Grand Traverse Bay Watershed Planning Project

Field Assessment of the Grand Traverse Bay Shoreline

March 2003
The Watershed Center Grand Traverse Bay

Introduction

As part of the Grand Traverse Bay Watershed Planning Project, The Watershed Center (TWC) completed a shoreline inventory of the entire 132-mile shoreline of the Grand Traverse Bay. The Grand Traverse Baykeeper, John Nelson, along with TWC staff and local volunteers, walked and inventoried the bay's shoreline in order to assess the current conditions surrounding the bay.

"To have walked the 132 mile shoreline of Grand Traverse Bay was as much an adventure as it was a task. The magnificence of Grand Traverse Bay was exhibited on each of the thirty-two days needed to complete the survey," (John Nelson, Grand Traverse Baykeeper). "The process to inventory the shoreline competes in interest and importance with the actual data and information collected. Of the thirty-two days only eleven were walked solo. Over 13 very qualified volunteers offered their observations on the other twenty-one days."

John Nelson, Grand Traverse Baykeeper, on the Antrim County Shoreline.

Methods and Protocols

The development of the survey protocol began in Fall 2001 and consisted of the following activities:

- Christopher Wright (TWC), John McKinney (MSU Sea Grant), Pam Smith (Great Lakes Environmental Center), Anne Hansen (TWC) and John Nelson (TWC) walked the shoreline from the Leelanau Lighthouse to Northport Point and noted potential significant features to record. (October 2001)
- Doug Fuller (Tip of the Mitt Watershed Council) shared his experience, survey techniques, protocols and advice. (January 2002)
- Field survey forms from the Northwest Michigan Council of Governments (NWMCOG), Michigan Department of Environmental Quality (MDEQ) and the World Wildlife Federation as well as a historical shoreline classification study, completed by the Michigan State University (MSU) Department of Resource Development's Agricultural Experiment Station in 1958, were reviewed.
- Dr. Ted Cline, a local environmental activist and aerial photographer (now deceased), screened his aerial video of the Grand Traverse Bay shoreline and offered his advice. (January 2002)

- Advice and input was also solicited from the Grand Traverse Band of Ottawa and Chippewa Indians, Michigan Department of Natural Resources, The Grand Traverse Bay Monitoring Group, Inland Seas Education Association, and NWMCOG. (January and February 2002)

A draft feature inventory sheet was prepared and tested on two walks in early February 2002. The results were shared with the Project Steering Committee and a working inventory protocol was prepared. The first field trial with this protocol was in April 2002. This inventory protocol was then used with minor additions for the remainder of the survey (Appendix A).

The feature inventory field sheets were used in conjunction with 1992 series USGS digital ortho-quad aerial photographs. One hundred fourteen photos were used. Water levels of Lake Michigan were 579.2 ft in 1992 and 578.3 ft for most of the inventory. The level of the bay was 11 inches lower than the level when the photographs were taken.

The shoreline was divided into segments containing similar characteristics during the inventory. Features such as nearshore substrate (clay, sand, stones, rock, macrophytes, etc.), endangered and exotic plant species, streams, seeps, public access, human impact (shore hardening, beach alterations), and beach characteristics (sand/stone/rock, bluffs, dunes, wetland, beach width) were noted as either specific points or as general segment characteristics. A specific point was noted if it was only seen a few times along a segment, otherwise, if a feature was common it was noted as a segment characteristic. Features and beach segments were indicated by letters on the photos and keyed by letter on the inventory sheets.

The field data has been entered into a digital database and is available on the Internet at **www.gtbay.org**. The field notes, including the aerial photographs and field inventory sheets, are available for review at The Watershed Center.

The MSU Department of Resource Development's Agricultural Experiment Station completed a previous shoreline classification study in 1958. The results from this inventory were reviewed in detail for this summary. The shoreline in these reports was characterized by 10 shoretype descriptions. The descriptions of the physical characteristics of the shore are as valuable and accurate today as they were in 1958.

Example of Beach Dunes Along Old Mission Peninsula

For purposes of this summary of the shoreline features inventory, standard common sense definitions of beach, bluff, dunes, and upland dunes can be used. (Written definitions can be found in the glossaries of the 1958 MSU shoreline inventory reports and the MSU Department of Resource

Development's 1964 Water Bulletin #14 titled *Lake Terminology,* authored by C.R. Humphrys and J.O. Veatch.) "Nearshore" areas were observed from the water's edge and have variously been defined as the area of land from the water's edge to a depth of anywhere between 2 to 6 meters. Except for observations by kayak from the Leelanau Lighthouse to Northport Point, "nearshore" was from the water's edge to what could be visually observed offshore. For the most part, the inventory followed the wet beach. From time to time, the dry beach was investigated for particular points of interest.

For purposes of respecting riparian privacy, former Attorney General Frank J. Kelley's "1978 Opinion Number 5327" was studied. The 1966 notice by the Department of Conservation (now equivalent to the MDNR) titled "Riparian Rights and the Public Trust in Michigan Public Lakes and Streams" as well as the passage "Basic Law for Shore Users" in Walter J. Hoggman's Field Guide to Great Lakes Coastal Plants were also read. We encountered only great curiosity and support for our effort from people we met along the shoreline.

Great Blue Heron – Antrim County Shoreline

Shoreline Features Summary

Leelanau Lighthouse to Traverse City – West Side

Lighthouse to Cherry Home (Figure 1)

Stones and rock covered a gradual nearshore and dry beach from the lighthouse to the northern limit of the Cherry Home (Figure 1, Point A) residential area. The upland was natural and much of it was parkland. The shore along the Cherry Home area was a mix of sand, stones, and rock with the rock and stones dominating nearshore. Zebra mussel shells were found in abundance on shore. Also thick layers of decaying algae were encountered. This stretch is 100% developed with cultured and natural upland. Some shore hardening exists as many homes are close to eroding banks.

Cherry Home to Northport Point (Figure 1)

South of Cherry Home two beautiful crescent sand beaches exist. Wide sand beaches with upland dunes run for a mile to Northport Point. These beaches are very natural with most development set back in the upland dunes and woodlands. An extensive rocky reef separates the beaches. With the low water levels a bermed beach has developed in some areas with emergent wetlands forming upland from the berm. Northport Point shoreline is highly developed. It is an old summer colony dating to the 1930's. Beautiful old cottages sit side by side with expansive new summer homes. The beach is mostly rock and stone with one small crescent beach tucked in between Stoney Point and Northport Point. The nearshore is also mostly rock and stone. The upland is cultured in a way that compliments the natural beach. Milfoil was significant on the west shore of the Point.

Northport Point to Village of Northport (Figure 1)

The shoreline into the Village of Northport is mostly rock and stone on the beach and nearshore. Two exceptions are Hall's Bay beach (Figure 1, Point B) and the half-mile long beach at the "bight" (a curve or bend in a beach shoreline). These beaches are gradual sand beaches with sandy, barred nearshore areas. The stony, rock beaches are highly vegetated with sedges, rushes and common shore grasses and plants.

From the "bight" to Northport Village the shore is mostly developed with cottages and homes and two marinas. Major seeps and small streams exist along Northshore Drive, draining wetlands to the west. One drains Woolsey Lake (Figure 1, Point C), or Mud Lake, and another empties into Hall's Bay. Northport Village hosts a full service marina, two small public sand beaches and riparian homes. The beaches in the village are mostly sand, as is the nearshore. Northport Creek enters the bay at the marina in town. A number of stormdrains discharging into the bay exist in the village as well. Several small streams exist between the Leelanau Lighthouse and the Village of Northport.

Village of Northport to Ingalls Bay (Figure 1)

The shoreline from the Village of Northport to Ingalls Bay (Figure 1, Point D) is very much developed. The nearshore is mostly stone and rock, as is the dry beach area. There are several small pocket sand beaches, and a half mile sand beach with adjacent sandy nearshore south of Ennis Creek (Figure 1, Point E). This shoreline has many small streams and extensive groundwater seeps entering the bay. Three private marinas exist with many small dredged basins

in the nearshore. Numerous small groins exist along with many attempts to harden the shoreline with rock or seawalls. Ennis Creek is the most significant stream entering the bay south of Timber Shores. Along this stretch of shoreline there are occasional 5 to 10 foot bluffs. Ingalls Bay is a north facing sand beach with sandy nearshore. It is a gradual beach with a natural upland and a good number of cottages.

Ingalls Bay to Village of Omena (Figure 1)

From Ingalls Bay to the Village of Omena the nearshore is mostly stones and rock with one small sandy nearshore area. The dry beaches are a mix of stone, sand and rock. A 5 – 10 foot bluff exists along much of the west shore of Omena Point. The upland is highly developed with cottages and homes. Similar to the shoreline north of Ingalls Bay, several private marinas and many small dredged areas are located along this shoreline area as well. Much shore hardening exists, mostly of rock but several major steel seawalls. Several spots containing groundwater seeps occur on the east shore of Omena Point. The residents of the Village of Omena enjoy a beautiful sand beach with a sandy nearshore. Several stormwater discharge pipes move water under M-22 to the bay. The village also houses a small private marina.

