-round culverts are likely barriers to at least upstream movements; however, adherence to best management practices and the general wildlife measures within WHAs for access that specify the use of bridges or open-bottom (half-round) culverts for road crossings (B.C. Ministry of Water, Land and Air Protection 2004) appears to have addressed this potential issue.

IUCN-CMP Threat 5. Biological resource use (5.3 Logging & wood harvesting)

Rocky Mountain Tailed Frogs have a lower frequency of occurrence in watersheds with a history of logging than in unlogged watersheds (Corn and Bury 1989; Richardson and Neill 1995; Frid *et al.* 2003). Declines in tailed frog tadpole abundance following timber harvesting have been documented (Gaige 1920; Noble and Putnam 1931; Metter 1964; Bury 1983; Bury and Corn 1988; Corn and Bury 1989; Aubry and Hall 1991; Gilbert and Allwine 1991; Welsh and Lind 1991, 2002; Kelsey 1995; Bull and Carter 1996; Dupuis and Steventon 1999; Biek *et al.* 2002), but much of this decline may be due to sedimentation (accounted for in Threat 9.3). There is wide variation (temporal and spatial) in tadpole abundance, which makes it difficult to use tadpole abundance as an indicator of long-term impacts of threats.

Impacts from logging and wood harvesting come from loss of forest cover, leading to hotter, drier conditions, both terrestrially and in stream; and removal of dispersal habitats and refuge habitats such as seeps that may dry out or be destroyed during yarding and skidding activities. Logging can also increase likelihood of flooding and increased run-off (see IUCN-CMP Threat 9.3).

Outside the cool and moist conditions of spring and fall, the upland forest matrix may be hot and dry and not conducive to Rocky Mountain Tailed Frog movement. These unfavourable conditions are exacerbated by forest harvest that generally reduces cover and results in drier conditions. Spear and Storfer (2010) found that gene flow was lower between populations separated by logged forests than those separated by burned stands. They also found gene flow (dispersal) in logged landscapes was primarily along riparian buffer corridors.

Logging may increase the peak discharge of small frequent floods (< 2 year return interval), but does not significantly affect larger, less frequent floods (Thomas and Megahan 1998). In this context, logging-related increases in event peak discharge are not thought to be a significant cause of channel disturbance. However, because interior creeks are snowmelt dominated, forestry activities can alter the seasonal hydrograph by removing forest cover and exposing the snowpack to direct UV radiation (versus long-wave radiation under a canopy), resulting in an earlier snowmelt freshet (Whitaker *et al.* 2002; Schnorbus and Alila 2004).

Most stream reaches with Rocky Mountain Tailed Frog are protected with buffers (50 m each side) through Wildlife Habitat Areas (WHAs), although in no cases is the entire drainage area protected. A small amount of logging is slated in the next 10 years (COSEWIC, in press). There is some uncertainty for the scope of this threat because harvesting plans can change any time. Severity score includes effects on Rocky Mountain Tailed Frogs from removal of trees and hydrology impacts and not effects that arise due to sedimentation. Currently the major logging company in the area has FSC (Forest Stewardship Council) certification that requires them to adhere to standards and to monitor impacts. This certification process is entirely voluntary on behalf of the licensee and can change at any time. If logging companies adhere to these standards and if WHAs function as expected, the impacts of harvesting are reduced. It is uncertain how logging outside of WHAs affect populations.

IUCN-CMP Threat 6. Human intrusions & disturbance

6.1 Recreational activities

All-terrain vehicle (ATV) use is ongoing and occurs in all areas where there is road access. ATVs cause habitat disturbance (e.g., reduce riparian vegetation leading to altered hydrological regimes and raised water temperature), mostly through increased sedimentation (see IUCN-CMP Threat 9.3). Direct mortality of frogs by ATVs is likely negligible to non-existent. Some stream crossings are armoured with rock in an attempt to reduce streambank erosion.

6.3 Work & other activities

The impacts of electroshocking which is commonly used for fish surveys in Rocky Mountain Tailed Frog habitat, are unknown. While there is evidence that there are no short-term effects on Coastal Tailed Frogs (few hours to a few days; R. Ptolemy, pers. comm., 2013), the long-term effects should be more rigorously assessed. Cossel *et al.* (2012, p. 362) noted that they have "held captured [Idaho Giant] salamanders [*Dicamptodon aterrimus*] (n > 500) for 1–3 nights after exposure to electric current and we have not observed any lingering effects, mortalities, or injuries attributable to electroshocking." They also reported one Idaho Giant Salamander "direct, immediate fatality" due to electric current in 5 years of electroshocking surveys for amphibians.

