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LASQUETI ISLAND WATERSHED ASSESSMENT FOR PRESENCE OF FISH HABITAT

Prepared for:

Ms. Linda Prowse
Islands Trust Northern Office
700 North Road, Gabriola Island, BC, V0R 1X3

Prepared by:

Jennifer Morgen, M.Sc., A.Sc.T., B.I.T.
MADRONE ENVIRONMENTAL SERVICES LTD.
1081 Canada Avenue, Duncan, BC, V9L 1V2

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LASQUETI ISLAND RAR WATERSHED IDENTIFICATION

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1.0 INTRODUCTION

The Riparian Areas Regulation (RAR) is the basis of streamside protection in British Columbia (BC). The RAR was enacted in 2004 under Section 12 of the Fish Protection Act. The RAR is a joint initiative with Fisheries and Oceans Canada (DFO), the Ministry of Environment (MoE) and local government. The RAR uses a science-based approach to help ensure land development activities do not result in a harmful alteration, disruption or destruction (HADD) of fish habitat.

In BC, the definition of fish habitat includes all aquatic and terrestrial areas that affect fish life processes. Fish habitat, therefore, includes the area directly adjacent to a stream (*i.e.*, the riparian area) because it provides food, nutrients, and other functions vital to fish survival.

Islands Trust retained Madrone Environmental Services Ltd. (Madrone) to assess and identify watersheds on Lasqueti Island. The primary objective of the project was to determine which watersheds possess fish habitat and may become subject to the RAR. According to a map provided by the Islands Trust, of the 22 watersheds on Lasqueti Island, only three have been designated RAR watersheds by the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO), those being Hadley Lake, Boat Cove and Sam Creek.

The remaining, 19 un-verified watersheds were to be assessed using the RAR methodology, to close the knowledge gap and provide a basis to make further decisions regarding the implementation of the RAR on Lasqueti Island. If adopted, , any proposed development within the 30 m Riparian Assessment Area (RAA) of a watercourse within a watershed determined as having fish habitat, would trigger the RAR process. Development within the RAA would be permitted if a Qualified Environmental Professional (QEP) completes and submits a Riparian Assessment Report to the local government (Islands Trust), DFO and the MoE.

2.0 METHODOLOGY

2.1 Background Research

Background research was carried out using the Fisheries Information Summary System (FISS) (http://a100.gov.bc.ca/pub/fidq/fissSpeciesSelect.do) and Habitat Wizard (http://www.env.gov.bc.ca/habwiz/) to determine whether any documented stream information existed for the study area. Base maps provided by Islands Trust were also reviewed prior to conducting the field assessment. The Islands Trust also provided copies of RAR reports previously submitted by QEP's as part of subdivision applications on Lasqueti. At the time of the assessment (March 2013), only three properties had been assessed under RAR—two of the properties were not applicable (LA SUB 2011.1 and LA SUB 2012.1). However, it was determined that residential lot (LA SUB 2011.2) was subject to the RAR process.

Local stream names were taken from the "Lasqueti Island Water Allocation Plan" (Bryden & Barnett, 1992) and applied to streams identified in the field. Where streams were not listed in the 1992 Ministry of Environment report, stream names were assigned based on local resident knowledge, or other identifiers such as the outlet bay name.

2.2 Assessment Areas

The 19 "unverified watersheds" defined the study area (Figure 1). Within these watersheds, only the mainstem stream was assessed, as any tributaries would also be applicable under the RAR, if adopted. We did not assess streams located outside the study area.

2.3 Definition of a "Stream" under the RAR

In order to identify applicable drainages in the field, the definition of a "stream" as listed under the provincial RAR, was used as a standard. As per Section 1.4.2 of the RAR Assessment Methodology; (http://www.env.gov.bc.ca/habitat/fish_protection_act/riparian/documents/assessment_methods.pdf), a "stream" is defined as follows:

> "…any watercourse – natural or human made – that provides fish habitat that contains water on a perennial or seasonal basis, is scoured by water or contains observable deposits of mineral alluvium, or has a continuous channel bed including a watercourse that is obscured by overhanging or bridging vegetation or soil mats. A watercourse may not itself be inhabited by fish, but may provide water, food and nutrients to streams that do support fish."

The RAR further identifies a stream as:

"…any of the following that provides fish habitat:

(a) a watercourse, whether it usually contains water or not;

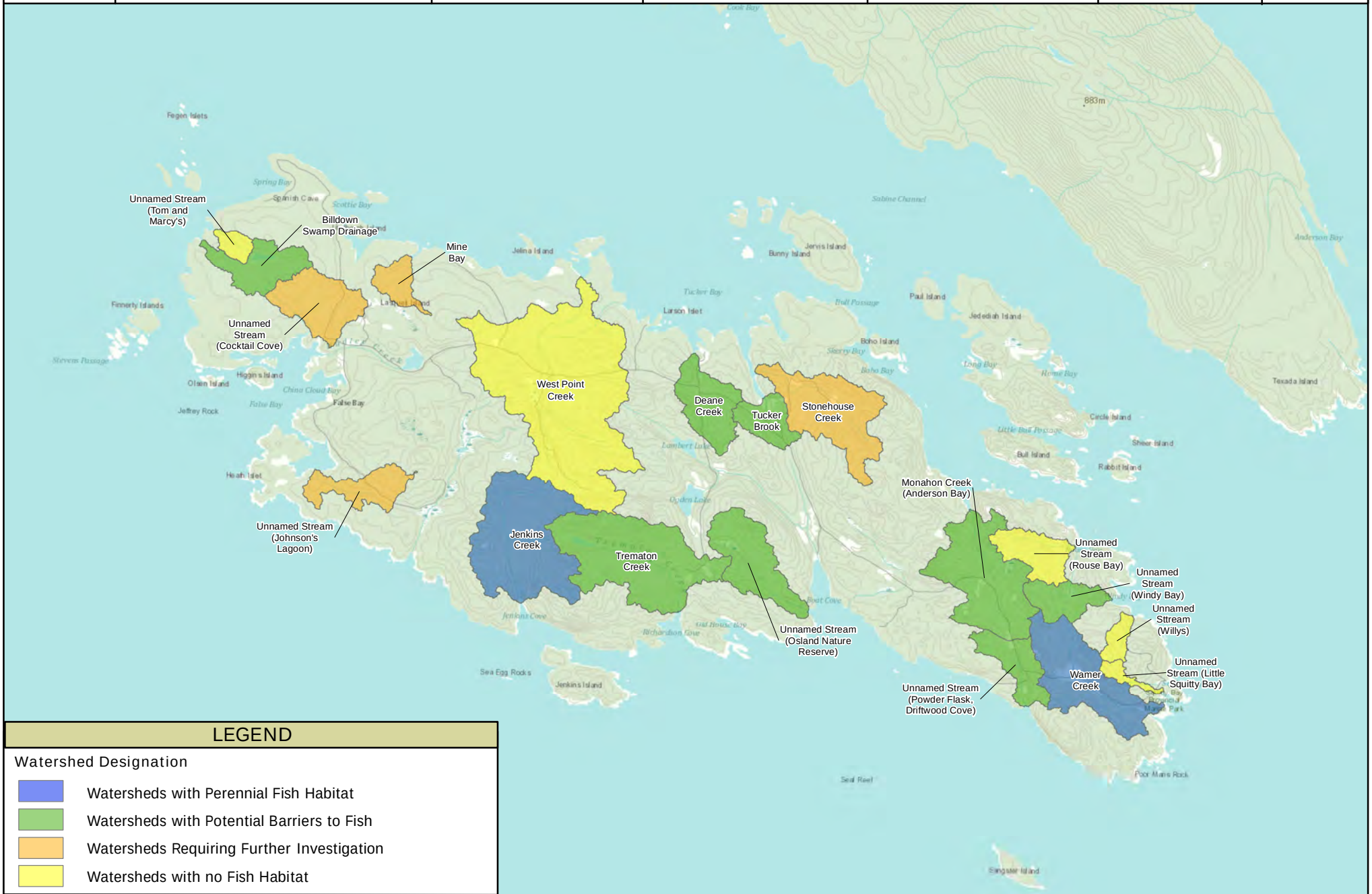
(b) a pond, lake, river, creek, brook;

