How To Identify and Record a Clam Garden: July 2021

The Clam Garden NETWORK

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Who is this guide for?

This guide is for First Nations and Native American Tribal members and your representatives. The guide is meant to be a tool to help Indigenous communities identify and record clam gardens in your traditional territories.

When beginning a clam garden project it is good practice to consult with the hereditary leadership in your community. They can help guide you to those families who hold the inherited rights and permissions to grant access to beaches in your Nation's or Tribe's territory.

We recognize non-Indigenous peoples may also be interested in learning more about clam gardens and traditional mariculture practices. We welcome your interest to learn more and invite you to read this guide. We ask that you visit clam gardens with permission from the Nation(s) or Tribe(s) whose territory you are interested in visiting.

The rock walls and terraces described in this guide belong to the Indigenous peoples of the northwest coast of North America. These are sacred places where families and communities have gathered marine resources for food, social, and ceremonial (FSC) purposes for generations. We ask that you respect these places and be mindful when you visit. When we come with open hearts and good minds we honour the ancestors, the people today, and the generations to come.

Indigenous laws and colonial laws, such as the Heritage Conservation Act in British Columbia, protect these cultural sites. The walls are not to be tampered with and we ask that you do not add or remove rocks from the walls unless you have secured permissions from the proper authorities, which may include specific families, communities, First Nations, Tribes, and/or Provincial or State governments.

To learn more about etiquette and cultural protocols for discussing or visiting traditional clam digging beaches and sea gardens please visit the linked FAQ page for more information: www.clamgardennetwork.com/FAQ (coming soon).

If you think you've found something and would like to reach out to the local Nation(s) or Tribes, refer to the Consultative Area Database to find out whose territory you're in: https://maps.gov.bc.ca/ess/hm/cadb/

What is a "clam garden"?

A clam garden is a raised clam beach stabilized by a rock wall that was built by First Nations and Native American ancestors. It has a flat clam digging area (terrace) behind the rock wall that can be accessed from zero to three-foot tides. Sometimes you can find a walled clam beach even higher, at a four-foot tide. The rock wall can only be seen at the lowest tides of the year. The rock wall and flat terrace maximize digging time. Along

many parts of the coast, you can dig in a clam garden for at least three hours during the lowest tides of the year.

Over time, with continuous use for FSC, the ancestors cleared the beach of rocks and boulders that were often the size of basketballs or smaller. In some cases, larger boulders were moved too. Sometimes they were floated by canoe into the wall. Other large boulders were left in the clam beach. These large boulders can be optimal places to dig clams today, especially butterclams. Butterclams, littlenecks and horseclams are the most commonly found clams in a clam garden. Cockles can sometimes be found on the beach surface too. Manila clams are invasive and have only been on the coast for about 90 years. Manila clams are often found higher in the beach than clam gardens.

"Clam gardens" are also "sea gardens"

In addition to finding clams in the digging area, the rock wall is home for many other culturally important species. Sea cucumbers, urchins, crabs, whelks, chitons, octopus, barnacles, and kelps are a few examples of other species that live in the wall. When the tide is high, the rock wall is home to many fishes as well. There are First Nations' communities along the coast who prefer to use the English term ***sea garden*** in recognition of the many species that are cared for in these places in addition to clams.

Words in local Indigenous languages

There are often terms for these places in the local languages. Sometimes the words refer to moving rocks and clearing or cleaning beaches to make clam digging easier.

In Kwakwala the term *lúx^{w}xiwey* means "rolled together; low tide mark", "where the stones roll", "rolled rocks forming a wall".

Speakers of *Éy7á7juuthem* have used the word *wúx̲wuthin* to refer to the piling up of rocks to create a barrier (*wux̲w)* at the mouth (*thin*). Elders have described *wúx̲wuthin* as being "like a breakwater".

In a northern dialect of *nuučaaʔnuɬ*, *t'iimiik̲* translates to "something being thrown" or "move aside rocks" and is a place name for a good clamming beach where clams were cultivated.

The Hul'q'umi'num word for "rock wall" is *smeentuxun* where *smeent* (*smaant*) is "rock" and *uxun* is "wall".

