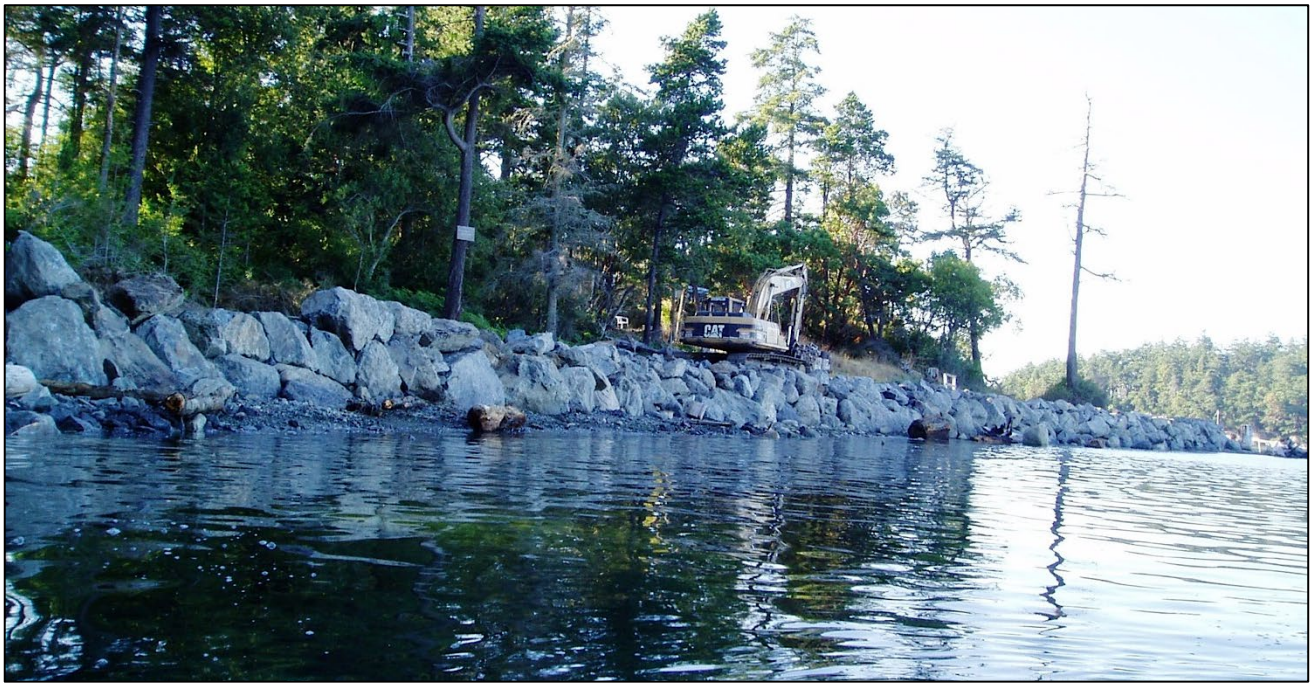
Changes in Shoreline Armoring in San Juan County, Washington, 2009–2019: *Mapping, Analysis, and Regulatory Review*



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Friends of the San Juans

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San Juan County Armor Change Analysis and Regulatory Review Project

Executive Summary

In order to provide objective data to inform shoreline management, Friends of the San Juans conducted an Armor Change Analysis and Regulatory Review Project for San Juan County. The project quantified changes in hard armoring that was constructed on marine shorelines in San Juan County from 2009 to 2019. The project then linked the on-the-ground results to permit records. The results showed an exceptionally high rate of unpermitted armor installations and minimal enforcement during a time when the impacts to nearshore and marine resources were known, regulations were strengthened, and efforts to remove harmful armoring were expanding.

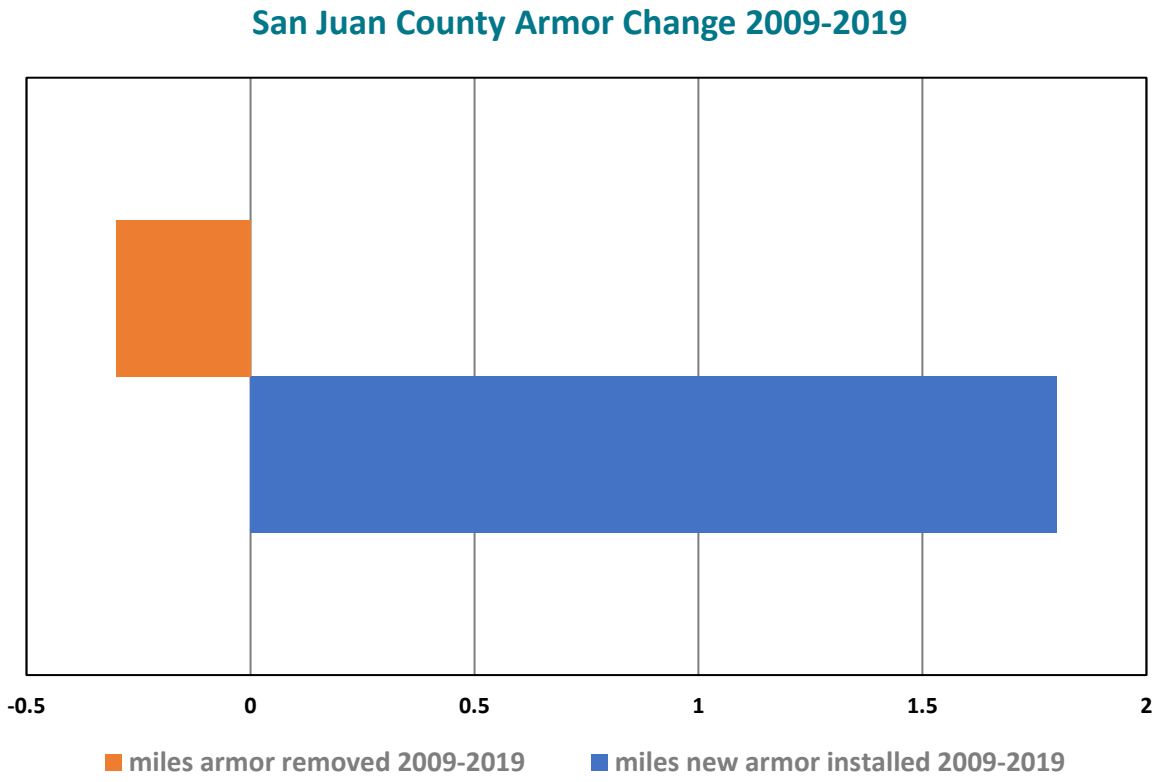
The San Juan County Armor Change Analysis and Regulatory Review Project:

- **mapped all hard armor on San Juan County shorelines in 2019;**
- **conducted a change analysis in on-the-ground armor between 2009-2019;**
- **compiled permit records to ascertain how many of the structures were permitted at the state and local level, or were subject to enforcement activity;**
- **analyzed permit application materials and processes;**
- **summarized armor application and approval requirements established under the Washington State Hydraulic Code (Code) and the Shoreline Management Act (SMA);**
- **highlighted related regional studies to identify trends and changes needed; and**
- **discussed management implications and recommendations.**

Research conducted over the past decade has significantly increased our technical understanding of the negative impacts of shoreline armoring. In response, there has been an expansion of voluntary and regulatory efforts to remove and reduce demand for armor locally and across the region. Some high-profile armor indicators have indicated that armor removal is outpacing armor installation.[1] However, those evaluations have relied solely on a review of state permit records, and assessments of actual changes on-the-ground have been limited. Friends of the San Juans' **Armor Change Analysis and Regulatory Review Project** fills that data gap for San Juan County's marine shorelines and provides up-to-date information on actual, on-the-ground armor conditions and trends as well as data on compliance and regulatory effectiveness.

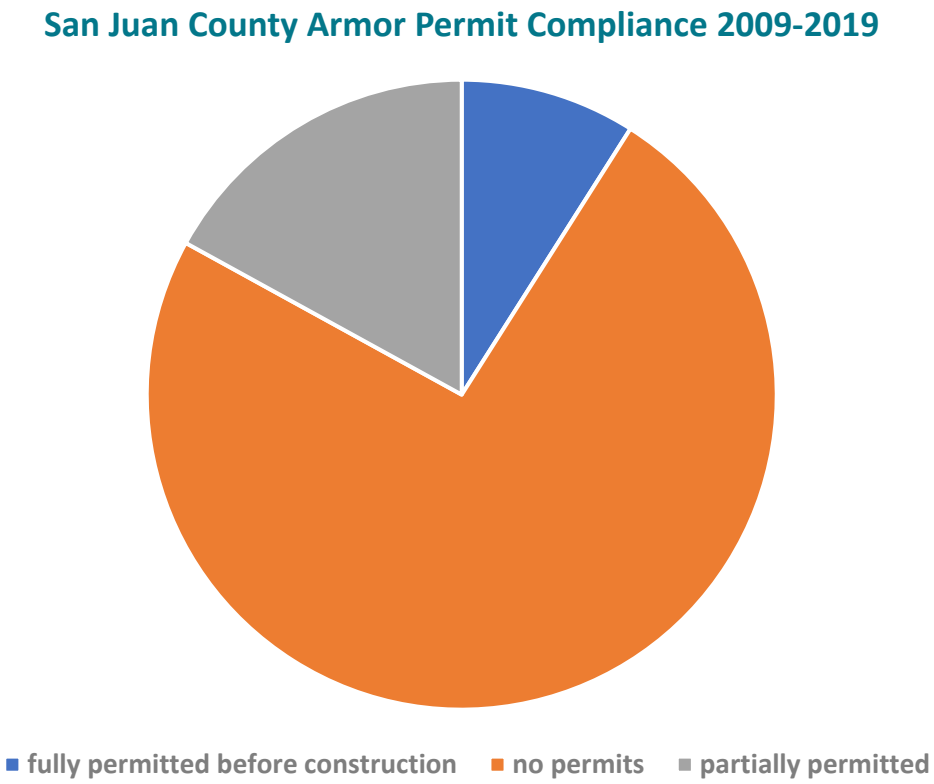
The **San Juan County Armor Change Analysis and Regulatory Review Project** found that new hard armor installation along the marine shorelines in San Juan County continues to greatly outpace armor removals, even in areas identified as priority habitats such as feeder bluffs and forage fish spawning beaches. ***Over 100 segments and 1.8 miles of new hard armor was installed between 2009 and 2019, while just 0.3 miles of armor were removed in that same period.***

[1] https://vitalsigns.pugetsoundinfo.wa.gov/VitalSignIndicator/ Habitat Strategic Initiative. 2018. Narrative. Shoreline Armoring Implementation Strategy. Washington Department of Fish and Wildlife and Washington Department of Natural Resources. https://pspwa.box.com/v/PublicIS-ShoreArmoring



Note: existing armor (present in 2009 and 2019) = 25 miles

Regulatory review results for new hard armor 2009-2019 found that 26% of new hard armor structures had one or more of the required authorizations under Washington's Hydraulic Code (Code) and Shoreline Management Act (SMA). **Just 9% of the 108 new structures installed between 2009-2019 were fully permitted prior to being constructed. 17% were partially permitted or permitted after construction as a result of enforcement. 74% had no permits at all and were also not part of any enforcement action by local or state managers.** Also, application information and permit review processes for the small amount of armor that was authorized varied widely in terms of the type and quality of the application materials, review process and permit conditions, and the tracking of outcomes with limited to no evidence of post construction site inspections or implementation of mitigation. **In three of the six cases where enforcement action did occur, armor was planned to be fully or partially removed. As of May 2022, none of these removals had taken place.**



Results of this project, along with other related research conducted across the region over the past decade, all clearly demonstrate that meaningful changes are needed to improve the effectiveness of local and state shoreline management and protection programs including:

- **interagency coordination;**
- **tracking of on-the-ground conditions;**
- **proactive compliance and enforcement efforts;**
- **improved consistency and rigor within the permit process, including inspections; and**
- **expanded education for property owners, contractors and shoreline managers.**

With over 90% of waterfront parcels in San Juan County in residential ownership, human population growth and impacts of a changing climate are expected to further increase demand for hard shoreline armoring. Having a significant commitment to improved effectiveness of protection systems in place now is essential to achieve marine ecosystem recovery and resiliency in the Salish Sea.

The importance of regulatory protection cannot be overstated if Washington is to retain what remains of its shoreline ecosystem health. Net gains in habitat quality or quantity from restoration cannot occur without regulatory programs protecting against new ecosystem impacts, including tracking unauthorized actions.