(c) a ditch, spring or wetland that is connected by surface flow to something referred to in paragraph (a) or (b).

If a barrier (either definitive or non-permanent) to the migration of fish is identified, a watercourse is classified as a stream above the barrier if there is potential fish habitat downstream of the barrier. Any part of a watercourse that is not inhabited by fish (e.g. above a barrier) that connects by surface flow to fish habitat is considered a stream under the RAR process.

Watercourses that do not support fish or connect by surface flow to fish habitat (e.g. isolated wetlands) are not considered "streams" under the RAR process. It should be noted that wetland ecosystem types still provide benefits to a range of species and provide important functions (e.g. stormwater retention).

MADRONE environmental services ltd	PROJECT: Watershed Assessment for Riparian Area Designation		LOCATION: Lasqueti Island, B.C.	CLIENT: Islands Trust	DOSSIER NO: 13.0054
	ASSESSED BY: Jennifer Morgen, M.Sc., B.I.T., A.Sc.T.	FIELD VISIT: March 22, 2013	MAP SCALE: 1:80,067	MAPPING DATE: April 03, 2013	DRAWN BY: Erin Philip



LEGEND

Watershed Designation

- Watersheds with Perennial Fish Habitat
- Watersheds with Potential Barriers to Fish
- Watersheds Requiring Further Investigation
- Watersheds with no Fish Habitat

0 500 1,000 2,000 3,000 m.

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

2.4 Field Assessment Procedures

Field work for the Lasqueti Island assessment was conducted by one field crew of two people during the period March 22nd to March 24th, 2013. Stream surveys during the winter months represent the best season regarding the delineation of drainage networks, as flows are near maximum.

Recent maps with orthophotos, TRIM stream data, watershed boundaries, lot lines and road networks were provided by the client. These were used to identify the main drainage for each watershed. The drainage was assessed in the field, beginning from the outlet at the tidal boundary to identify any immediate barriers to fish migration upstream.

Basic habitat data was collected at the tidal boundary, including gradient, channel morphology (e.g. riffle-pool/cascade pool or step-pool) and fish habitat potential. Representative site photographs were taken at the stream mouth, and upstream if habitat existed (Appendix I).

As many of the streams on Lasqueti Island flow through private property, it was important to gain land owner permission prior to accessing the stream. Due to time constraints, the Islands Trust personnel were unable to provide land owners with information packages prior to commencement of the project. However, Doug Hopwood, R.P.F., local resident and field crew member, identified land owners requiring contact and obtained approval prior to the site visit. Of the 19 watersheds, only three were inaccessible due to land owners not granting permission to access the property, and those streams (and therefore watersheds) were not assessed. However, one of the watersheds had been surveyed under RAR previously for subdivision application (LA SUB 2011.1). It was determined that West Point watershed was not applicable under RAR due to a barrier to fish passage at the outlet and a lack of perennial water source above the barrier.

2.5 Assessing for Fish Presence or Potential Fish Presence

While background research using databases is useful in determining the general distribution of fish, it cannot be relied upon as a complete inventory. For example, a lack of data for any given stream or watershed cannot be interpreted as indicating that the stream or watershed does not contain fish. Proving non fish presence generally requires rigorous sampling procedures during optimal seasons. Given the fact that the project was focused on identifying fish bearing or **potential** fish bearing watersheds,

no detailed sampling procedure was carried out. Fish sampling, therefore, was beyond the scope of this assessment.

For low gradient streams that connected directly to the ocean without a barrier, a default "potentially fish-bearing" status was used (considering the potential for access to the drainage by anadromous fish). It should be noted that a stream is considered to be fish bearing even if it provides potential habitat for fish during a very short period of time, such as seasonal spawning/rearing habitat or high flow ephemeral off-channel security habitat if it is connected to a larger freshwater system with fish habitat.

Identifying **permanent** barriers or high gradient reaches that could potentially limit the upstream movement of anadramous fish were a focal issue of the assessment when encountered at tidewater. Streams with barriers at tidewater, that according to local residents, lack perennial habitat for resident fish, were not considered "streams" under the scope of this assessment. However, it would be important to further confirm the lack of perennial habitat by assessing these watersheds when the flow is at its minimum. If perennial habitat and/or a source of fish was identified upstream of a barrier, the drainage would be considered potentially fish bearing and, therefore, classified as a "stream" under RAR.

Flow periodicity and the identification of potential fish "sources" (e.g. lakes or permanently wetted open water wetlands) were factors that were considered when assessing the potential for fish to occur. Based on a lack of habitat attributes for resident fish, the potential for seasonal use of the drainages by anadromous fish became the most important factor to consider. As a result, assessing the drainage outlets at tidewater for potential habitat and barriers was critical. Log debris at the tidewater boundary is not necessarily considered a permanent barrier to fish migration, though further investigation may prove otherwise.

3.0 RESULTS

3.1 Documented Stream Data

Fish distribution data for Lasqueti Island is limited. Only three watersheds are listed under FISS, and only two have documented fish observations. Hadley Lake (watershed code 905-119500-40900; waterbody identifier 00078PARK) is the primary water supply for the residents of Lasqueti Island. In January 1990 and October 1998, two endemic species of stickleback were observed in the lake, Hadley Lake limnetic threespine (*Gasterosteus aculeatus*) and Hadley Lake benthic threespine (*Gasterosteus*

aculeatus). However, by 1999 each population of stickleback had been eradicated by the introduced brown bullhead "catfish" (*Ameiurus nebulosu*). The two species to stickleback were listed as being extinct in May 2000 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC, 2013).

