Texas Beach Watch Marine Beach Sanitary Survey
Field Methods Manual Standard Operating Procedures

Prepared by
Center for Water Supply Studies
Texas A&M University- Corpus Christi

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Table of Contents

Chapter 1: Introduction

Sanitary surveys are assessments of an area that identify potential sources of pollution (usually pathogens). Sanitary surveys have been used since the 1920s to safeguard water quality. These surveys play a key role in beach classifications for the BEACH Act Grant Program under which beaches are classified in an appropriate tier based on the potential risk to human health presented by pathogens. The data collected by a sanitary survey are integrated to determine possible correlations with water quality measurements performed throughout the year.

Annual sanitary surveys are lacking for Texas beaches monitored through the Texas Beach Watch (TBW) program. Field observation sheets completed at the time of TBW water sampling contain a limited number of information. Currently two beach segments monitored by the program are listed on the Texas 303 (d) list as impaired for bacteria. Sanitary surveys will provide an additional assessment of pollution risks at area beaches which may be used to generate information for local government entities for mitigation and best management practices.

The USEPA developed the Beach Sanitary Survey Tool to help beach managers in the Great Lakes synthesize all contributing beach and watershed information so that they may improve water quality for swimming. This beach sanitary survey tool was tailored to the beach environment in the Great Lakes. Subsequently, the USEPA released a more general Marine Beach Sanitary Survey tool. The Center for Water Supply Studies (CWSS) has modified these tools to perform sanitary surveys on Texas marine beaches in the TBW program.

Beaches are dynamic systems and should be gauged periodically for short-term and long-term health risks. The CWSS has developed two types of beach sanitary surveys—the Marine Beach Routine On-site Survey and Marine Beach Annual On-Site Survey — to assist with short-term and long-term assessments. The Routine On-site Survey is performed during water quality sample collection. The Annual On-site Survey is performed annually to collect beach sanitary data that changes infrequently. In addition, the Marine Beach Annual Analysis Form and Marine Beaches Sanitary Survey Database have been developed to assist in data organization and analysis. These tools will support the TBW program and will be available for all the Texas marine beaches. After analysis of the sanitary survey data, recommendations for appropriate tier categories for each beach may be evaluated, and long-term as well as short-term trends may be noted.

The CWSS has developed this document, the Texas Beach Watch Marine Beach Sanitary Survey Field Methods Standard Operating Procedures Manual, which is a collection of standard operating procedures (SOPs) and other published methods. The SOPs contain detailed information on how to collect each parameter listed on the forms (Marine Beach Routine On-Site Survey, Marine Beach Annual On-Site Survey, and Marine Beach Annual Analysis) used for the Sanitary Survey project. These SOPs are current and reflect activities as actually performed. If SOPs have not been generated by CWSS, other published methods may be used as SOPs. When collecting data, CWSS employees will follow the SOPs described in this document. All SOPs, including manuals or published methods, are written clearly and in enough detail to provide instruction for any person collecting data to easily follow the methods.

Chapter 2: Site Conditions: Marine Beach Routine On-Site Survey Parameters Table

The sampling method requirements for data collected during the Marine Beach Routine On-Site Survey are listed in Table 1.

Table 1: Marine Beach Routine On-Site Survey Parameters.

PARAMETER	UNITS	MATRIX	METHOD	PARAMETER CODES
Field Parameters				
Present weather	1=Clear 2=Partly Cloudy < 50% 3=Cloudy > 50% 4=Rain 5=Drizzle 6=Fog 7=Other/Explain	NA	TCEQ SOP	47501
Tide stage	1=low 2=falling 3=slack 4=rising 5=high	Water	TCEQ SOP	84381
Air temperature	°C	Air	TCEQ SOP	00020
Longshore Current	m/s	Water	NA	70225
Water color	1=Brown 2=Red 3=Green 4=Black 5=Clear 6=Other	Water	TCEQ SOP	00081
Water Temperature	°C	Water	TCEQ SOP	00010
pH	su	Water	TCEQ SOP	00406
Turbidity	Mg/L	Water		45626
Tidal Pools Present/Quantity #	NA	Water	NA	C87000
Average Size of Tidal Pools	m	Water	NA	C87001
Days Since Last Rainfall	Days	NA	TCEQ SOP	72053
Rainfall (inches past 1 day)	Inches	NA	TCEQ SOP	82553
Rainfall (inches past 3 days)	Inches	NA	TCEQ SOP	82371
Rainfall (inches past 7 days)	Inches	NA	TCEQ SOP	82554
Wind intensity	1=Calm 2=Slight breeze 3=Moderate breeze 4=Strong wind Slight=5-10 mph, Moderate =10-30 mph, Strong >30 mph	Water	TCEQ SOP	00035

PARAMETER	UNITS	MATRIX	METHOD	PARAMETER CODES
Specific Conductance	S/cm	Water	TCEQ SOP	00094
Dissolved Oxygen	Mg/L	Water	TCEQ SOP	00300
Salinity	Ppt	Water	TCEQ SOP	00480
Water Odor	1=Sewage 2=Oily/Chemical 3=Rotten eggs 4=Musky 5=Fishy 6=None 7=Other/Explain	Water	TCEQ SOP	34773
Depth of Water Sample	ft	Water	TCEQ SOP	00068
Wind direction	1=North 2=Northeast 3=East 4=Southeast 5=South 6=Southwest 7=West 8=Northwest	Air	TCEQ SOP	00038
Water Surface or Intensity	1=Calm 2=Ripples 3=Waves 4=white Caps	Water	TCEQ SOP	46001

Chapter 3: Marine Beach Routine and Annual On-Site Survey Parameters Tables

The following tables (Tables 2 and 3) contain a listing of the data to be collected during the Sanitary Survey project during the Marine Beach Routine On-Site and the Marine Beach Annual On-Site Surveys. SOP document numbers and parameter codes are included.

Table 2. Marine Beach Routine/Annual On-Site Survey Parameters.

SOP Number	Parameter	Parameter Code
Beach Use		
SOP001	Swimming/Sunbathing	C87002
SOP002	Surfing/Windsurfing	C87003
SOP003	RVs on Beach	C87004
SOP004	Fishing/from Pier	C87005
SOP005	Watercraft	C87006
SOP006	Vehicles on Beach	C87007
SOP007	Fishing/from Shore	C87008
SOP008	Overnight Camping	C87009
SOP009	Other Types of Beach Use	C87010
Bather Load		
SOP010	Humans on Land	C87011
SOP011	Humans in Water	C87012
SOP012	Total People at Beach	C87013
Sampling Site Information/Potential Pollution Sources		
SOP013	Evidence of Beach Maintenance	C87014
SOP014	Appropriate Removal of Trash	C87015
SOP015	Floatables Present	C87016
SOP016	Type of Floatables Found	C87017
SOP017	Litter Present	C87018
SOP018	Type of Litter / Debris Found	C87019
SOP019	Seaweed (Algae) Present in Water	C87020
SOP020	Seaweed (Algae) Present on Land	C87021
SOP021	Type of Seaweed (Algae) in Water	C87022
SOP022	Type of Seaweed (Algae) on Land	C87023
SOP023	Seagrass Present in Water	C87024
SOP024	Seagrass Present on Land	C87025
SOP025	Type of Seagrass in Water	C87026
SOP026	Type of Seagrass on Land	C87027
Presence or Evidence of Wildlife/Domestic Animals		
SOP027	Presence of Fish Alive	C87028
SOP028	Presence of Fish Dead	C87029
SOP029	Presence of Avian Alive	C87030
SOP030	Presence of Avian Dead	C87031
SOP031	Presence of Avian Fecal Droppings	C87032
SOP032	Presence of Jellyfish Alive	C87033
SOP033	Presence of Jellyfish Dead	C87034
SOP034	Presence of Marine Alive	C87035
SOP035	Presence of Marine Fecal Dropping	C87037
SOP036	Presence of Crabs Alive	C87038