Village of Omena to Sutton's Bay (Figure 1 and 2)

Just south of the Village of Omena is a small sand beach with barred sandy nearshore. Weaver Creek (Figure 1, Pont G) enters at this beach. From this sand beach to Belanger Creek (Figure 1, Point H), which enters just south of McKeese Road, the dry beach is composed of stone and rock and is narrow with many small streams and groundwater seeps. Much of the shoreline in this area belongs to the Grand Traverse Band of Ottawa and Chippewa Indians. It is mostly a natural upland with a few homes near the shore and one marina (the Art Duhamal Marina) that services the tribe. The nearshore is comprised mostly of stones and rock.

The nearshore from Belanger Creek to Sutton's Bay is mostly stones with a little sand. The beach is narrow with a stone and sand mix. Several small streams and many groundwater seeps enter the bay along this shore. A dense mat of plant growth occurs where the seeps exist. This shoreline is heavily vegetated and the upland is very developed. Some shore hardening and groin building exists. Heavy shore hardening with rocks occurs where M-22 is adjacent to the shoreline. In addition, there are numerous stormwater discharge pipes crossing the road.

Example of a Groundwater Seep Entering the Bay

Village of Sutton's Bay (Figure 2)

A private marina has been built north of Sutton's Bay Village with significant shore impact. The upland is very cultured in this development. Sutton's Bay has developed a large boat access and parking lot at the junction of M-22 and M-204. Residents of the village also enjoy a public marina and sandy public bathing beach. Sutton's Bay Creek (Figure 2, Point A) enters the bay at the marina and has exhibited high *E.Coli* counts (Monitoring Results from The Watershed Center: Fall 2002-Summer 2003). Several stormwater pipes drain runoff from the village directly to the bay. The Inland Seas Education Association is located on the shoreline just south of the Sutton's Bay marina. Their educational schooner, *Inland Seas*, is docked on a private pier.

Village of Sutton's Bay to Stoney and Lee Points (Figure 2)

South and east of Sutton's Bay Village the beach and nearshore area are both sandy. This area is highly developed and cultured above the beach. Leo Creek also enters along this beach. The nearshore substrate quickly becomes more stone north to Stoney Point. The dry beach is narrow and combines stones and sand. The upland is developed with some open areas and upland farms. Stoney Point Road is adjacent to the shore for a long stretch. Several smaller streams enter the bay on this shoreline. The north end of Stoney Point has a wide, gradual stone and rock beach with stone and rock substrate nearshore. The houses are set back in the woods. Significant beach altering was done along the north end of Stoney Point. From Vic Steimal Park (Figure 2, Point B) to the road end of Nanagosa Trail the dry beach is mostly narrow and consists of stones with a little sand. There are very significant, thick layers of decaying algae in many areas. Many homes exist above the low bluff. There are also several small streams and significant groundwater seeps occurring. Sixty to seventy foot bluffs occur along the beach south of the end of Nanagosa Trail. This beach is very narrow. The bluffs are mostly clay, and groundwater seeps occur along the beach. The beach and nearshore substrate is mostly stones with areas of silt and sand. Thick clay, silt areas exist along the beach below eroded the bluffs. Homes have been built above the bluffs. The bluff tapers down to Lee Point.

Example of a Clay/Silt Beach Area

At Lee Point the dry beach widens and becomes sandier. The nearshore is a stony, sand mix. Lee Point has a very wide sand, pebble beach with a developed but natural upland. The beach from Lee Point to M-22 is sandy with a nearshore sand substrate. The beach is gradual up to a developed upland that is a mix of natural and cultured. A small bluff exists, above which is Lee Point Road. Homes here are built across the road from the beach. Several culverts under the road drain the wet areas from the north. Emergent wetlands are extensive on a bermed beach.

Lee Point to Cedar Creek (Figure 2)

From the Lee Point Road intersection with M-22 the beach can be generalized to Cedar Creek (Figure 2, Point C) in Elmwood Township. M-22 dominates the upland area. The highway is frequently adjacent to the shoreline. When development occurs between the highway and the shoreline, it usually is on a narrow lot. The dry beach is, for the most part, a mix of stones and sand. It is narrow, often with a 5 – 10 foot bluff above the beach. The beach is highly vegetated with emergent wetlands growing along much of the shore. Several small streams and groundwater seeps exist. There are also many groins, seawalls and rock erosion barriers. The shoreline here is developed to its maximum.

Where M-22 is next to the shoreline, heavy rock riprap along with stormwater discharge pipes and culverts are evident. There are three DNR scenic turnouts, discharging stormwater to the bay from paved surfaces. One sand beach exists with sandy nearshore just north of Crain Hill Road. There are areas of significant, thick layers of decaying organic matter, as seen near the DNR scenic turnout near Crain Hill Road. The nearshore substrate is mostly stones and rock with a little sand and silt.

Cedar Creek to M-72 (Traverse City – West Side) (Figure 3)

Near Cedar Creek (Figure 3, Point A) to the Harbor West (Figure 3, Point B) breakwall the dry beach is sandy and wide. A mat of decaying organic matter was in the water over a sandy, stony nearshore substrate.

From the Harbor West breakwall to M-72 the shoreline is highly modified by man. Marinas, dredged areas, piers, and public beaches are all located on a beach that naturally would be similar to that north of Sutton's Bay. Brewer's Creek (Figure 3, Point C) is the significant stream entering the bay near Elmwood Marina (Figure 3, Point D).

The shoreline from Northport Village to Traverse City is vegetated with sedges, rushes, grasses and other common shoreline plants whenever the stones and rock predominate. Where sand is the dry beach and nearshore substrate emergent wetlands appear when a berm is created at the water's edge.

Traverse City – West Side (Figure 3)

A significant stream enters the bay at M-72 and is culverted under the road. The dry beach from M-72 to the Traverse City Light and Power Plant (Figure 3, Point E) is sandy and varying in width. It is public land with public beaches and parking areas (West End Beach – Figure 3, Point F). The nearshore is a gradual sandy substrate. Grandview Parkway is adjacent upland and is armored with riprap in several spots. Three stormwater culverts empty into the bay along this area.

The Clinch Park Marina and Open Space (Figure 3, Points G & H) are located to the west of the Clinch Park public beach area. The shoreline along this area has significant shore hardening with concrete and large rip-rap. The Boardman River (Figure 3, Point I) empties into the bay just east of Clinch Park. The dry beach and nearshore are gradual in gradient and are sandy to Bryant Park (Figure 3, Point J) at the southwest corner of West Bay. The Maritime Academy Marina is a major dredged harbor on this stretch, with single-family homes located on sandy beaches between the Academy and Bryant Park. Two stormwater discharge culverts empty to the bay between the Maritime Academy Marina and Bryant Park. The entire section of the West Bay shoreline located in Traverse City is generous in its public access to this extraordinarily beautiful sandy beach shoreline.

Clinch Park Marina – aerial shot

Old Mission Peninsula

Traverse City – West Side to Bower's Harbor (Figure 3)

The shoreline of Old Mission Peninsula to Bower's Harbor, approximately eleven miles, is fairly uniform. Peninsula Drive runs adjacent to the beach. The shoreline is heavily developed with homes mostly located on the other side Peninsula Drive, but many have been built between the road and the beach. There are new homes being built on very marginal land on the waterside of the road that have the potential to impact the bay. The dry beach is, for the most part, narrow from the water's edge to a 5 – 15 foot bluff. This Nipissing Bluff is an ancient wave cut beach. The dry beach is a mix of sand and stones with much of this shoreline exhibiting vegetative growth of sedges, bulrushes, grasses and other common shoreline plants. There are numerous groins and small dredged areas where rocks have been pushed aside. The nearshore substrate is mostly stones and small rocks. There were several pockets of decaying organic mats observed. This shoreline is heavily developed. Several small streams and numerous groundwater seeps were observed.

Bower's Harbor to Old Mission Point

A private marina is in Bower's Harbor with a DNR boat launch adjacent to it. The dry beach that extends about one half-mile west is a wide, gradual sandy beach with emergent wetlands where a berm has been created by wave action. The nearshore is a gradual sand substrate. The upland on the beach is natural and cultured with many cottages. From this beach to Neahtawanta Point the dry beach narrows and the Nipissing Bluff reappears. The dry beach is a mix of sand and stones and is heavily vegetated with extensive emergent wetland. The upland is natural bluff with homes set back from the bluff. From Neahtawanta Point to Old Mission Lighthouse the shoreline is much less developed. The dry beach widens and is for the most part

a mix of sand and stones. The Nipissing Bluff parallels the shore at various elevations the whole length this shoreline. The nearshore area is composed of mostly stones and rock with some sand. Human impact on the beach is limited with a few spots of shore hardening where the beach narrows. M-37 abuts the shoreline for a substantial distance near Old Mission Point and is hardened with riprap. Old Mission Point is largely public access land and shoreline with a township and state park.