Lambert Lake (watershed code 905-119500-09100-70100; waterbody identifier 00097PARK) and Ogden Lake (watershed code 905-119500-09100; waterbody identifier 00105PARK) are both headwaters for Ogden Creek, which drains into Boat Cove. Fish stocking records for Ogden Lake indicate that it was stocked with brook trout (*Salvelinus fontinalis*) in 1915 and westslope cutthroat trout (*Oncorhynchus clarkii lewisi)* in 1930. There have been no recorded fish observations since the initial stocking program was introduced. Trematon Lake (watershed code 905-119500-16100, waterbody identifier 00112PARK) does not have any records of fish observations or releases.

3.2 Watersheds with Fish Habitat

Of the 16 watersheds that were assessed in the field, 10 were identified as having fish habitat and meet the definition of a "stream" under RAR. The majority of the streams on the island are known to dry up in the summer months, however, species such as chum salmon (*Oncorhynchus keta*) or pink salmon (*O. gorbuscha*), which do not require perennial rearing habitat for juveniles after emerging, could potentially occur in these systems if water is **consistently** available from fall to late spring. As such, we've divided this category into two groups: Streams with Fish Habitat and Streams with Potential Barriers to Fish. Please note the name in brackets represents the local name or drainage basin.

3.2.1 Watersheds with Perennial Fish Habitat

Within this category are watersheds that were determined to have the characteristics required to support fish on a perennial or seasonal basis due to the lack of barrier and adequate flow regimes.

3.2.1.1 Jenkins Creek

This stream flows into Jenkins Cove on the southwest coast of the island near Jenkins Island. It follows a consistent, low to medium gradient (on average 7%) to the ocean. Habitat enhancement has taken place on this creek, including the placement of scour logs, log structures, and boulder clusters within the stream. Also, a summer retention pond was created at the headwaters (see Appendix 2) to store water for use during dry periods.

During the assessment, some log debris was observed at the mouth of the stream in the cove, but it did not appear to be blocking the outlet. However, the local landowner adjacent to the outlet mentioned that in in previous years, salmon were observed in the cove, but unable to navigate beyond the log barrier. Logs have since been removed, though this appears to be a recurring problem in this location.

No permanent barrier to fish passage was observed on this creek and excellent, low-gradient fish habitat was observed throughout.

3.2.1.2 Wamer Creek

Wamer Creek is located in the southeast corner of Lasqueti Island. The headwaters are a series of wetlands/ponds located along the road to Squitty Bay Provincial Park. The local landowner has worked with several biologists to carry out habitat enhancement projects within the stream, including the creation of rearing ponds for juvenile Coho Salmon (*Oncorhynchus kisutch*) (See Appendix 2). Other enhancements such as the placement of scour logs, boulder clusters and log structures were also evident.

The creek follows a low-gradient (<5% slope) course from the wetlands to the ocean with no observed barrier to fish migration. At the ocean, the mouth of the stream is currently blocked by debris, but it doesn't appear to be preventing water flow. The riparian vegetation is intact, though over-grazing was apparent. Some sections of the stream had been fenced along the banks to keep the sheep out and allow vegetation to recover. There is also evidence of tree planting in some spots as well.

The habitat enhancement projects have not been as successful as hoped, but the presence of suitable fish habitat with perennial water makes this one of the more likely streams to support fish on Lasqueti Island.

3.2.2 Watersheds with Potential Barriers to Fish

Although these are watersheds with fish habitat, they possess features that may be a barrier to fish, such as a log jam at the outlet, or potentially discontinuous water flows during the critical season. Further investigation into these watersheds is recommended to ensure they are accurately designated, especially if RAR is to be adopted.

3.2.2.1 Billdown Swamp Drainage (Fisher, Toy Bay)

Billdown swamp is the headwaters of this watershed, and is drained by a single low-gradient stream, which drains into Toy Bay, located on the northwest coast of Lasqueti Island. Approximately 100 m upstream of the ocean, the stream transitions into a confined steep sided ravine. The gradient of the stream increases to approximately 15% (cascade-pool channel type).

The average channel width (at bankfull) of the stream is 1 m – 2 m and the substrate consists of a mix of cobbles and gravels, which provides potential spawning habitat for various salmonid fish species (*i.e.* trout and adult salmon). Cover in the form of LWD is abundant; pools and undercut banks are also well represented, providing potential security habitat for fish. Riparian vegetation is intact and provides biological function in the form of shade, leaf/litter input, insect drop and bank stability.

Chum and anadramous rainbow trout ("steelhead") (*Oncorhynchus mykiss)* have been observed in Toy Bay, but not within the stream. It is possible that water quality limitations currently preclude the use of the stream by fish.

3.2.2.2 Trematon Creek

Trematon Creek is the main outlet from Trematon Lake, located at the base of Mt. Trematon, the highest peak on Lasqueti Island. The stream flows into the west side of Richardson Cove, located on the south coast of the island, to the east of Jenkins Cove. The outlet was blocked by log debris but water was still observed flowing over the beach. Adjacent to the stream (east side), a private residence exists. The depth of riparian vegetation along this stream bank is sufficient in that it is functioning biologically (*i.e*., providing shade and nutrients to the stream).

At the tidewater boundary, the creek has a minimal slope and habitat suitable for anadramous fish. Approximately 150 m upstream from the tidewater boundary a tributary stream flows into Trematon Creek. The tributary flows from the north, but its headwaters are unknown as it was not traversed. It did appear to flow from the Richardson Bay Road area.

At the confluence with the tributary, the mainstem and its natural course has been anthropogenically altered by the creation of a holding pond, likely for irrigation purposes. The outlet of the pond was completely blocked by a dam, and the water flow out of the pond regulated by a valve positioned on a pipe. Fish cannot pass through this pipe to access the habitat upstream; as a result the dam is a barrier to

upstream fish migration. It is important to note that a natural cascade with 35% gradient does exist approximately 50 m upstream from the inlet of the pond. If the dam was to be removed in the future, this cascade would be a barrier to upstream migration.

3.2.2.3 Unnamed Stream (Osland Nature Reserve)

The headwater of this unnamed stream is a large wetland located within a property recently donated to the Islands Trust Fund as a nature reserve. It was named after the previous owner, John Osland who lived on the property for 62 years before leaving the property to the Trust in his will (Islands Trust Fund, 2013). In the past, the wetland had been ditched for agricultural purposes, but once it became a nature reserve, the ditch was filled in and water was allowed to settle in the fields.

The stream follows a steady slope from the wetland to the outlet at the ocean where there is a large log debris jam. The habitat at the top end of the stream is relatively flat, with many excellent habitat features for fish. The riparian corridor is intact, though lacks a well-developed understorey due to over-grazing by feral sheep. Many tall, mature trees exist, but young trees have been unable to establish. Evidence of historic logging was also present.

The lower reaches of the stream, down to the ocean, are channelized and flow through a steep sided ravine. Within the ravine, the stream flows over a series of small cascades. These likely act as a fish barrier, though gradient was not taken due to inaccessibility. Even if the cascade is a barrier, habitat does exist from the tidewater to the base of the first cascade. Therefore, this watercourse is classified as a "stream" and would be applicable under RAR.