Electroshocking surveys for fish have occurred throughout much of the Flathead distribution for Rocky Mountain Tailed Frog (see Appendix 1). Future electroshocking work is more likely to occur in the Flathead watershed than in the Yahk because both sport and conservation fishery values (particularly for Montana) are greater in the Flathead than the Yahk.

IUCN-CMP Threat 7. Natural system modifications (7.1 Fire & fire suppression)

Wildfire is the major natural disturbance in southeastern B.C. Rocky Mountain Tailed Frog range is primarily in "natural disturbance type 3" (NDT-3) forests (B.C. Ministry of Forests and Range and Ministry of Environment 2010), which historically experienced frequent wildfires ranging in size from small spot fires to large, stand-replacing fires covering tens of thousands of hectares. In areas of high burn intensity, the duff layer can be lost and the heated soils become hydrophobic. The surface erosion associated with vegetation loss and soil disturbance creates a high potential for sediment infusions into watercourses. Also, intense burns that travel to the water's edge can cause stream temperatures to reach potentially lethal levels for tailed frogs.

Fire has been thought to be highly detrimental to tailed frogs, due to their low motility and reliance on cool water temperatures (Pilliod *et al.* 2003) but evidence is not clear (Hossack and Pilliod 2011). Hossack *et al.* (2006) found significant reductions in Rocky Mountain Tailed Frog numbers in Glacier National Park (Montana) streams following wildfire, relative to the same streams before the fires. However, Dunham *et al.* (2007) found no difference in Rocky Mountain Tailed Frog numbers in streams before and after wildfire events in central Idaho. In B.C., the Ram-Cabin fire in 2003 burnt through the Flathead population's extent of occurrence. Effects of this fire appeared to be minimal to Rocky Mountain Tailed Frog (Cordilleran Geoscience and ESSA Technologies 2010).

Fire management may be detrimental to Rocky Mountain Tailed Frogs for several reasons. If dams or ponds are established within the channel for temporary water collection, habitat may be lost or altered. Roads are often built quickly in response to fire outbreaks with little, if any, of the normal regulatory requirements. Sumps installed in streams for helicopter water collection can cause significant erosion and sedimentation. The toxicity of fire retardant chemicals (e.g., yellow prussiate of soda [YPS] or sodium ferrocyanide) may be increased by exposure to UVB radiation from sunlight (Little and Calfee 2000). However, these streams have been identified to firefighting agencies so they can minimize the building of sumps and impacts due to flyovers with retardant.

IUCN-CMP Threat 8. Invasive & other problematic species and genes (8.1 Invasive non-native/alien species)

Chytridiomycosis, a fungal disease caused by *Batrachochytrium dendrobatidis* (Bd), has been implicated for widespread amphibian declines (Berger *et al.* 1998; Muths *et al.* 2003; Kilpatrick *et al.* 2010). Bd is widespread in B.C., but all Rocky Mountain Tailed Frog individuals from the Yahk and Flathead watersheds that were tested for Bd were negative (35 adults, 8 juveniles, and 14 metamorphs; Govindarajulu *et al.* 2013). Hossack *et al.* (2010) tested 128 larvae and

28 metamorphosed *A. montanus* individuals in Montana and Idaho with no positive Bd infections. Even in drainages where Bd is known to be prevalent and infect Western Toads (*Anaxyrus borealis*), Rocky Mountain Tailed Frog tadpoles did not test positive for the fungus (Hossack *et al.* 2010).

IUCN-CMP Threat 9. Pollution (9.3 Agricultural & forestry effluents)

The primary pollutant addressed in this section is fine sediment flowing into streams mainly from forestry activities, including road construction and use. Low tadpole densities have been documented in streams channels dominated by fine sediment (Dupuis and Friele 1996; Welsh and Ollivier 1998; Diller and Wallace 1999; Adams and Bury 2000; Wilkins and Peterson 2000; Stoddard 2002). Dupuis and Friele (2002, 2004a) reported significantly lower Rocky Mountain Tailed Frog tadpole abundances in creeks with moderate to high sedimentation and embeddedness, than in creeks with lower levels. Welsh and Ollivier (1998) claimed that tadpoles require interstitial spaces as thermal and predatory refugia, and as foraging substrates, and that interstitial spaces are best available in coarse, anchored channel substrates with a low percentage of sand and pebbles.