San Juan County Armor Change Analysis and Regulatory Review Project

Introduction

San Juan County includes over 400 miles of marine shorelines and diverse geology, habitats, and processes that support marine food webs and the larger marine ecosystem. Roughly two thirds of this shoreline is rocky, with the other third consisting of drift cell systems (feeder bluffs, transport zones, and accretionary beaches) and pocket beaches.[1] Twenty of the twenty-two stocks of threatened Puget Sound Chinook salmon as well as numerous Canadian stocks of Chinook rely on the nearshore marine habitats in the San Juans as important rearing and feeding habitat as they out-migrate to the Pacific Ocean.[2] Nearshore marine habitats including eelgrass, kelps, and forage fish spawning beaches all play an important role in supporting marine food webs.[3]

Shoreline armoring, including bulkheads, rip rap revetments and seawalls[4], impacts coastal processes and habitats essential to rearing juvenile salmon and their prey by directly burying beach and backshore habitat, disconnecting riparian areas and wetlands from beaches and marine waters,

[1] Whitman, T, MacLennan, A. Schlenger, P., Small, J. Hawkins, S. and J. Slocomb. 2012. Strategic salmon recovery planning for San Juan County Washington: the pulling it all together (PIAT) project. Prepared by Friends of the San Juans, Coastal Geologic Services, Confluence Environmental and Anchor QEA for the SJC Lead Entity for Salmon Recovery and the Washington State Salmon Recovery Funding Board. Final report RCO #10-1789.

[2] Beamer, E. and K. Fresh, April 2012, Juvenile Salmon and Forage Fish Presence and Abundance in Shoreline Habitats of the San Juan Islands, 2008 -2009: Map Applications for Selected Fish Species.
Teel, David, K. Fresh, A. Kagley, T. Sandell, B. Brown, D. Kuligowski, and E. Beamer. 2011.Genetic Analysis of Unmarked Juvenile Chinook Salmon in Nearshore Habitats of the San Juan Islands.
Chamberlain, J., M. Gamble, J. Connelly, J. Gardner, R. Barsh, M. O'Connell, J. Keister, D. Beauchamp, M. Schmidt, B. Beckman, and K. Warheit. 2017. Assessing early marine growth in juvenile Chinook salmon: factors affecting variability in individual growth in Northern Puget Sound.

[3] Penttila, D. 2007. Marine Forage Fishes in Puget Sound. Puget Sound Nearshore Partnership Report No.2007-03. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington.
Fresh, K.L. 2006. Juvenile Pacific Salmon in Puget Sound. Puget Sound Nearshore Partnership Report No.2006-06. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington.

[4] Puget Sound Armor Implementation Strategy. https://pugetsoundestuary.wa.gov/shoreline-armoring/

and disrupting the sediment supply and transport processes that form and maintain beaches[5] These impacts occur at the site-specific scale as well as cumulatively across shoreforms and landscapes.[6]

In 2009, Friends of the San Juans (Friends) completed a spatially explicit, boat-based inventory of modifications along San Juan County's extensive, widely distributed, and often vegetated marine shorelines. Until 2019, this constituted the only countywide mapping of shoreline armor for San Juan County. Results of the modification inventory have and continue to be applied to strategic salmon recovery planning efforts and to plan and project review by planners and managers.[7]

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[5] Schlenger, P., A. MacLennan, E. Iverson, K. Fresh. C. Tanner, B. Lyons, S. Todd, R. Carmman, D. Myers, S. Campbell and A. Wick. 2011. Strategic needs assessment: analysis of nearshore ecosystem process degradation in Puget Sound. Prepared for the Puget Sound Nearshore Ecosystem Restoration Project. Technical report No 2011-02.
Rice, C. 2006. Effects of Shoreline Modification on a Northern Puget Sound Beach: Microclimate and Embryo Mortality in Surf Smelt (Hypomesus pretiosus). Estuaries and Coasts. Vol 29, No. 1. p. 63-71.
Duffy, E., D. Beaucamp, R.M. Sweeting, R. Beamish and J. Brennan. 2010. Ontogenetic Diet Shifts of Juvenile Chinook Salmon in Nearshore and Offshore Habitats of Puget Sound. Transactions of the American Fisheries Society 139:803–823
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Puget Sound Regional Implementation Technical Team and the Puget Sound Partnership. 2012. A common framework for monitoring the recovery of Puget Sound Chinook Salmon and adapting recovery plans. NOAA technical memorandum
Friends of the San Juans. 2010. Shoreline Modification Inventory for San Juan County, Washington. Prepared for the Washington State Salmon Recovery Funding Board. Friday Harbor, WA.
Dethier, M., W. Raymond, A. McBride, J. Toft, J . Cordell, A. Ogston, S. Heerhatz and H. Berry. 2016. Multiscale impacts of armoring on Puget Sound shorelines: evidence for cumulative and threshold effects. Estuarine, Coast and Shelf Science. 175 (2016) 106-117.

[6] Dethier, M., W. Raymond, A. McBride, J. Toft, J . Cordell, A. Ogston, S. Heerhatz and H. Berry. 2016. Multiscale impacts of armoring on Puget Sound shorelines: evidence for cumulative and threshold effects. Estuarine, Coast and Shelf Science. 175 (2016) 106-117.
Sobocinski, K.L., J.R. Cordell and C.A. Simenstad. 2010. Effects of shoreline modification on supratidal macroinvertebrate fauna on Puget Sound Washington beaches. Estuaries and Coasts 33:699-711
Whitman, T., D. Penttila, K. Krueger, P. Dionne, K. Pierce Jr., and T. Quinn. 2014. Tidal elevation of surf smelt spawn habitat study for San Juan County Washington. Friends of the San Juans, Salish Sea Biological and Washington Department of Fish and Wildlife.
Dethier, M., W. Raymond, A. McBride, J. Toft, J . Cordell, A. Ogston, S. Heerhatz and H. Berry. 2016. Multiscale impacts of armoring on Puget Sound shorelines: evidence for cumulative and threshold effects. Estuarine, Coast and Shelf Science. 175 (2016) 106-117.
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Duffy, E., D. Beauchamp, R.M. Sweeting, R. Beamish and J. Brennan. 2010. Ontogenetic Diet Shifts of Juvenile Chinook Salmon in Nearshore and Offshore Habitats of Puget Sound. Transactions of the American Fisheries Society 139:803–823
Sarah M. Heerhartz, Megan N. Dethier, Jason D. Toft, Jeffery R. Cordell & Andrea S. Ogston. 2014 Effects of Shoreline Armoring on Beach Wrack Subsidies to the Nearshore Ecotone in an Estuarine Fjord. Estuaries and Coasts (2014) 37:1256-1268 DOI 10.1007/s12237-013-9754-5

[7] Whitman, T, MacLennan, A. Schlenger, P., Small, J. Hawkins, S. and J. Slocomb. 2012. Strategic salmon recovery planning for San Juan County Washington: the pulling it all together (PIAT) project. Prepared by Friends of the San Juans, Coastal Geologic Services, Confluence Environmental and Anchor QEA for the SJC Lead Entity for Salmon Recovery and the Washington State Salmon Recovery Funding Board. Final report RCO #10-1789.
Whitman, T., MacLennan, A. Schlenger, P. Rot B. 2017. Strategic Salmon Recovery Planning in the San Juan Islands:

In 2019, Friends integrated new regional armor mapping protocols and conducted a second boat-based, countywide survey of armoring on all of San Juan County's marine shorelines. Results include up to date information on the location, tidal elevation, extent, material, and condition of armor in the county. Using the 2009 survey as a baseline, Friends completed a change analysis to identify all new, existing, and removed armor for the ten-year period. Next, Friends conducted a detailed regulatory review of local shoreline and state hydraulic permits and enforcement actions for all armor identified as new between 2009 and 2019 in the change analysis. This review included an assessment of the available materials associated with the permit record for those sites that were found to be permitted, including reports and designs, permit conditions, mitigation, and permit process such as site inspections and interagency coordination.

Early sections of this report summarize methods and results for the mapping of all shoreline armor along the marine shorelines in San Juan County (2019) and the subsequent change analysis which identified new, expanded, existing, or removed armor for the period 2009 to 2019. This is followed by an exploration of the habitat impacts that hard armor causes in San Juan County. Next, the report summarizes the methods and results for investigating whether the armor documented as new by the change analysis received the applicable regulatory review and approval.

The regulatory review section includes a summary of the armor application and approval requirements established under the Washington State Hydraulic Code (Code) and the Shoreline Management Act (SMA), as well as findings from the shoreline survey and the findings from a detailed review of county and state permit records associated with new armor. The final management implications section summarizes similar studies over the last fifteen years that have uniformly reached the same conclusion: *a significant amount of shoreline armoring in the inland waters of Washington State is occurring without authorization or in sizes greater than authorized.* Lastly, the memo concludes with a discussion of potential policy and management implications from its findings, including recommendations to amend the regulations that implement the Code and SMA and to improve the implementation of existing regulations.

Data from the **San Juan County Armor Change Analysis and Regulatory Review Project** will improve understanding of actual shoreline conditions and directly inform voluntary and regulatory efforts associated with armor demand reduction, supporting adaptive management, and the improved effectiveness of existing programs.

2019 Mapping of Hard Shoreline Armoring in San Juan County

Armor Mapping Methods

The 2019 mapping effort was designed to be consistent with both the 2009 shoreline modification inventory for San Juan County[8] (and the recently developed armor mapping protocols for the Puget Sound region).[9] The primary survey method was boat-based surveys, followed by extensive desktop review of existing vertical and oblique aerial photography and ground or boat-based photos (Friends 2009 and 2019). Boat based surveys were completed for the 408 miles of marine shoreline in San Juan County excepting a small number of shallow embayments where small boat travel was infeasible. These included False Bay and Jackson's Beach lagoon on San Juan Island, Buck Bay on Orcas Island, and the inner shores of Fisherman Bay on Lopez Island. Desktop review of armor field data was consistent across all sites and included review of 2009 data and images for existing sites, as well as current and historic vertical and oblique imagery from San Juan County and the Washington Department of Ecology (Ecology).

Field Mapping Methods

Across twenty-seven boat-based and four land-based field survey days from April through June 2019, all of San Juan County's 400+ miles of marine shorelines were surveyed for the presence of shoreline armoring using standard Puget Sound Partnership (PSP) armor mapping methods.[10]

The survey used a small team of qualified mappers and equipment (binoculars, laser range finder, laptop, print versions of field forms, and digital cameras). Two of the four staff on the 2019 **San Juan County Armor Change Analysis and Regulatory Review Project** are the same lead staff (Friends and GIS/field consultant) who conducted the original 2009 surveys.[11] The project team met multiple times to review 2009 mapping methods and the 2018 PSP mapping methods and to refine 2019 field survey methods and consult with Coastal Geologic Services and King County. Multiple pre-survey field days were completed as training sessions with the full team. The boat-based survey followed standard field data collection protocols and recorded information on the following features: location and extent of armor (presence, length), material, primary development the armor was associated with (dock, beach access, road, house etc.), condition, lowest or toe elevation of the armor structure and if it was mapped in the 2009 survey or not. Map books with locations of 2009 armor results were in the boat each day and armor present in 2019 and 2009 were indicated on the field forms and confirmed following the surveys during desktop review.

The survey employed two vessels: an 18 ft. skiff and an approximately 30 ft. vessel. The vessels traveled close to shore and then approached after visual identification of an armor segment. At that

[8] Friends of the San Juans. 2010. Shoreline Modification Inventory for San Juan County, Washington. Prepared for the Washington State Salmon Recovery Funding Board. Friday Harbor, WA.
[9] MacLennan, Johannessen, J. and A. Lubeck. 2018 Armor mapping methods for the Puget Sound Region. Prepared for the Puget Sound Partnership by Coastal Geologic Services.
[10] MacLennan, Johannessen, J. and A. Lubeck. 2018 Armor mapping methods for the Puget Sound Region. Prepared for the Puget Sound Partnership by Coastal Geologic Services.
[11] Friends of the San Juans. 2010. Shoreline Modification Inventory for San Juan County, Washington. Prepared for the Washington State Salmon Recovery Funding Board. Friday Harbor, WA

point, the team of surveyors collected positional and supporting data. One person completed the hard copy of the field form and took digital photographs, another surveyor used the rangefinder to estimate length, and the third surveyor collected the GPS waypoint and entered site-specific data onto the electronic version of the field form. Field equipment included: Nikon Coolpix W300 digital camera, TruePulse 360R rangefinder, Garmin GPSMAP78s, and a standard Apple laptop with electronic data forms.

