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None.

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An unpublished paper of mine investigates the longitude of the Chief's village. John Stuart did not have the opportunity, instruments, or navigational tables he would have needed to make astronomical longitude observations, but we can deduce the longitude of the Chief's village based on dead reckoning from their leaving Musqueam. The time of day they left can be accurately established by Fraser's observation that while at the village the tide had ebbed. Standard tidetable calculations don't show this, but when the combination of the flow of the river and the tidal current is considered, the reality and timing of this "ebb" can be fixed. This plus the dead reckoning calculations and tidal observations during their return voyage up the river offer strong support for the notion that the Chief's village was at Port Hammond.

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# *Simon Fraser's Latitudes*

*by Nicholas Doe*

An analysis of the astronomical observations of John Stuart on his journey with Simon Fraser down the Fraser River in 1808 from Fort George to the Pacific Ocean and back.

Keywords: Fraser River, Simon Fraser, latitude, John Stuart, astronomical observations

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Charles William Jefferys (1869-1951) David Thompson Taking an Observation. National Archives of Canada (C-073573)

Measuring the altitude of the sun using a sextant and an artificial horizon. This drawing from Charles Jefferys shows David Thompson, but, given more trees and no horses, it could equally well be a drawing of Fraser's clerk, John Stuart. Artificial horizons came in two styles. One was a tray of liquid, usually mercury (quicksilver) or water, often sheltered from the wind with an A-frame of glass. The other was a "parallel" glass plate or a mirror, adjusted to be horizontal using a spirit level. The position of the true horizon, which can not be seen except at sea, is exactly halfway between the sun in the sky and its reflection in the artificial horizon. Unfortunately for the surveyors, artificial horizons made good "collectors' items" for the Natives.

Nick Doe: "Simon Fraser's Latitudes, 1808." Page 2-5

Where did Fraser sleep?

Walhachin's soldiers

The Kootenay's finest fruit

Who needs archives!

Landlubbers' ship

Malaspina Hotel

Norman Lee's mother-in-law

# *Simon Fraser's Latitudes, 1808*

## *Where was the Chief's village?*

*by Nick Doe*

In the summer of 1808, Simon Fraser, fur trader and employee of the North West Company based in Montréal, travelled with twenty-three companions from Fort George [later Prince George] to the mouth of the Fraser River and back. So far as is known, this was the first time that people of mainly European extraction had visited the Greater Vancouver area since the visits of the Spanish and British Royal Navies in 1792.

Unfortunately, the only record we have of Fraser's epic journey is a narrative summary of his journal composed from field notes some time after the journey was over. All that is left of the original notes, which contained details of the courses followed and the distances travelled, is a transcript covering the ten days from May 30 to June 10, 1808.<sup>1</sup> Although at least one of the two expedition's clerks, John Stuart [Stewart], also kept navigational and other notes, almost all of these too have now been lost.<sup>2</sup> All that we have of Stuart's work is a few scattered details contained in Fraser's surviving notes and journal, and what secondhand evidence can be gleaned from David Thompson's "Map of the Northwest Territory of the Province of Canada", completed in 1814. Thompson for sure must

have had access to Stuart's notes for Stuart's name appears in the map's title inscription, and, so far as is known, no other European-led expedition visited the lower Fraser River before December 1824.

Unfortunately, as Tomàs Bartroli has noted in his recently published review of the Fraser expedition,<sup>3</sup> Fraser's descriptions of some of the events are tantalizing bereft of detail. One such omission is evidence that would enable us to identify with certainty the site of the Native village where the party overnighted July 1–2, 1808, somewhere between Mission and Barnston Island. Fraser describes a large plank house 640-ft. long, carvings of beasts and birds, several tombs, and the custom of the inhabitants of using white paint as a cosmetic.<sup>4</sup>

I have recently taken another look at Fraser's journal and Thompson's map to see what can be learned about the site of what Fraser himself called "the Chief's village".

The first thing of interest was a note in Fraser's journal to the effect that Mr. Stuart had a Mer[idian] Alt[itute] O.L.L. 127°13' while staying at the village; that is, Stuart had measured, with his what-I-will-call a sextant,<sup>5</sup>

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<sup>1</sup> Both Simon Fraser's journal and the surviving fragment of notes are printed in full in "The Letters and Journals of Simon Fraser 1806–1808", edited by W. Kaye Lamb, McMillan Company, Canada 1960.

