

Resurvey of the Boundary Between the United States and Canada from Point Roberts on the 49th Parallel to the Pacific Ocean

by David Steele, PLS Survey Manager for the Washington State Department of Natural Resources

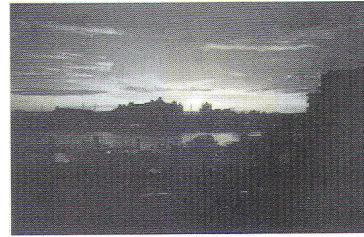
This article is part 2.5 of a series of reports on this project. The purpose of this project is to bring together volunteer surveyors from Washington and British Columbia, recover and remeasure the references to the international boundary turning points along the water boundary, and submit the information to the International Boundary Commission for historical documentation.

The line through the Straits of Georgia, Haro, and Juan de Fuca, as surveyed and marked by the Boundary Commission, is a reestablishment of the boundary as originally defined in Article I of the Treaty of June 15, 1846, between the United States and Great Britain, and as determined by the Award made on October 21, 1872, by the Emperor of Germany as arbiter pursuant to the provisions of Articles XXXIV to XUI of the Treaty of May 8, 1871, between the United States and Great Britain. The line as now established consists of twelve straight-line courses, the ends of which are fixed by reference marks on the shore. There are 12 turning points located approximately in the middle of major channels dividing the two countries. Each turning point is referenced on shore by 2 selected or established monuments; 21 in all, some of which reference more than one turning point. The references vary from lighthouses to cast-in-place concrete markers. Our work began in May, 2000 when a trip to Tatoosh Island was organized using the U.S. Coast Guard helicopter for transportation. This trip was documented in the Summer 2001 Evergreen State Surveyor, volume 25 no.

2. Another trip was organized in May and this would be a recovery and measurement-testing mission by boat.

On May 27, 2000, a truck load of equipment and supplies was carried to the Chinook Landing Marina in Tacoma and a small team comprised of Dave

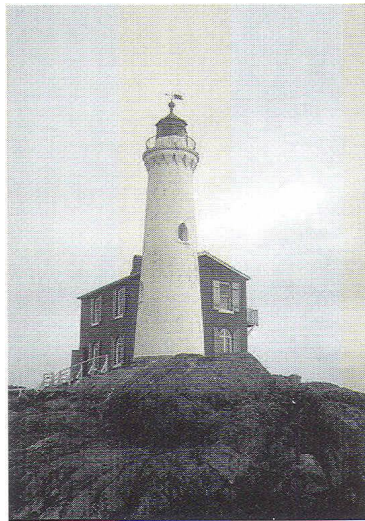
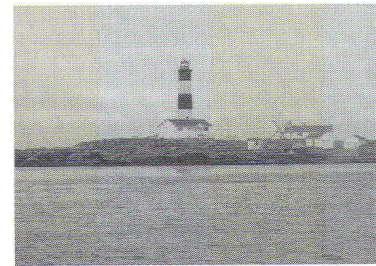
measuring its position.



Region Surveyor, who came via Port Angeles ferry.

Victoria Sunset

The next day, we traveled about 15 miles West to the Race Rocks lighthouse reference to turning point 9.



Fisgard Lighthouse

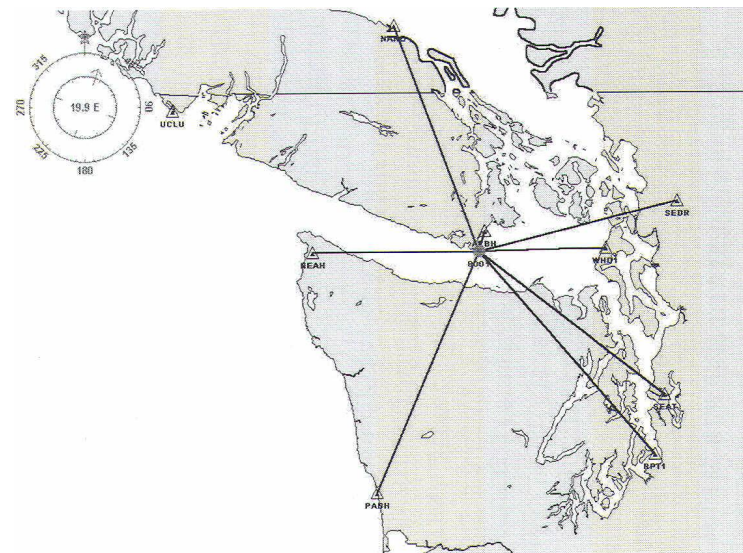
The lighthouse spire is the specific reference that was used and coordination will be done from two auxiliary points with angles turned from that baseline to the spire. The auxiliary points will be set or chosen from existing monuments and measured with dual frequency GPS receivers for 5 hours. We later decided to measure each point a second time for redundancy and assurance of each position. The GPS measurements will be processed against approximately 9 CORS stations in this region. We returned to Victoria Harbor and were joined by Brad Lymanagrover, DNR Olympic