For consistency, field team members collected the same data throughout the spring and summer field survey season. Team members discussed findings as data were collected to ensure that consistent entries were made on both the hard copy and electronic field data forms, and that consistent methods were applied across the multi-month survey effort. Digital photos were taken using two devices and included both zoomed and landscape scale views. Geographic positioning system waypoints were taken to document armor presence, and armor length was estimated in the field using the range finder and then refined during desktop review based on parcel boundaries and the identification of other key visible features. Common fields were assigned for material, condition, association, and toe elevation categories using coded domains for the attributes. Image numbers were recorded on the field forms, and a notes section allowed comments on any issues with weather, equipment, visibility, etc. At the end of each field day, electronic results were downloaded and reviewed for any potential issues. See Appendix A: Armor mapping field data sheet.

Data Compilation and Review

The primary difference between the survey methods applied in 2009 and in 2019 was the addition of a laser range finder to assist with field determination of armor segment length in 2019. In 2009, length was assigned a length class, and a visual estimate of actual length was also made in the field. Subsequent desktop review of imagery and parcel boundaries was then used to refine and determine final mapped lengths, which in the vast majority of cases were easily confirmed in Geographic Information Systems (GIS) with aerial photography. Length information was considered more accurate in the 2019 survey because of the use of the laser range finder in the field as well as the availability of higher quality aerial imagery for desktop review and updated waterfront parcel boundaries on the San Juan County Assessor's parcel data layer that more closely followed the natural contours of the shoreline. As a result, the decision was made to refine lengths for all armor segments that were considered existing and unchanged, between 2009 and 2019, using the 2019 lengths. This slightly longer new 2019 "2009" armor layer was then used as the baseline for the change analysis. For more details, please see the change analysis methods description in Section Two of this report, below.

Armor present in 2009 was reviewed with 2019 results to remove all armor less than 20 feet in length from our new 2019 '2009' armor layer for consistency with the minimum mapping unit outlined in the PSP/CGS armor mapping protocols and between data layers for application in the change analysis. Please note that the original 2009 geodatabase with all original 2009 data, even for small armor segments, still exists but was not used as the basis for the change analysis. Remote review determined if the structure was unchanged in length (not expanded or new), and flagged to

assign the more accurate 2019 length. Records, including imagery for sites mapped in 2009 and not in 2019, were reviewed for consistency with 2019 methods. Twenty feet was the minimum armor length established for 2019 survey, following standard regional protocol (CGS and PSP 2018) and all 2009 armor records of less than 20 feet were removed from the 2019 geodatabase. That subset of armor segments was then reviewed against known armor removal sites (based on the existence of a restoration permit) and the remaining segments received follow-up desktop imagery review and/or follow-up field review to confirm that they were absent and not just missed in the 2019 field effort before being mapped as removed since 2009 in the 2019 armor maps.[12]

Armor Mapping and Quality Review

Data were compiled into an ARC GIS 10.1 geodatabase, with attributes assigned to each waypoint and armor segment. Because of the improved accuracy of 2019 survey methods, the 2009 armor data layer was revised to reflect more accurate length data for armor still existing in 2019. As a result, the overall length of armor present in 2009 does not exactly match the total armor length results presented for the 2009 survey in the 2010 Shoreline Modification Inventory project[13]. During the review process, 2009 data and images were carried over into the 2019 project, and relevant vertical oblique imagery used in determining change since 2009 was added to the geodatabase for that record. Armor segments were aligned with the Washington Department of Natural Resources (DNR) Shorezone shoreline dataset.[14] Standard and best practices methodologies were used in the 2019 field survey, and the ability to cross check the majority of records with 2009 survey results provided even greater confidence than survey efforts that lack such as baseline for comparison. While some very small amount of uncertainty exists due to issues with field and photo based methods such as small structures under heavy vegetation, the combination of field and desktop review, coupled with 2009 and 2019 surveys provides high confidence in results.

In the field mapping effort, individual armor segment data points were assigned to discrete (non-contiguous) segments of armor, with new unique waypoint identifiers assigned for armor with significant changes in material, condition or tidal elevation. In the development of the project geodatabase, additional segmentation was made to also align armor segments with geomorphic shoreforms, to better support future analysis into potential impacts. This desktop segmentation by shoreform retained unique identifiers for noncontiguous and different elevation armor as well.

2019 Armor Mapping Results

Armor Presence and Length

1,110 segments of armor were identified and mapped, for a total length of 26.9 miles. The minimum armor length was 20 ft., maximum length 4,074 ft., and the mean length 165 ft. Armor was present along 6% of the county's 408 miles of marine shorelines. When hard bedrock shores

[12] MacLennan, Johannessen, J. and A. Lubeck. 2018 Armor mapping methods for the Puget Sound Region. Prepared for the Puget Sound Partnership by Coastal Geologic Services.

[13] Friends of the San Juans. 2010. Shoreline Modification Inventory. For the SRFB. Friday Harbor.

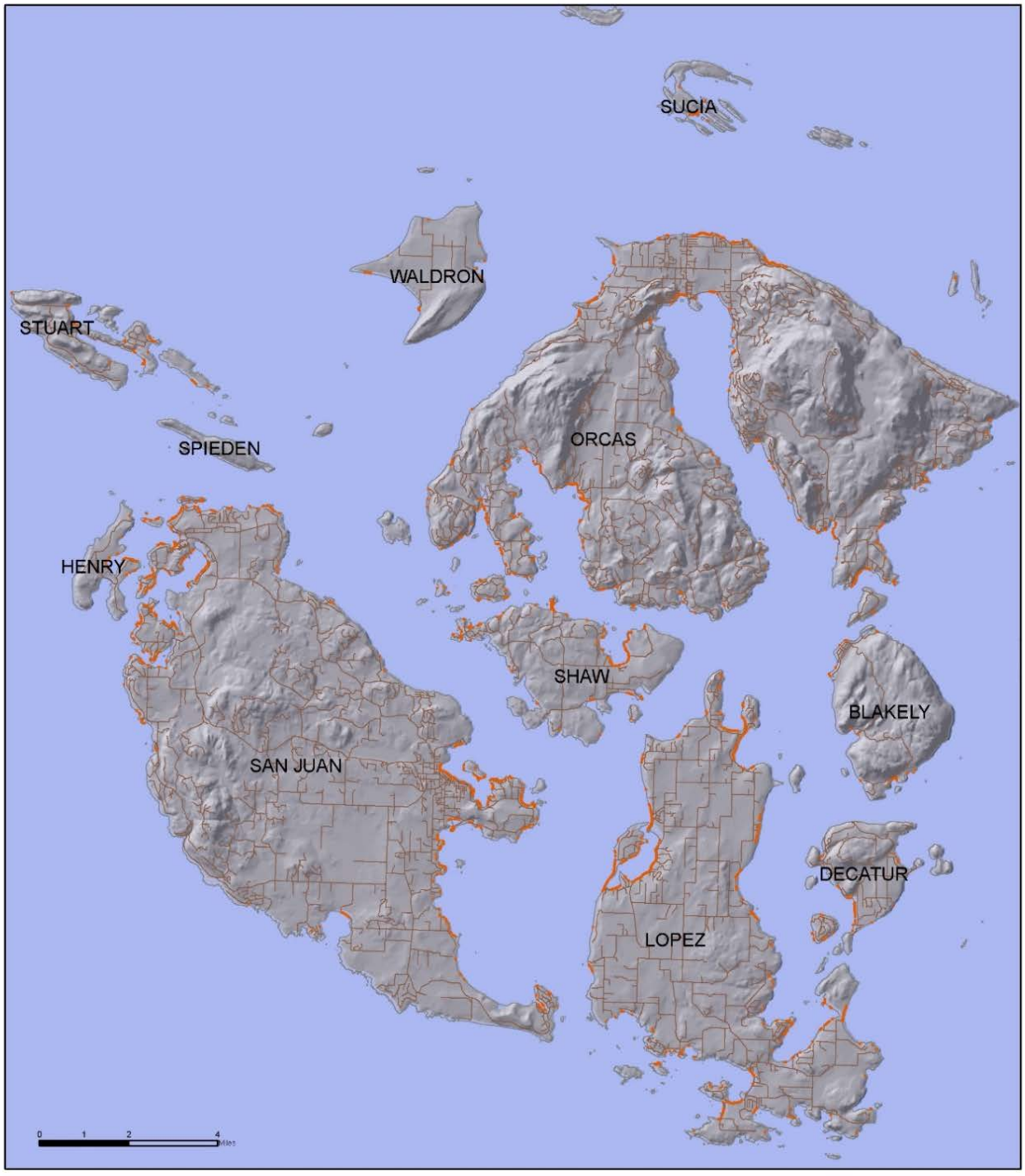
[14] Washington Department of Natural Resources. 2001. Shorezone nearshore habitat inventory. Nearshore habitat program, Olympia, WA.

are removed from the selection analysis, there are 158 miles of soft, or non-bedrock, shores in the county. of which 17% are armored. 88% of shoreline armoring length in San Juan County is located on one of the four most populated and ferry serviced islands, led by Lopez with nearly eight miles, San Juan with over seven miles, Orcas with six and a half miles and Shaw with just over two miles. The remaining three miles are located on 19 outer, or non-ferry serviced islands. Two-thirds of armor in the outer islands is located on the five largest and most populated islands of Decatur, Blakely, Stuart, Henry, and Waldron. Please see Appendix B. San Juan County armor change 2009-2019 map book.

TABLE 1 Shoreline armoring in San Juan County by island, 2019

Island	**Armor Count (segments)**	**Armor Length (miles)**
San Juan	347	7.3
Lopez	251	7.9
Orcas	240	6.5
Shaw	84	2
Ferry serviced islands subtotal	*922*	*23.7 (88% total armor)*
Henry	26	.32
Stuart	20	.42
Brown	20	.16
Blakely	19	.38
Center	15	.12
Crane	13	.16
Decatur	12	.63
Pearl	10	.1
Sucia	8	.21
Waldron	8	.19
Charles	5	.08
Barnes	2	.05
Johns	2	.15
McConnell	2	.014
Canoe	1	.01
Coon	1	.006
Finger	1	.01
Obstruction	1	.03
Posey	1	.008
Outer islands subtotal	*165*	*3.2 (12% total armor)*
Countywide results		**26.9**

Figure 1. Shoreline Armoring in San Juan County, WA 2019



Shoreline Armor in San Juan County, WA 2019

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Legend:

— All Hard Armor Present in 2019

Friends of the San Juans

Armor Association

Based on the 2019 survey, hard shoreline armoring in San Juan County consisted predominantly (78%) of bulkheads associated with residential development but 22% of armor by length is associated with shoreline roads, the majority of which are publicly managed, county roads. Understanding why armor is installed is important to the development and implementation of voluntary and regulatory programs that aim to remove armor or reduce future demand for armor. It should be noted that shoreline armoring associated with marinas was not included in this mapping effort and as a result is underrepresented in this table. In addition, armor associated with docks was included only if the armor footprint extended beyond the width of the pier where the dock intersects the shoreline.

TABLE 2 Armor association countywide, 2019

Armor Association	Percentage	Length (miles)
Bulkhead	97%	26
Beach Access	45%	12
House	30%	8.2
Road	22%	5.86
Dock*	20%	5.4
Other**	9%	2.34
Boat Ramp	5%	1.25
Stormwater Outfall	2%	1.74
Cabin	2%	0.59
Boat House	2%	0.46
Jetty	1%	0.25
Breakwater	<1%	.08
Road End	<1%	.03

Note: All relevant associations are noted, so some bulkheads are counted multiple times, resulting in a total overall percentage greater than 100%.

**Armor was only mapped associated with docks if it extended beyond the width of the pier base. Most of the approximately 500 docks in the county have some armor associated with the footprint that is not included in this armoring survey. Armor associated with marinas was not included either.*

*** This includes armor associated with marine railways, patios, hot tubs, ferry landings etc.*

Armor and Shoreforms

Pocket beaches and feeder bluffs were the shoreforms with the greatest length of armor in San Juan County in 2019, with over eight and six miles armored, respectively.

TABLE 3 Armor and geomorphic shoreforms countywide, 2019

Geomorphic Shoreform	Count (segments)	Total Shoreform (miles)	Armor Length (miles)	Shoreform Armor (%)
Artificial	14	2.6	.77	30%
Feeder Bluff	242	29	6.33	22%
Barrier (Accretionary) Beach	93	25	4.27	16%
Pocket Beach	347	48	8.33	17%
Transport Zone	171	34	3	8%
Embayment	59	17	1	6%
Bedrock Shore*	184	250	2.97	1%

** While some armor does occur on rocky shores much armor mapped as on bedrock is actually on small pocket beaches. Only pocket beaches with a minimum length of approximately 50 ft along the mean high tide line have been mapped separately as pocket beaches so many smaller sand and gravel pocket beaches are located within mapped bedrock shoreforms.*

Armor Elevation

Armor toe, or the lowest part of the structure, was calculated visually in the field in relation to tide (waterline/water level) at the time of the survey as well as visual indicators for elevation classification categories using the methods described by Coastal Geologic Services for the Puget Sound Partnership dividing elevation into: above extreme high water, ordinary high water to extreme high, mean higher high water to ordinary high, mean sea level to mean higher high water and below mean sea level.[15] Over 90% of existing hard shoreline armor in San Juan County had the toe of the structure located below the Ordinary High Water Mark (OHWM). The majority of armor segments were located above Mean Higher High Water (MHHW) but just over 40% of armor was located with the toe of the structure below MHHW where impacts to species, habitats and processes are most significant.[16] Please see appendix A. Armor mapping field data sheet for a detailed description of the tidal elevation categories.