3.2.2.4 Unnamed stream (Powder Flask, Driftwood Cove)

Located east of Boat Cove on the southeast coast, this stream drains from a manmade pond into the ocean at Driftwood Cove. The pond has been constructed with a dam on the south side, but the outlet is not blocked and, therefore, not a barrier to fish migration. The stream possesses a low gradient (5%) to the tidewater boundary. The outlet of the stream was blocked by log debris.

The riparian habitat has been anthropogenically altered and contains a mixture of exotic and native vegetation species. The depth of vegetation growth is limited to a few metres. Any watercourses entering the pond from the north were not assessed at this time.

Due to the presence of perennial habitat and lack of a permanent barrier, this drainage and watershed are applicable under the RAR. Despite the presence of the pond as a perennial water source, it is possible that water quality limitations currently inhibit the use of both the stream and pond by fish.

3.2.2.5 Unnamed stream (Windy Bay)

Located on the north east tip of the island, this watershed drains into Windy Bay. The main source of water for this watershed appears to be a wetland located approximately 500 m from the outlet at the ocean. Any tributaries into the wetland were not observed during the field assessment.

From the wetland, the outlet drainage flows through subdued terrain (5% slope) for approximately 200 m at which the topography changes such that the stream becomes more enclosed into a steep sided ravine. The overall stream gradient does not increase significantly. Evidence of historic logging is prevalent throughout the riparian zone and the understorey is comprised mostly of moss and lichens due to overgrazing by feral sheep.

At the tidal boundary, the outlet of the stream was blocked by driftwood and other debris. Wave action had also deposited gravel, creating a berm on the beach. The stream flows subsurface for a few metres prior to re-emerging and flowing into the ocean. Although this might initially be considered a barrier, it would not be considered a permanent barrier under RAR. As the stream only goes subsurface for a few metres beneath the log debris, it is possible that at high tide, the water levels will be such that the stream no longer flows subsurface. Further investigation would be required in order to confidently conclude that the stream is not continually connected to the ocean via surface flow and there is no potential for fish to migrate upstream. This was beyond the scope of the project at this time.

3.2.2.6 Monahan Creek (Anderson Bay)

The outlet of this watercourse empties into Bull Passage located on the north east coastline between Lasqueti Island and Bull Island. From the orthophoto imagery, the headwaters for the mainstem appear to be a cluster of small wetlands.

At the tidal boundary, the stream flows over cobbles and boulders. The landscape within the stream's eastern riparian corridor has been greatly altered by human use, with a residence, driveway and overgrazing by feral sheep observed. A thin strip of salmonberry (*Rubus spectabilis*) and sword fern (*Polystichum munitum*) comprises the

vegetation along the eastern stream bank. The stream channel is less than 1 m in width and possesses a gentle (3%) gradient for the first 30 m upstream of the ocean, where it then increases to 12%. Approximately 50 m upstream, a small cascade with 30% gradient would likely act as a barrier to fish passage. Above the cascade, the stream gradient is approximately 10%. Approximately 100 m upstream of the first cascade, a larger cascade exists immediately below a residential driveway.

Because there is some fish habitat, albeit limited, from the tidal boundary to the first cascade, this stream would be applicable under RAR.

3.2.2.7 Tucker Brook (Long Bay)

Tucker Brook flows into Long Bay, located along the northern shore of the island. This brook is located on a farm, though the property is currently uninhabited. The main source of this watershed is a large, manmade pond that could provide perennial habitat for fish if water quality was sufficient. The pond has a constructed dam along the northern edge. The outlet drainage channel flows out of the north east corner of the pond.

The stream follows a defined channel for less than 30 m before falling over a small step-pool cascade at the tidewater boundary. The gradient of the cascade at low tide is near 25%, though there may be opportunities for fish to pass at a higher tide when more water is available. This could not confidently be determined a barrier at the time of assessment. In addition, the presence of the perennial water source above the cascade contributes to the fact this drainage classifies as a "stream" under RAR.

3.2.2.8 Deane Creek (Tucker Bay)

Located on the north central coast of Lasqueti Island, Tucker Bay is located just west of Long Bay. The main headwater of the stream is a manmade pond, but there are at least three tributaries to the pond from within the watershed.

Near the tidewater boundary, the gradient of the stream is minimal (5%) and contains good spawning habitat for salmon. Upstream, the channel is approximately 1 m to 2 m wide with a well-established riparian canopy of western redcedar (*Thuja plicata*) and Douglas-fir (*Pseudotsuga menziesii*) and dense understorey of ferns and salmonberry. In-stream features such as woody debris, undercut banks and pools could provide shelter to juvenile salmonids.

At approximately 250 m upstream from the ocean, the gradient begins to increase and reaches slopes of 15% to 20%. A bedrock cascade of greater than 35% is located just below a residential driveway. This would be the natural barrier to upstream migration.

3.3 Watersheds Requiring Further Investigation

These watersheds were not classified during the field visit. Due to the time constraints in contacting landowners, permission was not granted to access two of the watersheds. The other two watersheds had barriers at the tidewater, but need further investigation to determine whether perennial fish habitat is available, as this was not made obvious during the site assessment.

3.3.1 Unnamed Stream (Mine Bay)

The landowner of this property was willing to have us investigate the stream, but required more notice. Upon investigation of orthophotos, it appears that there is no evidence of a perennial water source as the headwaters to this stream. The lack of perennial habitat and the relatively small size of the watershed would suggest that the stream dries up and has very limited habitat potential for fish. However, unless there is a barrier at the tidal boundary or water flows are shown to be inconsistent, this stream may provide fish habitat.

3.3.2 Unnamed Stream (Cocktail Cove)

At the tidewater boundary in Cocktail Cove, a small cascade acts as a barrier to upstream fish migration. The stream dropped approximately 1.5 m – 2 m over a cascade to the ocean, and no plunge pool was available.

The main headwater for this watercourse is a wetland swamp located adjacent to Conn Road. According to a local landowner, some water is retained in the swamp throughout the summer. The water from the swamp drains into a second wetland, approximately 100 m from the tidewater boundary. The water flowing out from the lower wetland is channeled through a wood box culvert, under a dirt road where it flows for approximately 30 m to the top of the cascade. The average channel width (at bankfull) in this area is 1 m. Despite the presence of the road, the riparian vegetation is mostly intact and provides biological function in the form of shade, leaf/litter input, insect drop and bank stability.

It is uncertain whether a resident fish population could be supported in the swamp as unfavourable habitat conditions (*i.e.*, high temperature and low oxygen) would likely

exist. If suitable perennial habitat does not exist, then this watershed would not provide fish habitat.

3.3.3 Unnamed Stream (Johnson's Lagoon)

One of the landowners of the property at Johnson's Lagoon was very cooperative and provided information regarding this watercourse. However, only being a ¼ owner of the property, he was not able to grant us permission to access the stream. He described the stream as low gradient up to a cascade beneath the driveway, which was several hundred metres from the tidal boundary. He mentioned chum salmon had been observed in the area, but was uncertain as to whether they utilized the stream. Due to the low gradient nature and lack of barrier, it is likely this stream would provide fish habitat if water flow requirements were met.