Old Mission Point to Haserot Point and Old Mission Harbor (Figure 3)

The shoreline from Old Mission Point to Haserot Point (Figure 3, Point K) is very natural and undeveloped. The dry beach is wide and gradual with mostly stones, rock and some sand. The nearshore substrate is stones and rock with a gradual slope to deeper water. The dry beach is vegetated with grasses and some emergent wetland plants. The Nipissing Bluff is present on the upland at varying heights for the entire shoreline and is quite steep and high at Haserot Point. Some bluffs are up to 30 feet in height.

From Haserot Point around Old Mission Harbor the dry beach is a mix of sand and stones with a beautiful, sand beach at the Township Park. The nearshore is a gradual substrate of stones and sand. Several hundred yards of the North end of the harbor is hardened with brick and steel seawall.

Old Mission Harbor to Traverse City – East Side (Figure 3)

The shoreline from Haserot Park in Old Mission Harbor to the East Bay Park Beach (Figure 3, Point L) in Traverse City can be summarized by a general description. The Nipissing Bluff is present along most of the fifteen-mile shore at varying heights, usually 5 to 15 feet. The nearshore is primarily stones and rock with little sand. Some pocket sand beaches do exist. The dry beach is narrow and mostly stones with some sand. This shore is very much developed with homes above the bluff or across the road when the road is adjacent to the shore. There is significant shore hardening, small dredged areas, and numerous groins. Much of the beach is vegetated. Just north of Bluff Road heavy beach erosion control efforts (rock riprap) have occurred below a 30-foot bluff.

Example of shore hardening using large rock rip-rap.

Traverse City – East Side to Eastport

East Bay Park to Mitchell Creek and the State Park (Figure 4)

The dry beach from the East Bay Park (Figure 4, Point A) to the southeastern corner of East Bay is a sandy, 25 - 100 foot wide gradual beach. US-31 parallels the beach with heavy developed property between the road and beach. This “miracle mile” is some of the most valuable real estate in the region. The value in 2003 of $7000 per front foot is quite high when compared with the “up to $100 per front foot” noted in 1958 (MSU historical shoreline inventory). The nearshore in this area is a gradual, barred, sandy substrate. Three major

stormwater discharge pipes are located at the west end of the beach. The Traverse City State Park (Figure 4, Point B) occupies about a quarter mile of this beach. Commercial and residential land uses share the beach with commercial use replacing residential where zoning allows. The southeast end of the beach has been built on fill over the years and the nearshore is shallow for several hundred yards from the water's edge. Emergent wetlands are lush and numerous here. Mitchell Creek (Figure 4, Point C) enters the bay just west of the State Park.

Mitchell Creek to Acme Creek (Figure 4)

A relatively overlooked small watershed is that of Baker's Creek (Figure 4, Point D), which drains the wetlands in the southeast corner of East Bay. Significant layers of decaying organic matter were observed on the southeastern corner of East Bay as well. US-31 dominates the shoreline for a mile north from the foot of the bay. The dry beach is narrow to non-existent with heavy riprap protecting the road bank. Two streams are culverted under the road. The nearshore is mostly stones and rock. The shoreline through the Village of Acme is heavily developed with commercial establishments. The dry beach is narrow and a mix of sand and stones. The nearshore is mostly sand and stones. The dry beach exhibits many emergent wetland areas. There is a DNR Roadside Park (Figure 4, Point E) and a private commercial marina. As in most marinas, milfoil and other macrophytes are numerous. There are several rock and steel seawalls. The beach to the north end of the village is where Acme Creek (Figure 4, Point F) enters the bay.

Acme Creek to Deepwater Point (Figure 4)

The beach from Acme Creek north has been kept relatively natural up to the Deepwater Point Nature Preserve. Along this stretch the dry beach is wide, gradual and primarily stones and sand. Homes above the beach exhibit cultured and natural settings. Significant milfoil was observed on the beach. The nearshore is mostly stones and drops off sharply to deep water.

Deepwater Point to Ptobego Natural Area (Figure 4)

The dry beach north of Deepwater Point is wide and gradual. A bluff arises and the developed land is set back from the beach or is above the bluff. The beach is very natural and is mostly sand with some stones. The nearshore is also sand with some stones. The shoreline along this area has many points (projections of land into the water). At each point, the sand gives way to more stones and extends in to the water to stony reefs.

Ptobego Creek and Pond Natural Area – aerial shot

This shoreline type continues to the Ptobego Natural Area (Figure 4, Point G). Yuba Creek (Figure 4, Point H) enters the bay on this shoreline. There are significant groundwater seeps to the bay along the shoreline as well. The Ptobego mile stretch of shoreline is a spectacular example of a

natural Lake Michigan shoreline. It is a wide, gradual, sandy, dry beach with both beach and upland dunes. The nearshore is a mix of sand and stones. Ptobego Creek (Figure 4, Point I) empties into the bay here.

Ptobego Natural Area to the Village of Elk Rapids (Figure 4)

The human impact on the shoreline from Acme Creek to Elk Rapids is minimal, probably because of the westerly winds, unprotected shoreline, and dynamic nature of the natural beach. From the Ptobego Natural Area to the Village of Elk Rapids the dry beach narrows to 25 – 100 feet. It is mostly sand with stones and rock. The beach gradually blends to the upland, which is developed to Elk Rapids. The nearshore is a mix of stones and sand. A fair amount of macrophytic growth occurs on the nearshore substrate. Emergent wetlands occur where a berm has formed but are not extensive.

The Village of Elk Rapids has, as do other urban areas, a diverse developed shoreline. Several public parks and open areas exist. A public marina is available which has been recently dredged. Three stormwater discharge pipes service the village. Milfoil and other macrophytes grow in the marina. The Elk River carries some 60% of the total surface water input to Grand Traverse Bay at Elk Rapids Village.

Village of Elk Rapids to Norwood (Figure 4, 5)

North of Elk Rapids the dry beach varies in width, usually 25 – 100 feet. The dry beach is sand and some stones and the nearshore substrate is comprised of stones with sand. An upland bluff that varies from 5 – 15 feet characterizes the shoreline. When the beach widens, beach dunes covered with beach grass and upland dunes occur. Development is residential homes and cottages. The development is consistent along the shore of Antrim County and is broken up by conserved land and public parks. Where development occurs, some dredging, groin building and shore hardening has occurred, especially on the narrow beach stretches, but not nearly as intense as on the Leelanau County side or the shoreline of Old Mission Peninsula. One private, dredged marina was observed along with one community, west of Williams Drive, that had a dredged harbor prohibiting access along the shoreline. Where a berm was created by the wave action, emergent wetlands occurred.

Twenty-four small streams were observed from Elk Rapids to Norwood. Many groundwater seeps were observed as well. The most interesting and beautiful seeps were observed north of Eastport seeping from the blue Antrim Shale Bluffs. Significant layers of decaying organic matter, chara, and chladophera were observed when caught on the lee side of reef points.

Close-Up of Antrim (Blue) Shale Bluff

North of Eastport to Norwood the beach narrows and becomes more stones than sand. The most unique observations of the whole shoreline inventory are the areas of exposed Antrim shale. The blue shale bluffs, the shale fragments on the beach and the layers of blue shale extending into the lake substrate were very impressive.

Power Island (Figure 6)

The last segment of the shoreline inventoried was Power Island in June 2003. Power Island, located in the central portion of West Grand Traverse Bay, is a public preserve owned and operated by Grand Traverse County. The shoreline of Power Island is a natural shoreline, which includes examples of many of the natural shore types surrounding Grand Traverse Bay.

From the public dock, located on the southeast side of the island, south to the middle of the southern shore, the nearshore is a mixture of sand and stones, as is the beach. The upland is natural with public picnic areas. The western end of the south shore has a mixture of stones and clay on the nearshore and beach areas with a 20-40 foot bluff to the upland. The western shoreline exhibits large rocks and stones both in the nearshore and on the beach. A 20-foot bluff runs above the beach for about 2/3 of the length of the western shoreline.

The north 1/3 of the island is low and flat with upland wetlands. These wetlands output groundwater into the bay in small streams and seeps. Some ephemeral ponds exist on the beach and emergent wetlands are found along most of this shoreline.

Bassett Island is connected to Power Island at the northeast tip. The beach and nearshore in this area is low, flat, and gradual with a mix of clay and stones. Except for the eastern shore near the public dock the nearshore is shallow shoal water. Near the public dock the nearshore drops off to deep water close to shore.

Endangered and Exotic Species

Exotic species observed during the shoreline inventory included purple loosestrife and zebra mussels. Purple loosestrife grows extensively along the shoreline. It mostly occurs where it is sheltered from direct wave action and on stony, rocky substrate. It may also occur on sandy substrate, although not as common, as demonstrated at the foot of West Bay and along the Boardman River. With relatively low lake levels, purple loosestrife has taken hold in some of the emergent wetland areas.