<sup>2</sup> So far as I know, there is no evidence that the second clerk, Jules Quesnel, also kept a journal, although it would not be surprising if it were discovered that he had. In any event, all trace of it has been lost.

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<sup>3</sup> Tomàs Bartroli, "Genesis of Vancouver City—Explorations of its site 1791, 1792 & 1808", Marco Polo Books, Vancouver 1997.

<sup>4</sup> Lamb, pp.102–104. Although recorded use of white pigment is rare in British Columbia, Aboriginal people in other parts of the world use it in ceremonial dances to ward off evil spirits, in imitation of a skeleton.

<sup>5</sup> Conventionally sextants are capable of measuring angles up to 120°, though their scales are frequently extended to 125°. Fraser

the height of the sun above the horizon at noon.<sup>6</sup> This information is sufficient for us to calculate the latitude of the village, a fact that appears to have been ignored by previous commentators on Fraser's expedition. Determinations of latitudes in the late-18th and early-19th century were commonly good to one or two miles. Because the lower Fraser River flows generally in an east-west direction, determinations of latitude in this

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himself calls the instrument Stuart used a sextant, Lamb p.62, yet, on July 1, Stuart measured an angle greater than 127°. I really do not know how he did this, but the most likely explanation is that his instrument had a back-horizon mirror rotated 90°, which would have changed the scale from 0–120° to 60–180°. That Stuart had such an instrument is possible, as David Thompson, who also worked for the North West Company, had a sextant made by Peter Dollond of London, and Dollond is known to have experimented with rotated back-horizon mirrors. See *Philosophical Transactions of the Royal Society*, Vol. LXII, pp.95–122, 1772. The other possibility is that Stuart had a quintant with a range of 0–144°, but I have found no evidence that these were used in the first decade of the 19th century.

<sup>6</sup> The letter printed as “O” is a symbol for the sun, usually handwritten with a dot in the middle. L.L. stands for “lower limb”, not as Lamb says, “lower left”. Navigational tables always print the position of the sun as measured at the centre of its disk; however, unfortunately, the sun does not come marked with a black dot at its centre, so the navigator must measure the height of either the upper or lower limb (edge) and subtract or add the semi-diameter of the sun's disk respectively. Note that Stuart's measurement is actually that of twice the height of the sun. This is because he was using an artificial horizon and measuring the angle between the sun as seen in the sky and its reflection in the artificial horizon.

area are not usually sufficient to fix locations unequivocally; however, they are far from being useless. They are sufficient, for example, to distinguish between say Matsqui at 49°06.5' N, and Haney, which at 49°12.8' N is seven miles farther north.<sup>7</sup>

Before we can reduce Stuart's altitude to latitude, we have to see what can be learned from the surviving data about the calibration of Stuart's sextant. Sextants are precision instruments, and always come with a small residual error, known as the index error, and this has to be accounted for in any very precise calculation of latitude.

Looking through Fraser's journal, I found a total of six meridian altitude measurements, some very fortunately, at locations that can be fairly precisely located from Fraser's descriptive narrative. In order to have the highest possible degree of confidence in the determination of the latitude of the Chief's village, I analyzed all six of these observations. The results are as follows.

The first observation was made on May 28.<sup>8</sup> After their usual early start at dawn, the party travelled from Fort George down through the Fort George Canyon, where, after “running down several considerable rapids”, they stopped for breakfast at 11 o'clock. Stuart then made his first observation which is recorded as meridian altitude O.L.L. 115°09'45" by artificial horizon; error of the sextant 7'30"+.<sup>9</sup>

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<sup>7</sup> Locations are taken from Canada 1:50 000 topographical maps 92 G/1 “Mission”, and 92 G/2 “New Westminster”.

<sup>8</sup> Actually recorded by Fraser as May 22, but this is identified by Lamb as most probably being a mistake. The astronomical data discussed in this paper shows that Lamb was right.