Are their words for specific clam beaches, clam digging, moving rocks, rock wall or cleaning beaches in your language? Sometimes the words in the local language can help to find unrecorded clam gardens. The words can also be present in stories or songs, which may highlight traditions and places connected to clam digging.

Clam or sea gardens are just one way of caring for land and sea

This guide focuses on walled beaches at the very lowest tide, but the ancestors have been caring for beaches from high to low tide for generations. We find evidence of their care throughout the beach. Rock walled fish traps can be found at high, middle and mid- low tides. They can be in, near, and away from streams. Sometimes there are small areas within a beach that have been cleared of rock. Other time you may find a ring of rock that once secured a large basket trap. Sometimes there are excavated ponds for holding fish. In addition to clearing rocks downslope to the low tide, we find some beaches have been cleared upslope with rocks piled at the high tide. Throughout the intertidal there are transportation features like canoe runs and footpaths. At high tide we may find rock walls and terraces that look similar to clam gardens but are used for plants like spring bank clover, pacific silverweed, rice root lily, sea asparagus and other species. There are many traditional ways of looking after all the plants, fish, birds, and mammals that visit and live in the beaches. This guide focuses on the very low tide, but no doubt you will see evidence of peoples' care all over the beaches.

What does a clam garden look like?

The biggest difference between a natural clam-digging beach and a clam garden is the rock wall and very flat clam digging area (terrace). The entire rock wall can only be seen at the lowest tides of the year in May, June, July and August. A zero tide is the best time to see the full clam garden walls. Sometimes people don't see the walls because they are so busy digging clams, but if you look up at low tide you can often see the wall emerging from the water. If you're on a boat you can often see the walls from the water.

The walls are usually as long as the beach. Length can vary from a few meters to over a kilometer long. Some clam gardens have steep, tall walls up to 1.5 m in height or more. These walls tend to be quite narrow measuring about 5-10 meters wide. Some clam gardens have very wide walls measuring up to 20 m but are quite thin (~40 cm thick). The shape of a clam garden often depends on the local area and where the shorelines were in the past.

If the ancestors were living in a place where shorelines have been falling gradually for thousands of years, the walls are often tall (1 - 1.5 m) and narrow (5-10 m). There may also be multiple terraces in the beach as people built new walls and terraces as the shorelines fell. The ancestors also used multiple tiers to target different species, so it can sometimes be hard to tell an ancient clam garden from a terrace that is designed for a different species and purpose.

If the ancestors were living with sea level rise, the walls tend to be very wide and thin and much of the wall may now be underwater, even at a low tide. This is true of Coast Salish territories around southern Vancouver Island, Gulf Islands, Puget Sound and the San Juan Islands.

Here we present a series of photos of clam gardens from different parts of the coast so you can see the variety that exists. Keep in mind that a clam or sea garden may look different in your territory. The shape of the wall often has to do with changing sea levels and local geology but cultural traditions affect beaches too. We're still learning what clam gardens look like up and down the coast and it's very possible they look different where you live. If you'd like to send us a photo of a garden in your territory, please do! We always love learning more about clam digging practices up and down the coast.


a.


b.


c.


d.


e.


f.

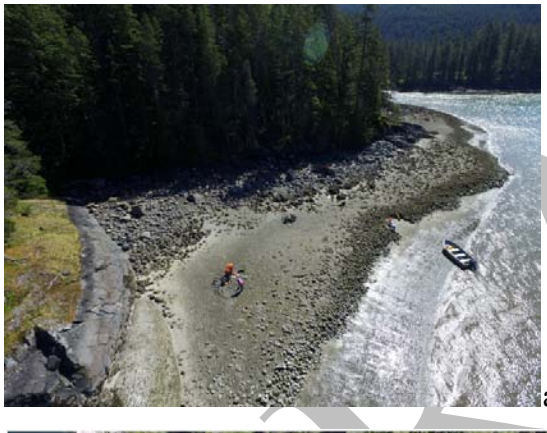
Figure 1 Various clam gardens on the coast: a) narrow wall and flat terrace, northeast Vancouver Island, b) photo from high point of land showing wall and terrace, Discovery Islands, c) photo at base of steep wall on central coast, d) if the tide is not low enough the wall may still be underwater - here wall is appearing on right of photo but is still underwater on left, e) sometimes the terrace will have large boulders numbering from one or two to dozens, e) sometimes the wall and terrace are covered in kelp and algae making the clam garden harder to see - unless you're in a plane in which case they may stand out better. (Photos by M. Morris (a,d), N. Smith (b,e), M. Hatch (c), J. Harper (f))