Purple Loosestrife

Zebra mussel shells were observed on the shoreline throughout much of the survey. Most shells were observed north of the 45-degree parallel. Some windrows of shells three feet deep were observed north of Northport and on the western side of Old Mission Peninsula.

Zebra Mussels

Pitcher thistle was the only endangered plant species observed and was found at one location north of Northport on the Leelanau Peninsula and at several locations north of the Village of Elk Rapids to Eastport.

Pitcher's Thistle

Other Areas of Concern

The areas of decaying detritus and organic matter (where the layers were of concern to riparian owners) occurred mostly on the Leelanau side of the bay. Some layers were 2 to 3 feet thick and resembled septage. Where the layers could be identified, the macrophytes were chara and chladophera.

Additional Inventory of Selected Tributaries

The Grand Traverse Baykeeper walked and explored four sub-watersheds. The Woolsey Lake (Figure 1) outlet was explored to its mouth at Seven Pines Road on the bay. The lake and much of its surrounding land is protected with conservation easements or public lands. The outlet of Woolsey Lake consists of a wetland complex that flows into the bay at Seven Pines Road.

Phil von Voigtlander of Northport hosted a walk from the mouth of Northport Creek (Figure 1, Point I) to its headwaters in the wetlands and springs off of Johnson Road. Phil and his neighbors have protected these headwaters with conservation easements. Northport Creek winds its way through woodland and fields to the Village of Northport where it finds its way to an old Mill Pond and then to the marina at its mouth. The hospital in Northport has a National Pollutant Discharge Elimination System (NPDES) permit to discharge wastewater into the Creek. The Village of Northport is also actively discussing wastewater issues in the village where only septic tanks handle wastewater.

Kid's Creek was walked with Sarah U'Ren from its headwaters to its entry into the Boardman River (Figure 3) in Traverse City. Kid's Creek is now an urban stream surrounded and encroached upon by development. Eroded stream banks and sedimentation impair the lower stream. Extensive wetlands remain adjacent to this stream and should be protected. There is an effort by Garfield Township, private sector interests, and non-profit organizations to restore and repair the impacted and impaired portions of Kid's Creek.

Larry Quimby hosted a walk of Baker Creek (Figure 4) that flows into East Bay at its southeast corner. This starts off as a small stream that drains from the high uplands to the South and East. The wetlands just south of US-31 are exquisite and deserve protective attention. These wetlands are under intense development pressure and are only a few hundred yards from East Bay.

Summary

In 1958 the MSU Department of Resource Development's Agricultural Experiment Station completed a similar shoreline inventory for Leelanau, Grand Traverse, and Antrim Counties (Humphrys et al. 1958) that identified 'shoretypes' in each county. The shoreline in these reports was characterized by 10 descriptive categories: location, length, access, use, erosion, services, upland, bluff, and dry beach and wet beach. For Leelanau County eleven shoretypes were identified and characterized. Grand Traverse County had four shoretypes and Antrim County only one.

The shoreline inventory that was completed for the Grand Traverse Bay Watershed Planning Project is much more detailed in its field observations than the 1958 MSU study. However, the general shoreline character remains essentially similar to 1958. The changes are mostly due to increased use and human impact. A significant increase in shore hardening is evident. The building of groins and the "creation" of beaches by moving the stones into groins is another significant change. Marinas have been constructed, both public and private, with their associated dredging. With lower water levels and increasing development along shoreline areas consisting of rock and stones or coastal wetlands, there is now evidence of activity to alter the shoreline to accommodate riparian landowner desires.

The upland lots along the Leelanau shoreline are close to 100% developed, meaning there is some sort of home or business along the entire shoreline. The shoreline itself has various degrees of human disturbance, with some areas left natural. If hardening, groins, and beach altering are included in the disturbance category, certainly more than half of the shoreline would be considered disturbed.

The Old Mission Peninsula shoreline is much the same as the Leelanau. From Bowers Harbor south to Traverse City, the human impact is much more significant, probably close to 80% disturbed. The East shoreline of the Old Mission Peninsula from Old Mission Harbor south is similarly disturbed. The Antrim shoreline is the least disturbed as it is open to the westerly wind effect of Lake Michigan.

Based on anecdotal evidence from the Inland Seas Education Association and the Leelanau Conservancy, as well as from riparian owners along the bay, there appears to be a significant increase in algae growth on benthic substrates in the bay over the past 10 years. A kayak trip taken by the Baykeeper in July 2003 just north of Northport Point and in Northport Point Bay in the nearshore area revealed observations of significant carpets (or mats) of cladophora and chara growing on the substrate, especially in water deeper than 3 meters, where wave action has less of an effect. These mats are extensive, covering most of the substrate along this shoreline. When these algal mats break loose from the bottom, they create large areas of rotting organic matter on shore, in some areas a half-meter thick and extending two to three meters off shore. Causes are probably numerous, interconnected, and complex. Zebra mussels have filtered the lake water, increasing clarity and allowing light to penetrate deeper. The increased nutrients carried to the benthic layers by the zebra mussels' filter activity have effectively fertilized the benthos of the bay. The increased growth shows up as increased decaying organic matter on the shoreline.

Over one hundred small streams were observed flowing into the bay; a list of these is found in Appendix B (Figure 7). Each stream is very important to those who live near it and cumulatively important to the health of the Grand Traverse Bay. Anecdotally, these small watersheds are under intense pressure from human activity and development. They must be protected. A minimum 25-foot setback and true riparian buffer could be established to protect these streams with little impact on the development rights of the landowner. Impairments of these streams are an impairment of the bay, by small incremental acts. Protection of the riparian wetlands of the bay is equally important as is evidenced by the observed frequency of groundwater seepage into the bay. If taken cumulatively, the small streams and significant groundwater seeps are found on 70-80% of the shoreline (Figure 8).

Both land development as well as economic development place pressure on the need for small shoreline communities to properly dispose of their wastewater. The discharge of wastewater, from both failing septic systems and over-taxed treatment facilities, has the potential to dramatically degrade the water quality of the bay. Added nutrients from wastewater would increase the amount of algae and plants noted in the water, causing even more of an increase than what was noted in this survey. At this time, the Northport Point Cottage Owners' Association, the Village of Northport, and the Village of Sutton's Bay are actively pursuing solutions to their wastewater issues. However, this will continue to be an important issue for all communities along the 132-mile shoreline.

Intense development increases the amount of stormwater discharge to the bay, due to increases in impervious surfaces. Numerous stormwater discharge pipes were noted entering the bay in Traverse City, as well as significant increases in the amount of impervious surfaces covering land adjacent to the bay. Increases in impervious surfaces increase the amount of stormwater and runoff directly discharged to the bay. Stormwater may contain harmful pollutants and excessive amounts of nutrients, both of which may harm aquatic life and pose health risks. Because of this, stormwater management must be of the utmost concern for growing shoreline communities.

Conclusions

Grand Traverse Bay's shoreline remains a beautiful commons for all to treasure. Increasingly, however, this concept of a commons is being segmented into a parcel-by-parcel view of what each riparian owner envisions for the shore. Cumulatively this is shortsighted and damaging to the long-term integrity of the shoreline of the bay.

Of increasing concern is the altering of the shoreline as development occurs in the shoreline that traditionally has been less desirable for homes and cottages. These are the shoreline segments of stones, rocks and coastal wetlands or marshes. One good example is the southeast shore of the East Arm of Grand Traverse Bay. This shoreline is an integral part of the Traverse City complex of the Lake Michigan coastal wetlands, as described in Hoagman 1994. This complex comprises 184 acres of wetlands to include the Baker Creek watershed.

In the Traverse City wetland complex area, this shoreline inventory identifies six small streams and very significant groundwater seeps in an approximate one-mile stretch. The nearshore here is shallow to 1000 feet offshore, before reaching a depth of 6 feet. This shoreline's beach and nearshore feature the growth of Great Lake wetland plants such as rushes and sedges. Development pressure has begun to alter this shoreline, attempting to create "sandy" beaches. The other examples are where homes are built on a stone, rock beach and equipment is used to scrape the stony, rocky material to the side to, again, attempt to create a "sandy" beach.

The water-land interface of Lake Michigan, and in particular Grand Traverse Bay, is a very dynamic space. The shoreline changes from day-to-day, year-to-year, and decade-to-decade. We can observe this dynamic change. What human activity occurs on a small part of the shoreline affects the shoreline adjacent to it for long stretches. The cumulative effect of many shoreline-altering acts eventually affects the erosion, habitat, and water quality of the bay. If these alterations continue, the natural beauty of this resource will eventually be destroyed and we will all suffer its loss. The public must protect its right to oversee shoreline altering as proscribed by law.

"In the past many activities have been undertaken in these beach areas with little or no awareness of the dynamic, ever changing properties of a shoreline area. Use must be planned in accordance with the natural characteristics and natural changes; otherwise the user may expect problems that are not only unpleasant, but expensive," (MSU 1958 historical shoreline inventory).