<sup>9</sup> Initially I did not know whether the “+” sign indicated that the error was positive, or the correction to be applied was positive. Clearing several of the observations both ways quickly

By my reckoning, the corresponding latitude is 53°38.5' N, just below the community of Stoner.<sup>10</sup> This is a good result. We cannot be sure exactly where they were, but they were certainly below the Fort George Canyon, and they had adequate time, given the strong current, to cover the 30 miles of rapids-free river from Stoner to the West Road River, which they reached at 4 o'clock that afternoon.<sup>11</sup>

The second observation was made on June 9 when the expedition had, by their own admission rather recklessly, just run through the rapids at French Bar Canyon [*Le Rapide Couvert*]. The observation is recorded as mer[idian] alt[itute] O.L.L. 112°58'30" by art[ificial] hor[izo]n. Somewhere down the line there has been a simple typographical error, because Stuart undoubtedly meant 122°58'30". The corresponding latitude is 51°10.7' N, which is at Big Bar Creek, about two miles below French Bar Canyon, and only about a mile south of exactly where Fraser says they were.<sup>12</sup> We can be especially

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showed that Stuart intended the "error" to be added.

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<sup>10</sup> The calculation is as follows. Add index correction 115°17'15"; divide by 2 to get 57°38'38"; correct for refraction 57°38'00"; correct for LL 57°53'48"; zenith distance 32°06'12"; add sun's declination 53°38'28". Canada 1:50 000 topographical map 93 G/10 "Red Rock".

<sup>11</sup> At this early point in the journey, the group were still using the four birchbark canoes (*canots du nord*). These were paddled at an average rate of five to six miles an hour on still and calm water, faster of course downstream.

<sup>12</sup> The calculation is as follows. Add index correction 123°06'00"; divide by 2 to get 61°33'00"; correct for refraction 61°32'27"; correct for LL 61°48'13"; zenith distance 28°11'47"; add sun's declination 51°10'41".

confident of this location, a fine sandy beach [*grève*] on the east side of the river, because a surviving fragment of Fraser's field notes gives the compass courses taken through the French Bar Canyon.<sup>13</sup>

The third observation was made on June 16. At noon, Stuart had a Mer[idian] Alt[itute]. O.L.L. 124°59' Art[ificial] Horiz[on]. The corresponding latitude is 50°34.4' N, ten miles downstream of Lillooet which Fraser had left on foot the previous day.<sup>14</sup> This position is exactly according to Fraser's narrative.

The next observation, the fourth, is the only one of the six to present a problem. Fraser records that on June 24, Stuart had a mer[idian] alt[itute] of 126°57'. This corresponds to a latitude of 49°38.2' N, which by my reckoning, is as much as twenty-five (statute) miles south of where they really were (approximately 50° N).<sup>15</sup> Maybe this was

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Canada 1:50 000 topographical map 92 O/1 "Big Bar Creek".

<sup>13</sup> Lamb, p.157. The compass course at the lower end, S 30 E [169° true] 1 [mile], ends at latitude 51°11.6' N. Fraser's subsequent estimate of distance travelled to Big Bar Creek is, as is often the case with him, a little on the high side [Lamb, pp.33–34].

<sup>14</sup> The calculation is as follows. Add index correction 124°06'30"; divide by 2 to get 62°33'15"; correct for refraction 62°32'44"; correct for LL 62°48'30"; zenith distance 27°11'30"; add sun's declination 50°34'25". Canada 1:50 000 topographical map 92 I/2 "Lillooet".

<sup>15</sup> The calculation is as follows. Add index correction 127°04'30"; divide by 2 to get 63°32'15"; correct for refraction 63°31'45"; correct for LL 63°47'30"; zenith distance 26°12'30"; add sun's declination 49°38'09". Canada 1:50 000 topographical maps 92 H/13 "Scuzzy Mountain", and 92 H/14 "Boston Bar".

wishful thinking on Stuart's part, for Fraser was, as Lamb notes, now approaching the most difficult and dangerous part of the Fraser Canyon at Hell's Gate. Stuart's position, if correct, would have put them comfortably past the worst, three miles below Spuzzum. I have looked very diligently to see what mistake might have been made, assuming that Stuart actually set the sextant correctly, and the best that I could come up with, other than there being a typographical error, is that Stuart inadvertently forgot to add 40' to his reading.<sup>16</sup> An observation of 126°17' would have put them at 49°58.2' N close to the Nahatlatch River which is about where they were at noon that day.<sup>17</sup> This is however, I hasten to add, conjecture. The fifth observation too initially caused me some problems, until I discovered that Lamb has probably made what for him is a very rare error in transcribing the journal manuscript.<sup>18</sup>