[15] MacLennan, Johannessen, J. and A. Lubeck. 2018 Armor mapping methods for the Puget Sound Region. Prepared for the Puget Sound Partnership by Coastal Geologic Services.

[16] Dethier, M., W. Raymond, A. McBride, J. Toft, J . Cordell, A. Ogston, S. Heerhatz and H. Berry. 2016. Multiscale impacts of armoring on Puget Sound shorelines: evidence for cumulative and threshold effects. Estuarine, Coast and Shelf Science. 175 (2016) 106-117.

Whitman, T., D. Penttila, K. Krueger, P. Dionne, K. Pierce Jr., and T. Quinn. 2014. Tidal elevation of surf smelt spawn habitat study for San Juan County Washington. Friends of the San Juans, Salish Sea Biological and Washington Department of Fish and Wildlife.

Armor Material

By length, three-quarters of the armoring in the county was made of rock of various sizes. About one quarter of bulkheads were untreated wood, followed by concrete structures. Creosote wood bulkheads were the least common armor material observed.

Armor Condition

The majority of bulkheads in the county were identified as being in functioning condition, with low percentages of armor categorized as poor or failing condition. Many structures in San Juan County appeared to be designed and installed without engineering or equipment and as a result were hard to characterize using the functioning or poor condition descriptors. A category for “low quality methods or materials but not failing” was added to the survey methods. More details on armor characteristics are provided in the change analysis section of the report below.

Shoreline Armor Change Analysis for San Juan County (2009 to 2019)

Change Analysis Methods

By comparing the survey results from 2019 with those from 2009, armor segments were considered *New* in 2019 if they were not mapped in the 2009 survey and they could not be identified as existing prior to 2019 in the desktop imagery review. Images utilized in the review included boat-based survey photos from 2009 and 2019 as well as Ecology oblique aerial photographs and San Juan County vertical aerials. Sites where length was adjusted upward based on improved survey accuracy in 2019 were not included as *New*, unless desktop photo review comparing 2009 and 2019 survey and other images clearly indicated a significant extension in length.

Armor was labeled as *Existing* if 2019 and 2009 results were consistent in location, material, elevation and length; sites where length was inconsistent received photo review to determine if they should be categorized as *New* or if the difference was due to improved 2019 survey methods (please see earlier discussion of length in 2019 armor mapping methods).

Armor was considered *Removed* if it was not mapped in 2019 and was present (mapped) in the 2009 survey and it could not be located in post 2009 imagery during the desktop review. Note: Two days of quality review field surveys were conducted in 2020 to a subset of sites classified as *Removed* where there was limited quality imagery. *Removed* lengths were assigned using 2009 survey results as well as as-built design data for armor removal restoration projects for sites where it was available.

All armor segments classified as *New* or *Removed* in the initial desktop review that was conducted by the GIS analyst received a second review by Friends Science Director. Relevant images used to support the determination, including 2009 Friends San Juan County shoreline inventory photos, San Juan County vertical aerials, and Ecology Coastal Atlas oblique aerial photos, were linked into the 2019 armor mapping and change analysis geodatabase with the armor segment, along with a comment field for notes, exceeding the armor mapping protocols.[17]

The change analysis applies to increases and decreases in the *linear extent of armor*; it does not include site specific changes in height, elevation, or material of existing armor across the ten-year study period. While this site-specific level of detail was beyond the scope of this project, trends in general characteristics such as elevation, material and condition were explored by comparing *Existing* (present in 2009 and 2019) armor characteristics with *New* (present in 2019 not 2009) armor characteristics.

Using the 2009 countywide inventory of shoreline modifications as a baseline, 2019 armor mapping results were analyzed to document changes in armor over the ten-year period. Summary results include 120 segments of *New* armor (mapped in 2019 not 2009) cumulatively measuring 1.8 miles;

[17] MacLennan, Johannessen, J. and A. Lubeck. 2018 Armor mapping methods for the Puget Sound Region. Prepared for the Puget Sound Partnership by Coastal Geologic Services.

990 *Existing* (mapped in 2009 and 2019) armor segments, covering 25 miles; and 24 sites where armor was classified as *Removed* (mapped in 2009 not in 2019), cumulatively measuring 0.3 miles.

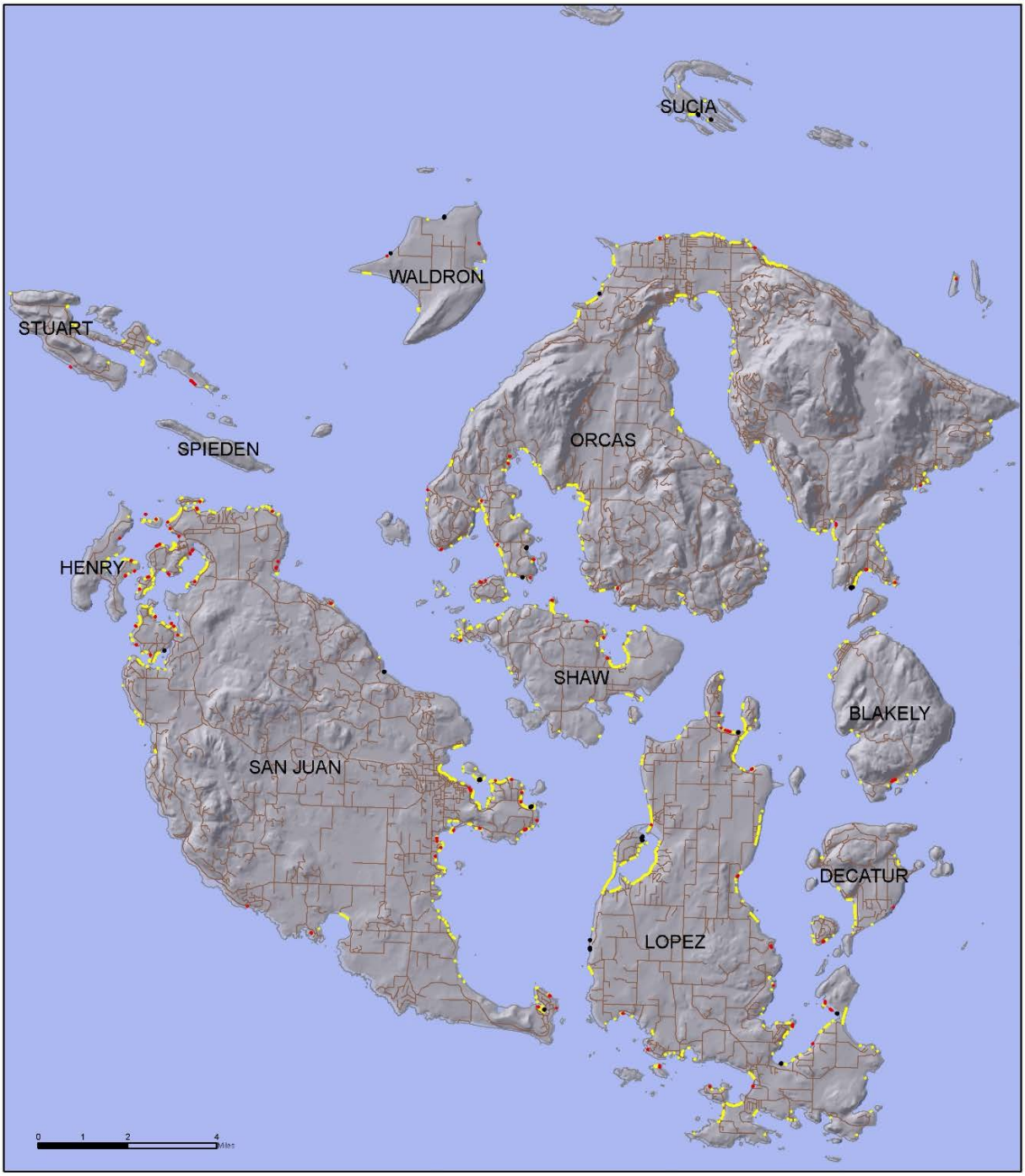
While roughly a third of the removed armor were known to have occurred during habitat restoration projects and a few large wood structures were known or were likely to have washed away, the reason for removal of remaining armor present in 2009 but not in 2019 remains unexplained. Please see Appendix B. San Juan County armor change map book for details.

Existing and new armor is concentrated on the non-bedrock, or soft shore areas of the county, with most occurring on the larger, more developed islands.

TABLE 4 Shoreline armor change analysis results, 2009-2019

Change Analysis Results 2009-2019	**Armor Count (segments)**	**Armor Length (miles)**
New (present in 2019 and not in 2009)	120	1.85
Existing (same in 2019 as in 2009)	990	25.2
Removed (not present in 2019, present in 2009)	24	-0.3
Total armor present in 2019	**1,110**	**26.9**

Figure 2. New, Existing and Removed Shoreline Armoring in San Juan County, WA 2009 to 2019



Shoreline armor in San Juan County, WA. 2019

Legend:

- Existing Hard Armor (present in 2009 and 2019)
- New Hard Armor (present in 2019 not 2009)
- Removed Hard Armor (present in 2019 not 2009)

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Armor Characteristics

Armor Elevation

Most new armor installed between 2009 and 2019 was located above Mean Higher High Water (MHHW) but below the Ordinary High Water Mark (OHWM). Most armor that was removed was located between Mean Sea Level (MSL) and MHHW.

TABLE 5 Tidal elevation of the armor toe, countywide, 2019

Tidal Elevation (armor toe)	Count (armor segments)	Length (feet)	Total
Above Extreme High Water			
New	3	200	.13 miles (< 1% of armor above EHW)
Existing	5	500	
Removed	0	-	
Ordinary High Water to Extreme High Water			
New	21	225	1.2 miles (8% of armor OHW to EHW)
Existing	121	11,550	
Removed	2	33	
Mean Higher High Water to Ordinary High Water			
New	71	6750	13.7 miles (51% of armor MHHW-OHW)
Existing	519	65,750	
Removed	0	-	
Mean Sea Level to Mean Higher High Water			
New	19	1,800	5.4 miles (20% of armor MSL to MHHW)
Existing	200	26,500	
Removed	12	1,222	
At or Below Mean Sea Level			
New	5	500	5.5 miles (20% of armor below MSL)
Existing	145	28,600	
Removed	5	238	

Armor Material

Fields for armor material were consistent with 2009 mapping and the 2018 PSP methods except for rock structures. Both the 2009 and 2019 San Juan County surveys categorized rock into large (rip rap), medium, and small size bins while the state methods utilized just one category for rock. We retained this distinction in part because of its potential application in the related regulatory review and its implications for compliance, as large rock is not typically handled by the property owner working alone, but instead indicates the engagement of professional contractors - and thus can inform the specificity of management implications.

Like existing armoring, the majority of new, expanded, and removed armor were made of rock. No new or expanded creosote wood armor was mapped between 2009 and 2019 and a small amount of creosote wood armor was removed.

TABLE 6 Armor material countywide, 2019

Armor Material	Count (armor segments)	Armor Length (feet)
Medium Rock: 20 miles		
New	73	5,881
Existing	635	98,808
Removed	7	650
Small Rock: 20 miles		
New	78	5,807
Existing	695	101,225
Removed	10	731
Large Rock/Rip Rap: 19 miles		
New	62	5,470
Existing	637	94,639
Removed	6	299
Wood: 6.6 miles		
New	36	3,422
Existing	241	31,665
Removed	9	588
Concrete: 3.3 miles		
New	11	557
Existing	125	16,680
Removed	4	397
Creosoted Wood: 0.2 miles		
New	0	-
Existing	16	1,104
Removed	1	21

Note: Totals and lengths are greater than the total number and length of bulkheads because bulkheads that are made up of more than one material are counted for each material.