SOP037	Presence of Crabs Dead	C87039
SOP038	Presence of Equine Alive	C87040
SOP039	Presence of Equine Dead	C87041
SOP040	Presence of Equine Fecal Droppings	C87042
Beach Measurements/Observations		
SOP041	Beach Length	C87046
SOP041	Z1 Width (m)	C87047
SOP041	Z2Width (m)	C87048
SOP041	Z3 Width (m)	C87049
SOP041	Z1 Slope %	C87050
SOP041	Z2 Slope %	C87051
SOP041	Z3 Slope %	C87052

Table 3. Marine Beach Annual On-Site Survey Parameters.

SOP Number	Type
Beach Materials/Sediment	**Sediment/Material Type (C87053)**
SOP042	Sand
SOP042	Mud
SOP042	Rock
SOP042	Shell
Habitat Around Beach	**Habitat Type**
SOP043	Dunes
SOP043	Wetlands
SOP043	River/Stream
SOP043	Forest
SOP043	Park
SOP043	Urban/Boardwalk
SOP043	Protected Habitat or Reserve
Shellfish Growing Areas	**Area Type**
SOP044	Shellfish Growing Areas
Bounding Structures	**Structure Type**
SOP045	Jetty
SOP045	Groin
SOP045	Seawall
SOP045	Pier
SOP045	Natural Formation
SOP045	Breakwater
Description of Sanitary Facilities	**Facility Type**
SOP046	Toilets
SOP046	Urinals
SOP046	Sinks
SOP046	Showers
Description of Other Facilities	**Facility Type**
SOP047	Bathhouse
SOP047	Restroom
SOP047	Portable Sanitary Unit
SOP047	Restaurant
SOP047	Marina
SOP047	Bar
SOP047	Parking Lot
SOP047	Fish cleaning Station
SOP047	Playground

SOP047	Dog Park
SOP047	Boat Pump Out
Disposal of Sanitary Wastes	**Disposal Type**
SOP048	Public Sewer
SOP048	Septic Field
SOP048	Pump Out
SOP048	On-Site Treatment
Observed Potential Pollution Sources	**Source Type**
SOP049	Wastewater discharges
SOP049	Sewage Overflows
SOP049	Septic Systems
SOP049	Subsurface Sewage Disposal
SOP049	Unsewered Areas
SOP049	Groundwater Seepage
SOP049	Bathhouse Leakage
SOP049	Drains and Pipes Nearby
SOP049	Stormwater Outfalls
SOP049	Erosion Prone Areas
SOP049	Vacant Areas
SOP049	Wetland Drainage
SOP049	Rivers/Streams
SOP049	Landfills, Open Dumps
SOP049	Urban Runoff, Industrial Waste
SOP049	Agricultural Runoff
SOP049	Land Application of Biosolids and Manure
SOP049	CAFOs or AFOs
SOP049	Domestic Animals
SOP049	Wildlife
SOP049	Marinas, Harbors
SOP049	Mooring Boats
Photographs Taken	**Image Type**
SOP050	Photographs
Litterbins	**Type**
SOP051	Litterbins

Chapter 4: Beach Use

SOP001 Swimming/Sunbathing (C87002)

Swimmers/Sunbathers may be defined by the number of people in the water participating in swimming activities. In addition, the parameter includes the number of people on land lying in the sun. Sunbathers may be identified by a person not partaking in any physical activity but typically lying on a towel, sitting on a beach chair or collapsible beach chaise.

Record the number of people in the water participating in swimming activities. Refer to Appendix A of this document for counting rules.

SOP002 Surfing/Windsurfing (C87003)

The number of people present at a survey site participating in water activities such as surfing and windsurfing should be recorded. Surfing/Windsurfing may be identified by human use of floatable boards. The typical use of the boards includes standing, kneeling, sitting or lying while the board is floating on water. Some boards may be identified by attached wind sails. This also includes kite boarding. Refer to Appendix A of this document for counting rules.

SOP003 RVs on Beach (C87004)

The number of RVs parked or in attendance at the beach is a factor when surveying the site for environmental issues. The number of RVs on-site is of importance because they may be directly related to the type of litter and amount of litter that is an endangerment to the surrounding wildlife or may impact sanitary conditions at the beach.

Record the number of RVs on the beach. Refer to Appendix A of this document for counting rules.

SOP004 Fishing/from Pier (C87005)

The number of people on-site fishing from a pier may give an idea of the number and type of debris and litter present that may be affecting the surrounding environment.

The number of people fishing from a pier includes any person(s) located on a pier or dock engaging in a fishing sport.

Record the number of fishermen fishing from the pier. Refer to Appendix A of this document for counting rules.

SOP005 Watercraft (C87006)

The number and variation of watercraft may be a factor in debris and pollution emitted in the surrounding environment. Watercraft may also have effects on wildlife in and out of water as well as sanitary conditions at the beach.

Watercraft may include any water transportation including boats, ships, kayaks, submarines, and jet skis present on-site. Note: Observations will not include surfing or windsurfing devices as they are accounted for in a different parameter.

Record the number of people participating in water transportation activities. Refer to Appendix A of this document for counting rules.

SOP006 Vehicles on Beach (C87007)

Vehicles are a concerning factor when considering the population and health of the wildlife present on-site. Unfavorable effects to wildlife may include endangerment through direct contact resulting in injury. Other adverse effects may include the destruction of wildlife habitats or dwellings.

The number of vehicles includes any vehicles of transportation parked or in motion located on-site. Record the number of vehicles of transportation parked or in motion located on-site. Refer to Appendix A of this document for counting rules.

SOP007 Fishing/from Shore (C87008)

The number of fishermen may give information concerning environmental conditions present at the time observations are made. The number of people fishing from shore may also be a factor concerning pollution type at the survey site.

The parameter 'Fishing from Shore' includes the number of people engaging in fishing sport from the shoreline. This parameter includes any out of water or wading water fishing sport being conducted. It may also include net fishing for crabs.

Record the number of people fishing from shore. Refer to Appendix A of this document for counting rules.