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<sup>16</sup> Nineteenth-century sextants, and modern ones too, commonly have three components to their readings. The number of degrees, plus a coarse-scale reading of 0', 20', or 40', plus a fine-scale vernier reading in the range 0–20'. Using a swivelled back-horizon mirror, 126°57' would have been read originally as  $180^\circ - 126^\circ 57' = 53^\circ + \underline{00}' + 03'$ . If Stuart had forgotten to add the coarse-scale reading, the correct reading might have been  $53^\circ + \underline{40}' + 03' = 53^\circ 43'$ , and the correct angle would then have been  $180^\circ - 53^\circ 43' = 126^\circ 17'$ .

<sup>17</sup> Briefly, the evidence for the location is that they were below the rapids at Kanaka Bar (June 24); and they were “a considerable distance” of rapids-free river and, on the way back, several hours walking distance above the Scuzzy Rapids below Boston Bar (June 25 and July 11). The rapids-free section must have included, if not comprised, the 10-mile stretch of river between Ainslie Creek and Scuzzy Rapids.

<sup>18</sup> The original is held by the Toronto Public Library.

On June 30, Stuart observed a mer[idian] alt[itude] O.L.L. 127°02' [Lamb has 127°23'] which translates to a latitude of 49°20.4' N.<sup>19</sup> The location corresponds exactly to the Ohamil Indian Reserve IR1 (*Shxwō'whámel*) on the southeast bank of the river. A substantial village at this site is shown in the 1859 sketch “Upper Part of the Fraser River—From Langley to Yale” by Lieutenant Mayne R.N., Captain Richards, and Judge Begbie. It is also interesting to note that one of the very few Indian villages marked on Thompson's 1814 map is also on the southeast bank of this stretch of the river, although, as near as one can tell, several miles further downstream.

Here again we can be fairly sure of the actual location. Fraser notes that the site was a camp of “400 souls”, nine miles above a point where the river expands into a lake. Thompson's map clearly indicates the “lake”, presumably formed by extensive flooding, along with an unidentifiable river mentioned by Fraser. By using a computer to scale Thompson's map independently in the latitude and longitude directions until it fits a modern map,<sup>20</sup> it is possible to show that this was probably a mile or so downstream of Sea Bird Island near Agassiz, where indeed, the river finally emerges from the confines of the Coast and

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<sup>19</sup> The calculation is as follows. Add index correction 127°09'30"; divide by 2 to get 63°34'45"; correct for refraction 63°34'15"; correct for LL 63°50'00"; zenith distance 26°10'0"; add sun's declination 49°20'24". Canada 1:50 000 topographical maps 92 H/5 “Harrison Lake”, and 92 H/6 “Hope”.

<sup>20</sup> Bartroli's book, Plate 21. For a discussion of the technique see Doe, N.A., “Some Anomalies in a Spanish Chart of Vancouver Island 1791”, Lighthouse, Journal of the Canadian Hydrographic Association, 56, Fall 1997. See also remarks on p.292 of Stewart, W.M., “David Thompson's Surveys in the North-West”, Canadian Historical Review, XVII, 3, Sept. 1936.

Cascade Mountains into the central Fraser Valley.<sup>21</sup>

This is not the only evidence that Stuart's latitude determination might be right. Some have suggested that it was at Ruby Creek the party overnighted June 29–30, 1808, but I disagree. Fraser left Hope at 4 o'clock having been entertained by the Native people for "a couple of hours". He reached the overnight camp of "170 souls", a place where the river was very wide (two miles he says) with islands, possibly near the present-day Hope Airfield,<sup>22</sup> only one hour later. To have reached Ruby Creek that evening, the speed of the canoes would have had to have been more than double their average speed between Yale and Hope. I think it more likely that it took the party another hour or so the next morning to reach the vicinity of Ruby Creek and the present-day Ohamil Reserve.<sup>23</sup>

The sixth and final observation was made at the Chief's village on July 1 when Stuart had a mer[idian] alt[itide] O.L.L. 127°13'. The corresponding latitude is 49°10.9' N.<sup>24</sup>

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<sup>21</sup> Canada 1:50 000 topographical map 92 H/4 "Chilliwack". My arbitrary "check-point" was 930530.