Sedimentation can result from logging, roads (new and eroding and heavily used old roads), fires, and cattle grazing (minor source because of small scope). Both the Yahk and Flathead areas have extensive road networks as potential sources for chronic sedimentation. The risk of road failures and the number of older roads and skid trails that are not being maintained make this a chronic threat, but if the roads are decommissioned and allowed to revegetate naturally, they could become more stable. Acute sedimentation events are likely the most serious, but chronic sedimentation is poorly understood and undocumented. Range in severity scoring reflects this uncertainty.

Roads and road traffic impact tailed frog habitat by increasing direct sedimentation into channel beds (Beschta 1978; Reid and Dunne 1984). For example, long ditch runs (> 100 m) that discharge directly into creeks contribute significant sediments into channels, especially along active roads. Improperly designed, installed, and maintained stream crossings also offer significant risk to tailed frogs and their habitat due to the potential for sedimentation, movement obstructions, failures leading to debris flows and erosion, and changes to natural flow regimes (Toews and Brownlee 1981). Even properly designed and functioning road systems may negatively impact habitat because the increase in drainage efficacy due to imposition of the road network (Jones and Grant 1996; Thomas and Megahan 1998) can increase the magnitude of the peak flow on the event hydrograph. Longer-term maintenance of roads is a concern, especially in areas where responsibility changes with land tenures and activities.

Some activities associated with timber harvesting practices continue to contribute sediment into channels (Dupuis and Friele 2002, 2004a). For example, ground-based yarding from bladed skid roads on slopes greater than 40% was and is employed in both the Yahk and Flathead watersheds. In the past these skid road networks, resulting in very high levels of site disturbance, were simply abandoned and left to erode. Thus, the historical sedimentation impacts are thought to be high. Today skid roads are decommissioned to restore the hydrologic integrity of the logged slope. Although not routine, the practice of blading firebreaks along the perimeter of

cutblocks can accelerate erosion, and if the cutblock is situated next to a creek, the firebreak can be a source of bank instability and sediment production.

IUCN-CMP Threat 10. Geological events (10.3 Avalanches/Landslides)

Sediment loads (see Threat 9.3 Agricultural & forestry effluents) also occur from landslide events. These may occur naturally or be induced by inappropriate forestry and road building practices and other developments. Dupuis *et al.* (2000) suggested that sedimentation impacts vary with the sensitivity of the channel. More specifically, impacts are greatest in creeks with higher sedimentation risks (e.g., gullies, easily friable rock types, excessively thick glacial sediments), most dramatic in creeks with high water power (steep relief, high debris flow risk, high discharge rate), and last the longest in small creeks (first to third order) with low water transport potential. Land sliding is not an issue in the moderate sloped, U-shaped sub-basins of the Yahk River watershed (Boyd, Sprucetree, and Norge creeks), but four fillslope failures were noted in the steep V-sided Upper Yahk valley (Dupuis and Friele 2002). In the Flathead the lower reach of Storm Creek and a major tributary to Cabin Creek are subject to potential land sliding and debris-flow activity. Other areas with unstable banks that may result in the introduction of abundant fine sediment and rubble into channels include the upper four kilometres of Cabin Creek (into Cabin Pass), the ephemeral headwaters of Storm Creek, and the adjacent headwaters of Leslie Creek.

IUCN-CMP Threat 11. Climate change & severe weather

Many current predictions of climate change could have negative impacts on the Rocky Mountain Tailed Frog, and hamper long-term recovery efforts. In general, the timeframe for assessing the scope of the other threat categories is ten years, but climate change threats may be considered over longer timeframes and cumulative effects may be considered (Master *et al.* 2009). However, if climate change occurs along the lines predicted by the models below and at perhaps an increased rate, impacts may be observed sooner than anticipated. Precipitation is projected to increase significantly within the range of the Rocky Mountain Tailed Frog in winter, spring, and fall, while summers are likely to be drier and temperatures are projected to increase in all seasons (Murdock and Werner 2011; Murdock *et al.* 2013). Shifts in precipitation levels and timing, along with earlier snowmelt is anticipated to result in an earlier and higher volume spring freshet (Murdock and Werner 2011; Schnorbus *et al.* 2012). This shift could lead to shorter reaches of permanently watered creeks and shrinkage of Rocky Mountain Tailed Frog habitat.