3.3.4 Stonehouse Creek

This stream was assessed during the field visit; however, the information obtained was not sufficient to confidently classify this watershed.

Located on the north central coast of the island, Stonehouse Creek empties into a small cove on the east side of Long Bay. This creek drains Oasis Swamp located approximately 2 km from the bay and is a part of relatively large watershed. At the tidal boundary, there is a 45% cascade barrier that would prevent upstream migration of fish. According to the Water Allocation Plan (Bryden & Barnett, 1992), Oasis Swamp has no outflow during the summer months. However, a local resident of the bay mentioned the stream continues to flow until late summer, and then flows again after the first rains in early fall. Habitat features observed within the stream corridor include; deep pools, closed tree canopy and undercut banks, ideal for supporting fish. If water was available year round, this stream would be able to support resident fish.

3.4 Watersheds with No Fish Habitat

Four watersheds were determined to not meet the definition of a stream under RAR and therefore do not have potential for fish. One watershed was not assessed as it had previously been assessed under the RAR for a subdivision application. All of these watersheds have streams with either a permanent barrier (*i.e.*, waterfall at tidewater), or they lack stream characteristics (alluvial deposits, evidence of scour) and categorizes them as non-classified drainages (NCD's) (Ministry of Forests, 1998). In addition, none of these streams had headwaters that could provide perennial habitat.

None of the mainstem watercourses visited had gazetted names and will be referred to by their geographic location or name of the current property owner.

3.4.1 Tom & Marcy's

Located on the northwest tip of Lasqueti Island, this watershed is adjacent to the Bulldown Swamp watershed. The TRIM streams data inaccurately shows that the main drainage from the swamp goes through this watershed. There appeared to be no significant headwaters and the stream gradient is relatively steep throughout. A cascade with a 30% gradient at the tidal boundary was observed and determined to be a barrier to fish passage.

3.4.2 Willy's

Located just east of Windy Bay, this stream drains a series of ponds and possesses a relatively steep gradient (20%). The stream flows through a ravine to the ocean, where it flows over a bedrock cascade into the bay. Due to the steep nature of the habitat, the barrier was only observed from above. However, it was determined to be significantly greater than 25%, which would be the upper limit for fish passage. In addition, it is unlikely the small ponds provide perennial habitat for resident fish.

3.4.3 Rouse Bay

A barrier to fish migration was observed at the tidewater boundary in Rouse Bay, which is located on the east tip of the island. The gradient of the barrier (step-cascade habitat) is approximately 35% with no plunge pool at the base to assist upward migration by fish. A recent storm had caused several of the trees along the stream banks to blow down, making the outlet of the stream difficult to see. Although some low gradient habitat was observed upstream, evidence from the orthophotos do not suggest that significant headwaters exist to provide perennial habitat. Therefore, this watershed is does not have fish habitat.

3.4.4 Little Squitty Bay

Located just east of Squitty Bay, this drainage empties into Little Squitty Bay. Errors in the TRIM data show this watercourse flows into Squitty Bay. The drainage was hardly recognizable as there was less than 10 cm of water in the channel. In addition, there did not seem to be a headwater source and the water within the depression went subsurface approximately 30 m upstream from the ocean. It lacked scour and alluvial deposits, therefore designating it as a non-classified drainage (NCD).

3.4.5 West Point Creek

This creek was not assessed during the field reconnaissance due to the landowner at its outlet stating it had previously been assessed under the RAR for a subdivision application. Therefore, this stream did not need to be reassessed. The results of the assessment showed that there is a barrier at the tidal boundary which would prevent upstream migration of fish, and there was no significant headwater source to provide perennial habitat. Although the information provided in the RAR assessment cannot be used by Madrone, it has been provided to the Islands Trust, and conclusions regarding lack of perennial fish habitat can be drawn by those with authority to do so.

4.0 DISCUSSION

Detailed background research using appropriate databases, orthophotos, existing reports and contour data, in conjunction with field reconnaissance trips, resulted in the identification of ten watersheds (in addition to the three already designated) that have some potential to provide fish habitat, though further investigation may prove otherwise. It was determined that five watersheds have no fish habitat and four require further investigation.

Under the RAR methodology, any watercourses within watersheds that connect by surface flow to the mainstem of any potential fish bearing systems, including modified watercourses and ditches, would be subject to the regulation, if it were to be adopted. A stream may not itself be inhabited by fish, but if it has a reasonable connection by surface flow to fish habitat, it is considered a stream under the RAR definition.

General fish habitat attributes on the majority of streams were low, based on information from locals regarding the seasonality of flow and the history of the streams. At this time, these streams and their watersheds have been included as having fish habitat because the ability to prove there are no fish is beyond the scope of this study.

The watercourses with the greatest potential for fish to occur include Jenkins Creek and Wamer Creek, as these both appear to have perennial habitat. The riparian area of several streams was relatively undisturbed with intact riparian vegetation. Evidence of over-grazing by sheep was a limiting factor to understorey development in some watersheds. Three watercourses had been drastically-altered for human use, though potential habitat still existed at all of these. Low gradient courses and favourable in-stream features such as undercut banks, CWD, pool-riffle habitat and diverse stream bed materials provide excellent opportunities for use by anadramous fish.

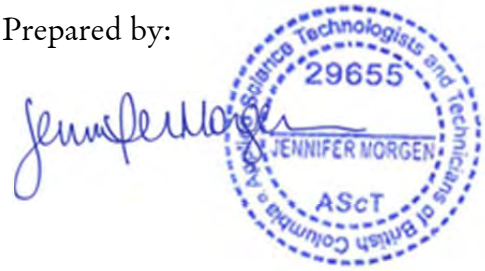
Four watersheds that need further investigation were also identified. Two of these were not verified during the field visit due to lack of landowner permission at the time. Based on the information provided by one of the landowners, it appears that the stream flowing into Johnson's Lagoon near the oyster farm would be applicable under RAR. However, this would need to be assessed at a later date.

Although there is a barrier at the tidal boundary on Stonehouse Creek and at Cocktail Cove, perennial habitat may exist. We recommend these systems be reassessed during the late summer when the flows are at their minimum to determine if they provide fish habitat.

On several of the south and east-facing beaches, logs brought in by winter storms often blocked the outlets of the streams at the tidewater boundary. These logs were only considered to be temporary barriers to fish migration. Further investigation into whether fish are able to pass through the logs will be required. If the logs are determined as a permanent barrier and there was no perennial habitat upstream, the watershed would not be considered to provide fish habitat.

Three watersheds were already designated by MFLNRO as being applicable under RAR due to presence of fish habitat. We recommend that the Islands Trust investigate further into the information that led to this designation as information provided by local residents indicates otherwise.

Prepared by:



Jennifer Morgen, M. Sc., A.Sc.T., B.I.T.