Thanks to Volunteers

The Watershed Center wishes to thank the following volunteers who accompanied the Grand Traverse Baykeeper on shoreline inventory walks:

Cory Arsnoe – Antrim Conservation District
Anne Brasie – Executive Director, The Watershed Center
Mike De Agostino – Grand Traverse Resort & Spa
Jerry Dennis – Poet and Author
Anne Hansen – Office Manager, The Watershed Center
Cal Karr – Teacher
John McKinney – MSU Sea Grant
Melody Myers – Biologist, Grand Traverse Band of Ottawa and Chippewa
Larry Quimby – Resident of Baker Creek Watershed
Christine Sleeman – Biologist
Pam Smith – Botanist, Great Lakes Environmental Center
Sarah U'Ren – Project Coordinator, The Watershed Center
Phillip von Voigtlander – Northport Resident and Scientist
Heather Wilson – Antrim Conservation District
Christopher Wright – Doctoral Student, MSU Department of Agriculture

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Jay Craft – Bay Breeze Yacht Charters
Matt Heiman – Leelanau Conservancy

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Appendix A
GRAND TRAVERSE BAY WATERSHED
SHORELINE INVENTORY DATA COLLECTION FORM

MAP NAME:_____

DATE COLLECTED:_____

NAME OF SURVEYOR(S):_____

Location	(I). Near-shore Features	(II) Flora	(III) Groundwater	(IV) Public Access	(V) Human Impact	(VI) Beach	Comments

Key to data codes:

(I) Nearshore Features: 1-cladophora 2-other algae 3-macrophytes 4-silt/clay/detritus 5-sand 6-stones 7-rock

(II) Flora: 1-endangered 2-exotics

(III) Groundwater: 1-seeps 2 streams

(IV) Public Access: 1-pedestrian 2-boatlaunch 3-permanent pier 4-auto (end-of-road)

(V) Human Impact: 1-shore hardening: a-steel b-stone c-groin
2-beach altering: a-landscaping b-erosion c-raking d- clearing e-dredging
3-stormwater drainage discharge
4-private permanent pier
5-water withdrawing

(VI) Beach: 1-sand 2-stones 3-rock 4-gradual 5-bluff 6-dunes 7-algae deposition 8-wetland
9-width: a-less than 25' b-between 25'-100' c-more than 100'
10-adjacent upland: a-natural b-cultured c-paved d-bluff e-dune

Other keys:
(+) = present
(++) = abundant

sand < 1/12"
stones 1/12" – 10"
rock > 10"

Appendix B
Streams Draining Directly to Grand Traverse Bay

Antrim County		
Data Sheet	**Number of Streams**	**Location**
?	1	Elk River at Elk Rapids
ANT 6	2	Just North and South of Winters Road
ANT 8	2	South of Erickson Road
ANT 9	1	Intermittent stream North of Erickson Road
ANT 10	1	South of Croswell Road
ANT 11	1	North of private marina north of Croswell Road
ANT 12	1	North of Croswell Road
ANT 13	2	
ANT 16	2	South of Core Road
ANT 17	4	Includes Guyer Creek
ANT 18	3	
ANT 19	2	Antrim Creek, 1 stream South of Antrim Creek
ANT 20	1	At Bank Township Park Road
ANT 22	1	At Norwood
Total	**24**	

Grand Traverse County		
Data Sheet	**Number of Streams**	**Location**
GTC 1	1	
GTC 2	1	
GTC 5	2	
GTC 8	2	
GTC 10	2	
GTC 11	1	
GTC 12	1	
GTC 16	3	
GTC 28	1	
GTC 29	1	
GTC 30	2	
GTC 37	1	
GTC 40	1	Mitchell Creek
GTC 41	3	Includes Baker Creek
GTC 42	3	
GTC 43	3	Includes Acme Creek
GTC 47	1	Yuba Creek
GTC 49	2	Includes Ptobego Creek
Total	**31**	

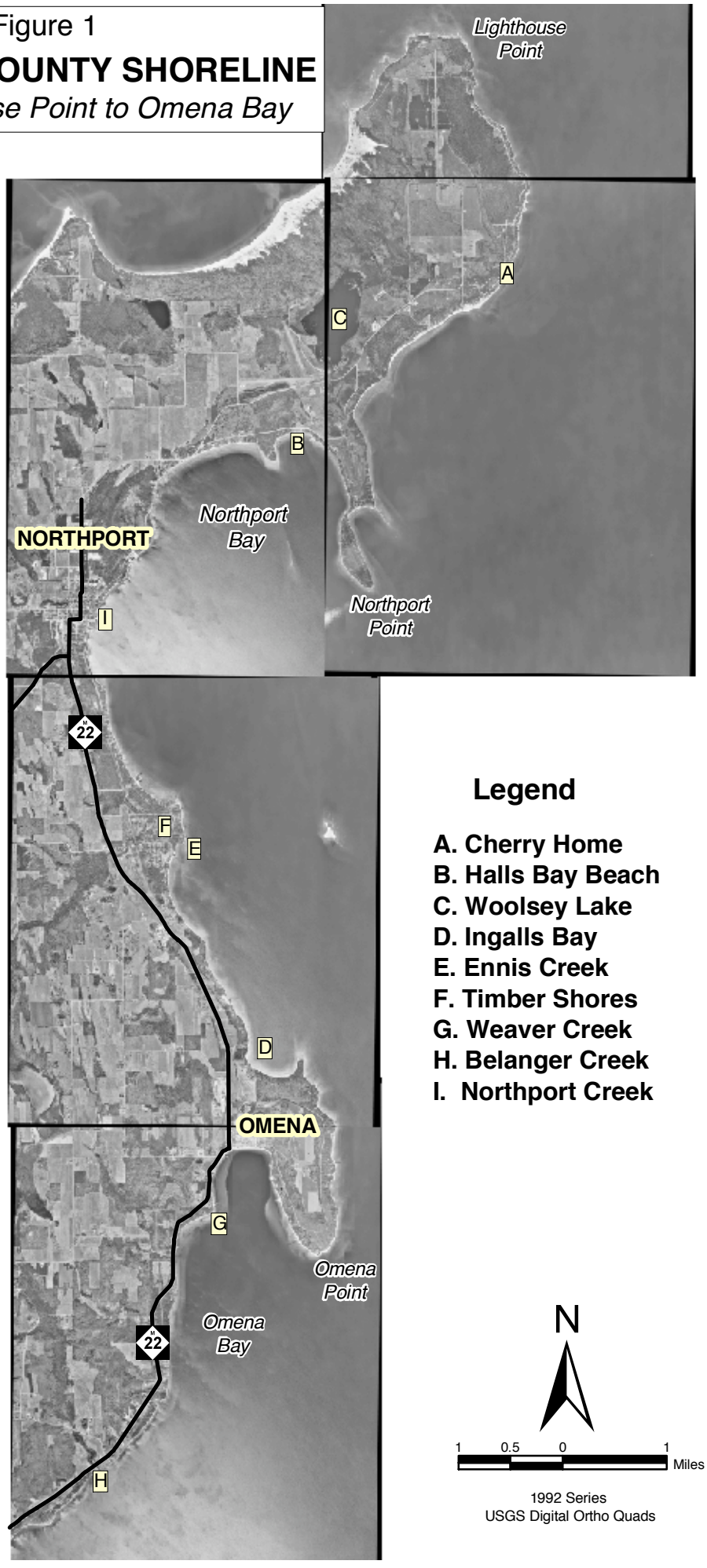
STREAMS DRAINING DIRECTLY TO GRAND TRAVERSE BAY CONT'D

Leelanau County		
Data Sheet	**Number of Streams**	**Location**
LEE 2	2	At Cherry Home
LEE 5	1	Woolsey Lake Outlet
LEE 8	2	Halls Bay
LEE 10, 11	8	Including Northport Creek, many draining wetlands West of Northshore Drive
LEE 12	4	
LEE 13	2	Including Innes Creek
LEE 14	1	
LEE 15	1	
LEE 20	2	Including Weaver Creek
LEE 21	1	
LEE 22	1	Belanger Creek
LEE 23	3	
LEE 24	2	
LEE 25	2	
LEE 26	3	
LEE 27	1	
LEE 30	6	
LEE 31	2	
LEE 32	3	
LEE 33	1	
LEE 34	1	
LEE 35	2	
LEE 36	1	
LEE 42	2	
LEE 43	3	
Total	**57**	

Figure 1

LEELANAU COUNTY SHORELINE

from Lighthouse Point to Omena Bay



Legend

A. Cherry Home
B. Halls Bay Beach
C. Woolsey Lake
D. Ingalls Bay
E. Ennis Creek
F. Timber Shores
G. Weaver Creek
H. Belanger Creek
I. Northport Creek