Armor Condition

As would be expected, the majority of new armor installed since 2009 was found to be in functioning condition during the 2019 survey. The condition of a particular segment of armor can indicate the likelihood of a forthcoming repair or replacement, which allows that armor to be prioritized for voluntary and regulatory protection programs or potential removal. Because a significant amount of armor in the 2019 survey of San Juan County was identified as low quality

methods or materials, such as handmade gabion baskets or loosely piled small rock, we kept a separate condition category for this type of armor. Extensive experience with waterfront owners indicates that the potential to engage with landowners regarding removal or redesign may be higher due to less financial investment and/or the likelihood of failure in the short to moderate time frame when compared with larger, engineered structures.

TABLE 7 Armor condition, countywide (2019)

Armor Condition	Count (segment)	Length (miles)
Functioning as Intended, 74%		
New	77	1.05
Existing	644	18.23
Poor or Failing Condition, 3%		
New	0	
Existing	66	0.9
In-Between/Moderate, 1%		
New	1	0.02
Existing	4	0.07
Low quality materials or methods but functioning as intended, 22%		
New	42	0.75
Existing	276	5.8

Armor and Building Setback

As documented in the 2009 armor mapping effort, there was a strong relationship between the presence of hard armor and the proximity of a primary structure to the marine shoreline. As theorized, armor was associated with smaller building setbacks, with 37% of armor located at sites with primary structures located closer than 50 feet to the marine shoreline and 63% where buildings are within 100 feet. While the vast majority of armor is associated with residential development, just under 6 miles of armor (22% in total length) was located in closer proximity to roads than any structures. Less than 20% armor on developed parcels had buildings located greater than 100 feet from the marine shoreline.

Armor Elevation

The impacts of armor on marine ecology increase when the armor is lower on the intertidal beach.[18] Armor toe, or the lowest part of the structure, was calculated visually in the field and assigned to an elevation bin using the methods described by Coastal Geologic Services for the Puget Sound Partnership[19]. Over 90% of existing hard shoreline armor in San Juan County had at least the lower structure edge, or toe, located below the Ordinary High Water Mark. While the majority of armor segments were located above Mean Higher High Water, just over 40% of armor was located below MHHW where impacts to species, habitats, and processes are most significant.[20] In addition, as the majority of forage fish spawning occurs on the upper one-third of beaches, more than half of the armor in the county is potentially burying forage fish spawning habitats. Impacts to forage fish spawning substrate include direct burial and reduced egg survival from changes in beach microclimate.[21] While not quantified in this study, previous research has documented correlation between the presence of armor and the removal of shoreline vegetation, as well as reduced egg survival when there is armor due to less vegetation, wrack and large wood helping to keep the beach moist and cool.[22]

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[18] Dethier, M., W. Raymond, A. McBride, J. Toft, J . Cordell, A. Ogston, S. Heerhatz and H. Berry. 2016. Multiscale impacts of armoring on Puget Sound shorelines: evidence for cumulative and threshold effects. Estuarine, Coast and Shelf Science. 175 (2016) 106-117.
Whitman, T., D. Penttila, K. Krueger, P. Dionne, K. Pierce Jr., and T. Quinn. 2014. Tidal elevation of surf smelt spawn habitat study for San Juan County Washington. Friends of the San Juans, Salish Sea Biological and Washington Department of Fish and Wildlife.

[19] MacLennan, Johannessen, J. and A. Lubeck. 2018 Armor mapping methods for the Puget Sound Region. Prepared for the Puget Sound Partnership by Coastal Geologic Services.

[20] Dethier, M., W. Raymond, A. McBride, J. Toft, J . Cordell, A. Ogston, S. Heerhatz and H. Berry. 2016. Multiscale impacts of armoring on Puget Sound shorelines: evidence for cumulative and threshold effects. Estuarine, Coast and Shelf Science. 175 (2016) 106-117.
Whitman, T., D. Penttila, K. Krueger, P. Dionne, K. Pierce Jr., and T. Quinn. 2014. Tidal elevation of surf smelt spawn habitat study for San Juan County Washington. Friends of the San Juans, Salish Sea Biological and Washington Department of Fish and Wildlife.

[21] Johannessen, J. and A. MacLennan. 2007. Beaches and bluffs of Puget Sound. Puget Sound Nearshore Ecosystem Partnership Report No. 2007-04. Published by Seattle District U.S. Army Corps of Engineers, Seattle, WA

[22] Rice, C. 2006. Effects of Shoreline Modification on a Northern Puget Sound Beach: Microclimate and Embryo Mortality in Surf Smelt (Hypomesus pretiosus). Estuaries and Coasts. Vol. 29, No. 1. p. 63-71
Sobocinski, K.L., J.R. Cordell and C.A. Simenstad. 2010. Effects of shoreline modification on supratidal macroinvertebrate fauna on Puget Sound Washington beaches. Estuaries and Coasts 33:699-711

TABLE 8 Tidal elevation of armor toe

Tidal Elevation of Armor	Existing Armor Length (miles), (% present in 2009)	New Armor Length (miles), (% present in 2019 not 2009)	All Armor Length (miles), (% 2019 mapping results)
Above extreme high	.10 (<1%)	.02 (1%)	.12 (<1%)
Ordinary high to extreme high	2.12 (8.5%)	.28 (15%)	2.36 (9%)
Mean higher high to ordinary high	12.4 (50%)	1.3 (71%)	13.7 (51%)
Means sea level to mean higher high water	5.10 (20%)	.14 (8%)	5.24 (19.5%)
At or below mean sea level	5.34 (21%)	.09 (5%)	5.43 (20%)
Totals	**25.02**	**1.83**	**26.85**

Armor and Priority Shoreforms

Most of the just under two miles of new armor installed between 2009 and 2019 was located at pocket beaches (0.77 miles), followed by transport zones (0.50 miles), feeder bluffs (0.26 miles), barrier beaches (0.2 miles), and embayments (0.12 miles). 22% percent of feeder bluffs were already armored in San Juan County, along with 17% of pocket beaches. Both feeder bluffs and pocket beaches are positively associated with rearing juvenile chinook salmon, as well as rearing and spawning forage fish.[23] In addition, feeder bluffs provide the sediment that forms and maintains beaches well beyond their specific locations.[24] Please see Appendix B San Juan County armor change analysis map book for details.

[23] Whitman, T, MacLennan, A. Schlenger, P., Small, J. Hawkins, S. and J. Slocomb. 2012. Strategic salmon recovery planning for San Juan County Washington: the pulling it all together (PIAT) project. Prepared by Friends of the San Juans, Coastal Geologic Services, Confluence Environmental and Anchor QEA for the SJC Lead Entity for Salmon Recovery and the Washington State Salmon Recovery Funding Board. Final report RCO #10-1789.
Beamer, E. and K. Fresh, April 2012, Juvenile Salmon and Forage Fish Presence and Abundance in Shoreline Habitats of the San Juan Islands, 2008 -2009: Map Applications for Selected Fish Species.

[24] Beamer, E. and K. Fresh, April 2012, Juvenile Salmon and Forage Fish Presence and Abundance in Shoreline Habitats of the San Juan Islands, 2008 -2009: Map Applications for Selected Fish Species.

TABLE 9 Armor change analysis and priority geomorphic shoreforms, 2009-2019

2019 Armor Results	Count Armored	Total Length Shoreform (miles)	Armored Length (miles), (%)
Feeder Bluff			
New	23	-	.26
Existing	219	-	6.06
Total	**52**	**29**	**6.32 (22%)**
Pocket Beach			
New	47	-	0.77
Existing	300	-	7.5
Total	**347**	**48**	**8.27 (17%)**

Figure 3. Shoreline Armor and Feeder Bluffs, San Juan County

Shoreline armor and feeder bluffs in San Juan County, WA. 2019

Legend:

- Existing Hard Armor (present in 2009 and 2019)
- New Hard Armor (present in 2019 not 2009)
- All Feeder Bluffs

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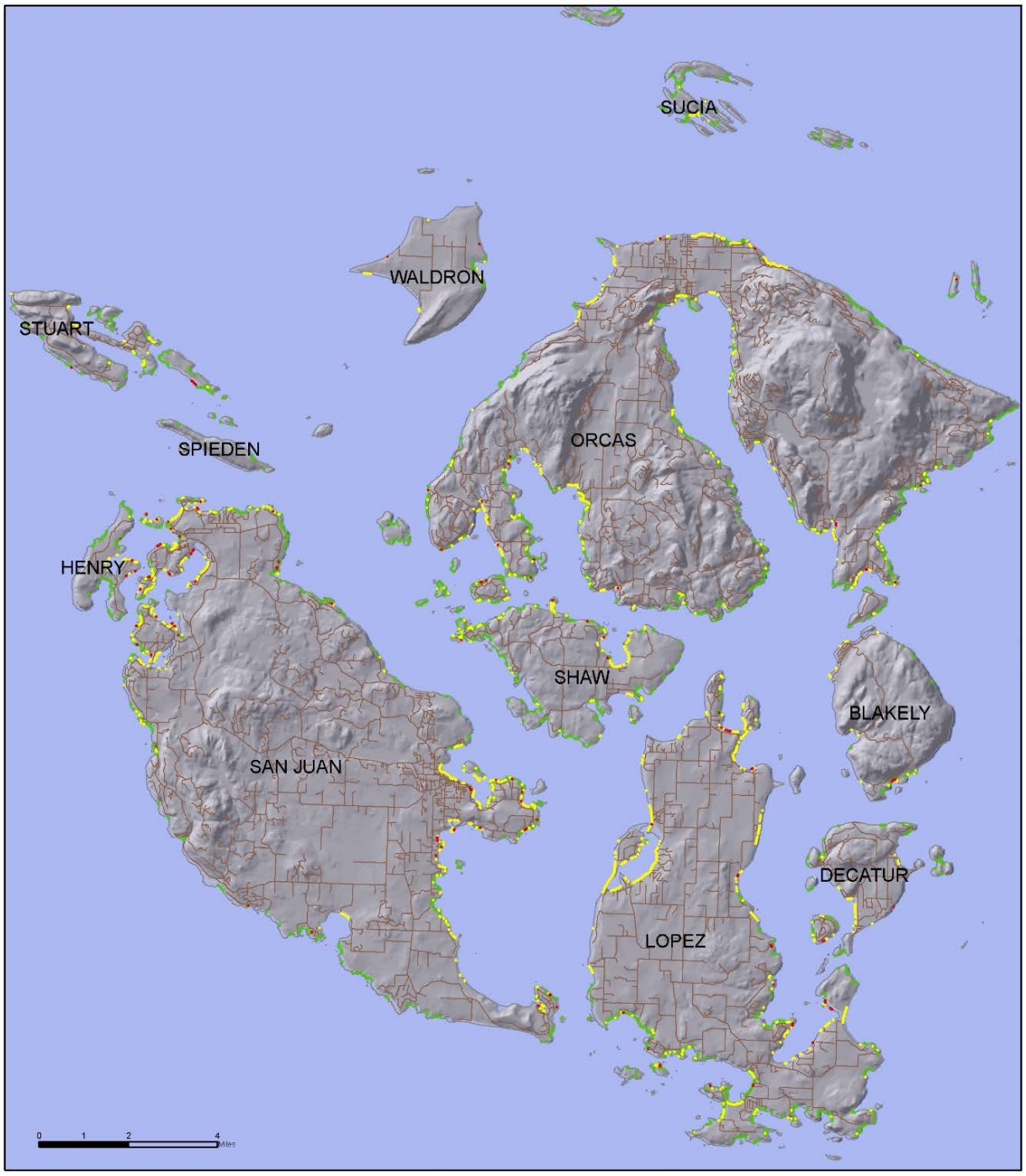
Figure 4. Shoreline Armor and Pocket Beaches, San Juan County



Shoreline armor and pocket beaches in San Juan County, WA. 2019

Legend:

- Existing Hard Armor (present in 2009 and 2019)
- New Hard Armor (present in 2019 not 2009)
- All Pocket Beaches