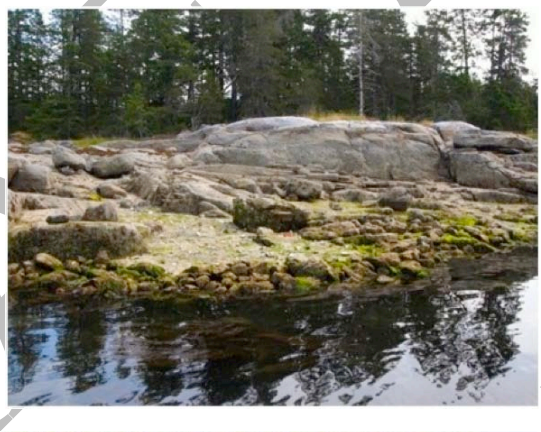
Where to look for clam gardens?

Clam gardens are common along shorelines with lots of current and good tidal flow. They will be along protected shorelines and not in exposed areas with strong waves and wind. Even though they can be found in protected areas, clam gardens tend not to be at the heads of inlets of bays, or near freshwater.

Clam gardens often occur in clusters, along the sides of inlets or within a group of islands. Sometimes the rock walls will join two outcrops of bedrock or rock piles together. Sometimes you can see a wall along a beach that connects a small islet to a larger island at low tide (also called a tombolo).

Clam gardens can be built on sediment beaches where people have expanded the existing clam digging area. People have also built clam gardens on bedrock platforms or along bedrock shorelines where they have levelled the eroding boulders to create new clam habitat.


a.


b.


c.

Figure 2 Clam gardens take many forms and are found: a) on soft sediment beaches, b) on bedrock platforms, and c) along steep, eroding bedrock shorelines that are levelled to create a terrace (photos by K. Holmes (a, c), D. Lepofsky (b)).

How to find a clam garden?

Do your survey at low tide

To find a clam garden you have to look during the lowest daylight tides of the year. Plan to do your survey during the week of zero, or near zero, tides in May, June, July or August. There are good tide tables online or you can download an app for your phone.

Online tide tables and predictions:
https://www.waterlevels.gc.ca/eng
http://tbone.biol.sc.edu/tide/tideshow.cgi

Remember to look for the tidal station near your survey area to know when to do your fieldwork. The time of a low tide varies up and down the coast. The low tides may be early morning on the north coast, but midday on the south coast. You can even find that the low tide on one side of an island can be an hour or two different from the low tide on the other side of the island.

Plan ahead

In the months or days before a low tide, it's a good idea to plan out where you want to look ahead of time. Since the low tide window is so short, planning ahead will save you time in the field.

You can often find good places to survey by looking at marine charts or Navionics. Often the green, shallow areas along the shoreline are clam gardens!