<sup>22</sup> According to this theory, the "islands" would include Croft, Greenwood, and Bristol Islands. Perhaps the island where Fraser was entertained that afternoon was near, or part of, the present-day Aywawwis Indian Reserve (*Iwówes*).

<sup>23</sup> The time that Fraser left the overnight camp was blank in the initial writing of the manuscript, although someone has later inserted 7 o'clock. This time is not printed in Lamb's edition. I suspect that the inserted time is wrong. Fraser had to negotiate the purchase of canoes and hints at a delay in his text. My guess is that he left between 9 and 10 o'clock that morning.

<sup>24</sup> The calculation is as follows. Add index correction 127°20'30"; divide by 2 to get

The Indian Reserves and archaeological sites in this area are shown in Table 1. Distances are miles north (+) or south (–) of latitude 49°10.9' N. The spelling of Native names may be inaccurate, for which I apologize.

Mr. Stuart was in my view a very skilled and competent observer, as evidenced by the four of the five previous observations that were "right on the money". I think therefore that there is no reason for not accepting this last latitude determination at face value, and to anticipate that any error might be ±1.5 miles, and certainly not more than ±2.5 miles. This would firmly rule out in my mind the possibility that the Chief's village was at Matsqui, or anywhere else further upstream than say Silverdale.

Although this is the end of this paper, it is by no means the end of the story. Further clues as to the location of the Chief's village are contained in the tidal observations of Fraser and, in 1824, François-Noël Annance; and in the timetable of events, particularly on July 2, 1808.

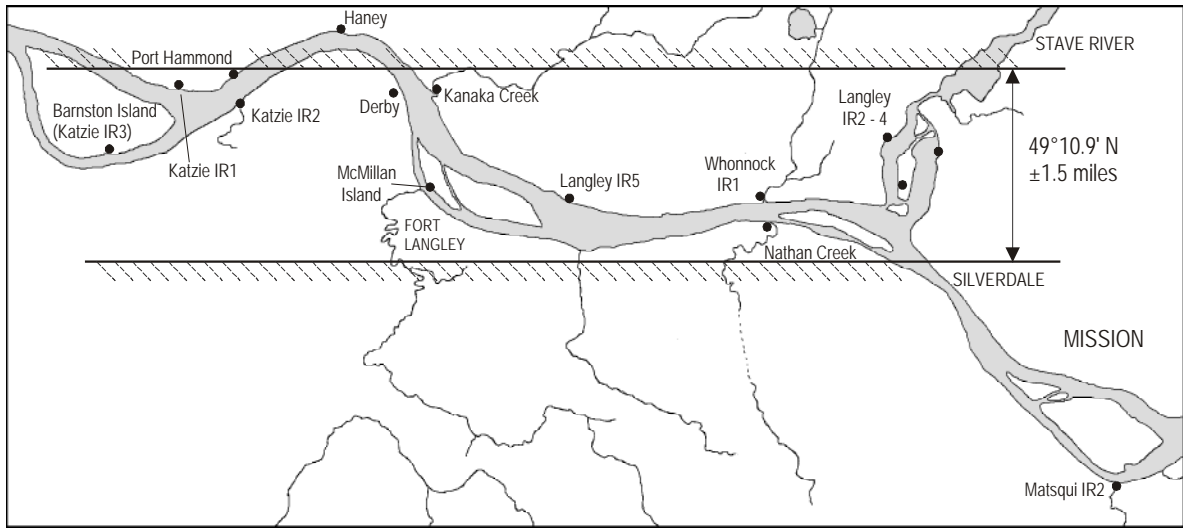
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*I should like to thank Tomàs Bartroli of Floresta, Spain, and Barbara Rogers of Vancouver, BC, for generating my interest in Simon Fraser's voyage. It was Barbara Rogers who astutely pointed out to me that, hitherto, historians appear to have neglected the astronomical observations of John Stuart recorded in Fraser's journal.*

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63°40'15"; correct for refraction 63°39'45"; correct for LL 63°55'30"; zenith distance 26°04'30"; add sun's declination 49°10'56".



