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Mooring Field Layout and Design

by

John B. McAllister, P.E.



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Introduction

This course has been designed to provide a background and broad overview of mooring systems and their components, as well show the design process behind laying out a mooring field. Moorings provide for easy and secure vessel tie up in areas of transient boat users or in locations in which berths or slips are not available. The advantage of a mooring over anchoring the vessel is that the moorings are typically selected based on the harbor bottom sediment types and are weighted and/or secured to better hold and secure various types of vessels in that area. When properly designed and laid out, a mooring field will represent a safer, more manageable harbor area, with less disruption and damage to the seabed, and less chance of damage between vessels.



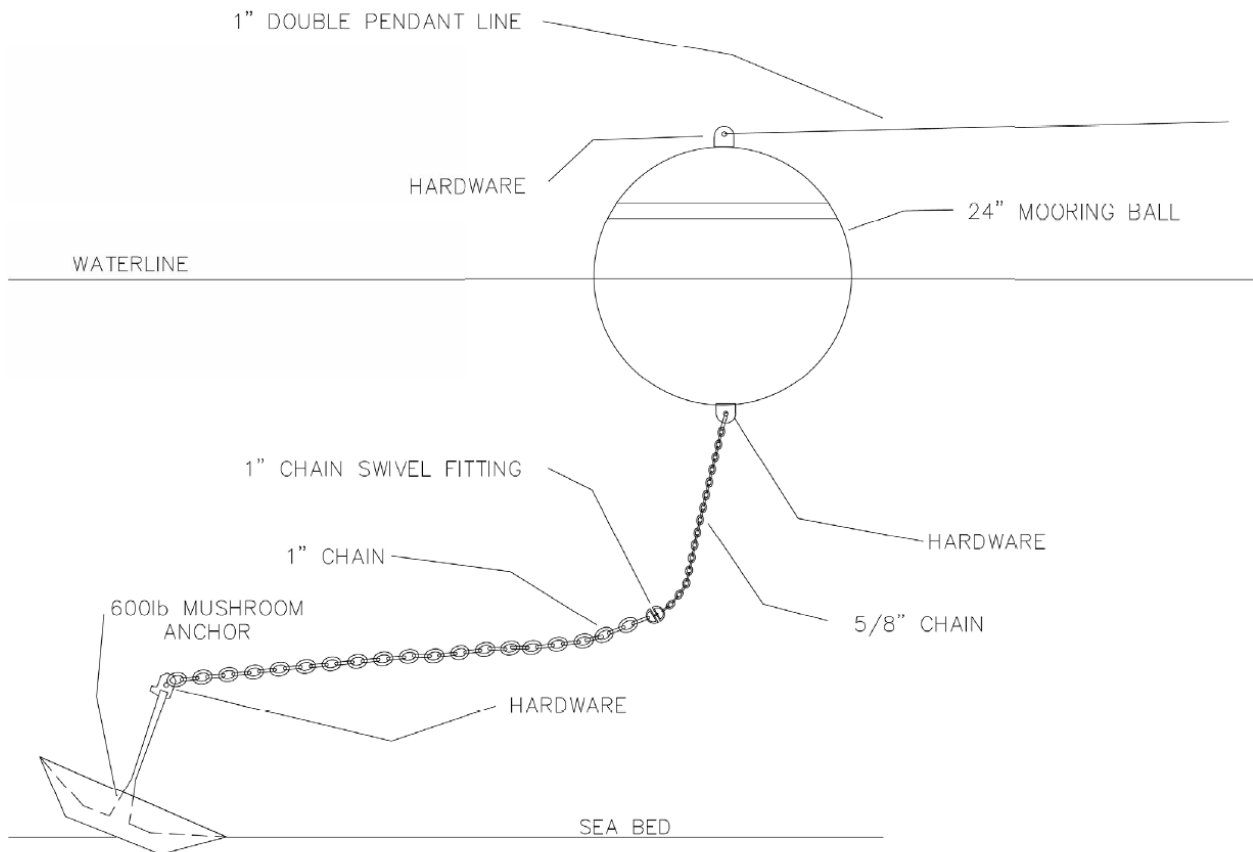
Understanding Mooring Systems and Equipment

Mooring systems are typically divided into two different types, conventional and conservation, which there being several subsets of conventional moorings. In either case the mooring systems



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are comprised of an anchor that is secured the harbor bottoms, some form of loose connection, often referred to as a rode, such as rope or chain, and something floating on the surface, like a mooring ball. A typical mooring layout is shown below:



It's best to then look at the mooring components, so you can understand each part and their advantages and limitations.

Anchors

There are several different options to use for the mooring anchor, but the most common include concrete or granite blocks, mushroom anchors, and helix anchors, each with their strengths and deficiencies.

Block type anchors, either concrete or granite, have excellent holding power and are appropriate for all types of sediment conditions. The blocks when settled can also allow for marine growth and new habitat to develop on them, and typically once they are set, they do not move, therefore there is minimal impact to the harbor bottom from the blocks. Their strength and adaptability



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come from their bulkiness and weight. When compared against mushrooms or helix anchors, they are several times larger and heavier. This can be issue for implementation as if you plan on installing a mooring field with 40 moorings that require 1 or 1.5 ton blocks, it's going to be slow, heavy and costly to install due to the bulk and all of that weight, therefore, block anchors are better suited for single installations or very small fields or in rocky, dense locations where it would be difficult to seat an anchor.