Race Rocks Lighthouse

This is a wildlife reserve and no anchorage is allowed nearby, so we moved East of Bentinck Island, about one mile away. Tarboo carries a 12' rigid inflatable tender that made the trip to Race Rocks Island easy. Dave and Brad explored the island and met the full-time lighthouse keeper Mike Slater, and from Pearson

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Steele, Cairn Steele, and Gary Perasso spent hours hauling, stowing, and preparing Tarboo for departure. Tarboo is Dave's pet project, a 45' heavy trawler. After a 1-1/2 boat day trip, we arrived in Victoria in the afternoon of May 28th and enjoyed the evening in town. The next day, our U.S. Memorial Day Holiday, we met Jeff Beddoes, Land Surveyor from the B.C. Surveyor General's Office and toured their office, met with Chuck Salmon, B.C. Surveyor General, and viewed many of their historical records dating back to the Hudson Bay Company days. This place could keep a survey historian busy for years. Jeff then took us on a trip to nearby Fisgard Lighthouse, reference to turning point 8 and we considered a means of



Resurvey of the Boundary *(continued)*

college, Angus Mathews and Gary Fletcher. The lighthouse is Canadian Coast Guard property, but the rest of the island is managed by Pearson College as an educational and historic site. You can visit the island by going to <http://www.race.rocks.com/> where cameras provide a real-time view of wildlife and a vast historical resource is at your mouse click. Race Rocks Light was lit for the first time in 1860 and is known as the oldest Canadian lighthouse on the Pacific coast. The name "Race Rocks" refers to the tide race, which swirls past the rocky outcrops at speeds of up to 8 knots, which is quite impressive in a small boat. It was again determined that two auxiliary points would be set for measurement. This lighthouse has a scaffold on top that might allow placement of a GPS antenna over the spire, but I can't find such a volunteer and the Coast Guard might view this as a little hazardous.

Beechey Head, reference to turning point 10 was the goal for May 31st and we found a volunteer land surveyor guide from the Surveyor General's Office, Jim Sutherland, who traveled with Brad to the monument. I was crippled by an arthritic hip, which was replaced by an artificial hip in September 2000, so I stayed behind for R & R. We knew this reference was one of the cast concrete monuments that could be measured, so GPS equipment was taken to the site. After a beautiful and partly rainy day, the long GPS measuring session was completed and the surveyors returned.

On June 1st, Jeff Beddoes and his son Dan met us in Victoria Harbor and we departed for Discovery Island about 15 miles East.

The lighthouse on Discovery Island was the reference to

turning points 6 & 7, but was destroyed many years ago and replaced by a newer lighthouse. We anchored in Rudlin Bay and traveled to the sheer rock shore via tender. There is a geodetic mark in the vicinity that we planned to measure; so all measuring equipment was taken along with all 6 people and Samantha, our team mascot, an Australian Sheppard. Three cast concrete cylinders referenced the original lighthouse. These were positioned in a straight line with distances measured between each and the lighthouse. Discovery Reset was found and the GPS commenced while we sat down for lunch and enjoyment of the beautiful day. Gary returned from the lighthouse with his pack, which had been lying open and his lunch exposed. We soon realized that Samantha had enjoyed lunch before the rest of us and Gary was now without. Well, it was time to explore further and look for more evidence. Two of the three lighthouse reference monuments were found in good condition and the third was broken loose and laying nearby. Jeff had a meeting back in town and I took both Dan and Jeff to Oak Bay, about 7 miles West via tender. After the GPS session was completed, we all headed back to Oak Bay and

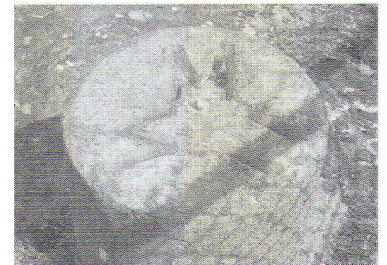
Brad departed. The night was spent a few miles away in Cadboro Bay on the hook.

A beautiful day greeted us as we headed back to Washington and the San Juan Islands. With Friday Harbor as our destination and only a few hours to travel, I made further arrangements to join other volunteers. Denny DeMeyer, a private land surveyor and international boundary historian from Lyndon and his corner finding wife, Delores traveled by ferry with Gavin Schrock, a City of Seattle surveyor. They left their vehicles behind and walked onto the ferry. We pulled into the harbor and they were waiting on the customs dock, all eager and ready to board. I was given directions to land on an adjacent dock, unaware that it was 1/2 mile dock hike around to where we had stopped. Finally, we all joined and stowed their many bags, while hearing about how far it was and why I couldn't just land where they were. Some volunteer help can be quite demanding and sometimes even demand steak for dinner and ice cream for desert. Yes, there is a story behind this dining comment and someday it may be told. Our destination for the afternoon was Sucia Island and once there, we moored in Fossil Bay.