Pitt River–west (too far west to be shown on the map)	<i>xwtí'tas?</i>	Old fishing-site on the west bank of the Pitt where it joins the Fraser below Mary Hill, now destroyed. Early HBC records (1827–1830) refer to a Kwantlen village on the Pitt (Quoitle), but its exact location is uncertain. This archaeological-site is an unlikely candidate because it is seasonally flooded and it is over three miles north of Stuart's latitude.
Pitt River–east (not shown)	<i>kll'ekwas?</i> <i>pipkwátsan?</i>	Two small sites, both too far north, one at the mouth of the Pitt, and one between the Pitt and Katzie IR1. I know nothing about their archaeology, history, nature, or precise location.
Barnston Island IR3	<i>qelesíhp?</i>	Fishing-site on south side of Barnston Island. It is unlikely Fraser would have taken the Parsons Channel to get to it.
Katzie IR1	<i>q'éyst'í</i>	North side of river, level with the eastern tip of Barnston Island. Although this village-site is old, its present importance is probably due to the influx of people in the latter half of the 19th century from Port Hammond a mile or so to the east, and from traditional Katzie territory along the Pitt River. A good candidate nevertheless.
Katzie IR2	<i>kwthèxth'exem</i>	Mouth of Yorkson Creek on south side of river. Now a Katzie village, but described in early HBC records as an important Nanaimo summer camp. The HBC descriptions of the village do not match Fraser's. A good candidate nonetheless.
Port Hammond	<i>ts'í:xwt</i>	Site now occupied by the Interfor Cedar Mill. Old village-site, once extensive, with burial grounds. People moved from here to Katzie IR1. Once accessible from the Pitt via Katzie Slough and so possibly the Kwantlen village in HBC records. Perhaps the best candidate of all.
Haney	<i>shxwleqwén'e?</i>	Old village-site which has now been destroyed. Probably depopulated by smallpox. The site is also more than two miles too far north. A possible candidate though.
Derby	<i>snálo melh?</i>	Site of the first Fort Langley founded in 1827. No mention of a village in early HBC records. Probably unoccupied in Fraser's time. An unlikely site.
Kanaka Creek	<i>tsilhxwéy'en?</i>	Shown in the early HBC maps as Berry Creek. No mention of anyone living there when the HBC people arrived. Probably unoccupied in Fraser's time. An unlikely site.
McMillan Island IR6 (and, prior to 1932, Brae Island)	<i>squàlets</i>	On McMillan Island across from the HBC fort. Either founded, or greatly increased in size, as a result of the construction of the second Fort Langley in the spring of 1839. The McMillan expedition was here in 1824 and makes no mention of any village. An unlikely site.
Langley IR5	?	On the north shore. Not mentioned in early HBC records. Probably only of any size after the foundation of the second Fort Langley. Early HBC records refer to a Kwantlen village "a few miles" upstream of the old fort at Derby, but where this village was exactly is not known.
Whonnock IR1	<i>xwèwenaqw</i>	On the north shore and formerly much larger than it is today. Not mentioned in early HBC records. Probably still too unoccupied in Fraser's time to be a good candidate.
Nathan Creek	<i>smō:qwe'</i>	Across the river from Whonnock IR1. Very small and without IR status since the 1860s. Nothing else known. A very unlikely site.
Langley IR2–4	<i>sxwòyeqs?</i>	Sites on the Stave River. These seem unlikely because Fraser does not mention a river, and he would have had to divert into it to reach the sites. McMillan's expedition visited a lodge in a bay at the confluence of the Stave and Fraser Rivers in 1824, but it had only 22 inhabitants.
Matsqui Main IR2	<i>máthe kwi</i>	About five miles too far south of Stuart's latitude and therefore a very unlikely site.

**Figure 2 & Table 1: The lower Fraser River from Mission down to Barnston Island showing all known Native sites and present-day Indian Reserves.**

*The horizontal lines in the figure indicate Stuart's latitude measurement at the Chief's village, and the likely error margin of ±1.5 miles. Error is due to instrument inaccuracy and uncertainties generated by atmospheric refraction. No significance should be attached to the position of sites within the ±1.5 mile error band; similarly, sites outside this band, although unlikely, are not absolutely excluded by Stuart's measurement. All sites are listed, but probably only three or four in the list are good candidates. Native usage of sites was drastically changed by devastating smallpox epidemics in 1782–3 and possibly again in 1801–2, which left many sites with no survivors. Other changes are associated with the foundation of Fort Langley in 1827 and its relocation in 1839; and the post-1864 reduction and elimination of many Indian Reserves.*