Mushroom anchors are probably the most common anchor types used in mooring fields. They have excellent holding power when properly installed. They work well in most sediment types, except for hard, dense bottoms, where the anchor is unable to dig in and get properly seated. The idea strength of the mushroom anchor comes from setting, pulling and twisting the anchor during installation, so that it buries itself in the bottom, thus seating the anchor. They are very effective for seasonal mooring fields, as if needed, they can be removed and/or reset as part of Operation and Maintenance Activities. Mushroom anchors are typically lighter than block moorings, so if they become unseated, they can drag along the bottom, which could have a negative environmental impact.

The helix anchor, which is commonly used for anchoring objects on the landside, can provide excellent holding power in the right sediment bottoms conditions. Because the anchor is essentially “screwed” into the bottom, it will not hold well in muddy or rocky/bony bottoms, or in areas subject to high sediment mobility. The installation is more specialized and therefore costlier than a typically installation, as it usually requires specific hydraulic equipment and divers to inspect and attach tackle.

Rode

There are two very common options for mooring rodes: chain or elastic type.

Chains are the most common type of rode used. Often the size of the chain is chosen based on the anticipated vessel loads. The chain, which can come in several different grades and coatings, provides additional weight to secure the vessel and transfer the surface loads from tides, winds and waves down to the anchor to keep the vessel where it is intended to be. In areas that have a large tidal range, you need to have sufficient chain to hold the vessel to the anchor at a high tide, so there is the risk of the extra chain resting on the bottom during the low parts of the tide cycle, impacting the harbor bottom and its benthic habitat.

The elastic type, often referred to as a Hazlet band is considered part of a conservation mooring, as they reduce contact with, and thus impact on benthic habitat. The specific design and



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composition of these elastic rode components will change depending on the manufacturer however most are flexible elastic rodes, which you might think of as a heavy-duty bungee cord or a series of those resistance bands you see at the gym. These are intended to flex during the higher parts of the tide cycle, but not have the extra length and thus the drag like chain rode. These rodes typically have some component that will ensure that the rode does not stretch beyond its designed holding capacity.

Other Components

There are several other components commonly used in a mooring system

Shackles

Shackles are used to connect mooring components together, typically connecting the chain to another part of the mooring system.

Swivels

Swivels are also used as part of the connection mechanism of the mooring system but are typically employed in an area subject to a lot of movement. The swivel allows for the connection of the components while still allowing them to move (rotate) and thus avoid tangling and bunching.

Balls /Floats

The mooring ball or float is the most visible part of the mooring system. It's what you typically see floating atop the water and is often used as a marking identifier for that mooring (i.e. B-25, to mark that its in field B, mooring 25).

Pendants/ Pennants

Pendants are typically rope or other softer material that is attached to the mooring ball or float and can then be used to secure the moored vessel. When users want to tie up to the mooring, they grab the pendant and secure that line to their vessel typically through a cleat or other hardware.

Conventional Moorings

Conventional, or “traditional” moorings are the most common type of mooring system out there. They typically employ an anchor or a couple of anchors seated into the harbor bottom. Conventional moorings are typically employed with either block or mushroom type anchors,



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along with a chain rode. Helix anchors can be used in a conventional mooring system, however that is very rare and mostly associated with conservation moorings.

The conventional mooring connections typically include a heavy bottom chain, which is then connected to swivel, attached to a lighter chain, which is then attached to the float or ball. The float or ball is then connected to the boat through the pennant. The heavy bottom chain is intended to rest on the bottom absorb some of the loads from the vessel as they are transferred to the anchor. The bottom chain is typically heavy and of thicker gauge than the top chain.



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<https://commons.wikimedia.org/w/index.php?curid=10538440>

Conservation Moorings

Conservation moorings is another type of mooring typically intended to reduce or minimize impact from the rode part of a mooring and the harbor bottom, which is particularly attractive in



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areas of sensitive benthic habitat such as eelgrass beds. When the elastic style rode is attached a helical anchor, there is also the added benefit of reducing bottom impact from dragging and setting a conventional anchor.

The flexibility of the rode is typically complemented by a guideline to prevent the rode from stretching beyond its limits. In situations when the harbor bottom contains a sensitive resource, a float can be added to the rode to prevent it from resting on the bottom. The stretching of the flexible rode acts in the same manner of the heavy bottom chain in absorbing some of the vessel loads from the anchor, plus the helical anchor is generally more thoroughly secured to the bottom than a conventional anchor. Conventional anchors can be used with a conservation mooring, however it's most often done with the helical anchor, as it allows for a shorter scope, which means the mooring field can be more densely packed sometimes with a 1:1 scope, with the same level of safety and security.

Proponents of the elastic rode believe that the flexible nature of the rode reduces the jerking sensation that occurs when a chain mooring becomes taut and reduces the loads and strains on the vessel's deck hardware to which the mooring is attached.

Holding Strength

Whichever mooring system is being used, the most important thing that any system must do is securely hold a vessel that is tied up to it. The holding strength will be derived from factors such as condition of boat's hardware, the strength and/or weight of the rodes, the strength of the shackles, the force resistance of the anchor(s), and the proper installation of equipment.

Boat US Insurance conducted a test of different anchor types to see which one had the greatest resisting force ((Source: <http://www.boatmoorings.com/hm.php>) . While not all of sediment types, water depths and scopes were the same, their test showed that the Helix anchor had the strongest holding force (did not break at 12,000 lbs.) followed by a double block (4,000 lbs. resistance) a 500 lb. mushroom (1,200 lbs. resistance) and finally a single block (800 lbs. resistance). They also tested a Dor-Mor anchor, but we are not reviewing that as part of this course.

Another important factor on the mooring system is the holding strength of the rode system. This is obviously influenced by the type of material, the size (thickness) of it and the condition of the rode. A lot of chains are rated with a working limit load, which is typically a factor of safety less



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than the breaking limit. It is best to always specify your chain based on the working limit load rather than the breaking limit load.