On June 3rd, a detour was made to Sucia Island and we



measured a lighthouse reserve monument and a mineral monument that were documented by Denny DeMeyer in a past Evergreen State Surveyor.' We would return later with coordinates to stamp on plaques set at the base of each monument. We then traveled over to Patos Island and moored in the small bay between Patos and Little Patos Islands. Patos



1858 USC & GS control station was located on the western end of Little Patos Island and was our first priority. We found that fairly quickly and started the GPS session ASAP. There were many other features of the geodetic control point to discover and we found three drill holes that were originally made for reference to the control station and three RM's set at later dates. The letters U S were found scratched into the sandstone near the control station. Measurement ran into the late night and the GPS receiver retrieved after dark.

The spire on Patos lighthouse

(Continued on page 16)



Resurvey of the Boundary *(continued)*



is the reference to turning points 2 & 3, so we traveled across the bay in the morning and a few hours searching for its references. A cast concrete hexagonal monument was found S10° W 140 feet from the lighthouse, but the triangular and square monuments were destroyed.

Departing Patos was not easy since much was left to find and measure, but this was a discovery trip and intended to get a feel for how to complete the project. It took several hours to travel southwesterly to Stuart Island and we moored on the North side in Montague Harbor. I dropped several people at the dock so that they could walk the 3-1/2 miles out to Turn Point. Gary and I then traveled to Turn Point with the tender. We landed on a sheer rock face and scrambled up into the timber and a short hike to the lighthouse. There we found a monument that is the reference to turning point 4 as well as the lighthouse and lighthouse keeper's residence. This lighthouse is now automated and there are no residents, but the buildings are maintained in good condition. Measuring this monument would be a challenge because of the very close proximity of the new light, which is only a few

feet to the southeast. There is even a metal grid platform on the light that overhangs, obscuring the sky more than desirable. About the time we had completed our investigation the three hikers arrived. You guessed it, they whined a bit since it was rather hot and then embraced the scenery and history of the Turn Point Light Station. Gary and I escaped with the tender and they all headed back on the trail. (This was their idea, not mine) I moved Tarboo to the dock about the time Denny, Delores, and Gavin arrived. There was some kelp stuck in the starboard stabilizer and Gavin volunteered to dive under the boat and dislodge the kelp. He figured this would be refreshing after the long hike. After plunging in and resurfacing, Gavin gasped for air in the 50° water, then dove under and completed the task. A warm shower helped revive him and return some color to his blue skin.

Another few hour run back to Friday Harbor passed quickly with the beauty of the San Juan Islands all around us. We all enjoyed a nice dinner in town while waiting for the next ferry, then Denny and Delores departed for home. The rest of us departed for Lopez Island

and dropped the anchor in Barlow Bay, Mackaye Harbor on the southern end of the island. This wasn't a great spot



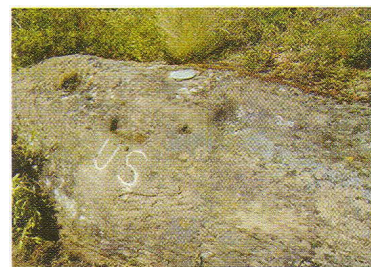
since rolling waves came into the harbor and we got rocked all night. On June 5th, we traveled by tender a few miles out to Iceberg Point and landed on a rock face. After a gentle 3/4 mile hike through the wet grass,



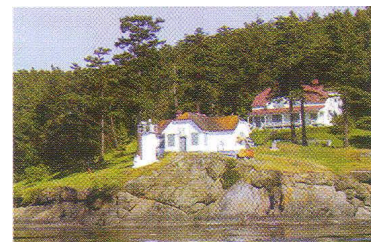
we arrived at the reference monument to turning point 7. My hip wasn't cooperating and we had equipment to carry, but the trip was enduring with all of the great assistants. This monument



sits atop an open rock knob with a series of vertical faces descending several hundred feet to the water. The tripod was placed over the monument using rock piles to elevate each leg over the 6-foot tall obelisk. While measuring



for the next 5 hours, we explored the area and recovered a geodetic control monument, Iceberg USC & GS and its references. John Thalacker, a well-known land surveyor from San Juan Island had surveyed



to this site and tied the international boundary reference monument. He also recovered a meander corner on one of the ledges far below. This was something to occupy our time and a search for John's meander corner became a goal. After an hour of searching, we assumed that a rockslide had covered the corner and no evidence could be found. This was to be our last monument visit in 2000 and we headed for Deception Pass, arriving in Cornet Bay in the evening.

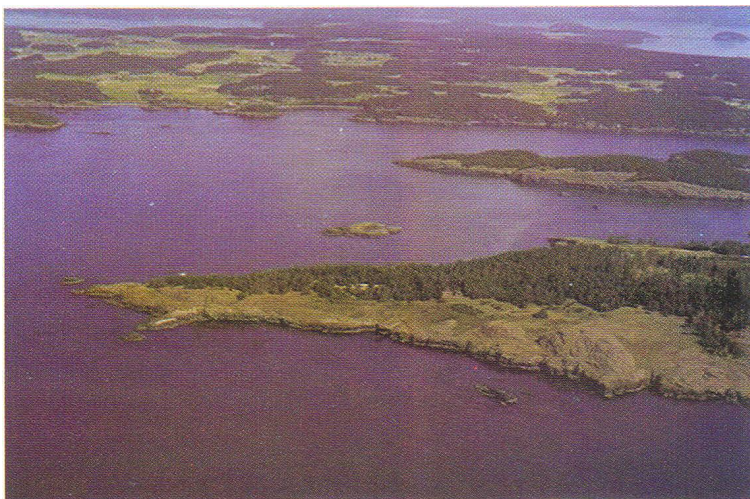
Our return trip carried us down the East side of Whidbey Island, past two gray whales along the way to Seattle, where we dropped Gavin at the Bell Harbor Marina. He headed into downtown Seattle with his pack and memories as we headed across the bay to Blake Island State Park and moored for the night. Homecoming was bitter-sweet on June 7th, since we had so much fun and developed lasting friendships with

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Resurvey of the Boundary *(continued)*

many others. I was happy to stop abusing my hip and ready to plan the next trip. Tarboo had traveled 312 nautical miles and 41 engine hours over the 12day trip.

We learned that the International Boundary Commission was interested in our data and our efforts, especially since it may save them some time and money to reproduce these efforts. The measurements would need to be better coordinated with greater redundancy. Some testing would be required to validate whether we could repeat measurements and meet accuracy standards. Only a few points had been measured on this trip, but the next trip would include multiple points with ties to each reference mark. Look for a future report on the four-week 2001 exploration

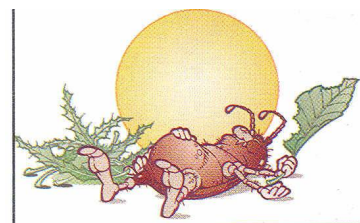


and adventure, uh survey, in the Evergreen State Surveyor. Plans have begun for another two-week trip in May 2002 and if you are interested in participating, contact Dave Steele at 360-902-1181 or dave.steele@wadnr.gov.



BASIC FLYING RULES:

1. Try to stay in the middle of the air.
2. Do not go near the edges.
3. The edges can be recognized by the appearance of ground, buildings, sea, trees and interstellar space; it is much more difficult to fly there.



Photos furnished by Dave Steele, article will following in another issue.



Sheringham Point Lighthouse



Patos Lighthouse



New Dungeness Lighthouse



Kelp Reefs Light



Couldn't hardly miss it



Fisgard Lighthouse



Tarboo, the mothership



An example of volunteer help



Transporting Gear



Dave Steele at Pile Point RM



Dave & Frank at Turn Point RM



Instructions will be ignored.

These marine pictures were gathered by Dave Steel during the past season of surveys for reCOORDINATING the International Boundary, Pacific Ocean to the 49th parallel (article to follow in future issue)

Remeasurement Of The Boundary Between The United States And Canada Forty-ninth Parallel To The Pacific Ocean