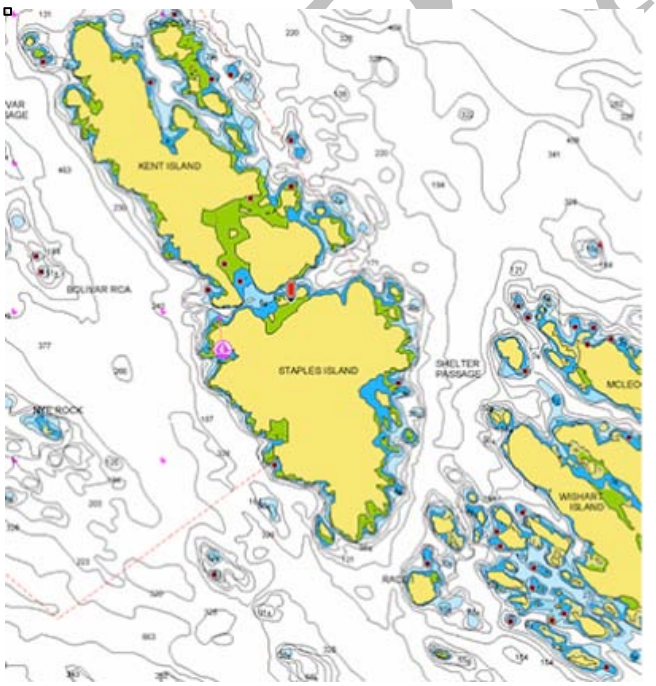


Figure 3 Example of Navionics chart. Shallow areas in green are good places to look for clam gardens. (https://www.navionics.com/usa/blog/post/canadian-rockfish-conservation-areas-added. Accessed July 15,2021)

You can also view air photos online. Aerial survey is a great way to survey vast shorelines in a short period of time, but it can be expensive. Fortunately many air photos of the coast are online already. The BC ShoreZone Imagery website is a database of air photos taken for much of BC and Alaska. Most of the photos were taken at low tide (<1.0 m). It is a great way to look at beaches before you go in the field. The images will show you if a shoreline is steep bedrock (low potential for clam gardens), or if it the beaches are gravelly and flatter (potential clam digging beach). Sometimes you may even see the rock wall of a clam garden in the photo!

You can access ShoreZone images here:
https://mcori.maps.arcgis.com/apps/Viewer/index.html?appid=c76377500f814914ad90149f229d4d66

Within the same website you can also access the BC ShoreZone Mapping Data. You can understand more about the habitat along different stretches of shoreline by clicking the different layers. Here is an example of wave exposure for southern Howe Sound. You generally don't find clam gardens on exposed shorelines so this layer can help limit your survey area.

Figure 4 Example of how ShoreZone displays wave exposure. The areas in red would have very low potential for clam gardens, whereas the orange and especially the blue and green areas would be better places to look.

Once you have identified possible beaches to visit then you're ready for the low tide. By doing some planning first you can often be more successful in the field.

Have you found a clam garden?

Sometimes it can be tricky to know if you've found a clam garden or not. The flow chart on the next page may help you decide if it is or isn't a clam garden as there are other cultural features, as well as historic development features, that can look like clam gardens. We've tried to capture some of these in the flow chart below. If you're still not sure we're very happy to help talk it over and look at photos with you.