SOP008 Overnight Camping (C87009)

Overnight camping may be directly related to environmental and wildlife issues and affect sanitary conditions. Observations of overnight camping may be of one individual or a group of people partaking in overnight activities. Overnight campers may be on the beach or in designated camping sites. Campers may be camping overnight in a variety of tents and camping trailers or RVs or may be camping without shelter.

The number of overnight camping parties located on the beach may be accounted for by direct communication confirming an overnight stay. Record the number of people camping overnight. Refer to Appendix A of this document for counting rules.

SOP009 Other Types of Beach Use (C87010)

Record other types of beach use on the Marine Beach Routine On-Site Survey form.

Chapter 5: Bather Load

Humans play a key role in the surrounding environment. The number of people in the water may be related to the quality of the water or quantity of trash washing upon the beach. The number of trash on-site may be linked directly to the number of people on land.

If there is poor water circulation, heavy bather loads may cause significant elevation in bacterial counts for total and fecal coliform bacteria as well as enterococcus bacteria. High-use areas with poor water circulation might also indicate a need for increased monitoring of microbiological indicator organisms and might require attention to the potential for algae blooms.

The following data should be recorded when counting beach attendance:

- Number of humans not recreating in or on the water (on land)
- Number of humans in the water
- Total number of humans at the beach

SOP010 Humans on Land (C87011)

Record the number of people on the beach. Refer to Appendix A of this document for counting rules.

SOP011 Humans in Water (C8012)

Record the number of people in the water. Refer to Appendix A of this document for counting rules. When making observations, it is important to keep in mind some people may be going underwater for periods of time.

SOP012 Total people at Beach (C87013)

The total number of people at the beach includes everyone on land and in the water.

Add the number of humans on land and the number of humans in water. Record the sum of humans on land and humans in water to determine the total number of people at the beach. Refer to Appendix A of this document for counting rules.

Chapter 6: Sampling Site Information/Potential Pollution Sources

Visible sources, including rivers, ponds, and outfalls, might carry contaminants that affect bathing beach water quality. Ground water, usually not visible, might also be a pollutant source. The person performing the Marine Beach Routine On-site Survey should identify visible sources of pollutants up to 152.40 meters (152.40 meters) from the beach boundary and, if possible, quantify the sources.

SOP013 Evidence of Beach Maintenance (C87014)

Evidence of beach maintenance is because the maintenance may have positive or negative effects on the wildlife and environment around it. Signs of beach maintenance include evidence of raked or leveled sand and/or construction.

Methods of observing and recording beach maintenance include any sign of raked or leveled sand or construction. If there is no sign of maintenance, a value of 0 should be recorded. Raked sand should have a value of 1. Leveled sand will have a value of 2. Construction will be recorded at a level of 3.

SOP014 Appropriate Removal of Trash (C87015)

Wildlife and water quality as well as sanitary conditions will be affected without the appropriate removal of trash on-site.

The appropriate removal of trash consists of the quantity of trash removal. Methods of appropriate removal of trash may be accounted for by the amount of trash at site. This may include the amount of trash washed-up on shore, the amount of trash left on the beach or in trash receptacles. The appropriate removal of trash may be recorded by values of 0-3. Zero (0) indicates that the trash has been removed appropriately. If trash has not been removed appropriately and trash bins are overflowing, a value of '1'should be used to indicate this. A value of '2' will indicate there are no trash receptacles present. A value of '3' indicates that trash bins are available but are not being used.

SOP015 Floatables Present (C87016)

Floatables are often made of plastics that may be harmful to the environment. The number of floatables present should be tallied.

Floatables may be present in the water. Record that there is floatable debris. The number of floatables on-site may be accounted for by observations made by the naked-eye. A hand-held counter may also be used when observing the number of floatables. The quantity of floatables may be recorded by the number present by using values of 0-3 (where 0 = no floatables present; 1 = a slight number present; 2 = a moderate number of floatables present; and 3 = a heavy load of floatables present).

SOP016 Type of Floatables Found (C87017)

It is important to list the different types of floatables present on-site, because the different types of floatables affect the surrounding environment differently.

Types of floatables found in the water may include street litter, food related items, medical items, household items, sewage-related floatables, construction materials, fishing-related materials, tar/oil, biological or other items. Record the types and number of floatable debris. Record the different types of floatables found on the Marine Beach Routine On-Site Survey form by their given values: 0=None; 1=Street litter; 2=Food-Related Items; 3=Medical Items; 4=Household Items; 5=Sewage-related Items; 6=Construction Materials; 7=Fishing-related Materials; 8=Evidence of Tar/Oil; 9=Biological Matter and 10=Other.

SOP017 Litter Present (C87018)

Litter has an adverse effect on the surrounding environment and wildlife and may be an indicator of poor sanitary conditions. It is important to list the amount of litter present, if any. Some of the effects may be directly related to specific types of litter or debris present. Litter may be a form of trash or objects forgotten or discarded on land or in water. Litter includes any type of trash located outside of trash receptacles. Note: All floatable litter and debris should be recorded in the 'Floatables Found' and 'Types of Floatable Found' sections.

If there is litter present on-site, assign a value for the amount of litter found. Zero (0) = None; 1= Slight; 2 = Moderate; 3 = Heavy.

SOP018 Type of Litter / Debris Found (C87019)

Different types of litter/debris found at the survey site may include street litter, food related items, medical items, household materials, sewage-related debris, construction materials, fishing related items, tar/oil material, biological items, or any other litter/debris present. Record which types of litter are present on the Marine Beach Routine On-Site Survey form.

SOP019 Seaweed (Algae) Present in Water (C87020)

Seaweed (algae) present in the water may flourish if the conditions are right. There are several factors that play a key role in the number of seaweed (algae) present in water. Some factors to consider are water salinity levels and the depth and temperature of the water. The quantity and type of seaweed present may give indications of water quality.

There may be seaweed (algae) present in the water. Record that there is seaweed (algae) present in the water. The number of seaweed (algae) present in water may be observed by either viewing it from outside the water or through observations made through diving. The number of seaweed (algae) should be recorded by values of 0-3; where 0=none, 1=Slight, 2= Moderate, 3= Heavy.

SOP020 Seaweed (Algae) Present on Land (C87021)

The number of seaweed (algae) that has washed up on land may occur because of several conditions. Some factors may include weather conditions or tides.

There may be seaweed (algae) present on the beach. Record that there is seaweed (algae) present on land. The amount of seaweed (algae) present on land may be recorded by using values ranging from 0-3; where 0 = no seaweed (algae) present, 1= Slight, 2= Moderate, 3= Heavy.

SOP021 Type of Seaweed (Algae) in Water (C87022)

The different types of seaweed (algae) present in water may be good indicators of the water conditions as well as other organisms that may flourish in the same conditions. The common types of seaweed (algae) present in Texas waters include *Ulva, Chaetomorpha, Cladophora, Acetabularia, Sargassum, Ectocarpus, Digenea, Palisada, Gracilaria, Chondria and Jania*.

Seaweed (algae) may be observed from above water, if conditions allow, or by making observations under water when diving.