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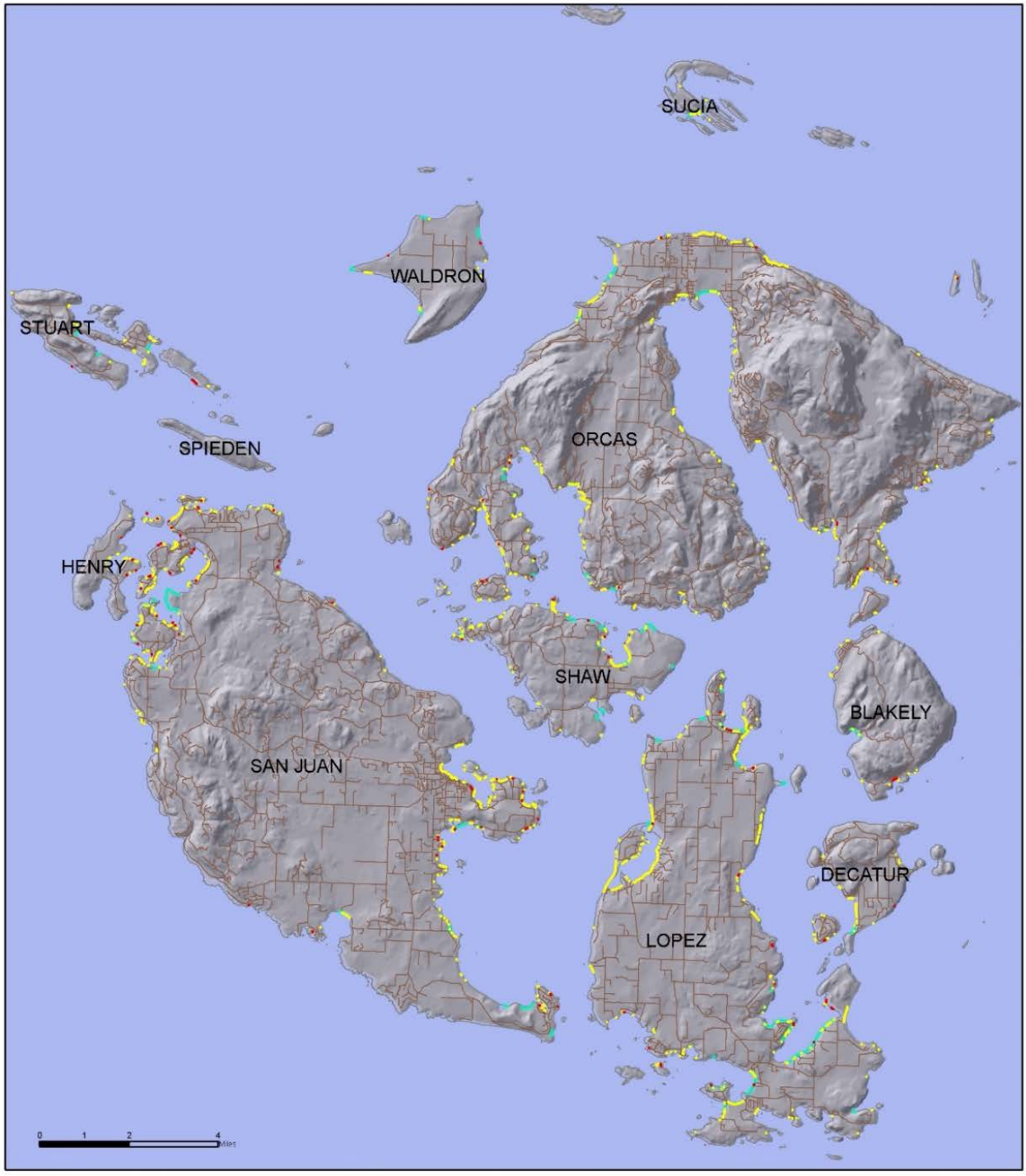
Armor and Beach Spawning Forage Fish Habitat

Over 1,000 feet of new hard armor were installed at documented forage fish spawning beaches between 2009 and 2019 while just 55 feet of armor were removed from documented spawning beaches. As of 2019, nearly one third of known forage fish spawning beaches in San Juan County were armored. Note: many additional hundreds of feet of intertidal rock cleanup have occurred in the intertidal beach at documented forage fish spawning beaches, but as these projects did not remove shoreline armor along the bank toe, these enhancement projects are not reflected in these numbers.

TABLE 10 Armor change analysis (2009-2019) and forage fish spawning beaches

Total Length Known Spawning Beaches (miles)	Total Armor, 2009 (miles)	New Armor, 2009-2019 (miles)	Total Armor, 2019 (miles), (%)
12	2.94	.19	3.13 (27%)

Figure 5. Shoreline Armor and Forage Fish Spawning Beaches in San Juan County, WA 2019



Shoreline armor and forage fish spawning sites in San Juan County, WA. 2019

Legend:

- Existing Hard Armor (present in 2009 and 2019)
- New Hard Armor (present in 2019 not 2009)
- Forage Fish Spawning Sites

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Mapping and Change Analysis Conclusions

The 2019 Armor Mapping and Change Analysis Project provides the most comprehensive and current information on shoreline armoring in San Juan County. Results improve understanding of this critical stressor, provide a high-quality baseline with detailed documentation of on-the- ground conditions as well as changes that have occurred over the past decade. Results provide an objective measure of changing conditions related to shoreline armoring, directly inform restoration and protection prioritizations, and highlight potential planning, policy, and enforcement improvements. These policy implications will be discussed further in the next sections that shares methods and findings of the regulatory review, key findings and implications and management recommendations as well as an overview of related regional studies. For a summary of the specific Code and SMA policies related to armor, please see Appendix C. State Hydraulic Code and Shoreline Management Act policies.

Regulatory Compliance and Effectiveness Review

This section discusses the permit status of the shoreline armoring constructed from 2009 to 2019 and proposes management and policy recommendations to improve the implementation of existing regulations. Several of these recommendations come from similar studies conducted in the last fifteen years that have similarly concluded that a significant amount of shoreline armoring in Puget Sound is occurring without authorization or larger than authorized. To provide context for the management and policy regulations, Appendix C offers a summary of armor application and approval requirements under the Hydraulic Code and Shoreline Management Act.[25]

Change Analysis Regulatory Review

Permit[26] Compliance Review Methods

A detailed review of all permit[18] and code violation records associated with the 120 new armor segments documented in the 2019 field survey was completed in 2021. Note: These 120 armor segments (discrete, non-contiguous lengths of armor or contiguous segments sectioned to align with geomorphic shoreforms) were located on 108 sites; in most cases, properties consisted of a single tax parcel, but in limited cases involved adjacent parcels under the same ownership. As permit records are linked to tax parcels and ownership, the subsequent regulatory review research, analysis, and results applied to these 108 sites with armor mapped as new between 2009 and 2019. The purpose of the regulatory review was to assess compliance with local and state permit requirements and provide a data driven, objective analysis of the regulatory effectiveness of existing local and state systems to manage marine shorelines. Results have been shared with local and state shoreline managers to inform the identification of management barriers and solutions.

To obtain permit records, Friends of the San Juans searched the online permit databases of San Juan County (San Juan County) and the Washington Department of Fish and Wildlife (WDFW). Formal public records requests were also made with San Juan County, the Town of Friday Harbor, and WDFW in order to obtain any information related to applications, decisions, permits and/or violations for the 108 waterfront sites identified as having new armor between 2009 and 2019. In addition to the online database review and public records requests, we reviewed Hearings Examiner and Shorelines Hearings Board decisions, past related reports and publications, and the multiple copies (pre-2005, 2005-2009, 2010-2018) of the San Juan County Land Use Permit Database we had on hand from previous related project work. Note: Due to the limited involvement of the U.S. Army Corps of Engineers in shoreline armoring cases in San Juan County during this time period as well as constraints in obtaining permit records from them in a timely manner, the regulatory compliance assessment was limited to an analysis of local (Town of Friday Harbor or San Juan County shoreline) and State (WDFW Hydraulic Project Approval) permits.

[25] While federal laws also apply to shoreline armor constructed at and seaward of the high tide line, this memorandum does not discuss applicable federal oversight because the US Army Corps of Engineers did not acknowledge until 2019 its responsibility to review armor at the higher beach elevations where most of it is constructed in the San Juans.

[26] We use the term “permit” to encompass all agency approvals, including both permits and letters of exemption.

Permit Compliance Results

The following results are based on information secured online and/or provided by San Juan County, WDFW, and the Town of Friday Harbor in response to records requests for information about the 108 newly armored sites between 2009 and 2019.

Results of the review of permit records completed in 2020 and 2021 indicated that 28 of the 108 (26%) new armor sites had at least one permit: local shoreline and/or WDFW Hydraulic Project Approval (HPA). Sixteen of the 108 (15%) new armor sites had both of the required local and state authorizations (including 2 town of Friday Harbor shoreline permits). Four sites had WDFW HPAs but no local shoreline permit and eight sites had San Juan County shoreline permits but no WDFW HPA.

Six of the 16 (38%) new armor sites with both local and state permits were after the fact authorizations that resulted from violations. Of these six, three are slated to be removed but still in the permitting process for removal' as of May 2022, two were authorized with some level of mitigation and/or design changes, and one was authorized to remain as built after-the-fact. **This means that just 10 of the 108 (9%) sites with new armor 2009-2019 requested and received authorization from local and state regulators prior to construction of the shoreline armoring.**

TABLE 11 Permit records for 108 sites with shoreline armoring mapped as new, 2009-2019

Permits	Count	Percent
Sites with no permits	80	74%
Sites with 1 local or state permit	28	26%
Sites with both local and state permits	16	15%
Sites with both local and state permits secured prior to armor installation	10	9%

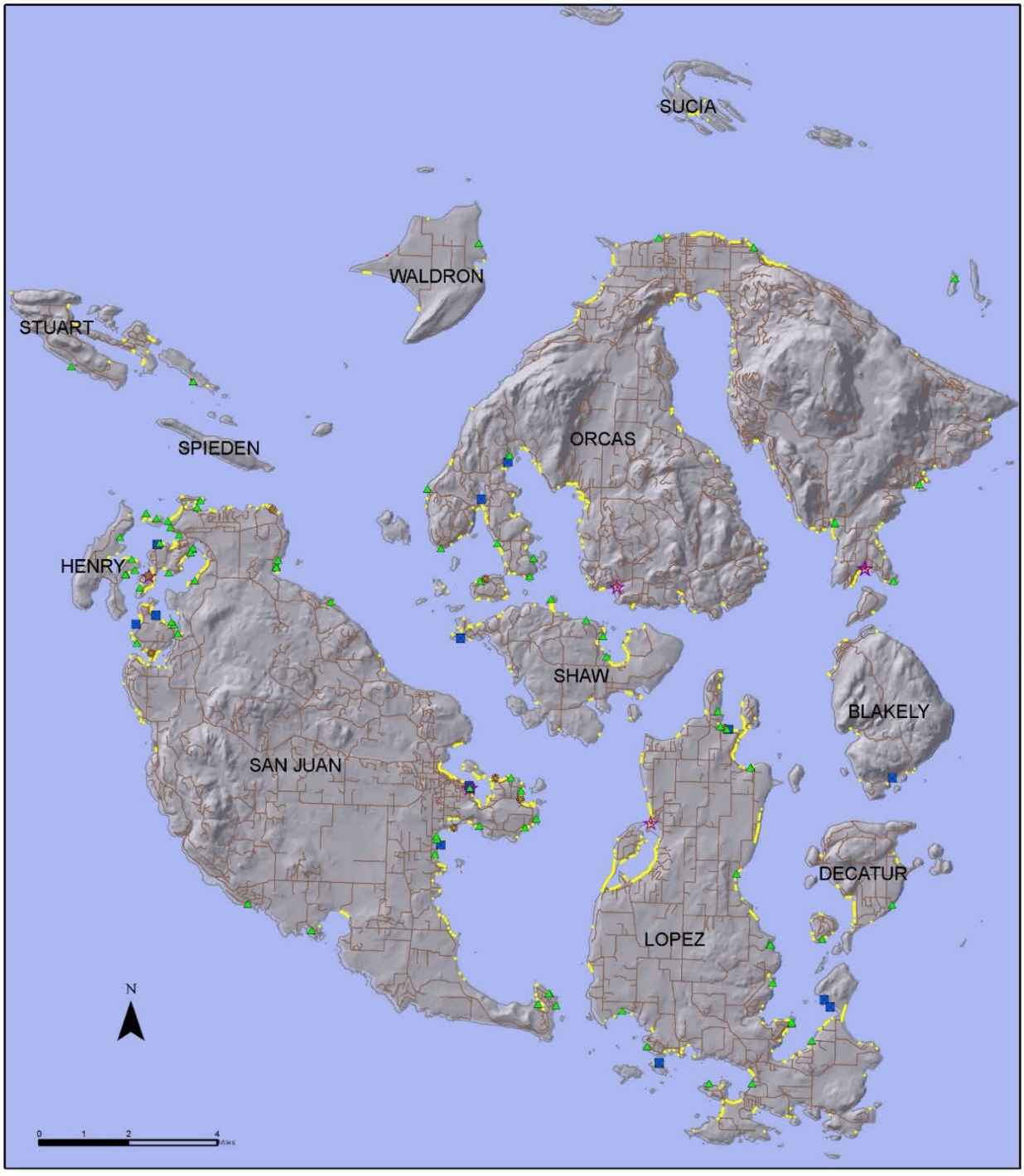
Note: Totals are more than 100% as sites with both permits secured prior to construction is a subset of the sites with both permits.

For the purposes of these compliance results sites with permits are those with permits for armor on record for that site. It does not refer to compliance with permit conditions such as size, location etc. So it is possible that even 'fully permitted' projects in these results were out of compliance with permit provisions.

Four of the permits secured for the 108 sites investigated (just under 4%) were issued prior to 2007; these older permits were all issued by San Juan County. It is possible that some form of armoring occurred at these sites before 2009 that was missed by the 2009 field mapping effort but captured in the 2019 field survey. As the field survey methods were the same in both efforts and armor was also not visible prior to 2009 during the associated desktop review of oblique and vertical aerial photos, it is also possible that some expansion of this now visible armor occurred in the decade this research focuses on, 2009-2019, resulting in the armor being more visible with survey methods. It is also possible that some structures were installed a few years after permits were secured.

The extremely low level of new armoring sites participating in either the up-front permit process or being identified as violations (and addressed through code enforcement or an after-the-fact permit process) indicates that much more effort is needed to accurately track on-the-ground conditions to adequately protect marine shorelines by ensuring compliance with existing regulations. Detailed review of permit materials for the limited number of permits that were obtained provides insight into how regulations are being implemented and can provide objective information to guide any potential management improvements.

Figure 6. Regulatory Compliance for New Shoreline Armor 2009-2019



Regulatory compliance for new shoreline armor in San Juan County, WA. 2019

Legend:

- Existing Hard Armor (present in 2009 and 2019)
- New Hard Armor (present in 2019 not 2009)
- New Hard Armor with No Permits
- New Hard Armor with Local Shoreline Permit only
- New Hard Armor with State Hydraulic Permit only
- New Hard Armor with Both Local and State Permits

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Regulatory Effectiveness

In addition to compliance results, this project reviewed permit materials where available to ascertain whether applications contained sufficient information to anticipate the armor impacts. This review provides a coarse look at trends in permit processing rather than an assessment of applications' regulatory compliance; some review factors may not be strict requirements under local or state land use regulations. As one example, while mitigation is not required in all cases, the fact that there was no evidence of mitigation occurring when it was required suggests that better systems for tracking mitigation are warranted. Also, it is important to note that the State Hydraulic Code and the San Juan County Shoreline Master Program experienced regulatory amendments during 2009-2019 and thus may have applied different criteria to individual permits issued. For a summary of the specific Code and SMA policies related to armor, please see Appendix C. State Hydraulic Code and Shoreline Management Act policies. Please note that no site inspections were completed as part of this project so the effectiveness review does not include adherence with permit conditions, except for those cases where this information is available in the permit record.

Regulatory effectiveness: Permit Analysis Results, San Juan County

Review of local shoreline permit records revealed that 23 shoreline permits were issued for the 108 sites that were mapped as having new armor installed between 2009-2019. Two sites with permits were located in the Town of Friday Harbor. Please note that Town permits are not included in this review of permit materials although the results ARE included in compliance results above as having a local shoreline permit. Detailed review of permit records was completed for permits issued in 2007 or later; four of these permits (representing 4% of the total 108 armor segments mapped as new in 2019) were issued in 2007 or earlier; these permits were not included in the regulatory review. A total of 17 San Juan County permits were included in this regulatory review. Note: all permit records found, including pre-2007 records and Town of Friday Harbor and San Juan County, are included in the permit compliance results provided above.

Of the 17 San Juan County shoreline permit records analyzed for this research project, 12 were shoreline exemptions and five were shoreline substantial development permits. Six of the 17 were the result of code investigations/violations. Of these six, three after-the-fact permits were for full removal of the structure and one for partial removal and authorization of the remaining armoring. There is no evidence in the records as of May 2022 that any of the structures slated for removal have been removed.[27] Two structures were authorized to remain in place.

[27] Whitman T. 2022. Personal communication with San Juan County code enforcement officer James Finn and shoreline planner Colin Maycock. Friday Harbor.

TABLE 12 San Juan County Permit Review: Permit Type

Permit Type (# of permits)	Results
Shoreline exemption (12)	71%
Substantial development (5)	29%
After the fact permit as a result of code investigation / enforcement (6)	35%
Unauthorized armor slated for partial or full removal (3)	18%

Note: Table refers to regulatory records only. An additional 80 armor segments installed 2009-2019 did not receive a permit or any enforcement action.

The files contained much more pre-construction information than post-construction verification. The County conducted pre-construction site visits for three of the 17 bulkheads, two of which were associated with enforcement actions of unapproved construction, and twelve files contained pre-construction photos. San Juan County required post-project inspections for only three of the permits; the files did not contain evidence that these post project inspections had occurred.

Habitat reports were found in the records with nine of the seventeen (53%) San Juan County permits reviewed, referenced in applications but not included in the file for three permits, and absent and un-referenced in files for five permits. For the purposes of this review, we categorized as habitat reports all of the following--biological assessments, biological evaluations, critical areas reports, no net loss reports, and any other report by a qualified professional on the topic of habitats and species.

Of the nine habitat reports reviewed, reports were completed by six different consultants. Five of the nine included an evaluation of no net loss; however, no report concluded that the new hard armoring would be associated with a net loss. Four of the five reports that specifically evaluated no net loss were associated with unauthorized armor installation situations where the current application was recommending removal and or redesign/reduction of the current footprint as the means of achieving no net loss. None of the San Juan County permit records had evidence of any forage fish spawn habitat surveys associated with the application materials or construction activities.

Geotechnical reports and construction drawings and/or plans were found in 11 of the 17 files. Four of those reports provided an estimate of the time frame in which a primary structure would be threatened by shoreline erosion. Two reports suggested that the primary structure would be threatened in 10 years, and two reports indicated that the threat would occur within 100 years. An estimated erosion rate was included in application materials/geotechnical reports for three of the 17 —1/2 inch/year, 1 inch/year, and 6 inches/year based on a short, 8-year review period.

Due to the fact that San Juan County may withhold access to cultural resources reports during records requests we did not evaluate the number of sites with archeological reports, but permit materials for many sites referenced these reports. Given the high percentage of newly armored sites with no permits at all (about 75%), many of these sites also likely had no assessments of cultural resources conducted prior to construction.

TABLE 13 San Juan County Permit Review: Application Materials

Application Materials	Results
Habitat report	53%
Finding of no net loss or no impact	0%
Geotechnical report	65%
Estimated erosion rate	18%
Estimated time of threat to primary structure	24%
Primary structure threatened within ten years	12%
Design drawings/plans (to scale)	11%

San Juan County required mitigation for four of the 17 permits. All four were after-the-fact situations and in three of the four, the mitigation action required was that all or some of the unauthorized structure to be removed. No mitigation was required by San Juan County for armor projects authorized prior to construction.

Twelve of the 17 (70%) permit applications included pre-construction photos. Post-project inspections were required for three of 17 San Juan County permit records. The permit records did not contain evidence of post-construction inspections.

Pre-construction site visits were conducted by San Juan County at three of the 17 (18%) sites, two of which were associated with unpermitted installations of armoring.

Evidence of agency coordination was found for four of the 17 (24%) sites; all instances of interagency coordination were associated with unauthorized installations of new armoring/violations.

TABLE 14 San Juan County Permit Review: Permit Conditions

Permit Conditions	Results
Mitigation required	17%
Evidence of mitigation being implemented	0%
Pre permit site visit	18%
Pre permit site visit after the fact, associated with violations	68%
Post construction inspection required	18%
Evidence of post project inspection	0
Evidence of interagency coordination	24%
Interagency coordination after the fact, associated with violations	100%

There was no evidence for any of the 17 sites of landowners receiving voluntary technical assistance from any source such as the Shore Friendly program. Also, none of the permits were for soft shore bank protection. It should be noted that the mapping methods are intended for hard armor and would be unlikely to detect soft shore projects. Armor materials included large rock, rock and wood, rock and treated wood, and concrete.

Regulatory Effectiveness Permit Analysis Results: Washington Department of Fish and Wildlife

WDFW records revealed that the agency had issued 20 Hydraulic Project Approvals (HPA) for armoring segments from 2009 to 2019, including 18 standard HPAs, one mitigation HPA, and one corrective, or after the fact HPA. Of the four sites with an HPA but without a local shoreline permit, there was no evidence in the file of a completed review under the State Environmental Policy Act (SEPA) for three of them, and one qualified as exempt from SEPA review.

A review of the online WDFW HPA "APPS" permit website[28] and WDFW responses to record requests revealed a total of 20 HPAs for the 108 (18%) sites with armor mapped as new 2009-2019. These included 18 standard HPAs, one mitigation HPA, and one corrective HPA. Four sites had HPAs but no local shoreline permit (San Juan County or Town of Friday Harbor). One new armor segment had an HPA application that was listed as rejected, but mapping efforts show it was built anyway.

Of the four sites with state HPA authorizations but no local shoreline permit, three had no evidence of a completed State Environmental Policy Act (SEPA) determination in the permit records and one was exempt from SEPA review.

TABLE 15 State Hydraulic Code Permit Review: Permit Type

Permit Type (20 HPAs)	**Results**
Standard HPA	90%
After-the-fact	10%
State HPA with no SEPA determination	15%
State HPA but no local shoreline permit	20%

The HPA files contained limited biological, geological, and mitigation information. Only five habitat reports were found within the HPA permit application materials. None of the files included an estimate for the time frame in which the primary structure would be threatened by erosion, though one included an erosion rate of one inch/year.

Pre-permit site visits by regulators were completed at seven of the 20 sites with HPAs, three of the seven sites with pre-permit visits by WDFW were associated with violations/post installation reviews.

[28] https://www.govonlinesaas.com/WA/WDFW/Public/Client/WA_WDFW/Shared/Pages/Main/Login.aspx

Three HPAs had evidence of interagency coordination, all of which involved after-the-fact violations. There were no permits that indicated the property owners had received any type of voluntary technical assistance. There were also no permits for soft shore bank protection, but it should be noted that the armor mapping methods utilized would likely not detect soft shore projects. Armor materials included large rock, rock and wood, and concrete.

WDFW staff did conduct per permit site visits in about a third of the cases, with half of these consisting of visits to sites seeking after the fact authorization (e.g. where the structure had been built without a permit). Permit records indicated that coordination between regulatory agencies (county or federal) by state regulators was uncommon (occurring in just 15% of the permits) and that all of this coordination was associated with after the fact situations.

TABLE 16 State Hydraulic Code Review: Application Materials

Permit Review (20 HPAs)	**Results**
Habitat report	25%
Erosion rate and/or time of threat to primary structure	5%
Pre-permit site visit	35%
Pre-permit site visits associated with violations	47%
Interagency coordination	15%
Interagency coordination associated with violations	100%

Mitigation was required in 10 HPAs, including four that required vegetation planting, one that required removal of the structure, and five that required beach nourishment. As of spring 2021, none of the files contained evidence that the required mitigation actions had been implemented or monitored.

All 20 HPAs restricted the timing of the work to limit fish impacts. Pre-construction forage fish surveys were required for three of the 20 HPA permits. There is evidence the surveys were completed in two of three permit records.

Post-project site visits were noted as being required for two of the 20 HPAs and post-project photos were required for five of the 20 permits. Just two permit records had evidence of post-project photos being submitted and there was no evidence in the record of any post construction site visits completed by WDFW.

TABLE 17 State Hydraulic Code Permit Review: Permit Conditions

WDFW HPA conditions	Required Condition #, (%)	Evidence Condition Met #, (%)
Construction timing to protect fish	20 (100%)	n/a
Pre-construction forage fish surveys	3 (15%)	2 (66%)
Post-project photos	5 (25%)	2 (40%)
Post-project site Inspection	2 (10%)	0
Habitat mitigation (planting, removal, nourishment)	10 (50%)	0
Interagency coordination associated with violations	n/a	100%

Regulatory Review Results: Habitat Impacts

As data in the armor change analysis and regulatory review are spatially explicit, results can be combined with existing information on the location of priority ecological features such as feeder bluffs, forage fish spawning beaches and pocket beaches. In addition, data were collected on the tidal elevation of the toe of the armor structure, which further informs understanding of armor impacts. While not a field-based assessment of the impacts of individual armor structures to priority habitats, the project's results provide a coarse understanding of how much of these priority habitats continue to be modified by new hard shoreline armor in San Juan County.