Reviewed by:

Justin Lange, B.Sc., R.P.Bio. A.Sc.T

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APPENDIX I – PHOTOS

Watersheds with Fish Habitat

Watersheds with Perennial Fish Habitat

Jenkins Creek

Figure 1. The outlet of Jenkins Creek at the tidewater boundary.

Figure 2. Facing south from the outlet toward Jenkins Bay.

Figure 3. The morphology of the drainage, upstream of the ocean. Note the lack of understorey vegetation due to overgrazing.

Figure 4. Placement of rock clusters and woody debris were part of past stewardship and stream restoration activities to improve habitat for fish.

Wamer Creek

Figure 5. Looking east from Wamer Creek to the tidal boundary. Note the amount of debris on the beach.

Figure 6. Photograph showing some of the in-stream features created to enhance fish habitat. Here, logs have been placed perpendicular to the stream and buried into each bank to create a cascade-pool channel habitat.

Figure 7. A sign located adjacent to the stream near the restoration work, which recognizes the funders and the local stewardship society.

Watersheds with Potential Barriers to Fish

Billdown Swamp Drainage

Figure 8. Outlet of the stream at the tidal boundary. Note the dense riparian vegetation and low gradient habitat.

Figure 9. Instream features such as pools, undercut banks and woody debris provide excellent opportunities for juvenile salmonids.

Trematon Creek

Figure 10. The outlet of Trematon Creek at the tidal boundary.

Figure 11. Looking south from the outlet of the stream.

Figure 12. Looking north at the outlet of the stream.

Figure 13. The manmade dam on Trematon Creek. Water flows through a pipe, not visible through the debris. This is a barrier to upstream fish migration.

Figure 14. The outlet pipe from the dam, which drains the pond into the mainstem of the creek. This point is also the confluence of an Unnamed Tributary with Trematon Creek.

Figure 15. The tributary to Trematon Creek. Photo was taken near to Richardson Bay Road.

Figure 16. The bedrock cascade, which is a barrier to fish migration. The cascade is located on Trematon Creek, upstream of the pond.

Unnamed Stream (Osland Nature Reserve)

Figure 17. The headwaters for the stream located within the Osland Nature Reserve. This wetland was recently re-created by filling in the agricultural ditches and allowing the fields to flood.

Figure 18. Looking north at the outlet of the stream. Note the accumulation of woody debris and that the stream flows under the logs.

Figure 19. The cascade located upstream of the ocean, which is likely a barrier to fish passage. It should be noted that suitable habitat exists downstream of this barrier.

Unnamed Stream (Powder Flask, Driftwood Cove)

Figure 20. The outlet of the stream, which is barely visible through the log debris on the beach.

Figure 21. Looking upstream from the ocean. The stream flows within a residential property and shows signs of human influence.

Figure 22. The manmade pond located approximately 100 m upstream from the ocean. There is a dam on the pond; however, water flow is not blocked.

Figure 23. Looking down at the outlet from a bridge that crosses over the stream. Note that water flow from the pond is not impeded.

Unnamed Stream (Windy Bay)

Figure 24. The outlet of the stream at tidewater, which is not visible due to the volume of debris located on the beach in Windy Bay.

Figure 25. Wave action has deposited a large amount of gravel onto the beach. Note how the stream appears to resurface from the gravel. It is uncertain whether this will be a barrier to fish migration during periods of high tide when the water levels are increased.

Figure 26. Photograph showing the low gradient habitat upstream from the tidewater boundary. Note the lack of established understorey vegetation due to overgrazing by feral sheep.

Monahan Creek (Anderson Bay)

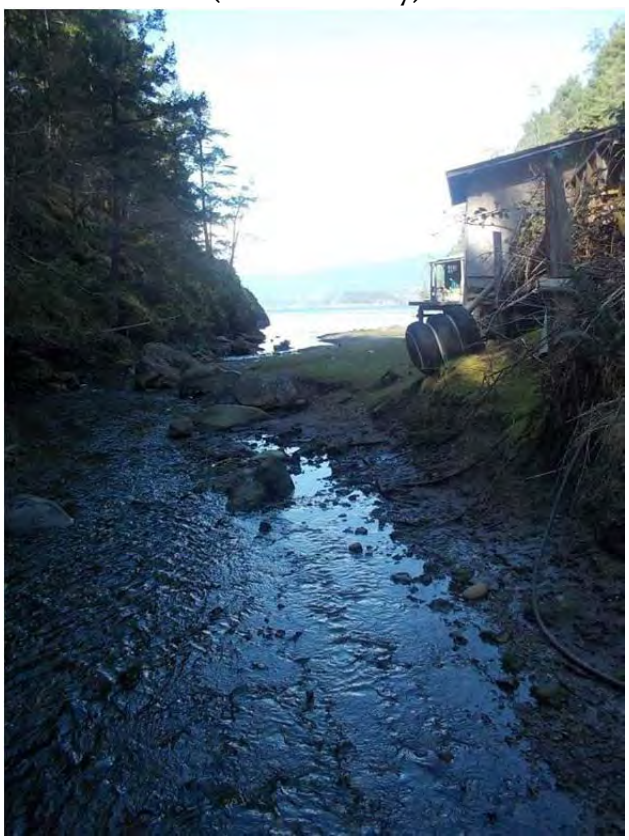

Figure 27. The tidewater boundary of Monahan Creek at Anderson Bay. Note the residence located on the eastern bank of the stream.

Figure 28. Looking south at the stream. Low gradient habitat exists from the tidal boundary and approximately 30 m upstream. Note the lack of vegetation along the eastern bank.

Figure 29. The lower cascade, located approximately 50 m upstream from the ocean. It should be noted that of the gradient is greater than 30% and likely a barrier to upstream fish migration.

Tucker Brook (Long Bay)

Figure 30. The manmade causeway dam and pond, created to hold water. If favourable water quality conditions exist within the pond, this could provide suitable habitat for fish. It is also considered a perennial water source under RAR.

Figure 31. Looking down at the confluence of the stream with the tidewater. Note how the water cascades down to the beach.

Figure 32. Looking south at the cascade from the beach. Although steep (25%), the cascade is short and may not act as a barrier to fish passage.

Deane Creek (Tucker Bay)

Figure 33. Looking upstream from the tidewater boundary. Note the well-established vegetation within the riparian corridor.

Figure 34. Low gradient habitat with a dense canopy of riparian vegetation is found throughout the lower reach of this stream.

Field Verified Watersheds with Potential Fish Habitat

Unnamed Stream (Cocktail Cove)

Figure 35. The outlet of the stream at the tidewater boundary. The cascade will likely act as a barrier to upstream migration at low tide.

Figure 36. Habitat upstream from the cascade is low gradient and is fed by a perennial water source, though water quality is likely an issue.

Stonehouse Creek

Figure 37. The tidewater boundary of Stonehouse Creek. Note how the water enters the ocean over a steep bedrock cascade (45% gradient). A perennial source of water may exist above this barrier and will need to be revisited during the period of low flows.