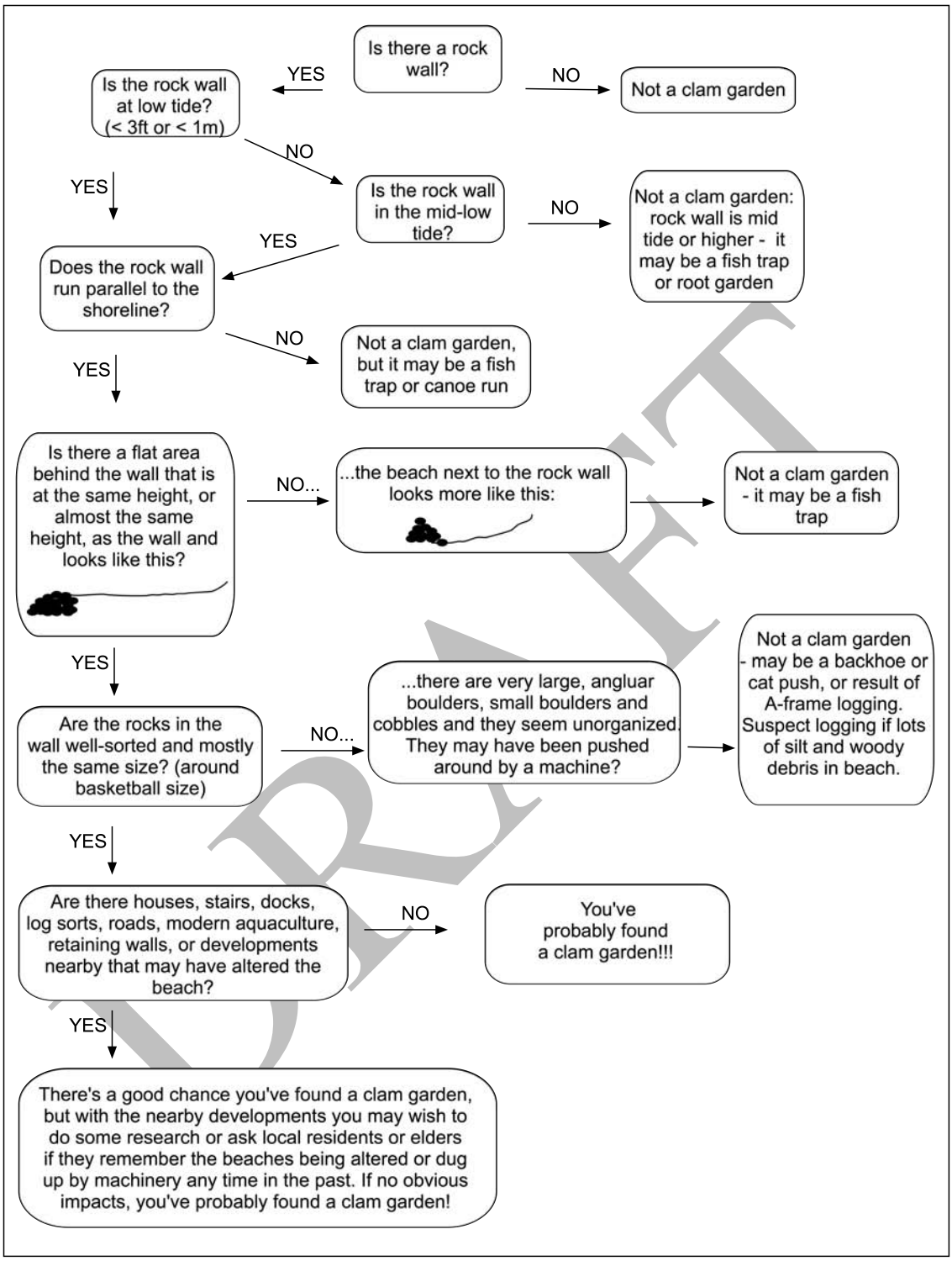


Figure 5 Flow Chart: Could it be a clam garden?

How to Record?

You've found a clam garden – Yay! Now what? In this section we highlight some of the most important things to record when you've found a clam garden. We understand that many Nations and Tribes have different systems for recording environmental data. By keeping things simple we hope that the data categories can be integrated easily into existing systems and databases. For those communities who are just starting to record environmental and cultural data in your territory, we provide a data collection sheet in Appendix A that can be printed multiple times and filled out in the field. The different categories can be transferred into a database or spreadsheet of your choosing.

Date, Time, and Tidal Height

It is always important to record the date and time you found the clam garden. The date and time help people know what the tide level was like when you visited. If you know the tidal height at the time of your visit, it's great to write that down too.

Location

At the very least, you should record the clam garden location. This is the most important thing to record if you're pressed for time. We like to record clam garden location by standing in the middle of the wall, about 1 m back from where the wall and terrace meet, and taking a GPS point. Label your GPS point using a system that makes sense to you; CG1, CG2, etc. You may also wish to write down the coordinates in your notebook.

It's also fine to drop and label a pin in Avenza maps or on your boat's chartplotter. Make sure you label your GPS point or pin.

Photograph

It is always great to have a photograph to go along with a location. Try to take a photo from a high place where you can see both the wall and the terrace. Include a photo with a person for scale. Photos from a boat on the water can be useful too. Write the photo number in your notebook or tablet, and note which clam garden it is (same label for your GPS point).

Wall Length

If you have time, record the length of the wall along the shoreline. You can do this with a 50 m or 100 m tape, or you can turn on 'tracks' in a GPS while you walk the length of the wall.