Record the type of seaweed (algae) that is found in the nearshore water. The types of seaweed (algae) present, if known, should be recorded, as well as the color of the algae. Record of the different types of seaweed (algae) present should be listed by their given values ranging from 0-11, where 0= None; 1= *Ulva*; 2 = *Chaetomorpha*; 3 = *Cladophora*; 4 = *Acetabularia*; 5 = *Sargassum*; 6 = *Ectocarpus*; 7 = *Digenea*; 8 = *Palisada*; 9 = *Gracilaria*; 10 = *Chondria*; and 11 = *Jania*.

Additional information may be given, if needed, in the Comments section of the form.

For a guide to Seaweed (algae) identification, please refer to Appendix B of this document.

SOP022 Type of Seaweed (Algae) on Land (C87023)

The different types of seaweed (algae) present on the shore may consist of *Ulva, Chaetomorpha, Cladophora, Acetabularia, Sargassum, Ectocarpus, Digenea, Palisada, Gracilaria, Chondria and Jania.*

Record the type of seaweed (algae) that is found in the shore of the beach. The types of seaweed (algae) present, if known, should be recorded. Record of the different types of seaweed (algae) present should be listed by their given values ranging from 0-11, where 0= None; 1= *Ulva*; 2 = *Chaetomorpha*; 3 = *Cladophora*; 4 = *Acetabularia*; 5 = *Sargassum*; 6 = *Ectocarpus*; 7 = *Digenea*; 8 = *Palisada*; 9 = *Gracilaria*; 10 = *Chondria*; and 11 = *Jania*.

Additional information may be given, if needed, in the ‘Comments’ section of the form.

For a guide to Seaweed (algae) identification, please refer to Appendix B of this document.

SOP023 Seagrass Present in Water (C87024)

The quantity of seagrass present in water may indicate water quality and weather conditions. The presence of seagrass may also indicate the different aquatic life that may survive in the same conditions.

Observations of seagrass may be made underwater or above water, if conditions allow. The quantity of seagrass present in water should be recorded by the appropriate number as defined by the values 0-3, where 0= None; 1= Slight; 2= Moderate; 3= Heavy.

SOP024 Seagrass Present on Land (C87025)

Large quantities of seagrass on land may be an indicator of environmental issues in the water or perhaps related to weather conditions.

The quantity of seagrass present on land should be recorded by the appropriate number as defined by the values 0-3, where 0= None; 1= Slight; 2= Moderate; 3= Heavy.

SOP025 Type of Seagrass in Water (C87026)

The type of seagrass present in water may indicate water quality and weather conditions, since different conditions are necessary for growth of a given seagrass type. The different types of seagrass in water may include *Halodule, Halophila, Thalassia,* and *Cymodeceae.*

The types of seagrass present in the nearshore water, if known, should be recorded. The types of seagrass present may be observed above or below water. The types of seagrass should be recorded by their given value as listed: 0=None; 1=*Halodule*; 2= *Halophila*; 3= *Thalassia*; and 4=*Cymodoceae*.

For a guide to Seagrass identification, please refer to Appendix C of this document.

SOP026 Type of Seagrass on Land (C87027)

The types of seagrass present on land may be a good indicator of the water quality on-site, as well as the weather conditions necessary for the given seagrass to thrive or die off. The seagrass must be washed up or on land to pertain to this parameter. The different types of seagrass on the beach may include *Halodule, Halophila, Thalassia,* and *Cymodeceae.*

The types of seagrass washed up on the beach, if known, should be recorded. The types of seagrass should be recorded by their given value as listed: 0=None; 1=*Halodule*; 2= *Halophila*; 3= *Thalassia*; and 4=*Cymodoceae*.

For a guide to Seagrass identification, please refer to Appendix C of this document.

Chapter 7: Presence or Evidence of Wildlife/Domestic Animals

Determine the presence of animals present in the water, on the beach, and in the air at the bathing beach through visual observation. Use binoculars and a handheld counter to keep track of the number of animals present. Record both the number and types of animals present. Note the presence of any types of animals not already listed on the form next to 'Other Specify'.

SOP027 Presence of Fish Alive (C87028)

As you walk the beach to conduct the sanitary survey, look for any fish alive on the shore or in the water. List the number of fish alive at the beach.

SOP028 Presence of Fish Dead (C87029)

As you walk the beach to conduct the sanitary survey, look for any dead fish on the shore or in the water. List the number of fish found dead at the beach.

SOP029 Presence of Avian Alive (C87030)

As you walk the beach to conduct the sanitary survey, look for any birds alive on the shore or in the water. List the number of birds alive at the beach.

SOP030 Presence of Avian Dead (C87031)

As you walk the beach to conduct the sanitary survey, look for any dead birds on the shore or in the water. List the number of birds found dead on the beach.

SOP031 Presence of Avian Fecal Droppings (C87032)

As you walk the beach to conduct the sanitary survey, look for any avian fecal droppings on the shore. List the number of avian fecal droppings found on the beach. Take a photograph.

SOP032 Presence of Jellyfish Alive (C87033)

As you walk the beach to conduct the sanitary survey, look for any jellyfish alive on the shore or in the water. List the number of jellyfish alive at the beach.

SOP033 Presence of Jellyfish Dead (C87034)

As you walk the beach to conduct the sanitary survey, look for any dead jellyfish on the shore or in the water. List the number of dead jellyfish found at the beach.

SOP034 Presence of Canine Alive (C87035)

As you walk the beach to conduct the sanitary survey, look for any canines alive on the shore or in the water. List the number of canines found at the beach.

SOP035 Presence of Canine Fecal Dropping (C87037)

As you walk the beach to conduct the sanitary survey, look for any canine droppings on the shore. List the number of canine droppings found on the beach. Take a photograph.

SOP036 Presence of Crabs Alive (C87038)

As you walk the beach to conduct the sanitary survey, look for any crabs alive on the shore or in the water. List the number of crabs found alive at the beach.

SOP037 Presence of Crabs Dead (C87039)

As you walk the beach to conduct the sanitary survey, look for any dead crabs on the shore or in the water. List the number of each species of dead crabs at the beach. If you cannot identify the species of crab, write a description of the crab and take a photograph.

SOP038 Presence of Equine Alive (C87040)

As you walk the beach to conduct the sanitary survey, look for any equine alive on the shore or in the water. List the number equine alive found at the beach.

SOP039 Presence of Equine Dead (C87041)

As you walk the beach to conduct the sanitary survey, look for any dead equine on the shore or in the water. List the number dead equine on the beach.

SOP040 Presence of Equine Fecal Droppings (C87042)

As you walk the beach to conduct the sanitary survey, look for any equine fecal droppings on the shore. List the number of equine fecal droppings on the beach. Take a photograph.

Chapter 8: Beach Measurements/Observations

Two people are needed to measure the length of the section of beach to which the sanitary survey applies. Note the fixed objects or beach formations that will be used as boundaries for the length of beach (e.g., lifeguard chair to lifeguard chair, edge of building to inlet) on the Marine Beach Annual On-Site Survey form. Before using objects like lifeguard chairs, make sure they are actually fixed objects and are not moved from year to year. In addition, take pictures of the boundaries and record descriptions of these photographs on the Marine Beach Annual On-Site Survey form.