11.2 Droughts

Hotter, drier summers will result in less water and increase the temperature in remaining water. Extended drought periods can cause perennial creeks to retract in the headwaters, thereby leading to a reduction in the availability of habitat. There are no data quantifying the response of tailed frogs, or their perennial headwater habitats, to droughts. Populations with the smallest snowpacks are likely to be most affected because the streams may be the most vulnerable to drying out during droughts but variability in basin geomorphology and hydrology will also contribute to an individual basin's vulnerability. Over the longer term, this could be a much higher threat.

11.3 Temperature extremes

Hotter summers and less water result in warmer water temperatures, which in particular are lethal above tolerable thresholds. Whether Rocky Mountain Tailed Frogs could move to higher elevations and colonize stream reaches currently too cold is unknown. Temperatures are unlikely to exceed lethal limits in the next 10 years, especially considering that the species exists at northern limits in B.C. and frogs could benefit if their distribution is limited by low water temperatures in B.C. Over the longer term, depending on how high the temperature spikes are, extreme temperatures could become an issue.

11.4 Storms & flooding

Extreme floods can disaggregate channel bedforms (Chin 1998) and mobilize sediment. For example, Flathead River and adjacent drainages were exposed to the most severe flooding on record on June 6, 1995, accompanied by extreme bedload movements on mainstem channels. The Flathead River received 25 cm of rain in a 12-hour period and approached the 100-year flood level. Cabin Creek was most affected – an estimated 200-year flood event. Large-scale bedload movement scours the channel bed causing direct mortality of tadpoles (Metter 1968). Despite this flooding, Rocky Mountain Tailed Frog tadpoles were encountered in headwater areas during the summers of 1996 and 1998, with the same frequency of occurrence (Dupuis and Wilson 1999). Although this resilience speaks of adaptability to creek life, the lack of pre-flood data does not permit an assessment of population size change in response to extreme events. The effect of extreme flooding can be great if the event occurs during July, August, or September, when tadpoles are predominantly on the substrate surface. Occurrences in small isolated drainages could be extirpated by such a large channel disturbance if the topography is steep.

5 RECOVERY GOAL AND OBJECTIVES

5.1 Recovery (Population and Distribution) Goal

The recovery (population and distribution) goal is to maintain stable or increasing populations of Rocky Mountain Tailed Frog distributed throughout the species' range in British Columbia, including any additional populations that may be discovered.

5.2 Rationale for the Population and Distribution Goal

The Rocky Mountain Tailed Frog is naturally rare in Canada, having a small distribution that is restricted to two unconnected watersheds, limited dispersal capabilities, slow reproductive rate, and specific habitat requirements. Therefore the goal to maintain stable or increasing populations of Rocky Mountain Tailed Frog throughout the species range in B.C. is considered realistic and appropriate. The intent is to achieve this goal through habitat protection, threat mitigation, and/or restoration.

The distribution of Rocky Mountain Tailed Frog in B.C. has been considered relatively well known and defined because of the extensive presence/not-detected surveys that were done from 1996 to 2004. However, recent anecdotal reports in Elder and McEvoy creeks suggest that the

species may have a larger range than previously thought (Appendix 1). These records need to be validated and any additional populations discovered also maintained.

5.3 Recovery Objectives

The achievement of this recovery goal is supported by the following recovery objectives:

1. Update distribution of Rocky Mountain Tailed Frog in B.C. by attempting to confirm anecdotal reports in the Flathead and conducting similar searches in other watersheds currently considered unoccupied.
2. Implement habitat protection measures, assess effectiveness by regular monitoring, and implement adaptive management as necessary to ensure habitat protection measures are effective over the long term.
3. Assess if populations are stable by monitoring and reporting on population size and trends at nested spatial scales, and initiate recovery actions as necessary and appropriate.
4. Monitor and report on habitat quality trends at nested spatial scales to evaluate continuing and emerging impacts of anthropogenic and natural habitat change (e.g., climate change) that may occur even in protected areas, and initiate mitigation as appropriate.

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

The following actions have been categorized by the action groups of the B.C. Conservation Framework (B.C. Ministry of Environment 2010). Status of the action group for this species is given in parentheses.

Compile Status Report (complete)

- COSEWIC report completed (COSEWIC, in press).

Send to COSEWIC (complete)

- Rocky Mountain Tailed Frog assessed as Threatened (COSEWIC, in press).

Planning (ongoing)

- B.C. Recovery Plan completed (this document, 2014).