If you are fortunate to have a mobile GIS device that records points, lines, and polygons, you can create a polygon for the wall by walking along the wall's perimeter. The wall's perimeter includes where the wall and terrace meet and where the wall and ocean meet. Back in the office when you upload the data to a computer you can measure the wall length in a mapping program like ArcGIS or Q-GIS.

Wall Width

Wall width is measured from where the wall and terrace meet, to where the wall and ocean meet. Record this in meters. You may wish to hold the line flat instead of following the slope of the wall to the water as the slope will add a bit of distance.

If you have a mobile GIS device, you can measure width of the polygon that you recorded for length above using the measuring tool in your mapping program.

Note: It's very possible that the wall will go into the water. Only measure into the water if you can do so safely. If you go into the water, write in your notebook how far into the water you went and whether or not you found the edge of the wall. For many clam gardens it isn't possible to know how deep the wall goes unless you dive or measure the wall using remote sensing technologies like sidescan sonar or multibeam. These methods are beyond the scope of this guide but we're always happy to chat more if you're interested in learning more.

Terrace Width

In addition to wall width, you may wish to record the width of the terrace. The terrace includes the flat part of the clam digging area and stops where the beach starts sloping up to the high tide line. You can use a measuring tape to measure from where the wall and terrace meet to where the flat terrace starts to slope up. Record width in meters.

If you have a mobile GIS device, create a polygon by walking the perimeter of the flat clam digging area. The clam digging area ends where the slope changes, or where you hit solid boulders and rock with no clams.

Height of Wall

It is useful to know how tall the wall is and how high it is above chart datum (0 tide). You will then know what tide you need to see the clam garden again. Sometimes these measurements can also be used to figure out how old a clam garden is. On Quadra Island, for example, the walls that are higher in the beach are older than the ones that are right near today's low tide.

To measure the height of the wall:

- start by finding the wall's high point. The high point is usually close to where the wall and terrace meet.
- Secure the end of a long piece of string with a line level to the high point of the wall.
- Unwind the string until you are at the edge of the wall nearest the water.
- Make sure your string is level by pulling it tight and making sure the bubble in the line level is in the middle.
- Measure from the string to the base of the wall or to the water if the wall goes under water. Record this measurement in centimeters. Note if you measured to the base of rock wall or to the water.

- Record the time.
- Record the tidal height if you know it. If you don't know tidal height you can figure it out using the time and looking at tide chart predictions.

If the wall goes underwater, you can walk out until you find the end of the wall or can't go any further. Then you can measure the distance from the water surface to the top of the wall. Record the measurement in centimeters. Record the time of your measurement. Only go into the water if it is safe to do so.

Beach Condition

In addition to recording basic measurements, you may want to make quick notes about beach health. Understanding how healthy the beach is can be useful for deciding which clam gardens to restore in the future. Below we note a few indicators of good and poor beach health. When you observe these, make quick notes in your notebook about your observations, or check the boxes on the data collection form in Appendix A.

Signs the beach is healthy

- Lots of sea life at the beach; you see birds, herons, mink, deer, moonsnails, etc.
- Clams are squirting, the more squirts the healthier beach
- Empty clamshells are on the surface of the beach
- Small holes or small mounds with holes in the beach
- Clam predators are around (mink, moonsnails, birds)
- Lots of sea life in the wall (crabs, sea cucumbers, tiny urchins, etc) and on the terrace
- Healthy seaweeds, kelp or algae
- Lots of broken and crushed shell in the sandy gravel when you dig.
- People dig clams here

Signs the beach may be unhealthy

- No squirting clams
- No empty clam shells on the beach surface
- Beach smells bad, like sulphur, when you dig
- Beach sediment is hard-packed; hard to dig
- Beach is covered in thick green seaweed or algae, 10 cm thick or more
- Beach is cobbly and rocky with no sand, gravel and crushed shell between the rocks
- You can see woody debris in the beach when you dig
- Beach is mostly fine silt and sand when you dig
- No broken shell in the beach sands and gravels
- No one digs clams here anymore

Restoration Potential

In addition to beach condition, you may wish to make notes about the beach that may guide future restoration decisions.