SOP041 Beach Length; Z1 Width (m) (C87047); Z2Width (m) (C87048); Z3 Width (m) (C87049)

Beach Length:

To measure the beach, one person should stand at one end of the beach and lay a tape measure on the ground. The second person should stretch the tape measure along the water line to the other end of the beach or as far as it will allow. If the beach is longer than the length of the tape measure, take incremental beach length measurements in a field notebook. Add the incremental measurements, and record them on the Marine Beach Annual On-Site Survey form.

An alternative method is to activate the path tracking function of a handheld GPS and walk along the water line. Record the length of the track as beach length.

Beach Width:

Enter on the Marine Beach Annual On-Site Survey form the three previously made beach width measurements (distance from fixed object or vegetation to high watermark) for width Z1, width Z2, and width Z3. Average the three measurements, and enter the value on the form for width (average).

Alternatively, you may take GPS readings to determine beach length or dimensions. Make sure you document on the Marine Beach Annual On-Site Survey form the method you use to calculate beach length or dimensions.

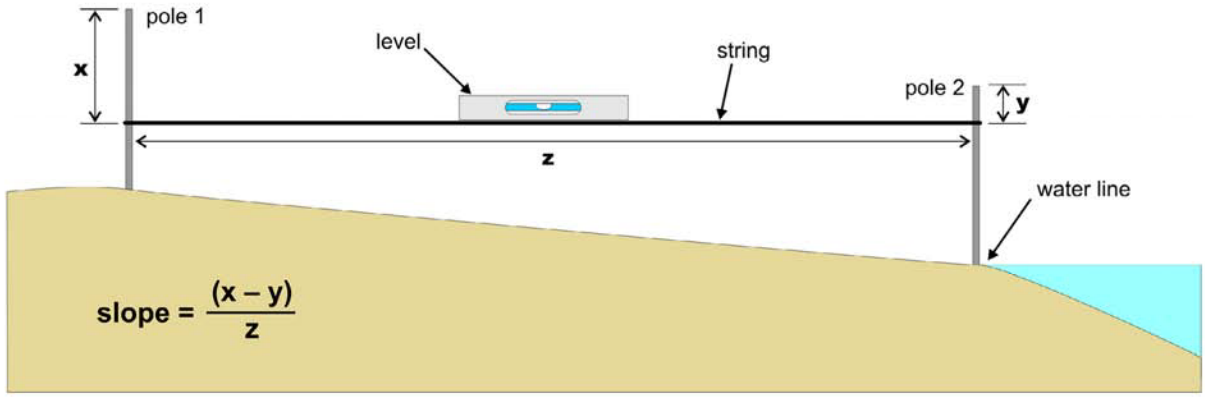
SOP041 Z1 Slope % (C87050); Z2 Slope % (C87051); Z3 Slope % (C87052)

Beaches exposed to high-energy waves tend to have a steeper slope than those exposed to low-energy waves. Steep, man-made, structure-induced slopes may be vulnerable to erosion when the structure is removed during beach nourishment operations if this fact is not considered in design (NOAA 2003).

Measure the slope at one or more of the locations selected for erosion/accretion measurements. The equipment needed for slope measurements includes two poles of equal length, tied together with several meters of string, and a tape measure. Alternatively, you may use surveying equipment, such as a laser level, if available, to measure slope.

Choose a fixed object behind the beach, such as a building or tree. Use the same fixed starting point when taking future slope measurements so that any changes in slope over time may be measured. Take photos of the fixed starting point, and record corresponding information on the sanitary survey form. Place a pole at the fixed starting point, and place a second pole down-gradient of the first pole. Pull the string taut. Move the string up or down on the poles until it is level (use a line level to determine this). Measure the distance between the two poles (Z), and the distance between the string and the top of each pole (X and Y), and record the data in a field notebook. For wide beach areas, move the first pole up to the second pole and repeat the process at each break of slope. The end of the profile should be the water's edge. For each set of measurements, calculate the difference between X and Y. That is the elevation or height. Divide this number by the distance between the two polls, and that is the slope. This process is illustrated in Figure 1. You may calculate percent slope for sections of the beach for a beach profile, or you may calculate an overall percent slope using the start and end point measurements.

Figure 16. Calculating a beach's slope.



Self-leveling rotary laser level tools may also be used to determine slope. If using the Johnson Level & Tool Self-Leveling Rotary Laser Level Kit, Model# 40-6517, please refer to the Acculine Pro Self-Leveling Rotary Laser Level Instructional Manual. All equipment manuals are maintained by CWSS and located in NRC 3100.

Chapter 9: Beach Materials/Sediment

SOP042 Sand (C87053); Mud (C87053); Rock (C87053); Shell (C87053); Other (C87053)

Beaches are often characterized by the materials and sediments they are composed of. Several sediment and material types may correlate with bacteria concentrations that may affect water conditions. Records of sediment/material size are important to review as changes in grain size may indicate erosion. The sediment/material grain size is also important for beach nourishment projects to avoid issues of beach narrowing. Sediment/material types present on-site may consist of sand, mud, rock and shell or other sediment/material types.

The following instructions for collecting sediment samples and are recommended by Richard Whitman of the USGS, 2006.

1. Each sampling site should consist of up to three sampling plots of 1 square meter. If the sediments present are fairly uniform one sample may be enough. Sample plots should be 1 meter beachward from the waterline.

2. Location of the site should be recorded and noted on a diagram or photo so the site may be revisited in the future without difficulty.

3. Of each sampling plot, five samples equal in size should be collected- samples from each corner and one from the center of the sample plot. Combine the five samples of the plot into one pre-labeled bag or bottle.

4. Send all samples to a lab to analyze sediment size. The lab should send results of mean grain size diameter and the uniformity coefficient.

   Simple, subjective observations (e.g., “sandy, very”) may be used to describe the materials or sediments present at a beach. This is adequate for most beaches. If you have the time and resources, however, collecting sediment samples and sending them to a lab for analysis will provide better data. If you choose to do this, the following is a simple procedure for collecting samples (recommended by Richard Whitman of the USGS, 2006).

1. Choose up to three plots that are 1 square meter in dimension. Plots should be approximately 1 meter beachward (i.e., away from the water) from the waterline. If the sediments at your beach are fairly uniform, one plot is likely enough.

2. Describe the locations of the plots and note them on a diagram or photograph so that they may be revisited in the future.

3. Within each plot, collect five equally sized sediment samples—one from each corner of the square plot and one from the center of the square. Composite the samples into one pre-labeled bottle or bag.

4. Send the samples to a lab to analyze the sediment size. The lab should determine the mean grain size diameter, as well as the uniformity coefficient.

Chapter 10: Habitat Around Beach

Changes of habitats over a period of time may indicate erosion problems. Examples may include a significant decrease in size or disappearance of sand dunes.

Record on the Marine Beach Annual On-Site Survey form the types of habitat present at a beach (e.g., dunes, wetlands, rivers/streams, forests, parks, urban areas/boardwalks, or protected habitats or reserves). Describe the habitat around the beach.

SOP043 Dunes

Record on the Marine Beach Annual On-Site Survey form if of dunes are present at a beach. Describe and take photographs of the dunes.

SOP043 Wetlands

Record on the Marine Beach Annual On-Site Survey form if wetlands are present at a beach. Describe and take photographs of the wetlands.

SOP043 River/Stream

Record on the Marine Beach Annual On-Site Survey form if rivers/streams are present around a beach. Describe and take photographs of the rivers/streams.

SOP043 Forest

Record on the Marine Beach Annual On-Site Survey form if forests or woodlands are present around a beach. Describe and take photographs of the forests.

SOP043 Park

Record on the Marine Beach Annual On-Site Survey form if parks are present at a beach. Describe and take photographs of the parks.

SOP043 Urban/Boardwalk

Record on the Marine Beach Annual On-Site Survey form if urban areas/boardwalks are present at a beach. Describe and take photographs of the urban areas/boardwalks.

SOP043 Protected Habitat or Reserve

Note on the Marine Beach Annual On-Site Survey form if a beach is a part of a protected habitat or reserve. Describe the protected habitat or reserve.

Chapter 11: Shellfish Growing Areas

SOP044 Shellfish Growing Areas

On the Marine Beach Annual On-Site Survey form, for each beach, describe any Shellfish Growing Areas (including size) and distance to swimming areas.

Chapter 12: Bounding Structures

Record on the Marine Beach Annual On-Site Survey form the types of bounding structures present at a beach. Take photographs of bounding structures. Record corresponding descriptions of the photographs in the 'Photographs' section.

SOP045 Jetty

Jetties are a type of perpendicular hard structure normally placed adjacent to tidal inlets to control inlet migration and to minimize sediment deposition within the inlet. Record on the Marine Beach Annual On-Site Survey form the number of jetties present at a beach. Take photographs.

SOP045 Groin

Groins are perpendicular structures used to maintain updrift beaches or to restrict longshore sediment transport. Record on the Marine Beach Annual On-Site Survey form the number of groins present at a beach. Take photographs.

SOP045 Seawall

Seawalls are shore-parallel structures designed to protect the beach in front of a property or properties. Record on the Marine Beach Annual On-Site Survey form the number of seawalls present at a beach. Take photographs.

SOP045 Pier

A pier is a structure built on posts extending from land out over water. Record on the Marine Beach Annual On-Site Survey form the number of piers present at a beach. Take photographs.

SOP045 Natural Formation

Record on the Marine Beach Annual On-Site Survey form the number of natural formations present at a beach. Take photographs.

SOP045 Breakwater

Structures like breakwaters are designed to alter the effects of waves and stop or alter natural coastal changes. Record on the Marine Beach Annual On-Site Survey form the number of breakwaters present at a beach. Take photographs.

Chapter 13: Description of Sanitary Facilities and Other Facilities

An examination of sanitary facilities includes a count of the facilities, their location (latitude/longitude), condition, distance to water, scheduled disposal of sanitary wastes and cleanings. An examination of sanitary facilities is conducted to determine whether they could be a source of pollutant to the beach. The number of toilets, urinals, and sinks should be enough to accommodate the bather load.

Other facilities may include showers, bathhouses, restrooms, portable sanitary units, restaurants, marinas, bars, parking lots, fish cleaning stations, playgrounds, dog parks, boat pump outs, and on-site wastewater treatment. These facilities may also act as a pollutant to beaches. Consult a sanitarian, public health official or city official to access sewer plans and layouts for further examinations.

Record on the Marine Beach Annual On-Site Survey form the types of sanitary facilities present at a beach (e.g. toilets, urinals, sinks, showers, bathhouses, restrooms, portable sanitary units, restaurants, marinas, bars, parking lots, fish cleaning stations, playgrounds, dog parks, boat pump outs, and on-site treatments). Write a description and take photographs of the facility. Any additional information gathered from further examinations with city officials etc. should also be noted. Describe whether the number and location of sanitary and other facilities are adequate to support beach use.

SOP046 Toilets

Record on the Marine Beach Annual On-Site Survey form the number of toilets present at a beach. Write a description and take photographs of the facility.

SOP046 Urinals

Record on the Marine Beach Annual On-Site Survey form the number of urinals present at a beach. Write a description and take photographs of the facility.

SOP046 Sinks

Record on the Marine Beach Annual On-Site Survey form the number of sinks present at a beach. Write a description and take photographs of the facility.

SOP046 Showers

Record on the Marine Beach Annual On-Site Survey form the number of showers present at a beach. Write a description and take photographs of the facility.

SOP047 Bathhouse

Record on the Marine Beach Annual On-Site Survey form the number of bathhouses present at a beach. Write a description and take photographs of the facility.

SOP047 Restroom

Record on the Marine Beach Annual On-Site Survey form the number of restrooms present at a beach. Write a description and take photographs of the facility.

SOP047 Portable Sanitary Unit

Record on the Marine Beach Annual On-Site Survey form the number of portable sanitary units present at a beach. Write a description and take photographs of the facility.

SOP047 Restaurant

Record on the Marine Beach Annual On-Site Survey form the number of restaurants present at a beach. Write a description and take photographs of the facility.

SOP047 Marina

Record on the Marine Beach Annual On-Site Survey form the number of marinas present at a beach. Write a description and take photographs of the facility.

SOP047 Bar

Record on the Marine Beach Annual On-Site Survey form the number of bars present at a beach. Write a description and take photographs of the facility.

SOP047 Parking Lot

Record on the Marine Beach Annual On-Site Survey form the number of parking lots present at a beach. Write a description and take photographs of the facility.

SOP047 Fish Cleaning Station

Record on the Marine Beach Annual On-Site Survey form the number of fish cleaning stations present at a beach. Write a description and take photographs of the facility.

SOP047 Playground

Record on the Marine Beach Annual On-Site Survey form the number of playgrounds present at a beach. Write a description and take photographs of the facility.

SOP047 Dog Park

Record on the Marine Beach Annual On-Site Survey form the number of dog parks present at a beach. Write a description and take photographs of the facility.

SOP047 Boat Pump Out

Record on the Marine Beach Annual On-Site Survey form the number of boat pump outs present at a beach. Write a description and take photographs of the facility.

SOP048 On-Site Treatment

Record on the Marine Beach Annual On-Site Survey form the number of on-site wastewater treatment present at a beach. Write a description and take photographs of the facility.

Chapter 14: Litterbins

SOP051 Litterbins

Record the total number of litterbins. Also record the location (latitude/longitude), condition (good, fair or poor), distance to bathing area in meters and frequency of emptying (daily, weekly, or monthly) of the litterbins. Describe whether the number and location of litterbins are adequate to support beach use.

Chapter 15: Observed Potential Pollution Sources

Observed potential pollution sources may include any of the source types listed on the Marine Beach Annual On-site Survey form under the 'Observed Potential Pollution Sources' section. Visible sources, including wastewater discharges, sewage overflows and septic systems, may carry contaminants that affect bathing beach water quality. Ground water, usually not visible but may be noted as spring discharge or seepage, might also be a pollutant source. Observations should include the source type, distance of source to water line in meters, the location (latitude/longitude), and estimated flow (ft^3/s).

Through resources and observations made, the source should be identified as a high, medium or low contributor to beach pollution. Determining when, how often, the amount of pollution and how it is affected by change in seasons should be explored.

Identify sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document the name of each potential pollution source on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether the sources occur only in conjunction with specific weather conditions. Obtain aerial photographs is strongly encouraged.

SOP049 Wastewater discharges

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the sampling station. Document wastewater discharges on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether wastewater discharges occur only in conjunction with specific weather conditions.

SOP049 Sewage Overflows

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document sewage overflows on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether sewage overflows occur only in conjunction with specific weather conditions.

SOP049 Septic Systems

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document septic systems on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether septic systems occur only in conjunction with specific weather conditions.

SOP049 Subsurface Sewage Disposal

Identify nonvisible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document subsurface sewage disposals on the Marine Beach Annual On-site

Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether subsurface sewage disposals occur only in conjunction with specific weather conditions.

SOP049 Unsewered Areas

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document unsewered areas on the Marine Beach Annual On-site Sanitary Survey form.

SOP049 Groundwater Seepage

Identify sources like seepage or springs that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document groundwater seepages on the Marine Beach Annual On-site Sanitary Survey form.

SOP049 Bathhouse Leakage

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document bathhouse leakages on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether bathhouse leakages occur only in conjunction with specific weather conditions.

SOP049 Drains and Pipes Nearby

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document the drains and pipes nearby on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether discharges from drains and pipes nearby occur only in conjunction with specific weather conditions.

SOP049 Stormwater Outfalls

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document the wastewater discharges on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether wastewater discharges occur only in conjunction with specific weather conditions.

SOP049 Erosion Prone Areas

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document erosion prone areas on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether erosion prone areas occur only in conjunction with specific weather conditions.

SOP049 Vacant Areas

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document vacant areas on the Marine Beach Annual On-site Sanitary Survey form.

SOP049 Wetland Drainage

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document wetland drainages on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether wetland drainages occur only in conjunction with specific weather conditions.

SOP049 Rivers/Streams

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document rivers/streams on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether discharges from rivers/streams occur only in conjunction with specific weather conditions.

SOP049 Landfills, Open Dumps

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document landfills and open dumps on the Marine Beach Annual On-site Sanitary Survey form.

SOP049 Urban Runoff, Industrial Waste

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document runoff from urban areas or industrial waste on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether runoff from urban areas or industrial waste occur only in conjunction with specific weather conditions.

SOP049 Agricultural Runoff

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document agricultural runoff on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether agricultural runoff occurs only in conjunction with specific weather conditions.

SOP049 Land Application of Biosolids and Manure

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document land applications of biosolids and manure on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether runoff from land applications of biosolids and manure occur only in conjunction with specific weather conditions.

SOP049 Concentrated Animal Feeding Operations (CAFOs) or Animal Feeding Operations (AFOs)

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document CAFOs or AFOs on the Marine Beach Annual On-site Sanitary Survey form. In the 'Additional Comments' section, add notes such as whether runoff from CAFOs or AFOs occur only in conjunction with specific weather conditions.

SOP049 Domestic Animals

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document the number of domestic animals present on the Marine Beach Annual On-site Sanitary Survey form.

SOP049 Wildlife

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document the number of wildlife present on the Marine Beach Annual On-site Sanitary Survey form.

SOP049 Marinas, Harbors

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document the marinas and harbors on the Marine Beach Annual On-site Sanitary Survey form.

SOP049 Mooring Boats

Identify visible sources that may be affecting the beach up to 152.40 meters (500 feet) from the beach area. Document the mooring boats present on the Marine Beach Annual On-site Sanitary Survey form.

Chapter 16: Photographs Taken

SOP050 Photographs

Photographs are a good way to document observations of beach and watershed conditions. Take some general photographs showing the overall beach condition and the locations of fixed objects. These photographs may be used as reference points to determine whether changes have been made from year to year. In addition, take photographs of beach use, bounding structures, sediments, habitat, sampling locations, pollutant sources, evidence of pollutants, sanitary facilities, and other facilities. If you are using a digital camera, write down the photograph number, a description, the date and time, and the file name (once the file is uploaded to a computer) for each photograph taken. Attach relevant photographs to the Marine Beach Annual On-Site Survey form.

Chapter 17: Erosion/Accretion Measurements

High water levels, storms, wind, ground water seepage, surface water runoff, ice, and frost are important factors that cause beach erosion. In addition, jetties and seawalls intended to protect against storm waves may actually accelerate beach erosion and reduce the capacity of beaches to absorb storm energy (NOAA 2003). Erosion may result in public losses to recreational facilities, roads, public works, and homes located along the shore (Surfrider 2007).

To determine whether a beach is eroding or accreting over time, and whether you need to implement an erosion control plan, you may take measurements from a fixed object behind the beach, such as a building or parking lot, to the high watermark, and compare changes over time. The high watermark is the highest point that waves reach on the day the measurement is taken. It may usually be identified as the line on the beach between where it is wet and where it is dry or by a line of debris (e.g., seaweed, shells). If there is more than one line of debris on the beach, use the line closest to the water body, because other debris lines farther from the beach might be the result of previous storms (UNESCO 2005).

Two people are needed to perform this measurement. For beaches at least 1609.344 meters (1 mile) long, choose at least three points along the beach for the erosion/accretion measurements. You may add additional points as needed. For instance, you may take measurements directly in front of and adjacent to man-made bounding structures to study their effects (UNESCO 2005). At the first point (point A), select the fixed object and record a description of it on the Marine Beach Annual Analysis form. In addition, take photographs of both the high watermark location and a corresponding fixed object, and record a description of these photographs on the Marine Beach Annual Analysis form. One person should stand at the high watermark and lay the tape measure on the ground. The other should stretch the tape measure to the fixed object and pull the tape measure taut. One of the persons should record on the Marine Beach Annual Analysis form the distance in meters. Proceed to the next point, repeating the measurement and recording corresponding information on the Marine Beach Annual Analysis form. Finally, the two people should measure the distances between sampling points (UNESCO 2005) and record them on the Marine Beach Annual Analysis form.

References

NOAA (National Oceanic and Atmospheric Administration). 2003. *Beach Nourishment: A Guide for Local Government Officials*. National Oceanic and Atmospheric Administration. <www3.csc.noaa.gov/beachnourishment/index.htm>.

Surfrider Foundation. 2007. State of the Beach. www.surfrider.org/stateofthebeach/05-sr/state.asp?zone=GL&state=mi&cat=be.

UNESCO (United Nations Educational, Scientific, and Cultural Organization). 2005. *Introduction to* Sandwatch*: An educational tool for sustainable development*. Coastal region and small island papers 19.