N

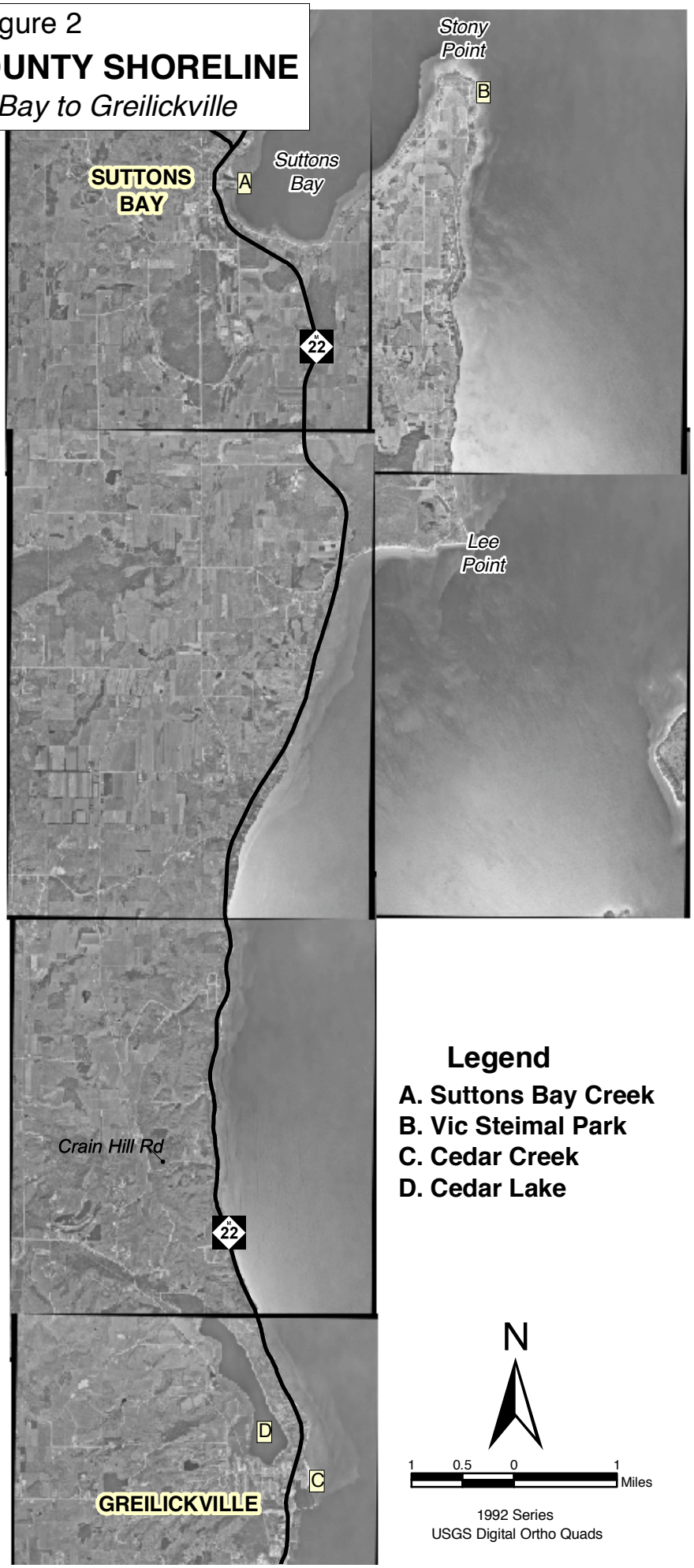
1 0.5 0 1 Miles

1992 Series
USGS Digital Ortho Quads

Figure 2

LEELANAU COUNTY SHORELINE

from Suttons Bay to Greilickville



Legend

A. Suttons Bay Creek
B. Vic Steimal Park
C. Cedar Creek
D. Cedar Lake

N

1 0.5 0 1 Miles

1992 Series