For example:

- What permission is required to access the beach? (Family, leadership, property owner, government, etc)
- Does this beach have a name, story or song?
- How far away is the beach from community?
- Is there potential for poaching?
- Has the wall been damaged by development, machinery, logging, dredging, submarine cables, dock construction, modern aquaculture, etc? You may be able to see that part of the wall is missing or damaged, or you may see tractor or backhoe marks in beach. Elders may know of disturbance to the beach over their lifetime.
- Is access to the beach blocked by docks, boat launch, etc?
- Is there a shellfish closure at the beach?
- How low does the tide have to be to see the wall? (1ft, 2ft, 3ft, etc.)

Answering these questions can be useful when it comes time to decide which clam garden the community may wish to restore. And of course feel free to write about any other observations that you think are important at the time of fieldwork. Your experiences, observations, and knowledge of the beach are very important.

Figure 6 Restoring a sea garden wall in the Gulf Islands. Much of the original wall is underwater today, even at the lowest tides of the year (Photo N. Norris, Alagamil).

Do you have Questions? Are you interested in learning more?

It is possible that you have questions we haven't answered here. You may also be interested in learning more about specific topics like: how to develop a survey plan using aerial photos; how to conduct boat based, helicopter or drone surveys; or are curious about underwater surveys, etc. If you have questions, would like to chat more, or are interested in a training program that goes into more depth about these topics, please reach out to us using the email below. Many members of the clam garden community are eager to share their experiences and we'd be happy to connect you with those who may be able to help. Our email is clamgardennetwork@gmail.com

Appendix A: Printable Clam Garden Data Recording Sheet

Form on following page

DATE: _____ **TIME:** _____

TIDAL HEIGHT (if known): _____ **feet / meters** (circle one) _____

LOCATION

UTM or LAT/LONG: _____

Description: _____

PHOTO NUMBER(S): _____

Record below if you have time

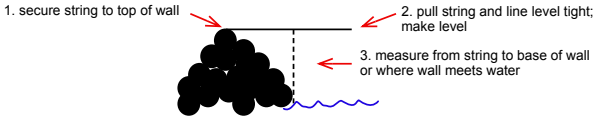
WALL LENGTH (m): _____ **WALL WIDTH** (m): _____

Does the wall continue underwater? Y / N (circle one)
If yes, can you how tell how far it goes underwater? (approximately): _____

MAXIMUM WIDTH of TERRACE or CLAM DIGGING AREA (m): _____

WALL HEIGHT (m): _____ **TIME RECORDED**: _____

To measure wall height use a string and line level to measure from high point of wall to base of wall or where wall and water meet.



Did you measure underwater? Y / N (circle one)
If yes, how deep is the wall below the water surface? (only measure if safe to do so): _____

BEACH CONDITION:

Healthy signs		***Unhealthy signs***	
Are clams squirting?	Y / N	Does the beach smell bad?	Y / N
Is there lots of sea life around?	Y / N	Is the beach sand hard packed?	Y / N
Are there empty clamshells on beach?	Y / N	Is beach covered in deep seaweed?	Y / N
Are there small holes/mounds in beach?	Y / N	Can you see wood chips when you dig?	Y / N
Can you see broken & crushed shell when you dig?	Y / N	Is beach cobbly and rocky with no sand, gravel or crushed shell?	Y / N
Can you see clam predators (birds, snails, mink, etc.) around?	Y / N	Is beach mostly find silt when you dig?	Y / N
People still dig clams here	Y / N	People don't dig clams here anymore.	Y / N

RESTORATION CONSIDERATIONS:

What permission is required to access the beach?
Does this beach have a name, story or song?
How far away is the beach from community?
Is there potential for poaching?
Has the wall been damaged?
Is access to the beach blocked by docks, boat launch, etc?
Is there a shellfish closure at the beach?
How low does the tide have to be to see the wall? (1ft, 2ft, 3ft, etc.)

NOTES: