

**Greenbank Beach and Boat Club, Inc.**

**Shoreline Permit Application No. 312/16  
ICC Chapter 17.05A.110.B.7 Evaluation of Impacts  
of 2016 Boat Ramp Repair Work**

**Greenbank, Washington**

**March, 2017**

## Executive Summary

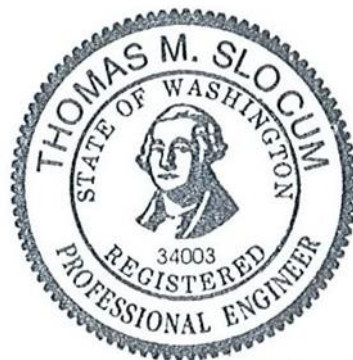
This report documents and evaluates potential and cumulative impacts associated with the repair of the existing concrete boat ramp located at the Greenbank Beach and Boat Club, Inc. (GBBC) property in Greenbank, Washington in January and February, 2016. The report is intended to address the requirements of Island County Code (ICC) Chapter 17.05A.110.B.7 as they relate to GBBC's application for Shorelines Development Permit (SDP) No. 312/16 for authorization of the boat ramp repair work.

In order to evaluate the impacts of the work on relevant considerations that are regulated by ICC, pre-project "baseline conditions" were evaluated for the physical boat ramp structure, shoreline geomorphology, ecological conditions, aesthetics and public access, and water quality and navigation. Observations of the potential impacts of the boat ramp repair work on these same ICC considerations were then measured and evaluated over the period of July 2016 to March 2017.

Of the several potential impacts that were evaluated, the most significant is a short to medium-term, partial interruption in natural sediment transport patterns from the south (up drift) to north (down drift) sides of the boat ramp. The study measured a gradual trend in the beach profiles equilibrating over time, which is expected to continue. Finally, mitigation measures for accelerating the gradual recovery of the natural beach profile are recommended, including monitoring the beach elevations relative to the boat ramp, placing gravel that is routinely cleared from the ramp onto the lowest-elevation part of the beach immediately north of the boat ramp, and potentially planning and carrying out a more aggressive beach nourishment project if natural aggradation is insufficient after three years.

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# 1. Introduction

## 1.1. Purpose and Regulatory Context

This report documents and evaluates potential and cumulative impacts associated with the repair of the existing concrete boat ramp located at the Greenbank Beach and Boat Club, Inc. (GBBC) property in Greenbank, Washington in January and February, 2016. The report is intended to address the requirements of Island County Code (ICC) Chapter 17.05A.110.B.7 as they relate to GBBC's application for Shorelines Development Permit (SDP) No. 312/16 for authorization of the boat ramp repair work (hereinafter "work").

The Island County Department of Planning and Community Development (ICPCD) identified the work as falling within the regulatory context of ICC Chapter 17.05A, Shoreline Master Program Regulations and Procedures.<sup>1</sup> Pertinent sections of the regulation include the following:

### **Chapter 17.05A.110.B Shoreline Modification Regulations – Moorage Facilities**

3. The location and design of new or replaced docks, piers, and floats, as well as the subsequent use, shall minimize adverse effects to fish, shellfish, wildlife, and water quality and shall not result in a loss of shoreline ecological function. Unavoidable impacts shall be mitigated consistent with the mitigation sequence of section 17.05A.090.C.7.

4. New or replaced docks, piers, and floats shall be located, designed, and operated so as not to interfere with rights of adjacent property owners, navigation, or adjacent water uses.

Each dock, pier, or float proposal shall be evaluated on the basis of multiple considerations, including but not necessarily limited to the potential and cumulative impacts on littoral drift, sand movement, water circulation and quality, fish and wildlife, navigation, scenic views, and public access to the shoreline and the best available background information on tidal currents, wave height, and prevailing storm wind conditions.

21. Unsafe docks, piers, and floats shall be removed or repaired promptly by the owner.

### **Chapter 17.05A.090.C Shoreline Use and Development – Environmental Protection and Critical Areas**

7. Mitigation measures shall be applied in the following sequence of steps listed in order of priority:

Avoiding the impact altogether by not taking a certain action or parts of an action;

Minimizing impacts by limiting the degree or magnitude of the action and its implementation by using appropriate technology or by taking affirmative steps to avoid or reduce impacts;

Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;

Reducing or eliminating the impact over time by preservation and maintenance operations;

Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and

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<sup>1</sup> Letter from ICPCD to GBBC, dated October 11, 2016

Monitoring the impact and the compensation projects and taking appropriate corrective measures.

## 1.2. Site Description and Work Background

The work took place on Island County Assessor's Parcel No. S7050-00-00001-0, which is owned by GBBC. The property is located on the shoreline of Holmes Harbor near the village of Greenbank. Development on the parcel includes an unpaved driveway connecting to North Bluff Road, an unpaved parking area and a concrete boat ramp. The boat ramp is used both for recreation by GBBC members and for marine emergency response by Central Whidbey Fire and Rescue. An underground stormwater drainage pipe, which originates on the adjoining parcel to the south, crosses underneath the driveway and outlets to Holmes Harbor on Washington Department of Natural Resources state-owned aquatic land (SOAL) located shoreward of GBBC's property. Figure 1 is a site plan that shows these site features. All figures are attached in Appendix 1.

The boat ramp, which was originally constructed in the late 1940s, was severely damaged by a winter storm in December 2015 and further damaged by a second storm in January 2016. Storm-related erosion undermined part of the ramp, which caused that part of the ramp to disintegrate and collapse. GBBC officers believed that the damage was likely to worsen in subsequent winter storms and could result in further unsafe conditions and negative environmental impacts to the beach, and, consistent with ICC 17.05A.110.B.21, decided it was obligated to promptly repair the damage.

In late December 2015, GBBC worked with Sound Slope and Shoreline, Inc., a local construction company specializing in shoreline work, to plan repairs for the damaged boat ramp and apply for a WDFW Hydraulic Project Approval (HPA) permit for doing the work. At the time, GBBC believed that its existing Island County Shoreline Exemption Permit No. SHE/164/14, which authorized the removal of gravel and routine maintenance and repair work on the ramp, would also cover the proposed new repair work. On January 14, 2016, WDFW issued HPA permit No. 2016-4-15+01 which authorized the installation of twelve pin pilings bolted to the ramp to keep it from collapsing further. Sound Slope and Shoreline began this work on January 14th, but was only able to install three of the pilings before the second storm interrupted the work. This storm caused further erosion under the ramp, which further damaged the concrete and caused the central part of the ramp to collapse and additional 6 to 9 inches.

At this point, GBBC decided that the pin piling work would not be effective and contracted with Puget Sound Concrete Pumping, Inc. to stabilize the ramp. Puget Sound Concrete Pumping subsequently encased the top of the existing boat ramp plus the three pin pilings in a six-inch layer of reinforced concrete and constructed an approximately 2-foot tall concrete scour wall along the north side of the lower boat ramp to protect that area from being further undermined by erosion. The work on the lower northern edge added 8 inches to the original 14-foot width of the boat ramp at that location. The work was done at night during three minus tides by constructing wooden forms, tying rebar and pumping concrete from a truck staged in GBBC's parking area. Each concrete pour hardened by the time the tide came back in. The work was completed on February 14, 2016. Figure 2 shows as-built drawings of this work and Figure 3 shows photos of the damaged ramp and the completed repair work.

## 2. Baseline Environmental Characterization

ICC 17.05A.110.B.7 identifies various environmental "considerations" that must be evaluated for permitting the construction of moorage facilities, including the permitting of GBBC's 2016 boat ramp

repair work. The following section presents an overview of “baseline” conditions for environmental considerations that are most relevant to the boat ramp repair work. The potential impact that the work had on these considerations is presented in Section 3.

### 2.1. Boat Ramp and Tidal Elevations

The Whidbey Island Conservation District (WICD) measured site features in October 2013 and again in summer 2016 to support engineering design work related to proposed improvements for drainage and fish and wildlife habitat at the GBBC property. Relevant data from WICD’s work can be used to compare site conditions both before the 2016 boat ramp repair work as well as after the completion of the work.

In the 2013 baseline condition, the boat ramp extended 100 feet from the edge of GBBC’s parking area to a natural slope break on the gravel beach. In 2013, the ground surface elevation (GSE) at the top of the ramp was 10.74’ NAVD88<sup>2</sup> and the GSE at the base of the ramp was 1.14’. The beach slope break at the bottom of the ramp represents roughly the boundary between the upper beach and the lower sand flats. The flats then slope gradually to deep water in Holmes Harbor. For reference, the Mean Higher High Water (MHHW) tide elevation at the site is estimated to be 9.38’ NAVD88 and the Mean Lower Low Water (MLLW) tide elevation is estimated to be -2.21’.<sup>3</sup> The October 2013 baseline width of the ramp was 14.0 feet. At that time, the ramp surface was approximately at grade with the beach. Figure 3 shows a view of the boat ramp in 2013.

### 2.2. Shoreline Geomorphology

The shoreline at the GBBC site is identified as lying within the long “WHID-8” sediment transport zone that runs from south to north along the west shore of Holmes Harbor (Coastal Geologic Services, 2005). Shoreline sediment movement is driven primarily by winter storms, during which the prevailing southeast winds blow up the long fetches of Homes Harbor and Saratoga Passage. Sediment deposition patterns against the original boat ramp corresponded to the prevailing south to north sediment drift pattern. Beach gravel routinely accumulated along the south (up-drift) side of the ramp and migrated over the ramp. GBBC members report that it has been their practice over many years to clear several wheel barrow loads of gravel from the ramp three or four times each year. In 2014 GBBC was issued WDFW Hydraulic Project Approval Permit No. 2014-4-427+01 and Island County Shoreline Exemption Permit No. SHE/164/14, which authorized this routine clearing of gravel from the boat ramp.

There are three artificial structures on the up-drift side of the boat ramp that are believed to potentially impact the natural movement of beach sediment along the beach, both before and after the 2016 boat ramp repairs. The historic remains of a large wharf at the seaward end of Wonn Road lie about 2200 feet south of the site. The remaining structures include a large rock groin and numerous intact log pilings. Current satellite photos clearly show how these structures interrupt sediment movement along the beach, with a large area of gravel accumulation against the south side of the groin and an accompanying large area of beach depletion on the north (down-drift) side. Starting about 900 feet south of the project site and continuing about 400 feet northward, the upper beach is armored with vertical concrete bulkhead. This bulkhead prevents natural movement of gravel into the backshore area and instead deflects it northward along the beach. Finally, the natural movement of sediment over

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<sup>2</sup> All ground and tidal elevation data in this report are referenced to the North American Vertical Datum of 1988 (NAVD88).

<sup>3</sup> Tidal datum as determined by Pacific Survey and Engineering, Inc., October 2016.

wash into the backshore area is also blocked along the last 150 feet of shoreline up-drift of the ramp by an artificial beach berm constructed along the seaward side of GBBC's parking lot. Quantification of the impact of each of these structures on the baseline geomorphology of the project site is beyond the scope of the present study, but it is believed that their cumulative effect on shoreline sediment transport through the project area is not insignificant.

The predominant sediment size class on the upper beach is gravel, which transitions to sand flats below a slope breach at approximate GSE of 1' NAVD88. An exception to the typical beach profile is a slightly elevated gravel "delta", which extends seaward approximately one hundred feet from the end of the boat ramp. It is believed that the formation and persistence of this delta is related to the hydraulic effect of stormwater discharge from an outfall pipe, which is located about 25 feet north (down drift) of lower end of the ramp. A May 2015 satellite image shows the delta extending approximately 40 feet north and south of the centerline of the outfall (Figure 4).

### 2.3. Ecological Baseline Conditions

Public comment letters that were submitted during the permit process for the 2016 boat ramp repair work identified forage fish and salmon habitat, shellfish resources and eel grass as prominent ecological considerations.<sup>4</sup> Drift wood accumulation and its effect on backshore dune ecology is a fourth key consideration. Limited available information on the pre-project baseline condition of these ecological attributes is presented below.

The beach and shallow offshore in the vicinity of GBBC's boat ramp is documented as habitat for forage fish spawning. WDFW documents surf smelt spawning on the beach and herring spawning immediately offshore. No sand lance spawning is documented in the vicinity (WDFW, 2017). Review of 2015 satellite imagery shows an approximately 2400 square foot, discontinuous patch of what appears to be eel grass located about 150 feet offshore of the boat ramp (Figure 4). but no field identification was done to verify this within the scope of the present study. The Island County Marine Resources Committee (MRC) has inventoried eel grass resources in the vicinity of the project site for the past several years, but at the present time published data on the inventory were not available for review (Ken Urstad, personal communication, 2017).

The 2005 Water Resource Inventory Area (WRIA) 6 Multi-Species Salmon Recovery Plan identifies the GBBC boat ramp site as lying in a "Tier 2" second priority area for salmon recovery efforts, targeted for protecting and restoring nearshore rearing habitat for juvenile salmonids migrating out of the Skagit and Snohomish rivers. (Island County WRAC, 2005). No field investigation of utilization of the site by salmonids was conducted within the scope of the present study.

Local residents report that clams have historically been abundant in the sand flats lying below the MLLW elevation in the vicinity of GBBC's boat ramp. One long-term resident who has dug clams along the beach for decades reported that the relative abundance of different species of shellfish, including butter clams, Manila clams, "horse" clams and cockles has varied over the years (Joan Wimmer, personal communication, 2017).

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<sup>4</sup> A summary of comments received during the public comment period is included in Appendix 2.

The beach actively recruits drift wood, which is carried above the extreme high tide line into back shore areas during winter storms. The drift wood and other wrack help to stabilize native dune vegetation in the backshore area, as well as create habitat for invertebrates on the upper beach and back shore.

#### 2.4. Aesthetics and Public Access

Before the 2016 repair work, GBBC's boat ramp was situated approximately at-grade on the beach and did not project into the line of site of the view from houses along the beach or of people walking along the beach. GBBC members and residents of adjacent home owner associations (HOAs) frequently enjoy walking the beach in the vicinity of the boat ramp. Except for the use by the members of the private HOAs, public access is not allowed to the beach.

The "baseline condition" ramp provided private recreational boat launch access for the GBBC membership. Members have access to the ramp through a locked gate on their private driveway off North Bluff Road. GBBC provides Central Whidbey Fire and Rescue with a key to the gate and allows it to use the boat ramp for marine rescue purposes. The ramp is the closest and most easily accessible ramp to the central Whidbey fire station for marine rescue purposes.

#### 2.5. Water Quality and Navigation

Public comment letters identified water quality concerns related to flooding of private, residential septic systems located in the backshore area to the south and north of GBBC's property. WICD has compiled records of the locations of several septic systems on neighboring properties and some appear to be located at elevations lying below the highest estimated tidal elevations and/or below 100-year flood elevations. Under extreme high tide and storm surge conditions, sea water can cross into the backshore area at the entrance to GBBC's boat ramp, as well as at other locations along the natural beach crest on neighboring properties to the north. Water quality impacts associated with the potential for storm surge to reach septic systems in the backshore area was not investigated as part of this study. The most direct source of potential water quality impacts associated with the baseline boat ramp was the potential for accidental leakage of small amount of fuel that is typically associated with recreational boating. Because the baseline condition of the surface of the boat ramp was approximately at grade with the beach, it did not present an obstacle to local navigation.

### 3. Potential Impacts of the Repair Work

The following discussion identifies and evaluates the potential impacts that the 2016 boat ramp repair work reasonably may have had on the baseline conditions that were identified in Section 2.

#### 3.1. Boat Ramp and Tidal Elevations

As-built conditions of the repaired boat ramp were measured in July 2016 for use in comparing changes to the baseline measurements that were completed by WICD in 2013. The 2016 repairs expanded the footprint of the "baseline" boat ramp by increasing the width of the ramp from 14'-0" to 14'-8" along the lower 66 feet of the north side of the ramp. This expansion increased the total surface area of the ramp by 3.2 percent relative to the baseline condition. The work also raised the elevation profile of the ramp by up to 8 inches relative to the baseline surface, with the surface at the top end of 2106 ramp at 11.06' NAVD88 (compared to 10.74' in the baseline condition) and the surface at the bottom end of the ramp at 1.77' (compared with 1.14' in the baseline condition). The length of the 2016 ramp did not



change from the baseline condition. Figure 2 shows as-built drawings of the 2016 repair work. Figure 3 shows a view of the ramp in July 2016.

The relative difference between the ramp surface and the beach surface immediately adjacent to the north side of the ramp is larger than the 3-inches to 8-inch increase in the ramp surface elevation. In October 2013, the north side of the ramp was approximately at grade with the beach surface. When surveyed in July 2016, the ramp surface was 18” to 24” higher than the adjacent beach grade on the north side. The reason for the difference is that the storms that damaged the ramp in the winter of 2015-2016 also eroded the beach north of the ramp. High flow from the stormwater outfall combined with strong waves created a large scour hole in the beach just north of the ramp, which led to the erosion and collapse of the boat ramp. As described in Section 3.2, below, the beach profile relative to the boat ramp surface on both the north and south sides of the ramp varies depending on particular storm or wind conditions, with a long-term trend of gradually decreasing the elevation difference between the ramp surface and the beach.

### 3.2. Shoreline Geomorphology

Three series of beach profile surveys were completed to evaluate the long-term impact of the 2016 work on the shoreline geomorphology in the vicinity of the project site. Seven beach transects were established, running from the beach crest to the natural slope break that divides the upper beach from the lower beach. The transects covered an elevation range of roughly the Ordinary High Water elevation (11.3’NAVD88) to the MLLW elevation (-2.2’). The transects were spaced laterally along the beach to bracket the boat ramp on the south (up drift) and north (down drift) sides in order to evaluate the relative effect of the boat ramp on the adjustment of the beach profile. The specific spacing of the transects is listed as follows. Transect locations are shown on the site plan (Figure 1).

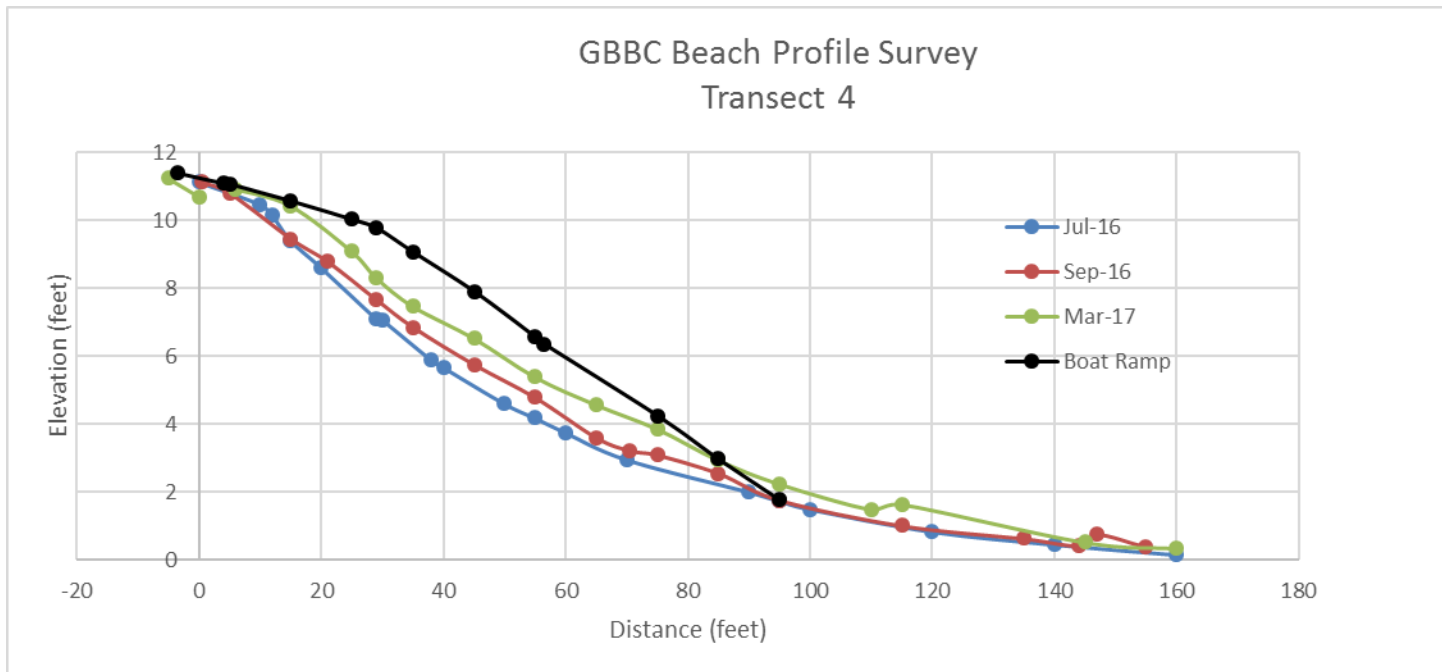
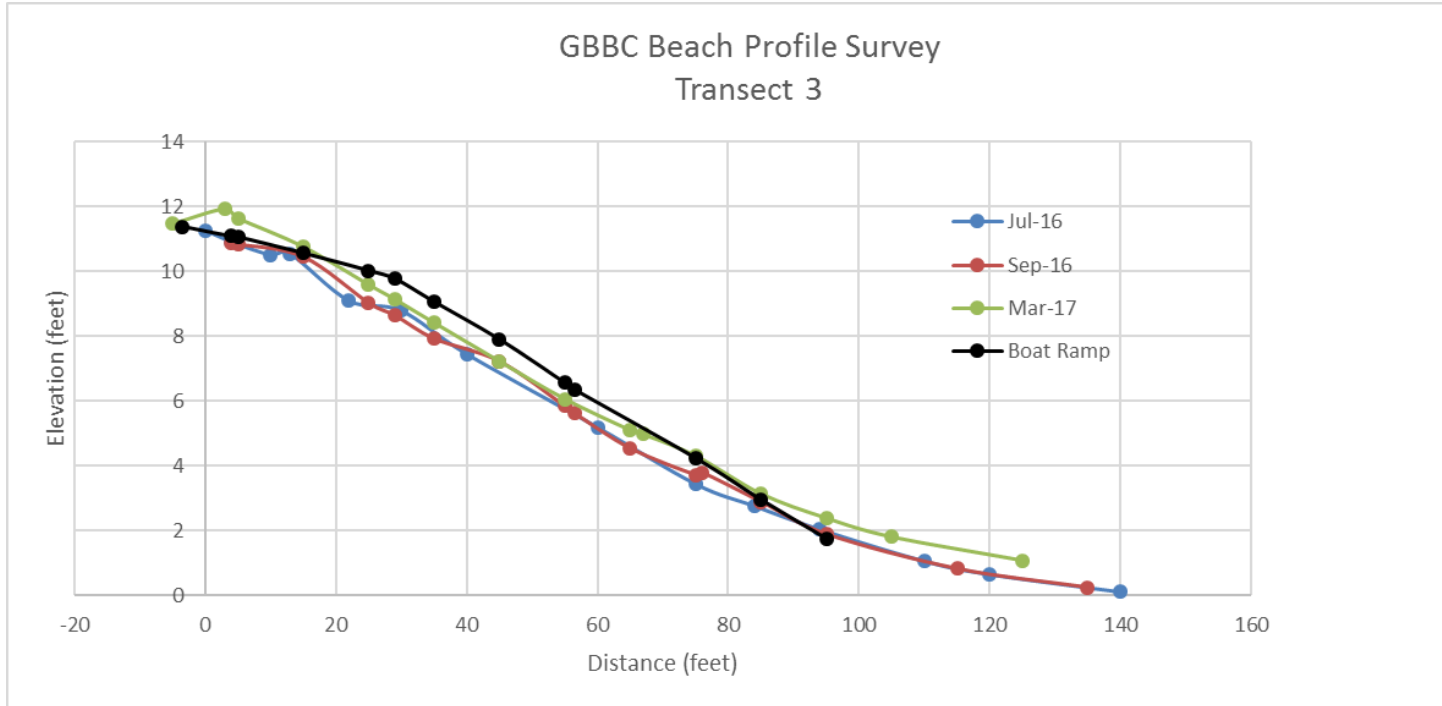
Transect No.	T1	T2	T3	T4	T5	T6	T7
Location relative to the boat ramp edges	150’ south	60’ south	South edge	North edge	50’ north	135’ north	25’ north (near the outfall)

Elevations of the beach surface were surveyed every 10 feet along each transect during three surveys. The first survey was on July 16, 2016, the second on September 28, 2016 and the third on March 30, 2017. The timing of the surveys was intended to evaluate how the beach profile adjusted during different seasons of the year. In particular, the March 2017 survey was intended to evaluate conditions following seasonal winter storms. All beach elevations were referenced to a surveyed elevation bench mark located on GBBC’s property near the top of the boat ramp.

Data points from the three surveys are plotted for each transect in Figures 5-13, with individual plots highlighted for illustration purposes in the text, below. The trend of the data plots shows relatively stable beach profiles at each of the transects between July and September 2016 with a slight increase in elevation along the south (Transect No. 3) and north (Transect No. 4) sides of the boat ramps over the summer. This increase is interpreted as reflecting a modest movement of sediment along the beach from the south to the north during the relatively calm summer months. The rate of net sediment movement during summer appears to be greater lower in the beach profile than at higher elevations on the beach: by the second set of transect surveys (September 2016), the beach surface was at grade with the lower end of the ramp on the south side, and GBBC members reported cleaning two or three wheelbarrow loads of gravel off the end of the ramp during the summer. Gravel movement was also

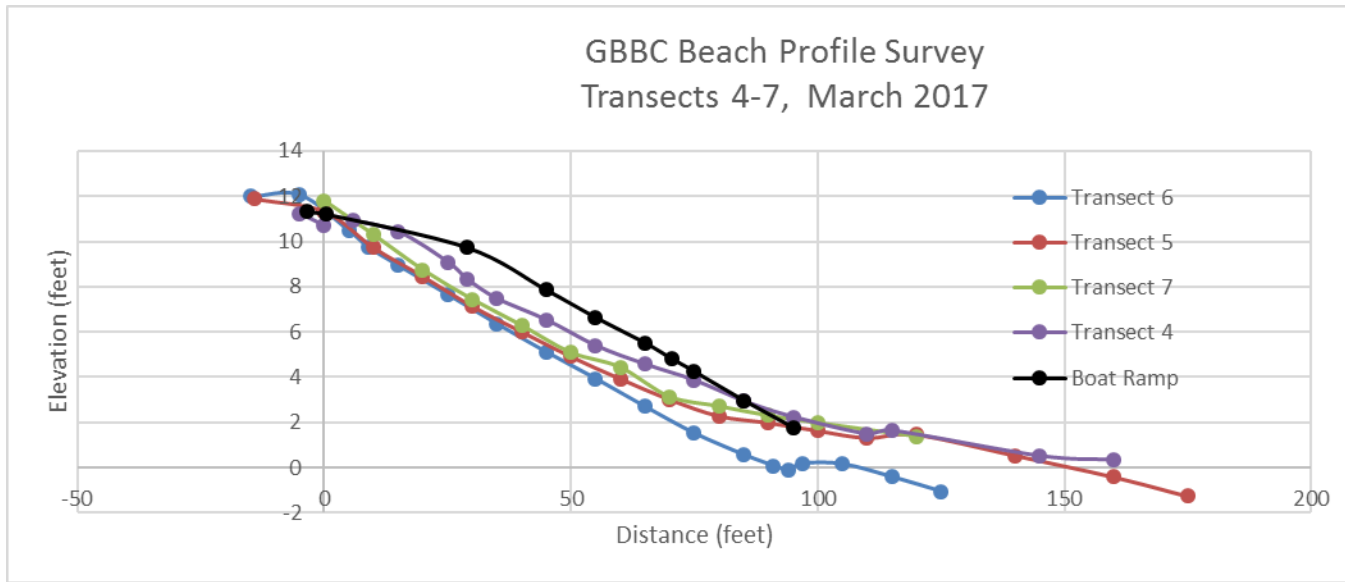
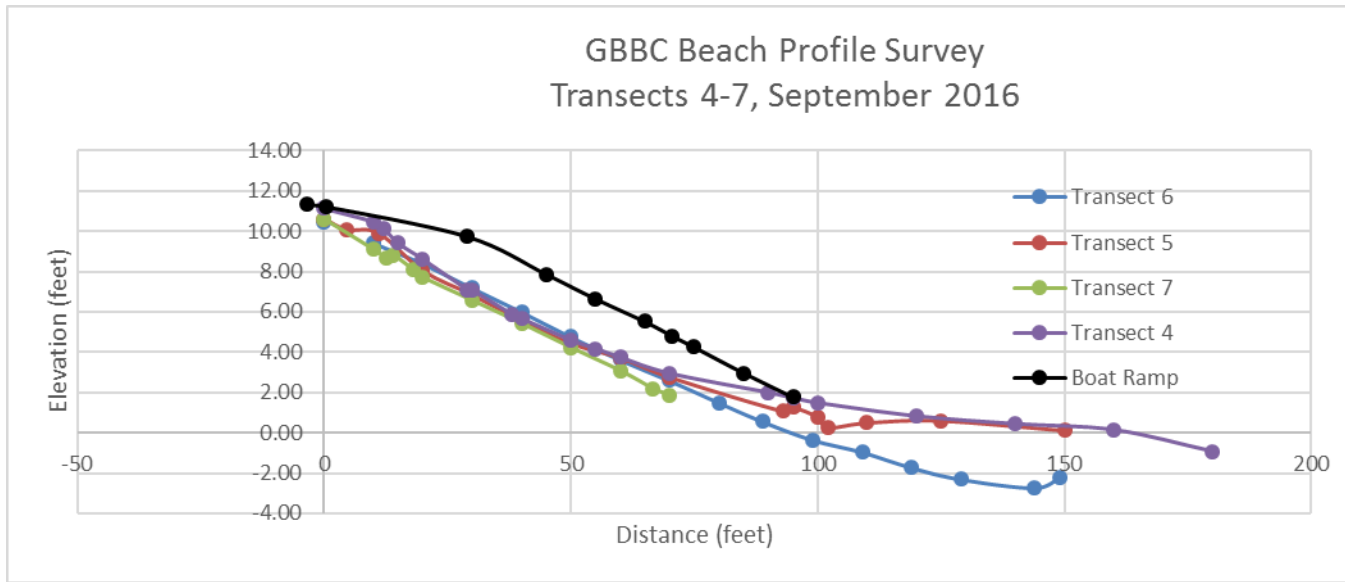
beginning to fill in the scour hole created by the stormwater outfall down-drift of the north side of the ramp.

The change in the beach profiles between July 2016 and March 2017 on the south (Transect 3) and the north (Transect 4) sides of the boat ramp is illustrated in the following two plots.



The general trend for both plots is that the beach profile gradually aggrading and filling in, relative to the ramp surface, with the maximum difference between the ramp and the beach on the south side decreasing from about one foot to about 6 inches and the difference on the north side decreasing from about 2 feet to about 18 inches. As described in Section 3.1, the beach profiles can vary with particular storm and wind conditions: for example, the greatest difference between the beach and the north side of the ramp as shown in the December 2016 photo in Figure 3 is considerably less than 18 inches, but it grew to about 18 inches in March 2017.

A similar trend of the beach profile gradually filling in can be seen in the other transects located immediately down-drift of the ramp. The two data plots below show profiles at Transects 4, 5, 6, and 7 as surveyed in September 2016 and March 2017. Over the winter, the profile at Transect 6 (the furthest west of the boat ramp) was relatively stable, while Transects 4, 5 and 7 each rose.



The trends shown in the beach profile data plots indicate that beach sediment continues to move from the south to the north along the shoreline, either around or over the boat ramp, especially during the winter storm season. Beach aggradation is greatest at the bottom of the ramp, which is consistently covered with gravel, and at the upper end of the ramp, above the MHHW elevation, where over one foot of gravel had accumulated in March 2017.

An attempt was made to evaluate relative difference in sediment coarseness between the south and the north side of the boat ramp. Beach gravel samples were collected in late summer 2016 and again in March 2017 approximately midway along Transect Nos. 2, 7, and 5. The results of standard sieve analysis are presented below:

Table 1: Grain Size Distribution August-September 2016

Transect	Grain Size Distribution (mm)			
	D <sub>15</sub>	D <sub>50</sub>	D <sub>85</sub>	D <sub>100</sub>
T2	0.9	4.8	23	42
T7	2.4	22	45	70
T5	1	9.5	34	55

Table 2: Grain Size Distribution March 2017

Transect	Grain Size Distribution (mm)			
	D <sub>15</sub>	D <sub>50</sub>	D <sub>85</sub>	D <sub>100</sub>
T2	0.7	3.0	15	28
T7	1.3	5.5	19	35
T5	0.9	2.4	15	29

The late summer 2016 gravel distribution data indicate a trend of coarsening of substrate size between “background” conditions south side of the ramp (T2) and the area immediately north of the ramp (T7, situated along the centerline of the stormwater outfall). Sediment size then becomes less coarse as the beach substrate trends toward the background condition further to the north (T5). The subsequent March 2017 data show the same trend, but with uniformly finer sediment size distribution. The finer sediment sizes may reflect general seasonal variation along the beach, but not enough data is available to discern a clear pattern. The distinct differences seen in the data for Transect 7, where the March 2017 size distribution is much finer than the late summer distribution, does however indicate a trend of finer sediment filling in the erosional area along the north side of the ramp that was caused by the stormwater outfall scour hole.

The baseline gravel “delta” feature associated with the stormwater outfall (described in Section 2.2, above) persisted in the post-construction beach transect surveys, suggesting that this feature is primarily related to the presence of the stormwater outfall, and that the 2016 boat ramp repairs did not have a significant effect on it.

### 3.3. Ecological Conditions

No information is available regarding the potential effect of the boat ramp on forage fish spawning habitat or salmonid utilization of the project site. No surf smelt spawn was observed along GBBC’s beach front in 2016, and it is unknown how long ago the spawning activity that WDFW documented in

the Greenbank vicinity actually occurred. The most recent satellite photos that show the extent of eel grass at the site date from 2015, so no satellite photo-based comparison can be made between baseline and post-project eel grass coverage at the present time. Island County MRC member Ken Urstad stated that MRC's ongoing monitoring of eel grass coverage in the vicinity of the project site has not seen a decrease in coverage (Ken Urstad, personal communication, March 2017), but at the time of writing, no published data were available to confirm this.

Statements from public comment letters that shellfish resources have been impacted have not been independently substantiated. Two local residents provided statements to GBBC to the effect that they were able to harvest their limits of clams on the sand flats at the site during summer 2016 (personal communications with Robert Monroig and Joan Wimmer, 2017). Large numbers of clam and cockle shells were observed on the sand flats and the gravel delta at the site during the March 2017 beach profile survey.

Figure 14 shows drift wood deposited on the boat ramp and back beach areas following a storm in January 2017. Drift wood accumulated as far inland as the existing old cobble dike located west of the GBBC parking area. Observations during winter of 2016-2017 indicate that drift wood continues to accumulate along the upper beach, both up drift (south) and down drift (north) of the boat ramp, in similar abundance as it did in the baseline condition (GBBC, personal communication).

### 3.4. Aesthetics and Public Access

As discussed in Section 3.1 above, the surface of the center section of the ramp currently extends about 6 inches above the beach surface on the south side and about 18 inches above the beach grade on the north side. The beach transect surveys indicate that these differences in grade are gradually diminishing over time. Figure 3 shows the ramp profile as seen from the south and north in March 2017. At the present time, the elevated ramp profile protrudes into the line of sight along the beach and also impacts beach walking access, compared with the baseline condition. The 18-inch difference in elevation between the beach and the ramp surface along the center section of the ramp on the north side is too high to easily step over, requiring beach walkers to detour as much as fifty feet up or down the beach to avoid it. In addition, a small quantity of loose quarry spall left on the beach along the north side of the boat ramp following construction is unnatural and aesthetically unattractive.

The ramp remains available for GBBC members and Central Whidbey Fire and Rescue to use for launching boats. Painted fog lines and rough-textured surface provided an improvement for boat launch access compared to the baseline condition. On the other hand, this improvement is offset by the greater risk of damage to trailers or vehicles associated with accidentally driving off the edge of the ramp, which currently is up to 18 inches above the beach grade on the north side.

### 3.5. Water Quality and Navigation

The risk of flooding of private, residential septic systems located in the backshore area to the south and north of the boat ramp site remains unchanged, compared to the baseline condition. The beach profile survey data indicate that the elevation of the natural beach crest to the north and south of the ramp is unaffected by the presence of the boat ramp, and extreme high tide/storm surge conditions continue to push sea water into the backshore area along the majority of the Greenbank shoreline, as is the natural condition. The elevation of the top of the repaired ramp is slightly higher than the baseline elevation.

(11.06' NAVD88, compared with 10.74' originally), so no higher incidence of tide/waves flowing onto the back shore at that location has been created.

Short-term, localized water quality impacts associated with the forming and curing of concrete likely occurred during construction of the ramp repairs. The raised profile of the boat ramp likely has a small, localized effect on water circulation for short durations during the tidal cycle, but otherwise is not believed to effect water quality any differently than the baseline condition ramp did. Likewise, the raised profile creates a small navigation risk for boats running along the shore to hit it, as compared with the baseline condition.

### 3.6. Summary of Project Impacts

Actual or potential impacts of the boat ramp repair work are summarized as follows.

Consideration	Actual or Potential Impact
Boat ramp and tidal elevations	<ul style="list-style-type: none"> <li>• Increased area footprint of the ramp by 3.2%</li> <li>• Raised elevation by 3" to 8", depending on location</li> <li>• Up to 18-inch difference between ramp surface and beach grade on the north side primarily due to beach erosion at the stormwater outfall during 2015-2016 storms</li> </ul>
Shoreline geomorphology	<ul style="list-style-type: none"> <li>• Ramp protrudes an average of 3" to 6" above beach grade on the up-drift (south) side, which interferes with movement of gravel northward along the upper beach. Sediment movement on the lower beach/seaward end of the boat ramp is less effected, if at all.</li> <li>• Relative effect of the ramp on sediment drift, compared with other nearby shoreline modifications (groin, bulkhead, elevated beach berm) and the 2015-2016 stormwater outfall scour hole has not been determined.</li> <li>• Successive beach profile surveys indicate the beach elevation north of the ramp is rising and substrate is becoming less coarse.</li> </ul>
Ecological conditions	<ul style="list-style-type: none"> <li>• Insufficient information on baseline forage fish, salmon and eel grass presence prevents accurate comparison of pre-project and post-project impacts.</li> <li>• Reported impacts to shell fish resources are speculative; local residents harvested clams and cockles in summer 2016 as in previous years, and large numbers of shells are present in 2017.</li> <li>• Drift wood accumulation and transport appears equivalent to baseline conditions.</li> </ul>
Aesthetics and public access	<ul style="list-style-type: none"> <li>• The ramp currently protrudes up to 18 inches above the beach on the north side, which impacts line of sight and forces beach walkers to detour around it.</li> <li>• Boat launch access to GBBC members and Central Whidbey Fire and Rescue is unchanged. Risk of damage to vehicles due to driving off the edge is increased.</li> </ul>
Water quality and navigation	<ul style="list-style-type: none"> <li>• No direct impacts to water quality, both in baseline and post-project condition</li> <li>• The raised profile of the ramp poses small increased risk of localized boat grounding, compared to baseline condition.</li> </ul>

Public comment letters that were submitted for the boat ramp repair shoreline permit application identified various other issues that were associated with the storm water outfall pipe that is located on

the beach adjacent to the boat ramp. Because these issues do not address impacts caused by the ramp repair work, they are not addressed in this report.

## 4. Proposed Mitigation of Potential Project Impacts

### 4.1. Proposed Mitigation Activities

The evaluation of actual and potential project impacts in Section 3.6 indicates that the most significant impact of the 2016 boat ramp repair work is the raising of the boat ramp surface 3 inches to 8 inches above the baseline beach surface profile. This change appears to have interfered with normal gravel movement along the upper beach, at least for the medium term until enough sediment aggrades along the landward end of the south side of the ramp to match the adjacent beach profile. Raising of the ramp profile, combined with up to two feet of erosion at the stormwater outfall during 2015-2016 winter storms, has resulted in an abrupt wall of up to 18 inches high on the north side of the ramp, which interferes with beach walking and is aesthetically unattractive.

GBBC proposes to mitigate the impact of raising the boat ramp elevation by proactively accelerating the natural rate of beach recovery at the work site. Two mitigation activities will be done, consistent with the requirements in ICC Chapter 17.05A.090.C.7. First, GBBC will take steps to reduce the impact over time by doing maintenance activities. GBBC currently has a Hydraulic Project Approval permit and a Shorelines Exemption permit that allows it to routinely clear gravel and drift logs off the boat ramp for a period of five years. Previously, GBBC members removed gravel from the ramp and placed it on the upper beach north of the ramp. At this location, the gravel generally stays in place and is not remobilized along the beach except during winter high-tide/high wave storm events. GBBC proposes to begin placing the gravel that it removes from the ramp onto the beach along the north side of the ramp where the gap between the beach and ramp surface is greatest. It is anticipated that this gravel will be spread out by waves and current and gradually fill this area in. As part of this activity, GBBC will remove exposed, loose quarry spall from the beach surface along the north side of the ramp and dispose of it at on the existing dike on its property, above the MHHW line.

Second, depending on the effectiveness of the first activity, GBBC may do additional activities to restore the beach profile adjacent to each side of the ramp. GBBC will monitor the long-term recovery of the beach by measuring the distance between the ramp surface and the beach surface along the south and north sides of the ramp for the next three years. If the measurements show that the distance is not decreasing, then it will meet with WDFW to plan and carry out a beach gravel replenishment project, per WDFW's direction.

### 4.2. Relation to the Stormwater Outfall

As discussed in Section 3.6, this report does not address impacts that the stormwater pipe located on GBBC's property may have on beach geomorphology, ecology and other relevant ICC 17.05A.110.B.7 considerations. The pipe has been in place since at least the 1940s, and no work was done on it at the time of the 2016 boat ramp repairs. Accordingly, the presence of the outfall pipe is not regulated within the scope of Shorelines Development Permit No. 312/16.

GBBC recognizes, however, that the outfall pipe effects sediment movement and other natural shoreline processes at the beach, and it is currently taking steps to improve the situation. GBBC is working with local and state agencies to plan a large-scale habitat restoration project that will include removal of the

stormwater outfall pipe and creating an open tidal connection to the lagoon and salt marsh on its property. Evaluation of potential environmental impacts and other relevant considerations will be completed in due course during the design and permitting of this project.

## 5. References

Coastal Geologic Services, 2005. Island County Feeder Bluff and Accretion Shore Form Mapping: Final Report. Prepared for: Island County Marine Resource Committee, November 30, 2005

Island County Water Resources Advisory Committee, 2005. Water Resource Inventory Area 6 (Whidbey and Camano Islands) Multi-Species Salmon Recovery Plan

WDFW, 2015. Washington State Surf Smelt Fact Sheet

WDFW, 2017. Marine Beach Spawning Fish Ecology (website URL=

[http://wdfw.wa.gov/conservation/research/projects/marine\\_beach\\_spawning/](http://wdfw.wa.gov/conservation/research/projects/marine_beach_spawning/)



## Appendix 1: Report Figures

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