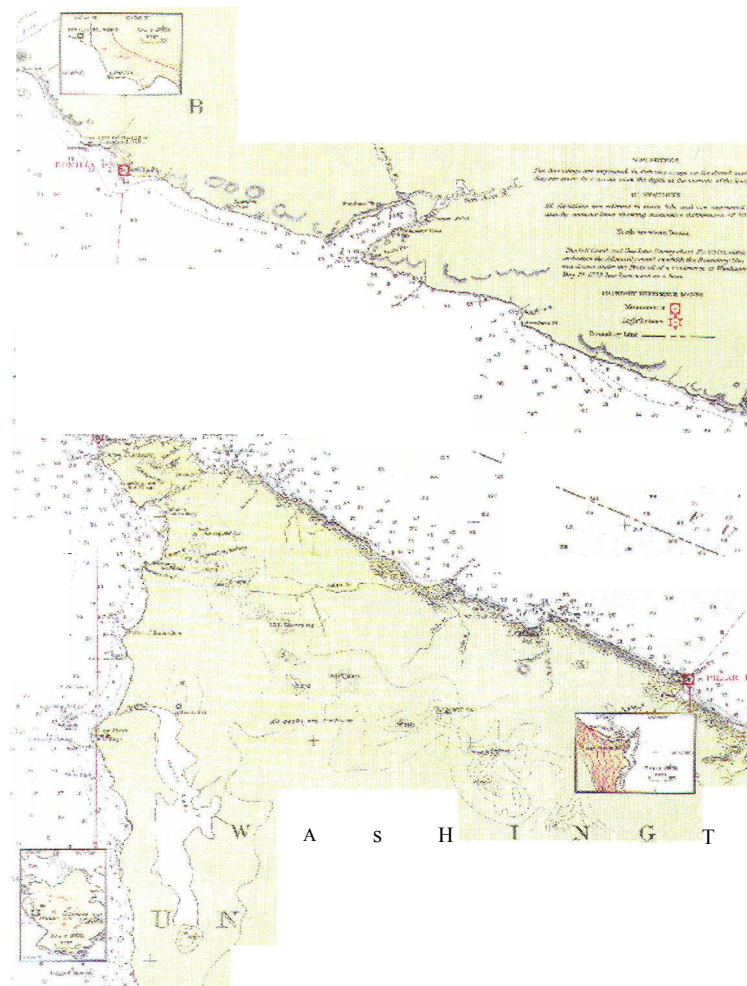
by David Steele, PLS, Chief Surveyor, Washington State Department of Natural Resources

INTRODUCTION

Intent and plan to remeasure the boundary references.

The intent is to remeasure all of the reference monuments to the International Boundary angle points from Point Roberts on the 49th Parallel to the Pacific Ocean. Any of the monuments that can be occupied directly with GPS equipment will be measured by direct occupation. We have been using Trimble 4000ssi GPS receivers and 5 hours of data collected in a single session of optimal satellite configuration. This data is processed against the many CORS in this area where NAD 83/91 coordinates can be assigned. The U.S. National Geodetic Survey, as a result of measurements made during 1999, determined the U.S. CORS coordinates. The British Columbia CORS were then coordinated from the U.S. CORS. Multiple GPS sessions were used during this work and those data sets were processed with the CORS data sets at stations NANO, UCLU, NEAH, ALBH, WHD1, SEDR,

"... remeasure all of the reference monuments to the International Boundary angle points from Point Roberts on the 49th Parallel to the Pacific Ocean."



Angle Point 12 at entrance to the Strait of Juan de Fuca.



Tatoosh Island.

SEAT, PABH, and RPT1. The boundary reference points are well surrounded by these CORS and the resulting error ellipses are quite reasonable with network accuracy of about 0.02 meters

Our field procedures at reference monuments that do not allow direct occupation with measurement equipment will be somewhat different. If any geodetic monuments currently exist in the proximity of the reference monument, usu-

ally a lighthouse, we will measure that geodetic monument with GPS equipment for 5 hours. A second monument will either be recovered or established and measured for 5 hours. These two references to the lighthouse will then be occupied with equipment with which to turn angles to the lighthouse spire, which represents the center of the lighthouse. Angles will be measured with appropriate redundancy, using a one-second

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Forty-ninth Parallel To The Pacific Ocean *(continued)*

theodolite and multiple fore-sights & back sights.

to improve the boundary location accuracy for activities that cross the border, like fiber optic cable easements

on a gray sandstone dwelling, the lantern is painted black, and the point of reference is the pinnacle or culmination of the roof of the lantern.

with a Spanish expedition named it Isla de Tutisi.



Cape Flattery Lighthouse on Tatoosh Island.

NGS DESCRIPTION:

The station is the center of the Cape Flattery Lighthouse. It is white and conical. The base of the tower joins the light keeper's dwellings. The focal plane is 53 feet above the ground and 156.6 feet above mean high water. Above the main platform the housing is metal and 12-sided. The glass has 12 sides also. The elevations were determined by spirit levels run from the water line. A discrepancy was noted in the 1955 recovery where the computed distance to Tatoosh 1886, a control station, is 114.56 meters and the distance given in J.J. Gilbert's original computations is 114.54 meters.

Cape Flattery Lighthouse was built in 1857, but only after great difficulties with the Indians. "Before commencing the lighthouse, it was necessary to build a blockhouse, and 20 muskets with ammunition were furnished for protection against Indians from the Canadian side of the Strait. Shortly after the light was completed the keeper resigned because the numerous Indians who used the island as a fishing and whaling station annoyed him." From the Lighthouse Journal dated May 18, 1858 by Isaac H. Smith, "I find that Cowbetsi, one of the chiefs, has broken open the door of the storehouse which contains valuable public property, and on one occasion struck the keeper, and that another chief has struck the

A report will be prepared for each reference station that covers the history of the monument and site, methods used to measure, the network configuration for coordinating the point, field notes, and all of the reports generated from network processing. We also archive the digital raw and processed data. Upon completion of the reference monument measurement, we will work with the Boundary Commission to determine coordinate values for any angle points in the boundary that may be affected.

or geographic information system mapping and charting.

ANGLE POINT 12 OF INTERNATIONAL BOUNDARY

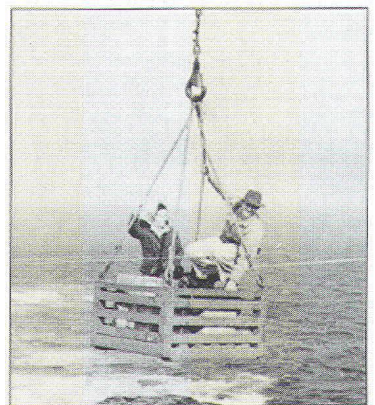
Cape Flattery or Tatoosh Island Reference Mark

The Tatoosh Island lighthouse, a.k.a. Cape Flattery Lighthouse is the United States reference mark to point 12, the terminus of the International Boundary at the Pacific Ocean. The reference mark is in line with point 12 and Bonilla Point Reference Mark in Canada. It is located on the South side of the entrance to the Juan de Fuca Strait and about 3,000 feet northwest of the northwestern most point of the mainland of Washington State, which is Cape Flattery, Clallam County. The NGS description states that the lighthouse is a white conical tower

Cape Flattery Lighthouse is now electrified, and is fitted with a diaphone fog signal and a radio beacon. The U.S. Coast Guard operates the lighthouse in 2000 and it is in good condition.

BRIEF HISTORY OF TATOOSH LIGHTHOUSE AND MARKS

J.J. Gilbert, United States Coast and Geodetic Survey, 1893, originally determined the geographic position of the mark. In 1857, the lighthouse was built to guide ships entering the Strait of Juan de Fuca. Capt. John Meares named the island Tatootche in 1788 when he was entertained nearby by Chief Tatootche. The Chinook name means Thunder Bird, or nourishing beast, as the island was the legendary home of that huge creature. In Makah language the name is Tututsh. In 1790, Alferez Manuel Quimper, who came



Transportation to Tatoosh Island (1943). Photograph provided by LaVera Roland.

keeper and threatened to kill him, others have made similar threats on different occasions.

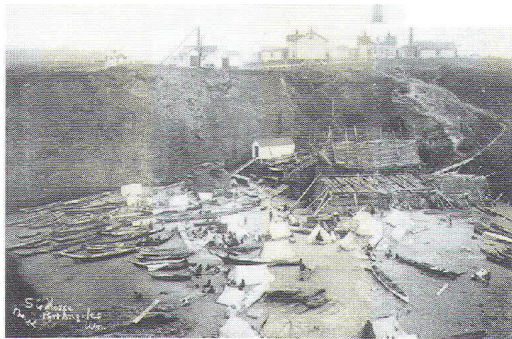
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Our schedule and plan of execution will cover several years, beginning in 2000 and running through 2004, approximately. I am working with any interested volunteer Land Surveyors in Washington and British Columbia and providing transportation to many of the remote and inaccessible sites with my boat, Tarboo. The purpose of this survey is

Forty-ninth Parallel To The Pacific Ocean (continued)

The keeper also reports that he has found it impossible to keep

along on his hands and knees kept him from being blown



Joint use access on Tatoosh Island in early years.

the Indians out of the lighthouse, as they meet any remonstrance with threats, and threat he cannot, therefore, be responsible for the safekeeping of the public property:

On May 16, 1900, James Cowan stepped ashore on Tatoosh Island with Mrs. Cowan and their seven children, to learn that there was no school atop the seventeen-acre empire for his youngsters. James Cowan stayed on Tatoosh for 32 years, retiring in 1932, having saved five lives over the years and nearly blown from the island during the 1921 gale. The gale wrecked chimneys and roofs, and blew Mr. Cowan end over end for 300 feet. Only clinging to the grass and crawling

from the island into the sea. The same gale leveled thousands of acres of timber on the West end of Clallam and Jefferson Counties. A bull from the Tatoosh herd of the Cowan's, was blown off the island and written off on the lighthouse log as "lost at sea", but later swam ashore climbed the emi

nence and demanded an extra ration of hay for privations and exposure suffered in the sea and surf. (This information was obtained from a Newspaper article dated Oct. 25, 1932.) During this time period, life was different aboard the island. There was a school, plenty of company, and movies. The government was even digging a fresh water well. Tatoosh boasted 40 inhabitants, all in government service, naval, radio, weather bureau and lighthouse service. Access to Tatoosh Island was by Lighthouse tender; an example of such is "Heather" as pictured on the previous page. Whaleboats would be lowered to transport passengers and freight to the small bay on the Northwest side of the island.



Transportation By U.S.C.G.

A crane jutting from the cliff top would hoist anything coming onto the island. The 75foot lift was quite exciting, but very reliable.

LaVera Roland, an employee with the Weather Bureau from 1943 to 1946 stated "so perpendicular are the seventyfive foot cliffs, no ship can land. The mail boat making its weekly trip pulls up under the lee of the north wall. If the weather is mild (which is usually isn't) diesel-powered winches lower a basket on a cable. With many misgivings, the visitor hurriedly scampers into the cage and up he goes like the man on the flying trapeze, dangling between sea and sky. A half dozen coast guardsmen steady the basket as it plunks on the platform, and there you are."

THE YEAR 2000 TATOOSH JOURNEY

Planning for this trip began many months before the field visit and in conjunction with the DNR Resource Mapping staff. Control was to be established for an aerial photo project at the same time that we were recovering and remeasuring the lighthouse control. There are only two ways to get to Tatoosh Island today; by boat and by helicopter. A boat trip can be arranged through the Makah

Tribe yet this is fairly complicated and they don't like to haul people to the island. Tatoosh Island is part of a marine bird sanctuary and approach by boat is problematic with a small beach upon which to land.

We chose the helicopter as the preferred method of travel and Chris Hansen, a Photogrammetrist with DNR, made the arrangements with the Coast Guard. They would take up to six people that worked for some form of government, since insurance was an issue.

A crew was assembled and was comprised of Terry Curtis, DNR Photogrammetry Supervisor, Chris Hansen, DNR Photogrammetrist, Dave Steele, DNR Survey Manager, Brad Lymangrover, DNR Region Surveyor, Mike Hazlett, DNR Surveyor, and Gary Perasso, NGS Advisor. We were required to send the Coast Guard a roster and equipment list several months before the trip, so that weight planning could be done. May 3, 2000 arrived and we met the Coast Guard at Hoquiam Airport on a blustery morning. We thought this would be simple, but after unloading our rigs and creating a huge pile of survey and personal gear, we were told to dress in flight gear. "Now lets see who can

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wear which suit," since these are not designed to fit all sizes.

Brad got nearly dressed and found that his suit was just too small and Chris had one that was bagging all over. After an exchange of suits, we loaded the chopper and headed up the coast. We dropped the Photogrammetry crew on Destruction Island for the first phase of their project.

The Photogrammetry crew needed to locate some control on Destruction Island on the way to Tatoosh Island. As the Coast Guard helicopter came into Destruction Island, eagles rode the wind in all directions. This place was impressive, being a green island in a dark sea with crashing waves all around. We were having a ball, if only we could move around. The floor of the helicopter was so full of equipment that we had no legroom and everybody was cramping. The look of cramped pain on most faces, well described our concern for moving on to Tatoosh Island.

Arrival at Tatoosh Island was much like Destruction Island, with the helicopter circling around a couple times to scare the birds away. This prevents some of the problem with birds and rotors coming in close contact. Tatoosh Island and the surrounding area is a bird sanctuary and visitors are required to respect the local wildlife. Upon approach, one doesn't feel like



the loud helicopter is particularly respectful or wildlife friendly, but at least this was an official visit. Now was the time to begin the search for these various strange things, like a cistern and a 30-foot diameter catch basin, a railroad and just what is a Weather Bureau. We had some additional tools like a 1950s oblique aerial photo that was taken by the DOT. I scanned a small portion of the large, wall-size photo and planned our field activities. We also used a 1": 1000' aerial photo that was very useful. It was great to get out of the flight suits and work out the kinks from the flight.

On the DOT aerial photo, shown above, one can see the

many structures, most of which have now been removed. The Weather Bureau is in the back right and is collapsed. The school building in the back, foreground is now gone. The catch basin, in which the Tatoosh Reset is located, is directly beyond the lighthouse and is shown as a circular gray area. A small cemetery is located in the far upper right part of the photo.

The various control features to be recovered, that have been reported in the past are:

CAPE FLATTERY LIGHTHOUSE or TATOOSH LIGHTHOUSE, PID TS0295 mentioned in some detail previously

TATOOSH 1886 located SE 114.54 meters from TATOOSH LIGHTHOUSE.

WEATHER BUREAU THEODOLITE SUPPORT, PID TS0300

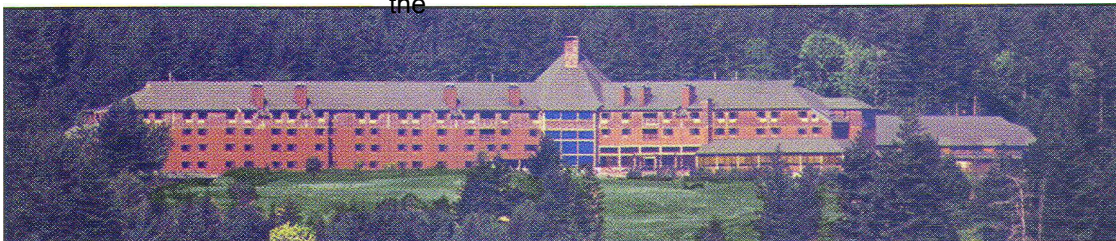
EPI TATOOSH, PID TS0299 located on the Southwest extreme of Tatoosh Island

TATOOSH RESET, PID TS0301 is a replacement of TATOOSH 1886 and referenced by 2 reference monuments.