USGS Digital Ortho Quads

Figure 3

GRAND TRAVERSE COUNTY SHORELINE

Traverse City and Old Mission Peninsula

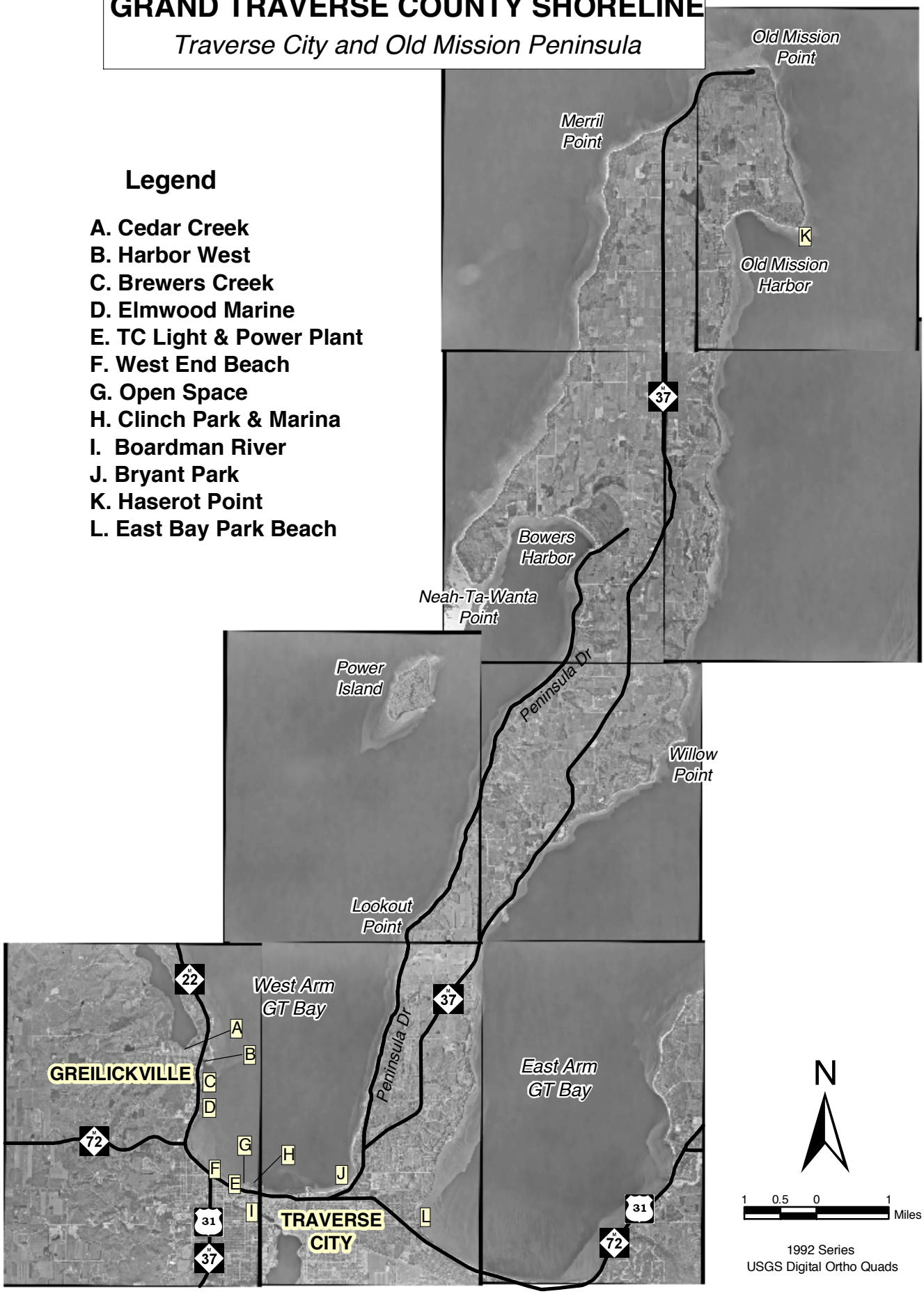


Figure 4

ANTRIM COUNTY SHORELINE

from Acme to north of Elk Rapids

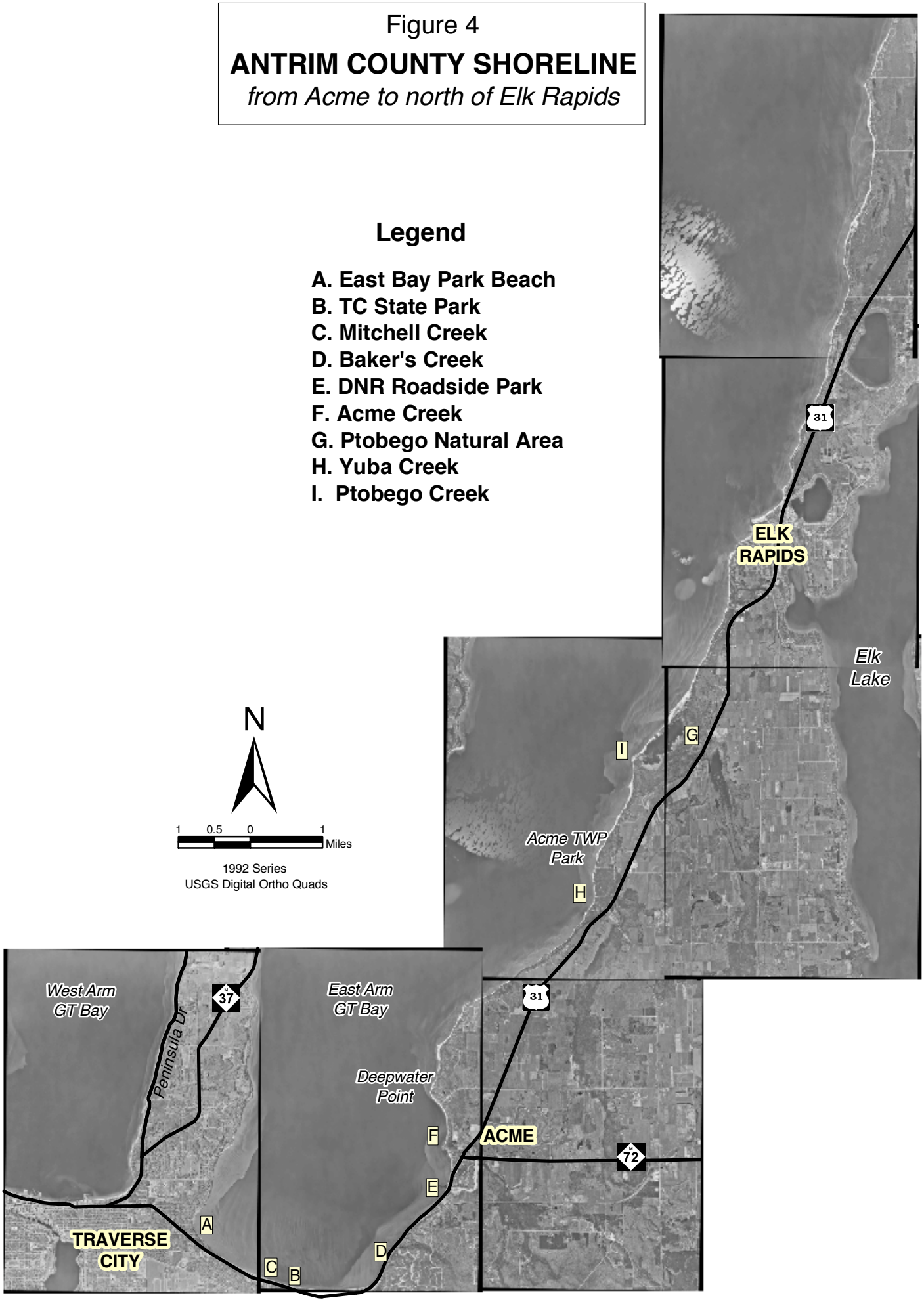
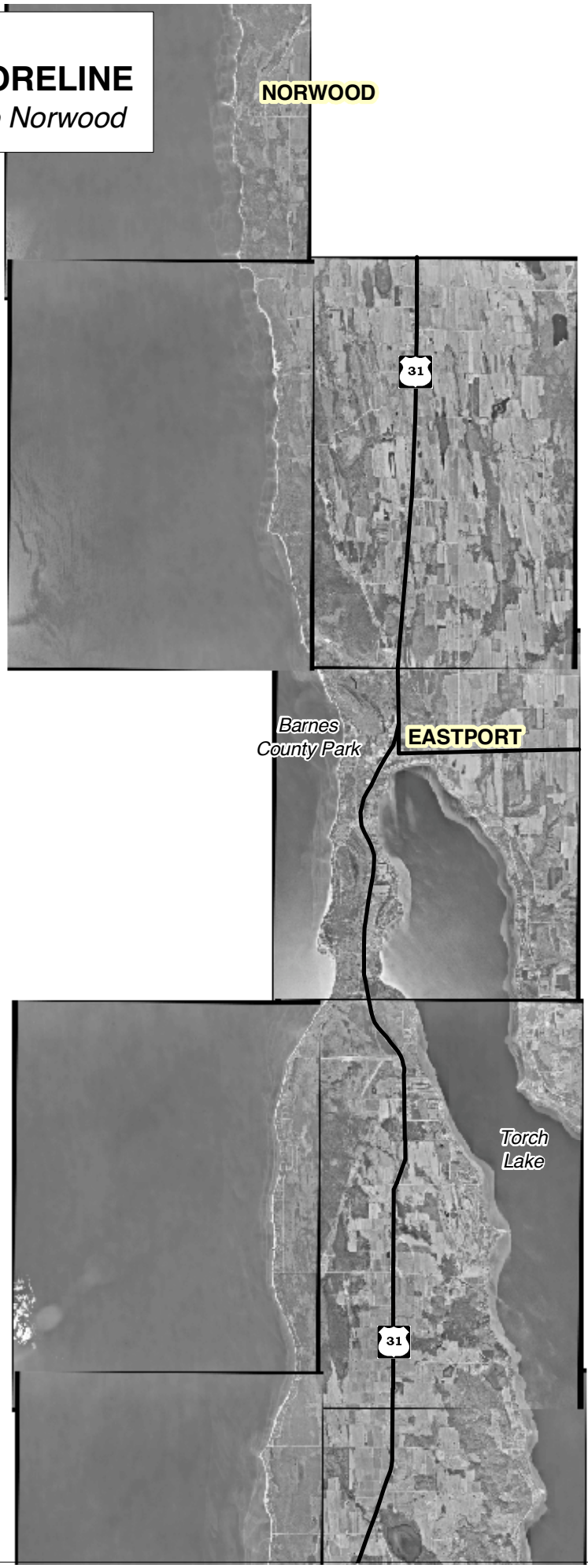