APPENDIX A: Sanitary Survey Counting Method

Several methods may be used when counting various parameters during the Marine Beach Routine On-Site Survey and the Marine Beach Annual On-Site Survey.

Depending on the quantity, methods of observation may include visual calculations made by use of the naked eye.

Binoculars and a hand-held counter may aid in calculations. For larger sums, observe using a pair of binoculars and use a hand-held counter to make an accurate assessment.

Photographs may also be used in observation. Photographs should be taken and used to analyze and record larger numbers.

APPENDIX B: Seaweed (Algae) Identification Table

Seaweed (Algae)	Description	Pictorial Description
Ulva	Green algae; marine and brackish water algae; hollow, one-layered thalli; nuisance in areas that are nutrient enriched from sewage outfalls	Figure 1
Chaetomorpha	Green algae; intertidal; can be found in groups of hundreds or thousands of individuals in sandy areas, on rocks or around tide pools	Figure 2
Cladophora	Green algae, grows in the form of a tuft or ball with long strands; commonly found in mats that float on the surface of the water and wash on shore	Figure 3
Acetabularia	Green algae, umbrella-like; at top of the tall, slender stalk, is a ring of branches that may be separate or fused to form a cap	Figure 4
Sargassum	Brown algae; may be free-floating; ribbon-like fronds containing air sacs	Figure 5
Ectocarpus	Brown algae; hair-like found in pools at high tide levels, often seen as a fine hairy growth on other algae	Figure 6
Digenia	Red algae	Figure 7
Palisada	Red algae	Figure 8
Gracilaria	Red Algae; found in shallow subtidal or mid-intertidal tidepools on reef flats or eroded limestone; although normally cylindrical, the branches are frequently found flattened	Figure 9
Chondria	Red algae; profusely branched	Figure 10
Jania	Red algae; generally inhabit sheltered, somewhat shaded areas of the reef, often in crevices	Figure 11

Figure 1. *Ulva*

Figure 2. *Chaetomorpha*

Figure 3. *Cladophora*

Figure 4. *Acetabularia*

Figure 5. *Sargassum*

Figure 6. *Ectocarpus*

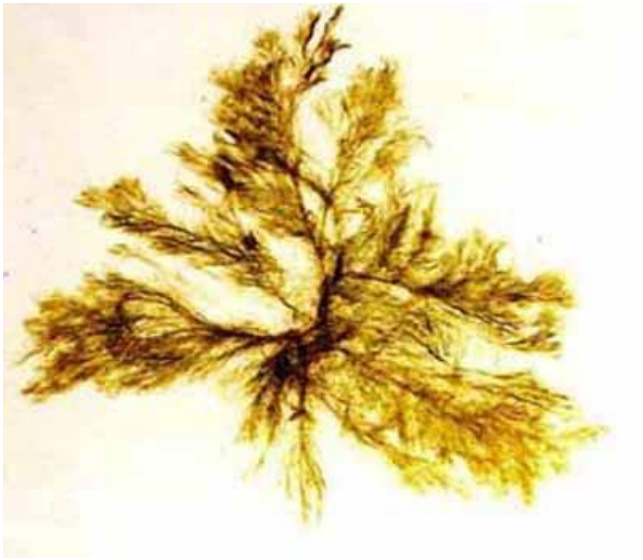


Figure 7. *Digenea*

Figure 8. *Palisada*

Figure 9. *Gracilaria*

Figure 10. *Chondria*

Figure 11. *Jania*

APPENDIX C: Seagrass Identification Table

Seagrass	Description	Pictorial Description
Halodule	May form carpet-like beds in warm, shallow waters; usually grows in water too shallow for other species	Figure 12
Halophila	Can be identified by its smooth margins and spatulate leaves in pairs; grows in coastal lagoons in the intertidal zone, or deeper than many other seagrasses; has been found in coarse sand and muddy substrates and in areas of turbid waters and high tidal currents	Figure 13
Thalassia	Grass blades are flat and ribbon-like; long, broad blades distinguish it from other species of seagrasses	Figure 14
Cymodoceae	Can be found in clear water and in high intertidal areas; hardy species and is adaptable to marginal conditions; cannot handle full exposure at low tide and dry conditions	Figure 15

Figure 12. *Halodule*

Figure 13. *Halophila*

Figure 14. *Thalassia*

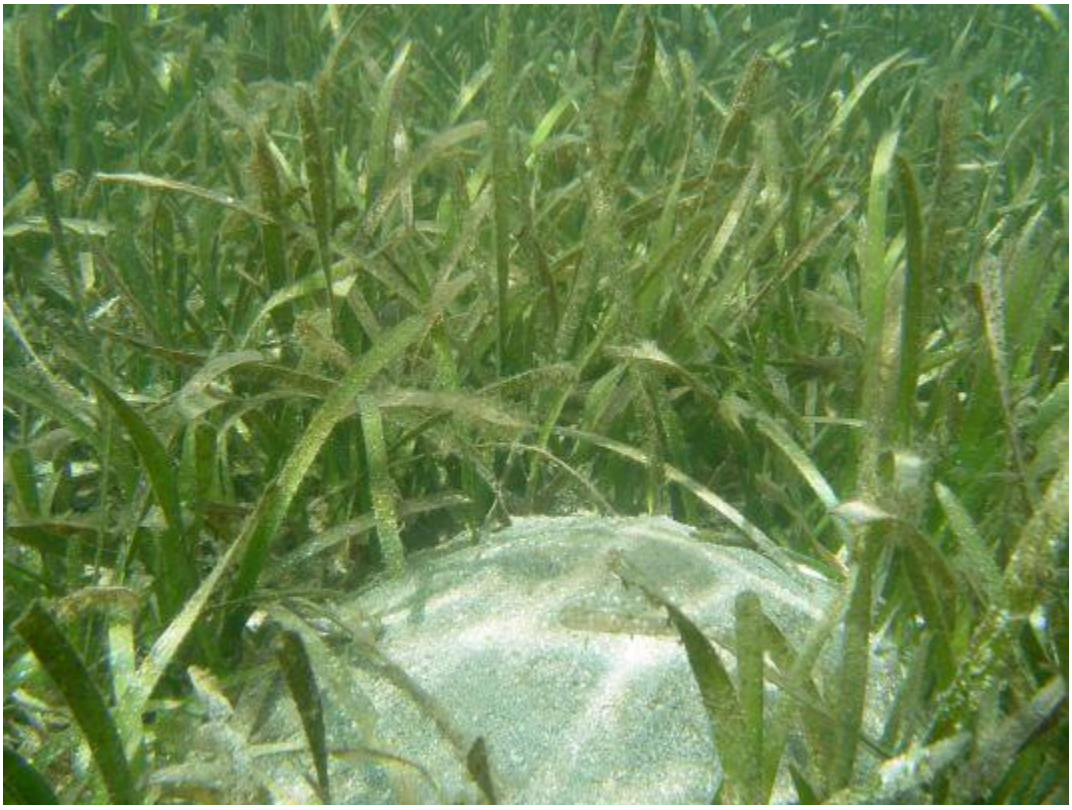


Figure 15. *Cymodeceae*