Habitat Protection; Habitat Restoration (ongoing)

- Rocky Mountain Tailed Frog is listed as a species that requires special management attention to address the impacts of forest and range activities under the *Forest and Range Practices Act* (FRPA) and/or the impacts of oil and gas activities under the *Oil and Gas Activities Act* (OGAA) on Crown land (as described in the Identified Wildlife Management Strategy; B.C. Ministry of Water, Land and Air Protection 2004).

- Habitat protection for this species was put in place at both the stand level and the watershed level for this species:
  - stand-level: to protect riparian habitat along all perennial creeks occupied by Rocky Mountain Tailed Frog; and retain contiguous mature and old forests (or younger forests in the absence of older ones) near the core and frontier zones of key sub-basins, especially around seepage sites, in key headwater linkage areas, and in high windthrow hazard areas; and
  - watershed–level: to minimize sedimentation in Rocky Mountain Tailed Frog bearing sub-basins and maintain hydrological regimes required to support Rocky Mountain Tailed Frog.
- Nineteen Wildlife Habitat Areas (WHAs) (Table 3) have been established for all perennial creeks inhabited by Rocky Mountain Tailed Frog in the Flathead drainage (WHAs 4-046 through 4-055; Province of British Columbia 2005a); and in the Yahk drainage (WHAs 4-056 through 4-064; Province of British Columbia 2005b).
- All WHAs are 100-m wide buffers centered on the core stream. On each side, there is a 30-m "core area" (total 60 m both sides), followed by an additional 20-m "management zone" (40-m total both sides. These WHAs represent a total area of 1238.3 ha, split fairly evenly between the Yahk (625.1 ha) and Flathead (613.2 ha) populations. There is a broad range in area of individual WHAs, from 8.3 to 198 ha.
- General Wildlife Measures that apply within WHAs address access issues, forest harvesting and silviculture, pesticide use, and range activity. Key measures include (not all listed):
  - minimize roads and stream-crossings;
  - avoid disturbance to stream and surrounding areas to reduce sediment loading;
  - no harvest in core areas (30-m buffer each side), including salvage;
  - partial harvesting in management zone that maintains 70% of basal area;
  - no use of chemical applications (e.g., dust stabilizers and soil binders);
  - no pesticide use; and
  - minimize livestock use of the WHA, ensuring alternate water, forage, and shade sources.
- An ongoing program is in place to monitor effectiveness of WHAs to maintain important habitat features and, thus, viable populations of Rocky Mountain Tailed Frogs. Work on this effectiveness monitoring is currently underway (Cordilleran Geoscience and ESSA Technologies 2010; K. Paige, pers. comm., 2013). Activities include:
  - comparing time-constrained searches versus area-constrained searches for consistent relative abundance estimates;
  - determining effectiveness of permanent monitoring sites (sentinel sites) as indicators of population status;
  - studying stream weather regimes and their effect on tadpole abundance and distribution;
  - exploring other approaches to monitor WHA effectiveness; and
  - developing and implementing population estimation methodology.
- The *Flathead Watershed Conservation Act* prohibits mining, and oil and gas activities in the area (Province of British Columbia 2011). This addressed concerns around exploration or development of "high subsurface resource potential" in the Cabin Creek area that were not included in the General Wildlife Measure for WHA 4-051 in the Flathead drainage (Province of British Columbia 2005a).

Table 3. Details of approved Wildlife Habitat Areas for Rocky Mountain Tailed Frog (Province of British Columbia 2013).

WHA #	WHA name	Forest district	Population	Effective date	Area (ha)
4-046	Leslie 1	Rocky Mountain	Flathead	29-Jul-05	29.8
4-047	Leslie 2	Rocky Mountain	Flathead	29-Jul-05	32.6
4-048	Big Horn	Rocky Mountain	Flathead	29-Jul-05	22.3
4-049	Storm	Rocky Mountain	Flathead	29-Jul-05	117.8
4-050	Little Cabin	Rocky Mountain	Flathead	29-Jul-05	12
4-051	Cabin	Rocky Mountain	Flathead	29-Jul-05	151
4-052	Burnham	Rocky Mountain	Flathead	29-Jul-05	140.5
4-053	Couldrey Trib	Rocky Mountain	Flathead	29-Jul-05	23.7
4-054	American Couldrey	Rocky Mountain	Flathead	29-Jul-05	29.3
4-055	Upper Couldrey	Rocky Mountain	Flathead	29-Jul-05	54.2
4-056	Upper Yahk	Rocky Mountain	Yahk	29-Jul-05	198
4-057	Norge	Rocky Mountain	Yahk	29-Jul-05	91.7
4-058	Malpass	Rocky Mountain	Yahk	29-Jul-05	100.3
4-059	Canyon Creek	Rocky Mountain	Yahk	29-Jul-05	27.7
4-060	Sprucetree Creek	Rocky Mountain	Yahk	29-Jul-05	102.8
4-061	Noname	Rocky Mountain	Yahk	29-Jul-05	31.5
4-062	Cedartree Creek	Rocky Mountain	Yahk	29-Jul-05	35.6
4-063	Boyd Creek	Rocky Mountain	Yahk	29-Jul-05	29.2
4-064	Screw Creek	Kootenay Lake	Yahk	29-Jul-05	8.3

Recovery Planning Table

Table 4. Recovery planning table for Rocky Mountain Tailed Frog.

Actions to meet objectives	Threat[a] or concern addressed	Priority[b]
Objective 1. Update distribution of Rocky Mountain Tailed Frog in B.C. by attempting to confirm anecdotal reports in the Flathead and conducting similar searches in other watersheds currently considered unoccupied.		
• Investigate anecdotal, extra-limital reports of Rocky Mountain Tailed Frog occurrence in Elder and McEvoy creeks and other potential Flathead River tributaries.	Knowledge gap	Essential
• Conduct searches in Yahk River tributaries and other watersheds (e.g., Yahk River, Wigwam River, possibly Bloom Creek) currently considered unoccupied. Focus on areas where they have not been previously detected but where they could be present either based on anecdotal reports, habitat suitability and/or proximity to existing populations.	Knowledge gap	Beneficial
• Assess effectiveness and safety of emerging techniques such as environmental DNA (eDNA) and electrofishing to detect Rocky Mountain Tailed Frog presence.	Knowledge gap	Beneficial

Actions to meet objectives	Threat[a] or concern addressed	Priority[b]
Objective 2. Implement habitat protection measures, assess effectiveness by regular monitoring, and implement adaptive management as necessary to ensure habitat protection measures are effective over the long term.		
• Ensure adherence to General Wildlife Measures associated with approved WHAs.	5.3, 9.3	Essential
• Monitor mining, quarrying, or petroleum exploration activities that may arise within Rocky Mountain Tailed Frog Yahk population range and work with B.C. Ministry of Mines and Energy representatives to ensure they are aware of Rocky Mountain Tailed Frog locations and species requirements.	3.1, 3.2	Essential
• Continue communication with firefighting agencies to ensure streams have been identified so they can minimize the impacts due to flyovers with retardant and limit the building of sumps in the species habitat.	7.1	Beneficial
• Identify key mature (100- to 140-year-old) or old growth (> 140 years of age) forest stands adjacent to riparian zones and at seepage sites, as priorities for long-term protection through conservation covenants or other stewardship agreements with logging companies, and non-government organizations.	5.3, 9.3	Necessary
• Where there is an absence of mature and old forests to provide headwater linkages, retain younger forests as future old-growth recruitment.	5.3, 9.3	Necessary
• Develop watershed-specific hydrological green-up plans for sub-basins that contain all or part of key Rocky Mountain Tailed Frog occurrences. Plans should take into account influential parameters such as elevation, aspect, and slope, and emphasize cutblock size and tree retention.	5.3, 9.3	Necessary
• Implement long-term protection through conservation covenants or other stewardship agreements.	All	Beneficial
Objective 3. Assess if populations are stable by monitoring and reporting on population size and trends at nested spatial scales, and initiate recovery actions as necessary and appropriate.		
• Develop population estimation methodology at nested spatial scales (i.e., stream reach, sub-basin, watershed).	All	Essential
• Estimate population size for each occurrence every 10 years.	All	Essential
• If population size decreases at any occurrence, investigate causes (e.g., reconsider impacts of chytridiomycosis, habitat change in adjacent areas) and develop appropriate response.	8.1+	Essential
Objective 4. Monitor and report on habitat quality trends at nested spatial scales to evaluate continuing and emerging impacts of anthropogenic and natural habitat change (e.g., climate change) that may occur even in protected areas, and initiate mitigation as appropriate.		
• Monitor for declines in habitat quality that may occur within protected (WHA) Rocky Mountain Tailed Frog habitat due to activities outside protection zone, such as harvesting of upland and upstream forests	All	Beneficial
• Monitor for emerging global threats such as emerging infectious diseases (e.g., chytridiomycosis) that may impact the species even in protected areas.	8.1	Beneficial
• Monitor for abiotic and biotic changes at Rocky Mountain Tailed Frog locations caused by global climate change as these impacts may cause population declines even in areas with intact and effective habitat protection from proximate anthropogenic activities.	11	Beneficial

[a] Threat numbers according to the IUCN-CMP classification (see Table 2 for details).

[b] Essential (urgent and important, needs to start immediately); Necessary (important but not urgent, action can start in 2–5 years); or Beneficial (action is beneficial and could start at any time that was feasible).

6.2 Narrative to Support Recovery Planning Table

Significant effort and cost have gone into identifying Rocky Mountain Tailed Frog range within B.C. and description of the species' habitat requirements. However, recent anecdotal reports of Rocky Mountain Tailed Frogs on the eastern section of the Flathead need to be verified.

Reliable and reproducible population size and trend estimation techniques to assess stability of existing populations and effectiveness of existing habitat protections are essential. To date, survey and monitoring techniques have focused on visual searches[5] (K. Paige, pers. comm., 2013). Standard protocols for occupancy and relative abundance trend estimation are currently being assessed. Two emerging techniques may be used to increase detectability in low abundance or difficult to search streams. Electrofishing techniques used for stream surveys have been suggested as one potential method (Cossel *et al.* 2012; R. Ptolemy, pers. comm., 2013). Observations of Rocky Mountain Tailed Frog from McEvoy and Elder creeks in the Flathead River watershed were made during electrofishing surveys (Montana Fish, Wildlife and Parks, unpubl. data 2013). The other emerging technique is environmental DNA (eDNA) (Ficetola *et al.* 2008; Thomsen *et al.* 2012). This method has been effective for stream amphibians, including Rocky Mountain Tailed Frog (Pilliod *et al.* 2013). The testing of these two techniques is considered essential as they may enable the detection of new Rocky Mountain Tailed Frog populations, which could expand the current known range of the species in B.C.

Significant and very detailed effort has gone into developing an approach and protocols for effectiveness monitoring of Rocky Mountain Tailed Frog WHAs (see Cordilleran Geoscience and ESSA Technologies 2010). Further monitoring and reporting should be completed to confirm WHAs are effective.

In the absence of mature and old forests, younger forests should be retained at these headwater linkages as future old-growth recruitment. Old-growth management in headwaters will contribute towards maintaining a prolonged summer freshet. Flows can also be maintained by developing hydrological green-up plans for sub-basins that contain all or part of key Rocky Mountain Tailed Frog occurrences. These plans must be watershed-specific, taking into account such influential parameters as elevation, aspect, and slope; they must also emphasize cutblock size and tree retention.

7 INFORMATION ON HABITAT NEEDED TO MEET RECOVERY GOAL

Threats to Rocky Mountain Tailed Frog habitat have been identified. To help facilitate the actions to meet the recovery (population and distribution) goal for this species, biophysical attributes that are required by Rocky Mountain Tailed Frog have been described and locations of survival/recovery habitat have been geospatially described on the landscape.

[5] "Visual searches" here includes rock-rolling, time-constrained searches, area-constrained searches, and hand searches.

7.1 Description of Survival/Recovery Habitat

The habitat used by Rocky Mountain Tailed Frog across its global range has been documented in a number of studies (see Section 3.1).

7.1.1 Biophysical Attributes

Biophysical attributes that are required by Rocky Mountain Tailed Frog are described as follows:

Eggs and tadpoles require:

- very low sediment levels;
- permanently flowing water;
- cascade streams with a step-pool morphology combined with stable bedform substrates that offer pore-space refugia during both low water and flooding events; and
- suitable stream temperatures:
    - between 5 and 18.5°C for eggs
    - between 9 and 16°C for tadpoles.

Post-metamorphic frogs require:

- suitable habitat in which to deposit eggs (as above);
- suitable habitat for foraging, hibernating, mating, and dispersal, and migration routes between watersheds, including:
    - higher elevation streams that may be too cold to support egg and tadpole development, but may provide dispersal and migration corridors;
    - riparian forest areas adjacent to stream reaches for foraging, hibernating, and dispersal;
    - appropriate upland habitat: all remaining mature (100- to 140-year-old) or old-growth (> 140 years of age) forest stands *adjacent* to riparian zones and at seepage sites necessary to maintain present and future riparian microhabitat conditions, and terrestrial foraging and dispersal habitats for juveniles and adults; where mature or old-growth forest stands are absent, younger forests are necessary for long-term restoration and recovery.
    - Older forests along ephemeral headwaters to provide key linkages between occurrences and subpopulations/sub-basins.
- Suitable stream temperatures (i.e., < 24.1°C for adults).