Figure 5

ANTRIM COUNTY SHORELINE

from north of Elk Rapids to Norwood



N

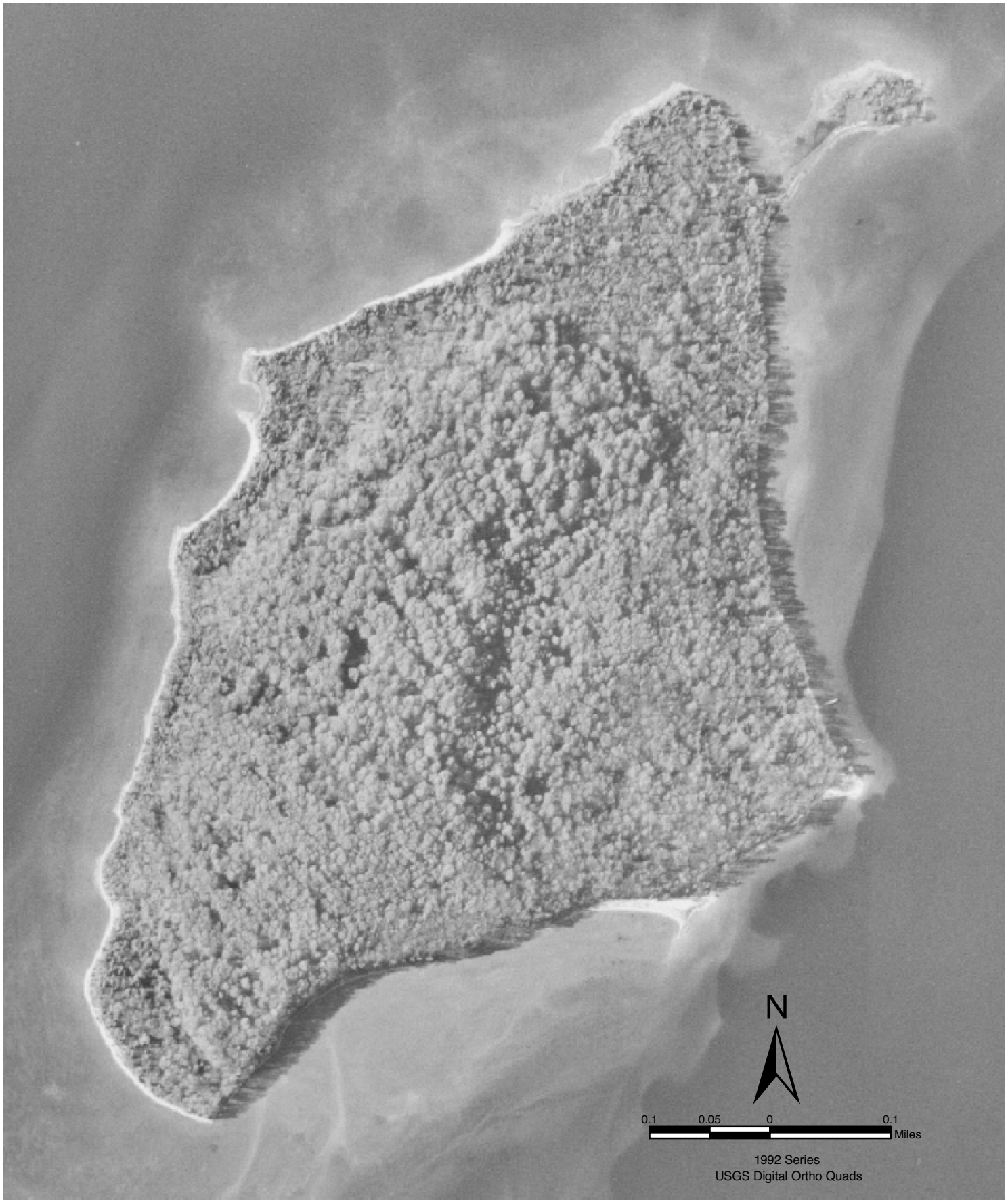
1 0.5 0 1 Miles

1992 Series
USGS Digital Ortho Quads

Figure 6

GRAND TRAVERSE COUNTY SHORELINE

Power (Marion) Island



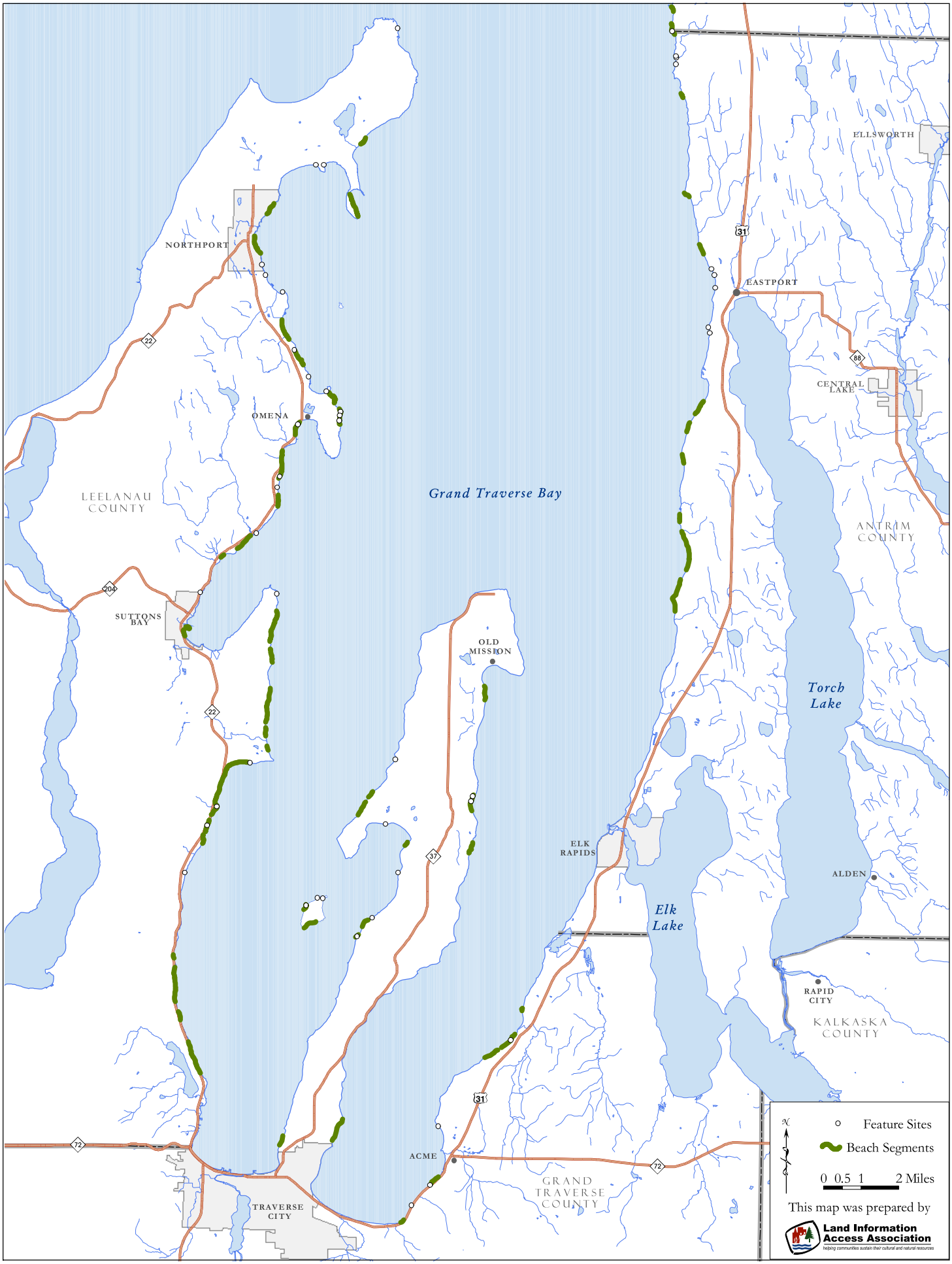


FIGURE 7: FEATURE SITES AND BEACH SEGMENTS WHERE STREAMS WERE OBSERVED ENTERING THE GRAND TRAVERSE BAY

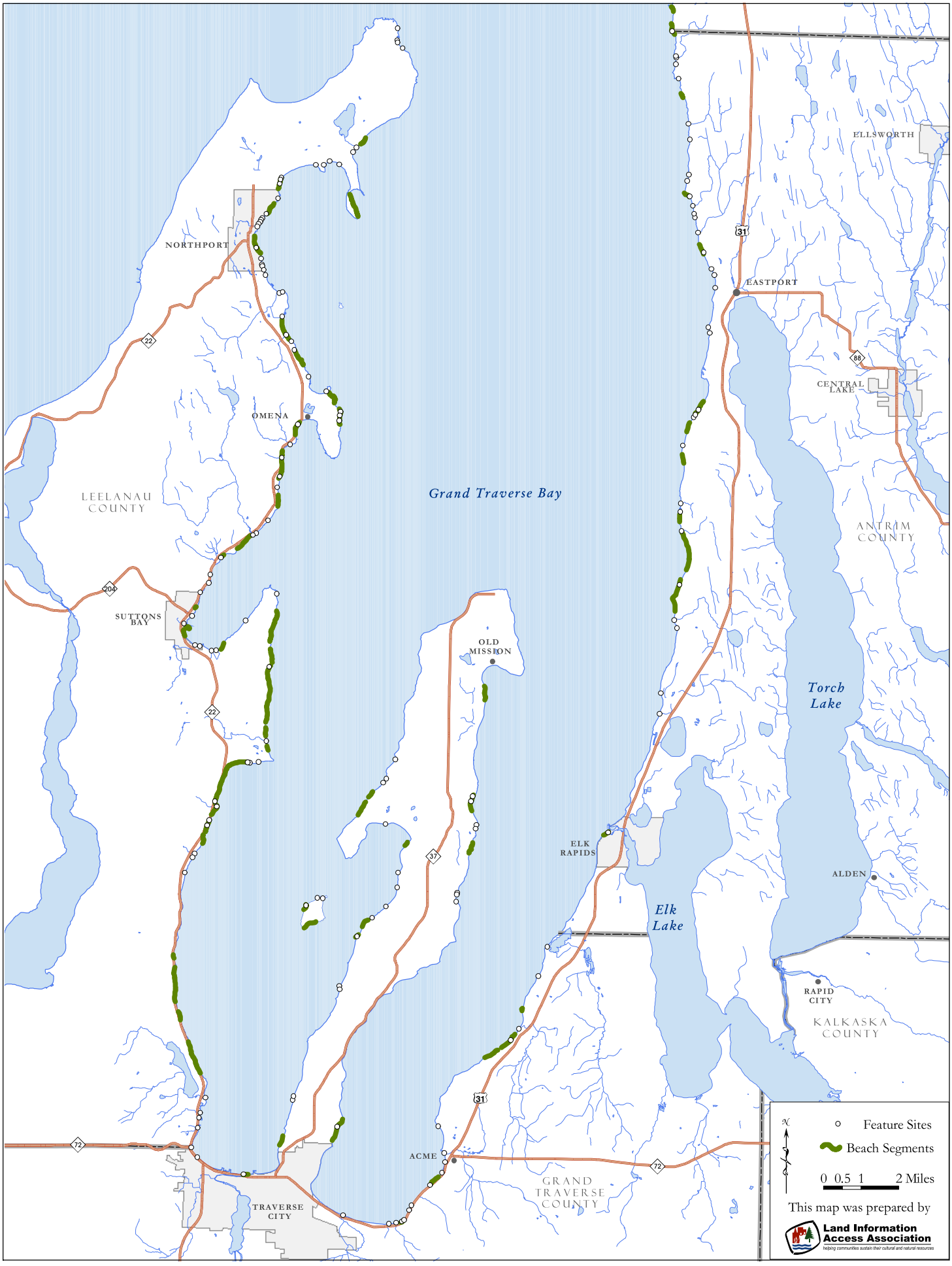


FIGURE 8: FEATURE SITES AND BEACH SEGMENTS WHERE STREAMS AND/OR GROUNDWATER SEEPS WERE NOTED