Watersheds with No Fish Habitat

Tom & Marcy's

Figure 38. A cascade of greater than 30% at the tidewater boundary acts as a barrier to upstream fish migration. In addition, a lack of perennial flow classifies this as not a stream under RAR.

Willy's

Figure 39. The stream possesses a relatively high gradient throughout (20%), and empties into the ocean over a steep cascade. There is no perennial habitat above the barrier.

Rouse Bay

Figure 40. Looking at the stream prior to its entry into the ocean. It should be noted the gradient is steep, at 35%.

Figure 41. Looking upstream from the beach. The cascade is barely visible (in the centre of the photo) through the recent blowdown at the tidewater boundary.

Little Squitty Bay

Figure 42. The tidal boundary of the non-classified drainage (NCD). Note the small amount of water and lack of a defined channel.

Figure 43. Approximately 30 m upstream from the ocean. Note the flow stops and goes subsurface. Also, note the lack of scour and alluvium.

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APPENDIX II – HABITAT RESTORATION PROJECTS

ON LASQUETI ISLAND

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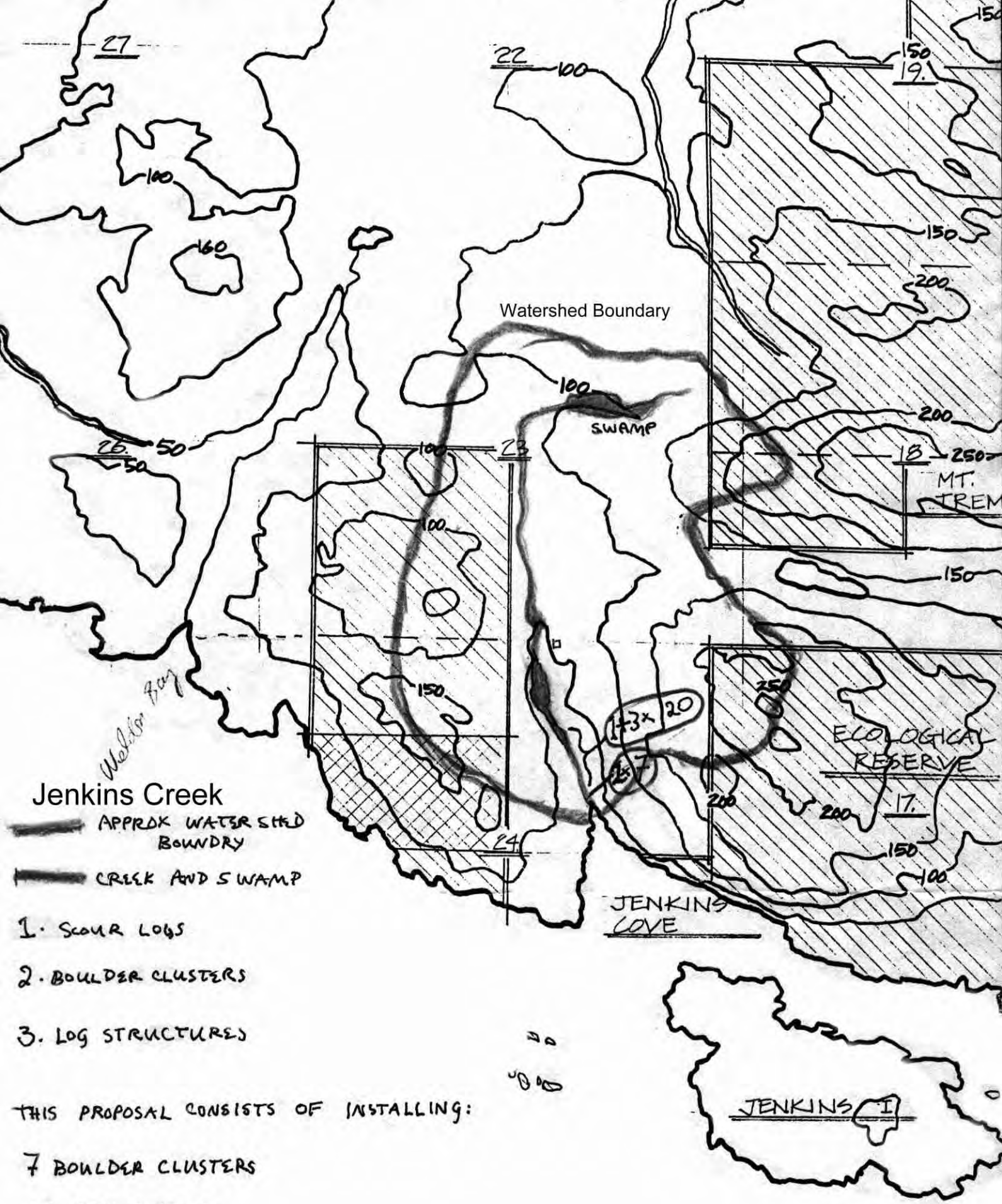
27
22
100
19.
150
160
150
200
Watershed Boundary
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SWAMP
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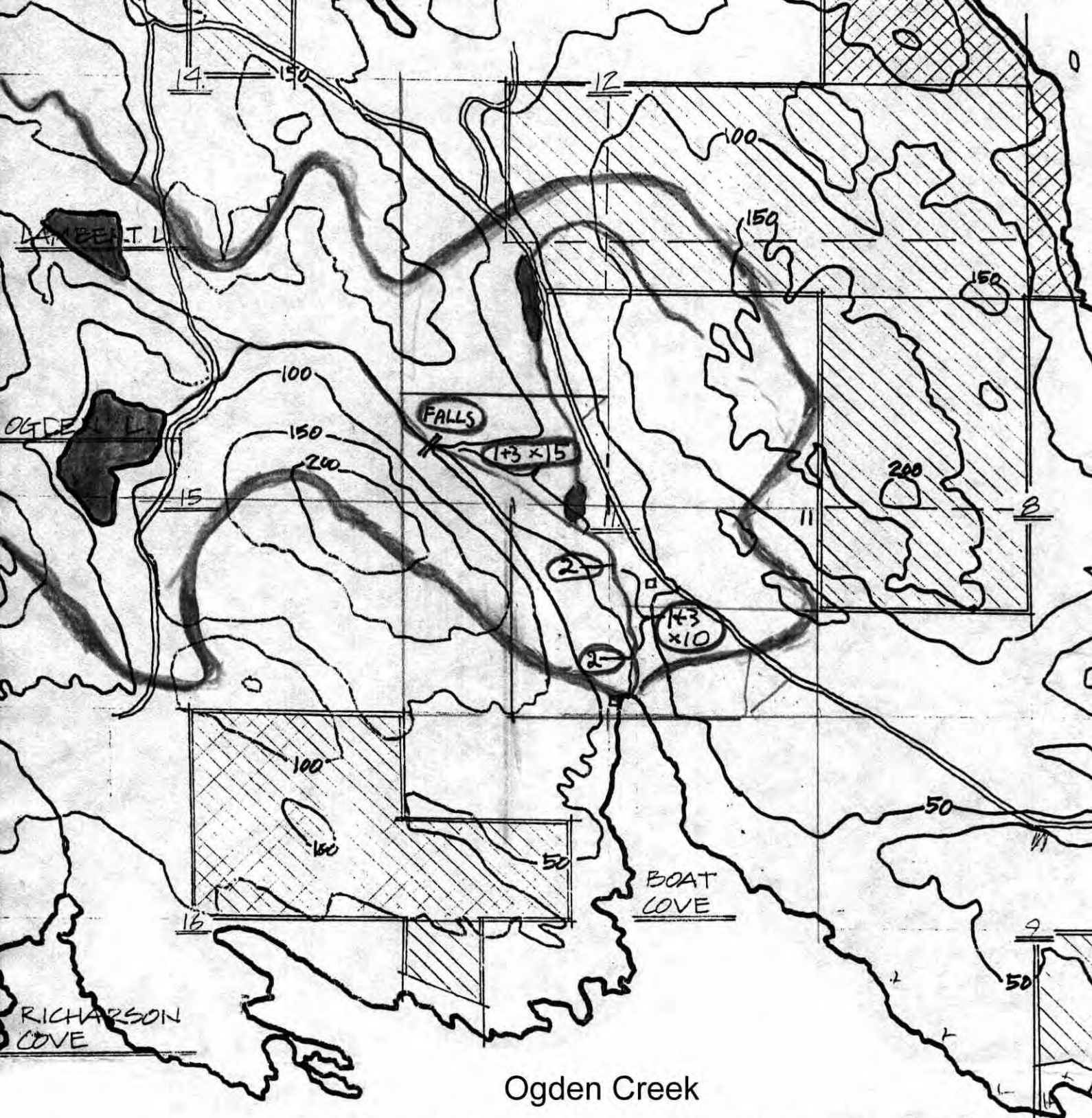
26.
50
50
100
23
18
250
MT.
TREM
100
150
150
1+3x
20
ECOLOGICAL
RESERVE
250
200
200
17.
150
100
24
JENKINS
COVE
JENKINS I
Jenkins Creek
APPROX WATERSHED
BOUNDRY
CREEK AND SWAMP
1. SCOUR LOGS
2. BOULDER CLUSTERS
3. LOG STRUCTURES
THIS PROPOSAL CONSISTS OF INSTALLING:
7 BOULDER CLUSTERS
10 SCOUR LOGS
10 LOG STRUCTURES