POINT A 1942, PIDTS0298.

POINT B 1942, PID TS0297.

The recovery work went well and after a couple of hours the critical monuments had been verified and GPS measurements commenced. We recovered TATOOSH RESET and 2 references. A brief search for other monuments and features was performed with no success. The area is heavily overgrown with 10-foot tall brush and many of the original structures have been removed or are in disrepair. Tatoosh Reset was originally



Forty-ninth Parallel To The Pacific Ocean *(continued)*

described by the Coast and Geodetic Survey in 1893 as located on a small knoll 375 feet S87(59'41" E

(true) from the center of the ball or ventilator on top of the lantern of the Tatoosh Lighthouse. The station was marked by the center of a brick pier over the subsurface mark, which is a 3/4 inch copper bolt, 6 inches long, projecting 7/8 inch above the surface of the rock, which is 20 inches below the surface of the ground.

The brick pier was recovered in 1921 and in 1931 and was in good condition, but by 1942, the top of the pier showed signs of disintegration. A new cap 3 inches thick was put on the pillar and marked with a bronze disk, stamped 1886, 1942. The pier was described as 1.4 feet x 2.0 feet and projects 3.4 feet above ground and set on solid rock. The station is 68.5 feet East of the centerline of a narrow gauge railroad, 95 feet East from the NE corner of a schoolhouse building and 67 feet NE from the NE corner of a Weather Bureau Power House, and 60 feet North of the NW corner of a cistern. Reference Mark NO.1 is a bronze disk SE of the station at the NE corner of an octagonal collar around a manhole in top of the cistern. Reference Mark No.2 is SW of the station, a bronze disk set in a drill hole in bedrock. In 1954, the brick pier was found fallen over. In 1955, the surface mark and references were found. In 1974, the surface mark was noted as removed and a concrete catch basin 30 feet in diameter constructed over the station site. They chipped a 6-inch hole in the concrete and recovered the subsurface mark. The hole

was left open and no new surface mark set. Both references were found in good condition.



"Tatoosh Reset" at catch basin.

On May 3, 2000, we found the catch basin that had been constructed over the mark as shown on the photo. This catch basin is designed to capture rain as it runs off of the dome surface and into the gutter around the edge. Just don't mind the bird droppings scattered about; that counteracts the acid in the rainwater. The water is then piped into the cistern to the East.

The station's subsurface mark was found in a 6-inch hole in the concrete as described in 1974. We described it as a 1/2-inch copper shaft with a cross on top at 0.25 feet below the surface of a concrete catch basin. Reference Mark No. 1 was recovered, but has been damaged. The brass shank of the mark is left in the broken edge of a concrete octagonal collar around a manhole in the top of a cistern. The cistern is approximately 6 feet tall x 10 feet x 20 feet and the top is about the 5 feet in height below the catch basin. We did not measure to this mark since there is about 75 feet of 15-foot tall dense brush between marks.

Reference Mark No.2 was recovered at S27(W 34.6 feet where we found a standard USC&GS brass disk 6 inches below the ground surface and

cemented into bedrock. This cap is marked Tatoosh 2 1942 with an arrow pointing in the station direction.

Several new references were noted during our recovery. The edge of the catch basin is 13.8 feet South and 12.0 feet West. The Eastern corner of a concrete block once used as the eastern part of a three-leg antenna base bears S45°W 23.36 feet and the Eastern corner of a concrete block once used as the Northern part of a three-leg antenna base bears S64°W 19.51 feet.

In order to coordinate the lighthouse, a second control point was established, intervisible with Tatoosh Reset. A 5/8 inch rebar with aluminum cap marked DNR GPS 6283 was set about 600 feet Northeast of

the lighthouse. This point, as well as Tatoosh Reset, was measured by GPS for 5 hours. Angles were then turned, with back sight toward Tatoosh Reset and foresight toward the lighthouse spire. Angles were also turned, with back sight toward point 6283 and foresight toward the lighthouse spire. The lighthouse spire will then be coordinated using a bearing-bearing intersection.

The GPS measurements were post processed against CORS stations at which NAD 83/91 coordinates had been established. See a previous description about the establishment of CORS coordinates. The vectors for the two stations were processed from CORS at NEAH, ALBH, RPT1, SEAT, and WHD1.