7.1.2 Geospatial Description

Wildlife Habitat Areas were established for Rocky Mountain Tailed Frog based on these biophysical attributes. As such, the geospatial description of survival/recovery habitat for the Rocky Mountain Tailed Frog uses the polygon boundaries that have been delineated for the existing WHAs (Province of British Columbia 2005a, 2005b, 2013).

7.2 Studies Needed to Describe Survival/Recovery Habitat

Sightings of Rocky Mountain Tailed Frog that expand the species range in Canada have been reported for the Flathead River watershed (Montana Fish, Wildlife and Parks, unpubl. data, 2013). These reports require verification. Stream reaches where Rocky Mountain Tailed Frog is confirmed should also be included in the description of survival/recovery habitat.

8 MEASURING PROGRESS

The following performance indicators provide a way to define and measure progress toward achieving the population and distribution goal and recovery objectives. Performance measures are listed below for each objective.

Measurables for Objective 1:

- Reports of Rocky Mountain Tailed Frog in McEvoy and Elder creeks are verified by 2014.
- Potential tributaries in the Flathead and other watersheds (e.g., Yahk River, Wigwam River, possibly Bloom Creek) are resurveyed using newer and more effective techniques by 2015.

Measurables for Objective 2:

- Finalized WHA effectiveness monitoring protocols be in place by the 2015 field season.
- Ongoing WHA monitoring shows no decline in Rocky Mountain Tailed Frog habitat.

Measurable for Objective 3:

- Approved population estimation techniques in place by next COSEWIC status report (approximately 10 years after last assessment; i.e., 2024).

Measurable for Objective4:

- Measurables for Objective 2 cover Rocky Mountain Tailed Frog sites with WHA protection measures. At new sites and sites without WHA monitoring, a habitat quality reconnaissance should be conducted by 2019.
- Protocols developed for assessing habitat changes arising from climate change and other emerging threats by 2020.

9 EFFECTS ON OTHER SPECIES

Recovery efforts for Rocky Mountain Tailed Frog are expected to benefit other species occupying similar habitats. No negative effects are anticipated. Riparian ecosystems are well documented as being very diverse and ecologically important habitats (Gregory *et al.* 1991). A wide variety of terrestrial and aquatic invertebrates are known to use headwater streams in this area, particularly aquatic insects (Hauer *et al.* 2007). Riparian zones are used by nearly 75% of B.C.'s vertebrates (Bunnell and Dupuis 1995). They are valuable to wildlife because of their high primary productivity, diversity of plant taxa, rapid growth, and abundant forage (Franklin

1988). Many species are more abundant and/or reproductively successful near watercourses than upslope (e.g., Corn and Bury 1989; Dupuis *et al.* 1995; Forsey and Baggs 2001; Virgos 2001; Jones *et al.* 2002).

Other mountain stream vertebrate inhabitants include Harlequin Duck (*Histrionicus histrionicus*), American Dipper, and Water Shrew (*Sorex palustris*). Additional provincially and/or federally listed species at risk occurring within the Rocky Mountain Forest District that are closely associated with riparian or aquatic habitats are Western Toad, Fisher[6] (*Martes pennanti*), and Grizzly Bear (*Ursos arctos*). The Western Toad is also federally listed under SARA as Species of Special Concern. Recovery planning activities for Rocky Mountain Tailed Frog will be implemented with consideration of all co-occurring species at risk, such that there are no negative impacts to these species or their habitats.

[6] Fisher is extremely rare and possibly extirpated from areas where Rocky Mountain Tailed Frog occurs. There were occasional reports from the Yahk drainage in the early 2000s, possibly moving north from Montana, or remnants of an unsuccessful reintroduction project to the East Kootenay (Weir *et al.* 2003). Fisher is very unlikely to occur in the Flathead area occupied by Rocky Mountain Tailed Frog.

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APPENDIX 1.

Electroschocking sample sites targeting Bull Trout (*Salvelinus confluentus*) by Montana Fish, Wildlife & Parks staff between 2008 and 2012. Coloured circles indicate amphibian observations as noted.