Ogden Creek

APPROX WATERSHED BOUNDRY

CREEKS AND LAKES

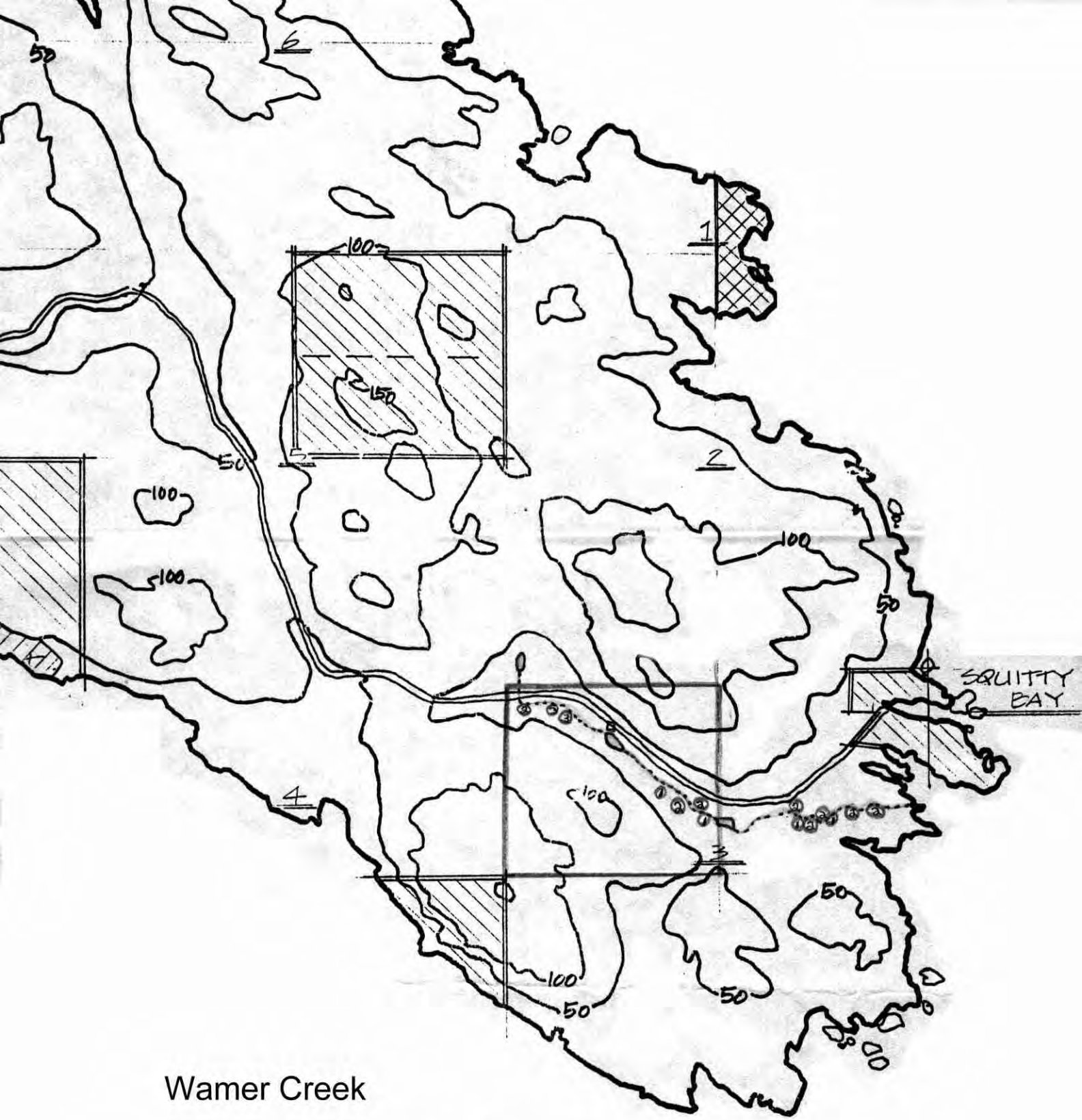
1. SCOUR LOGS
2. BOULDER CLUSTERS
3. LOG STRUCTURES

THIS PROPOSAL CONSISTS OF INSTALLIN

2 BOULDER CLUSTERS

13 SCOUR LOGS

12 LOG STRUCTURES



Wamer Creek

wamer creek (intermittant) ----

coho summering ponds

property lines NW 1/4 sec 3 ——

scour logs #1

Boulder clusters #2

Log structures #3