In order to have some perspective on what type of holding strength you'll need or want, you must understand the loads that are exerted on a mooring. It can be difficult to define all the loads that go into a mooring, particularly as some are more intense at times when others are not and the loads act differently on different vessels. There are however three main loads that act on a vessel tied up to a mooring, waves, wind, and current. The vessel itself is the heaviest load, and it can be acting in conjunction with or working against the load. The profile of the vessel will also determine the effect the three loads have on it. For example, some boxy type boats that sit higher out of the water are known to have more "windage" or are more affected by wind, both when cruising and when moored/anchored. While it is difficult to pin point what loads will act on your vessel, the three types of loads generally are rather consistent on which areas are most affected. Winds generally follow a prevailing direction, currents usually go out and in through the same path, and waves are more likely to occur in open, exposed area. For those reasons you need to know what areas you are looking at are most susceptible to these loads and try to locate the mooring fields where the exposure is minimized.

Initial Assessment

Whenever getting started on a mooring field design project, the first step should be to see what information about the proposed area is readily available. Your client or the local municipality or the harbor master may have copies of plans, reports, studies, and permits for work previously done on an area. Historical documentation review is very important because it can provide plenty of background on an area and keep you from repeating work that has already been completed, particularly if they were strategies that didn't work or environmental issues that prohibited a project from moving forward.

Following the review of the historical documentation, checking publicly available information is another great planning tool. GIS programs and databases can provide a wealth of data and information on a project area that can help to mold the path forward for the project. Some valuable information you may be able to gain from GIS analysis can include:

- Presence of Eelgrass or Seagrass beds
- Presence of Shellfish beds



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- Presence of Endangered Species and/or Habitat
- Presence of Essential Fish Habitats
- Other natural resources in the area

Another important resource to review is get a copy of the published nautical chart for the area. NOAA, the National Oceanic and Atmospheric Administration, has a great resource available that allows you to download the latest of all published navigational charts, <http://www.charts.noaa.gov/InteractiveCatalog/nrnc.shtml> . These charts can help you learn:

- Approximate depths in the study area
- Presence of navigational buoys in the area
- Presence of navigational channels in the area
- Presence of known obstructions/ shoal points in the area.

Lastly, if your project is located near a federally maintained navigational channel, the US Army Corps of Engineers, through its navigation section, posts their most up to date channel conditions surveys on their website. While you certainly won't be able to locate a mooring field in a federally maintained channel, this resource will allow you to see what depths are available in that channel and can be used for planning to see how far away the navigational channel is from your proposed mooring field.

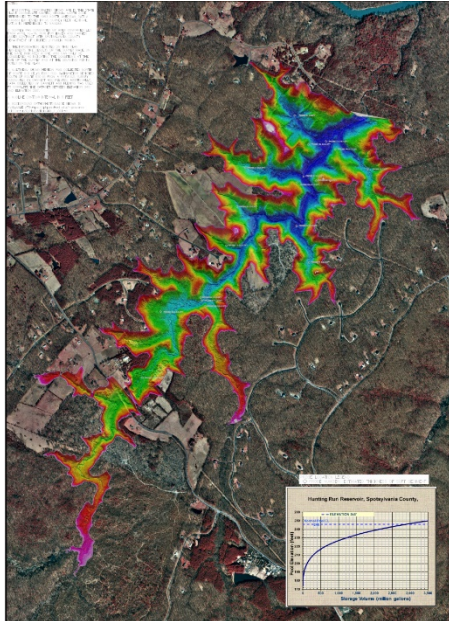
Once the desktop study is completed, then you can to move into the more detailed engineering study and design phase.

Field Data Collection

The first step in field data collection for a mooring field design is to gain some accurate data regarding the bottom conditions. The NOAA navigational charts show general depths; however, a lot of the data is consolidated into a single sounding shown on the plan to visibility purposes and therefore a lot of data gets filtered out. So, the best way to generate an existing conditions plan is to conduct a hydrographic survey.



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The two best survey methodologies for a mooring field are single beam and multi-beam surveys. A single beam precision acoustic fathometer which has a 3-degree range is typically accurate to approximately one-tenth of a foot. The fathometer samples many times per second, translating to a data point sample every 1-2 foot along the vessel's track. A GPS (either DGPS or RTK) unit will provide accurate lateral (X, Y) positions. The hydrographic data is typically collected with lines running along the long axis of the water body, and occasional cross-tie lines to ensure data accuracy. The exact spacing of the hydrographic data collection lines may vary in the field due to field conditions and/or the data needs as determined by the field crew. Single beam surveys provide an accurate depiction of bottom conditions, however because they don't provide complete bottom coverage, there is the risk

of variations in topography or obstructions that could exist between the survey lines.

The most accurate survey technique, but which requires a deeper water pool and solid vessel access is a multibeam survey. The multibeam transducer typically has a 45-60-degree range, with the data collected up to 45 degrees in most depths being the most reliable. The data is usually collected at sufficient density to provide 200% bottom coverage in water depths greater than 10 feet and up to 150% bottom coverage in minimum water depths of 4 feet.



The survey crews typically space their lines to ensure sufficient overlap, so the survey data is the most accurate available and “flyers” or bad points are worked out in the processing of the data, something that isn't always an option in single beam data.

Depending on the type of waterbody and the associated concerns and risks, there are other geophysical tools that should be deployed, such as side scan sonar, sub bottom profiling and magnetometry. These geophysical tools can be used to identify archaeological resources, obstructions, changes in strata, and other items that could affect the implementation of a mooring field that typically would not be picked up in a bathymetric survey.



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Sub-bottom Profiling sometimes called Sub-bottom Sonar is a remote sensing technique that uses a vibrating transducer to generate “acoustic vibrations” that transmit into the water and into the sediments at the bottom of the Harbor. This in turn generates a remotely sensed image of certain sediment characteristics (such as basic geologic strata) below the Harbor bottom. As with any survey, the spacing between lines will vary depending on the survey area size, but you’ll want a tow depth sufficient to not have influences from the water surface (4 feet below waterline tends to work). The survey lines are run in a general direction like in a single beam survey, with cross lines spaced consistently to tie the data together. Sound velocities need to be set up and calibrated to penetrate the water column.

Side Scan Sonar

Side-scan sonar, commonly abbreviated to SSS, is a sonar device that sends out sonar pulses down to the harbor. Those pulses are reflected back to the SSS, which is often towed by surface vessel. The side scan sonar produces picture-like acoustic images of the harbor bottom to map bottom features and objects, often in what is referred to as waterfall. Because of the way the data is collected, the images often need to be stitched together to recreate the harbor bottom along the path of the vessel. SSS is a great tool for identifying obstructions and debris in a project area.

Magnetometry

A magnetometer is another geophysical instrument that measures the magnetism of a study area. The magnetometer is also deployed by being towed behind the surface vessel, however it needs to far enough away that the vessels magnetic field doesn’t influence the magnetometer. The data from the magnetometer is processed to produce magnetic field maps of the harbor areas to detect metallic objects on the harbor bottom or in the shallow harbor sub-bottom.

Design Process

Once the bathymetric and geophysical surveys are completed, all of the data, including any notable data layers taken from the GIS research, should be combined into a working plan set so you can begin laying out the mooring field. The working plan set should show water depths in the correct local datum, however in tidal areas, it should always show depths at some form of low water, either mean low water (MLW) or mean lower low water (MLLW), because its always important to know how much draft is available to boats at low tide, else they risk bottoming out or worse. The plans should also show locations of objects, boulders or pipelines on or below the



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seafloor detected by side scan or magnetometry and any sensitive resource areas such as eel grass or shellfish beds that will need to be avoided.

The next thing you'll want to know are the qualitative factors around the mooring fields. From the sub bottom profiling, you should have an understanding of the basic geologic strata in the area, and the side scan might have picked up any large boulders or other dense objects along the surface. Other information that will be important are factors such as currents, tidal range, exposure, winds and competing or nearby incompatible uses. A great resource to start with for some of this information is the local Harbormaster or Shellfish warden. They typically have years of experience working in that area and know what you should be aware of and factoring into your design. They can tell you the prevailing wind direction, which areas get exposed or hit hard by certain storm events, and where they think the best area for a mooring field would be. Resources such as NOAA can provide you with currents and tidal ranges for an area, and if there is a weather station nearby, such as an airport, then you'll have access to wind speeds and directions.

With the qualitative data in hand you can start to lay out the mooring field in an area that makes sense that boaters will want to use and will want to and feel secure about tying up their vessel to. In general, the mooring fields should be located in a protected harbor or other leeward side of an island, so that they are better protected from coastal storm events that create wind and waves, which are far worse in exposed, windward areas. Areas that are subject to significant currents will need to be accounted for when designing the holding strength of the mooring, as the currents will create strong forces on the vessel that will change in direction every six hours or so.

Once you have a mooring area generally chosen, you can then start laying out grids for the moorings. You'll want a minimum of 6 feet of water depth at low tide, which will allow for the safe mooring of most recreational vessels, however some sailboats do draft more than six feet, so you'll also want to have some moorings in deeper water. In general you don't really want to have moorings in much more than 25-30 feet of water, as they start becoming expensive and have a larger swing radius, due to all of the additional rode required for that depth. On the grid, you'll want to avoid areas where objects, pipelines or vegetation were detected. If there are place where you have items to avoid, it's best to build in a do-not-disturb buffer around the object to make sure there is no accidental contact with that object.

Moorings on the grid should be organized by vessel sizes to facilitate the proper spacing of each mooring. Once implemented, mooring size classes can be colored or marked on the mooring ball to minimize the chances that boat operators would select an improperly sized mooring. Generally, shallower areas are suitable for the mooring smaller vessels, with deep waters areas used for larger vessels. The easiest approach to designing the mooring field, which won't allow for the most



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densely populated mooring field but offers a more conservative approach is to use one standard size mooring, with anchor and mooring tackle sized for the largest design vessel. This can eliminate the potential problems of selecting an improper mooring and would make managing the field much simpler including mooring placements and vessel assignments. If a mooring basin is being designed to offer long-term stays, the moorings that offer the most protection from the elements should be reserved for long term stays.

The next step would be to determine your design vessel. The harbormaster or municipality may have a list of the size of all the registered vessels that use your area, otherwise you can check for regional surveys of recreational boat users.

Your design vessel is going to influence the layout of the mooring field because it will be factored into the scope, or length of the rode, required to safely moor a vessel. For conventional moorings, scope is generally between 2.5:1 to 4:1. For conservation moorings, depending on the manufacturer of the elastic rode, it could be as short as 1:1 or 2:1, which allows for denser fields. These rodes will stretch, so I would recommend planning conservatively and adding in a factor of safety in laying out the field if using an elastic rode.

Once you have your mooring field area chosen, known your depths, and know what type of bottom of you have, you can determine your type of anchor. Then with your design vessel(s), additional factors such as wind loads you can determine the size of your anchor and the rode you want, then determine the scope you are comfortable with. With that information, you can begin to lay out the moorings, which I typically do with a series of circles whose radius equals the scope of the mooring. The mooring would be the center of the circle and the circle would represent the swing radius of a vessel tied up. You don't want any of the circles to overlap as that could represent a possible collision of vessels. The design process is best illustrated in the following design example:

Design Example

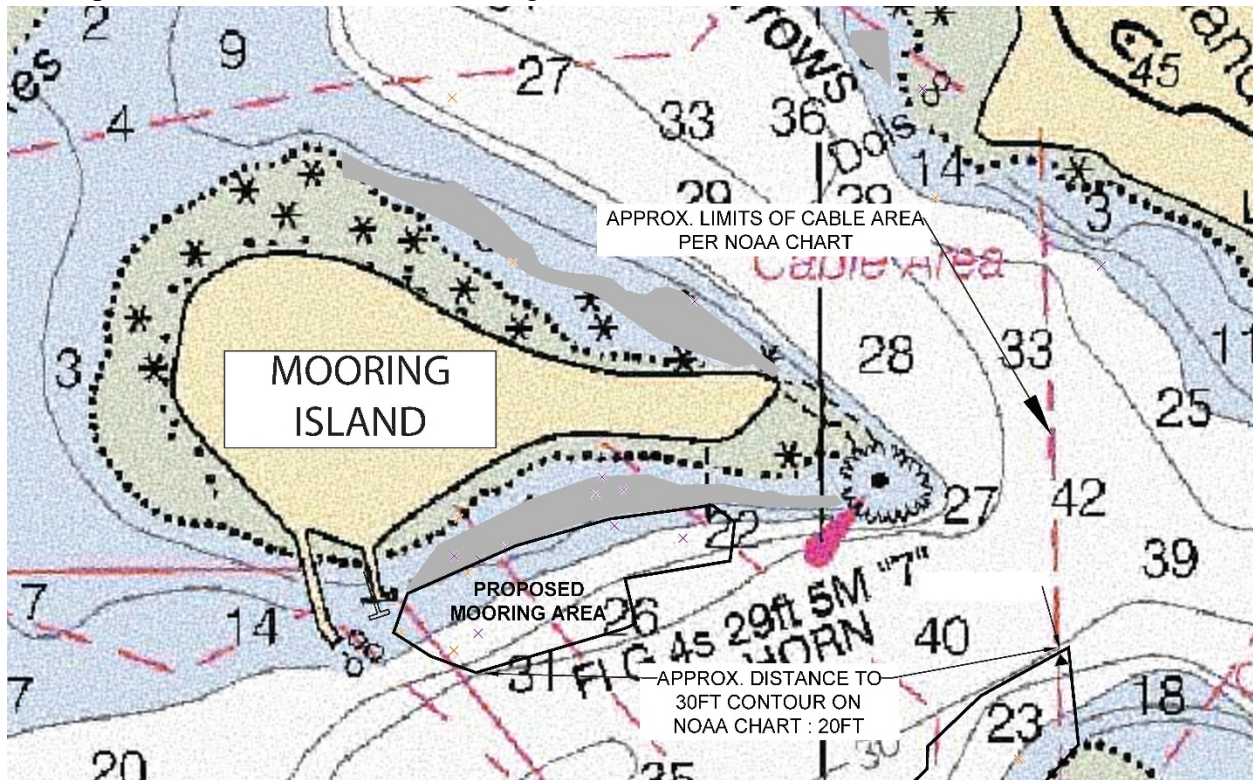
Now that we have reviewed the basics of the moorings and their designs, let's look at a design example to see how all the elements come together. Our client wants us to come up with a design for 10-15 moorings to be located around an island, "Mooring Island" that is a great spot to explore in summertime.



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So the first thing we do is go to the GIS application and see if there are any issues that surround the island that would prevent us from developing the mooring field. Based on this review, there does not appear to be any eelgrass or seagrass beds in the area, nor is there any shellfishing beds or fishing restrictions.

Next up is the review of the NOAA navigational chart.



The NOAA chart shows that there are deeper channels to the south and the east, and a cable crossing area that would need to be avoided. There does appear to be some shallow protected water to the south that could work for a mooring area. We know from the data from a nearby weather station that the northern part of the island would be exposed to the prevailing winds, and therefore not a good candidate for a mooring field.

The next step would be to conduct the bathymetric and geophysical surveys of the site.



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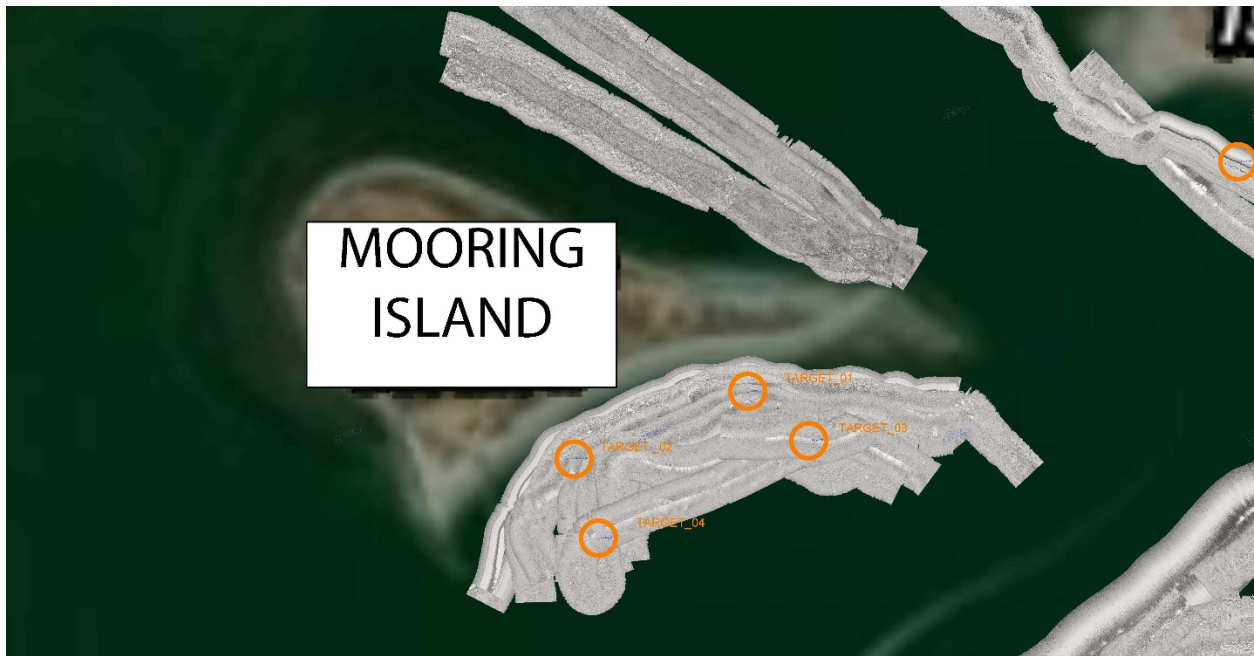


Here is our bathymetry (in a color shaded relief, warmer colors are shallow, cooler colors are deeper). We can see that on the south side of the island, in our study area we have between 4 and 30 feet of water and in general it slopes away from the island to the south.

Next up is our geophysical surveys.



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The side scan survey above shows that there were 4 targets that require looking into. Targets don't necessarily represent "no-go" zones, but they identify areas that need further study. For instance, if the side scan picked up some discarded fishing debris, that can be removed, and the location can be used from moorings. If it picked up a ledge outcropping however, it's going to prevent that location from being useful for moorings.



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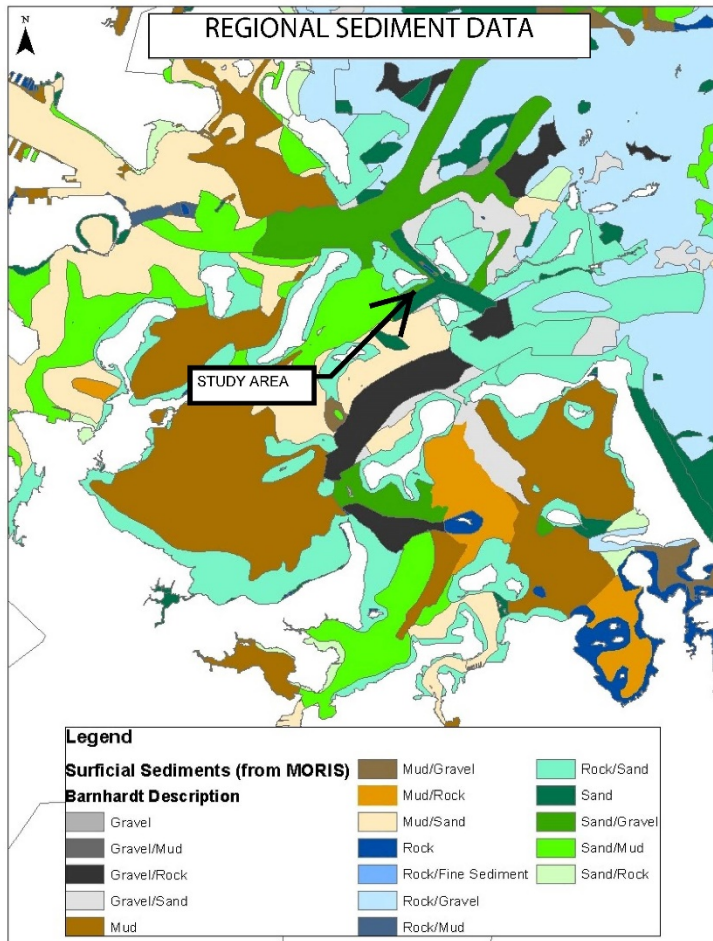


Next up is our magnetometer survey. As you can see on the attached image, we had a couple more targets come up (signified by the x). As with the side-scan survey, these targets represent areas that require further investigation.

We did not do any sub-bottom profiling for this mooring field, as we were only concerned with the superficial sediments and because we are familiar with the local area and its geology, it was an expense we could avoid for this survey. We do know from experience that this part of the harbor that there is a lot of sandy material as well as some boulders and cobbles. The area is subject to a decent amount of sediment movement with tides and nor'easter storm events.



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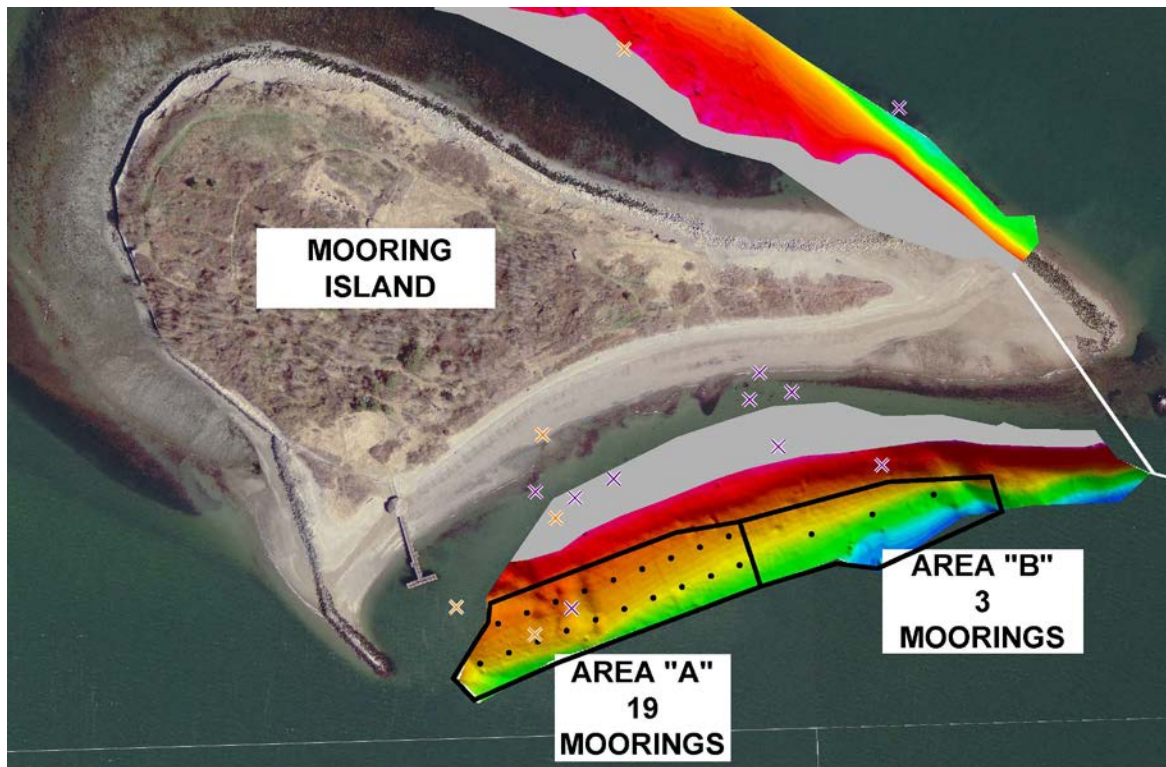
The above image shows the mapped surficial sediments in our project area are shown as either “Sand” or “Sand and Gravel.” This is consistent with our experience in the harbor.

Now that we have all our background data together, it’s a good time to combine all our data onto a plan and start laying out a mooring grid. This isn’t the final layout, just a gridded area of potential mooring locations.



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- LEGEND**
- MOORING LOCATION
 - ✕ MAGNETOMETRY TARGET
 - ✕ SIDE SCAN TARGET
 - AREAS TO AVOID
 - EEL GRASS



This plan shows our bathymetry, some of our geophysical targets, and a rough grid layout of the mooring areas. This grid is not based on a specific vessel design, but its mostly for discussion with our client to see how they would like to proceed with the design.

So, with all that data in hand, we went and met with our client to discuss options and possibilities. The first thing we wanted to review was anchoring of the mooring. We know the soils are sandy and could be rocky, however we also know there is a decent amount of sediment movement in the area, so that would limit the effectiveness of a helix anchor. Furthermore, our client would like to avoid the high maintenance cost associated with helix anchors. Therefore, we are going to use a conventional mooring design.

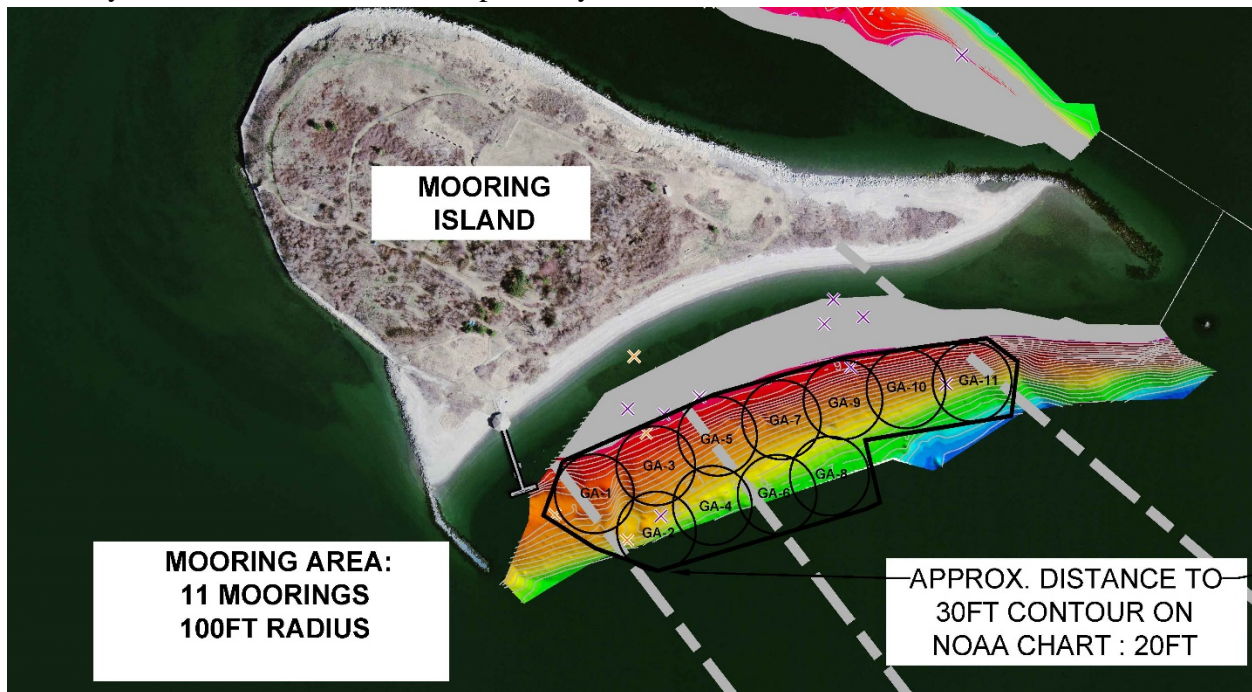
Next up, we need to figure out our design vessel. We looked at recreational boater survey data for the area conducted by others and found that 80% of recreational vessels were 25 feet or less and 98% were 40 feet or less. After reviewing this data in conjunction with the fact that we don't



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have a very shallow mooring field (the shallower the field, the more likely it'll be used only by smaller vessels), we decided to use a single design vessel, 40 feet in length, so that any size vessel 40 ft or under can use any of the moorings.

With the design vessel chosen, next we should look into the scope of our rodes to use. The tidal range in our area is 8-10 feet, and our depths for the area range between 8 and 24 feet MLLW. While we use our depths in a low water datum, you want to specify your scope of chain against a high-water datum to make sure there is enough chain to hold the vessel and absorb the loads at when the boat is furthest away, which is at high tide. So our design basis for our scope is between 18 feet and 34 feet (using the top end of the tidal range). Let's round it up to 40 ft. to be conservative. Next up we look at the mooring radius at a couple of scope options. At a 2:1 scope, we would need 80-foot radius', at 2.5:1 its 100 foot, and at 3:1 its 120 feet. We know our client wants 10-15 moorings, so at this point it's as simple as laying out some circles on the plan to represent the scopes and seeing what works. At a 100-foot radius, we can fit 11 moorings in the study area, which seems to work perfectly.



This is what that the design layout looks like with 100 ft mooring radius.

Implementation



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A professional mooring installer or marine contractor is best prepared to install the mooring. They installer will need to be able to place the moorings at specific GPS coordinates, in accordance with the mooring plans, otherwise the moorings could become placed too closely together and lose the design factor of safety built into the design. Conservation Moorings are highly specialized and if helix anchors are used, the installer will need to have the hydraulic equipment and diver needed to install those anchors. Additionally, if conservation rodes are used, the installer must be trained to size the mooring tackle appropriately to ensure that the rodes function properly.

The best way to prepare the moorings for installation is to gather all the materials to be used, anchors, blocks, chains, swivels, shackles, pendants, etc. and assemble the unit together on dry land. This is a lot easier to troubleshoot if there are issues and typically there is a lot more space available in a contractor's yard or a staging area than on a barge or vessel. Once the mooring components are assembled and checked, they can be loaded onto a barge or work deck to be taken out to the mooring field area.

Once the mooring assemblies have been brought out into the field, the anchors will need to be properly set to ensure they have the designed holding capacity. For a conventional mooring, the anchor will need to be placed at the design location. It is best to perform this work at the higher end of the tide cycle so that the not all the chain rode is slack. Then once the rode is taut, but not dragging the anchor out of place, the contractor should circle mooring location 3-5 times in a skiff or vessel with sufficient power, all while keeping the line taut. That will help the anchor to twist and dig into the harbor bottom to get properly seated. Once the contractor feels the anchor is properly seated, they should conduct a pull test on the anchor, whereby the mooring chain is pulled by a vessel in the same direction as the prevailing winds. The anchor should hold and dig in more if anything, and not move more than five feet, otherwise it was not properly seated. In rockier or dense soils where digging in anchors isn't feasible, typically a block option style anchor is chosen. Due to the weight and bulk of the block, "seating" isn't necessary and the weight of the block allows it to settle in its locations. Those blocks are bigger and heavier, and therefore are typically set with a barge and a crane or other type of lifting equipment.

Operation and Maintenance

Mooring fields are most active in the warm summer months, at least in the northeast. There is, however, some level of effort and planning that needs to be accounted for throughout the year with the mooring fields. It's best if there is a storage area nearby and easily accessible to the



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mooring field. The maintenance should be performed by qualified personnel with proper equipment, such as a rugged stable vessel with an A-frame or lifting system capable of lifting the mooring anchor.

With the initial installation, it's always good to purchase extra equipment like mooring balls, chains, pendants, etc. to have on hand in case items need to be replaced. Signage or buoys may be needed to delineate the mooring field, or a "no-wake" zone. Please note any buoys delineated an area will need to be registered with the USCG as a Private Aid to Navigation.

As for the seasonal requirements, below is a brief list of general activities to be conducted:

Springtime

This is the time to re-attach the mooring balls if they were removed for winter storage. Check the top chain, shackles and swivel for each mooring. Install the pendants. If you have a GPS available, the location of each mooring should be verified. Any issues or things that seem out of normal should be noted and the mooring shouldn't be put into service until a more thorough evaluation has been conducted.

Summertime

This is high season for moorings. For the most part the moorings should be in full use and there shouldn't be too much maintenance activities. The biggest amount of activity will come when issues are reported by mooring users.

Fall

As the season winds down, you'll need to prep the fields for winter. This will include removing the mooring ball/floats and the pendants. These items will have a full season's amount of marine growth on them, so they'll likely need to be cleaned before being put in storage. Winter sticks are often put on the mooring tackle to replace the ball and pendant for the winter. These sticks are designed so that you'll be able to find and access each mooring in the spring, and any freeze/thaw activity doesn't damage the surface equipment.

Winter

This is a good time to repair any of the damage that has been done to the floats and pendants. Balls/float may need bottom paint touch up or their identifiers (mooring number) replaced. Any chafed pendant lines should be replaced or spliced with new line.



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Inspection schedules and maintenance requirements should be established for the mooring areas. The easily accessible items (floats, pendants, top chain) should be inspected annually and the bottom chains, elastic rodes (if used), and anchors should be inspected every 3-5 years.

Some mooring fields are set up with a launch service as well to bring mooring users to and from their vessels to some point on land. If that is the case for your mooring field, operations for both the launch service and the moorings should be done together.