TABLE 18 Regulatory review results: Habitat Impacts

Armoring in San Juan County, WA, miles	Total Armor, 2009 (miles)	New Armor, 2009-2019 (feet)	New Armor, 1 or more permits (feet)	New Armor, no permit, (feet)	Total Armored, 2019 (miles), (%)
Pocket Beach, 48	7.5	4,256	1,561	2,695	8.31 (17%)
Feeder Bluff, 29	6	1,365	62	1,303	6.26 (22%)
Documented Forage Fish Spawning Beach, 12	2.94	1,013	62	951	3.13 (27%)

Research on the negative impacts of armor on shoreline habitats has documented that greater impacts occur when a structure is installed lower on a beach[29]Armor installed near the mean higher high water mark has an even more marked effect on key indicators including large woody debris, wrack, and beach infauna. While the current Hydraulic Code Rules require new hard armor to be installed landward of the Ordinary High Water Mark[30] where feasible, our results show that the majority of new armoring continues to be installed below the OHWM. This discrepancy was also observed in the permit records, with most applications asserting that armor would be constructed landward of OHWM but post-construction field mapping finding the vast majority of new structures built at a lower tidal elevation, between MHHW and OHWM.

These results show that despite clear language protecting both documented forage fish spawning beaches and feeder bluffs in state and local regulations, as well as improved understanding of the strong association of pocket beaches with out-migrating juvenile salmon, hard shoreline armor continues to be installed in these priority locations. As observed with the overall trends in San Juan County, the majority of the armor installed in priority habitats and shoreforms in the past decade was unauthorized. The study's results highlight that San Juan County is not meeting no net loss standards. Also, these data can help track cumulative impacts as required under the SMA.

[29] Whitman, T., D. Penttila, K. Krueger, P. Dionne, K. Pierce Jr., and T. Quinn. 2014. Tidal elevation of surf smelt spawn habitat study for San Juan County Washington. Friends of the San Juans, Salish Sea Biological and Washington Department of Fish and Wildlife.

Dethier, M., W. Raymond, A. McBride, J. Toft, J . Cordell, A. Ogston, S. Heerhatz and H. Berry. 2016. Multiscale impacts of armoring on Puget Sound shorelines: evidence for cumulative and threshold effects. Estuarine, Coast and Shelf Science. 175 (2016) 106-117.

Carrasquero-Verde, J., T. Abbe and S, Morrison. 2005. Bulkheading in Thurston County: impacts on forage fish spawning habitat. Proceedings of the 2005 Puget Sound Georgia Basin Research Conference. Herrera Environmental Consultants.

[30] Note that while the Hydraulic Code Rules use the term Ordinary High Water Line, they define that term as Shoreline Master Programs define OHWM – "the mark on the shores of all water that will be found by examining the beds and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in ordinary years as to mark upon the soil or vegetation a character distinct from the abutting upland." WAC 220-660-030(111).

Key Findings and Implications

Friends' permit compliance research discovered that ten of the 108 sites (9%) had obtained both of the San Juan County and WDFW approvals prior to installing the armor. Six more armor segments had been approved by both San Juan County and WDFW after they had been constructed, for a total of 16. An additional 12 sites had obtained either a San Juan County or WDFW approval, but not both, for a total of 28 sites with one or more permit (26%). Of these, four were approvals by WDFW and eight were approvals by San Juan County.

In sum, approximately one-quarter of all new armor received some public review, and approximately one in 10 had been installed lawfully with pre-construction review and approval by both applicable public agencies. Nearly three-quarters of all armor segments constructed during the decade from 2009 to 2019 had not been reviewed or approved.

The low level of new armoring sites participating in either the up-front permit process or being identified as violations and addressed through code enforcement or an after-the-fact permit process indicates that much more effort is needed to accurately track on-the-ground conditions to ensure compliance with existing regulations. With just 10 of 108 (9%) sites requesting the required permit authorizations, it is clear that improving methods for engaging property owners and contractors, as well as tracking actual changes, is essential.

As 12 of 28 sites with permit/s had just one of the required local and state authorizations (eight sites had county but no state authorizations and four had state HPA but no local shoreline permit) better coordination between local and state regulators is one simple method that can be used to increase the overall percentages of projects that receive adequate review and obtain required local and state permits.

However, the low number of enforcement cases (n=6) relative to the number of new structures installed 2009-2019 without any permits at all (n=80) highlights an urgent need for regular monitoring of on-the-ground conditions and the development of additional methods for identifying and addressing the significant proliferation of unauthorized shoreline armoring.

Summary of Regulatory Review

In addition to the fact that over 90% of new armor constructed from 2009 to 2019 did not have both of the required state and county permits prior to construction, this analysis into the permitted armor found generally that the associated applications did not contain sufficient geological, biological, or construction information to assess the ultimate impacts of that approved development. There was also extremely limited follow-through after permits were issued to ensure that armor construction compiled with permit conditions. These results demonstrate that our community is not achieving the protection of essential shoreline functions required by the Code and SMA.

For those sites that did receive permits, detailed review of the records points to some changes that could be made to improve the effectiveness of the regulatory process. Standardizing and ensuring

consistency of the required application materials and the type of information and design details required for an application to be considered complete could help to identify, avoid and track impacts, and ensure that authorized projects are consistent with relevant state and local regulations. For example, most permit applications failed to include estimated erosion rates or the timing of threats to primary structures. Many also erroneously located the OHWM or failed to include scaled site plans or design drawings.

Inspections are a topic that has been highlighted before by previous related efforts in San Juan County such as the San Juan Initiative.[31] Review of the permit records indicates that little, to no, post-project review is occurring, even for sites where post-construction photos were required in lieu of site inspections.

A particular area of concern in terms of armor impacts is the habitat or no net loss reports provided by consultants. **Even in those cases where proposed armoring would clearly bury portions of the upper intertidal beach and/or remove shoreline vegetation, none of the consultant reports reviewed in this process ever concluded anything besides "no net loss" or "no impact".** Further, except for after-the-fact situations, no habitat reports recommended any mitigation. No local permits included any required mitigation actions as conditions prior to construction. State HPAs did more commonly include requirements for mitigation but there was no information in the permit records to demonstrate that mitigation had been implemented, monitored or successful.

In half (three of six) of the unauthorized cases of shoreline armor where enforcement action was being taken, armor removal was noted as being required. However, as of May 2022, none of the armor removals had yet occurred.[32]

Unfortunately, these permit implementation situations are dwarfed by the proliferation of unauthorized armor installed during 2009-2019: according to the permit records, 80 of the 108 sites with new armor 2009-2019 had no permits and no enforcement action.

Discussion

As can be seen from the information presented in the regulatory overview, Appendix C., both the Hydraulic Code and the SMP prohibited unauthorized construction of armor during the period 2009-2019. In addition, since at least 2013, San Juan County rules required that applications provide sufficient information to demonstrate a need for the armor and that the armor would result in no net loss of shoreline ecological functions. The results of the 2009-19 change analysis and permit file reviews indicated that these rules have not been followed for new armor construction.

This section discusses management and policy implications of these findings and proposes steps to limit the amount of unauthorized armor construction and to evaluate likely impacts from new

[31] Windrope, A. T. Quinn, K. Fresh, A. MacLennan, J. Gaydos. 2016. Management shoreline management- a 35 year evaluation of outcomes in San Juan County, WA. Coastal Management. Vol. 44 (1116)
San Juan Initiative. 2008. What's working and what's not. Prepared for the San Juan Initiative, Friday Harbor.
[32] Whitman T. 2022. Personal communication with San Juan County code enforcement officer James Finn and shoreline planner Colin Maycock. Friday Harbor.

armor so that they may be addressed during project application and construction. This report does not discuss the federal regulatory regime because the Seattle District of the U.S. Army Corps of Engineers did not regulate armoring at an elevation above the Mean Higher High Water Mark until 2020.[33]

The results of the permit compliance research clearly shows that the current regulatory system is broken. Of the 108 new segments of armor constructed on San Juan County shorelines between 2009 and 2019, only 10 had been reviewed and approved by both WDFW and San Juan County prior to construction. San Juan County alone approved an additional 8 lengths of armor and WDFW alone approved 4 more. Six were reviewed as part of corrective actions, and there is no evidence that any of them have been removed in the permit record or through follow-up conversations with local government officials.[34] For the small amount of new hard armor installed 2009-2019 that did have permits, the type and amount of information provided by applicants varied significantly from one project to another.

These numbers suggest that:

(1) The majority of shoreline property owners and armor installers either are unaware of the permit requirements for armor or are not motivated to comply with them;

(2) Shoreline property owners who do see the need to obtain a permit may be confused about how to do so and which agencies to contact;

(3) State and county agencies are not conducting an shoreline compliance surveys to identify new construction and instead rely solely on a complaint-driven enforcement process; and/or

(4) Permitting authorities are not consistently requiring the submission of all information necessary to determine a proposal's impacts and confirm the location and size of the structure built.

The following sections discuss recommendations for improving policy implementation as well as the adoption of new policies.

Manager Outreach

Following completion of the regulatory review, Friends of the San Juans shared the compliance and regulatory effectiveness results through virtual meetings with small groups of shoreline managers including:

- WA Department of Fish and Wildlife compliance, protection, habitat, and research staff;
- San Juan County Local Integrating Organization committee members as well as local and regional Puget Sound Partnership staff;

[33] The Mean Higher High Water line ("MHHW") is a tidal elevation marked by the average of the higher high tide over a period of approximately 17 years. Most bulkheads in San Juan County are constructed at tidal elevations higher up the beach than MHHW, near the toe of the bank, so U.S. Army Corps of Engineers involvement in bulkhead permitting has been limited.
[34] Whitman T. 2022. Personal communication with San Juan County code enforcement officer James Finn and shoreline planner Colin Maycock. Friday Harbor.

- San Juan County Environmental Stewardship and Community Development Departments; and
- Staff members from the WA Department of Ecology Shorelands Team.

These initial discussions were largely focused on the high level of unauthorized structures, enforcement and compliance monitoring, versus implementation effectiveness related to the permit process itself. Key themes around management implications and solutions from the manager meetings included:

- Proactive compliance and improved enforcement capacity (staff, resources, incentive and disincentive mechanisms or tools, as well as better systems for tracking over time);
- Improved monitoring of on-the-ground conditions (imagery, boat surveys, etc.) linked to both compliance and effectiveness of policies such as the Shoreline Management Act and No Net Loss;
- Prioritizing unauthorized structures from a habitat impacts perspective to support a coordinated enforcement effort; and
- Improved training of consultants and permit reviewers.

Results from Other Compliance Studies in Puget Sound

While corresponding data sets do not exist for all of the counties in greater Puget Sound, several studies completed over the past 15 years have emphasized the failure of existing shoreline management to meaningfully track and address the impacts of new hard shoreline armoring. These studies are summarized in the narrative below and in a table that identifies concerns expressed by each study.

Washington Department of Fish and Wildlife Hydraulic Permit Approvals Analysis

WDFW has completed multiple internal analyses of the HPA regulatory process with a goal of improving regulatory effectiveness and improved understanding of the relationship between the HPA program and No Net Loss policies. A summary of these efforts and key findings related to marine shoreline armoring are provided below.

In 2007, a WDFW study concluded that although the majority of bulkheads approved by WDFW complied with their permit, less than 50% received a medium adequacy score or better for achieving no net loss.[35] And in 2019, Carman et al. found a need for regular, systemic monitoring over the long-term.[36]

WDFW implementation and effectiveness monitoring of hydraulic projects (2013-2015) [37]

WDFW monitored implementation of HPAs in two counties to identify specific opportunities to improve the regulatory process. Armoring-related key findings include:

- Information on structure location such as waterward extent and length was limited;
- Compliance was difficult to assess without a site inspection; and
- Site inspections that did occur found that the majority of projects were installed larger (longer length, taller structure or higher on the beach) than authorized.

The study recommended that applications be required to include clear design specifications on a new, mandatory form.

San Juan Initiative (Puget Sound Partnership, San Juan County) 2007-2010[38]

The San Juan Initiative was a state and local partnership steered by independent stakeholder and science advisory panels. The Initiative conducted a detailed case study of shoreline developments in four geographic areas, and found that:

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[35] T. Quinn, et al., A Pilot Study of Hydraulic Permit Compliance, Implementation, and Effectiveness in Region 6 (2007), *available at* https://wdfw.wa.gov/publications/01338 (last visited May 11, 2022).

[36] Quinn, T. 2012. A Pilot Study to Estimate Levels of Unpermitted Construction Along Marine Shorelines in Puget Sound. Washington Department of Fish and Wildlife. Olympia, WA.

[37] Dionne, P.E., H. Faulkner, W. Dezan, K. Barnhart, S. Key, and T. Quinn. 2015. Tracking and Monitoring of Marine Shoreline Stabilization Permits Final Report. Habitat Program, Washington Department of Fish and Wildlife, Olympia, WA.

[38] San Juan Initiative, Protecting Our Place for Nature and People, 18 (Dec. 2008), San Juan Initiative. 2008. San Juan Initiative Protection Assessment Nearshore Case Study Area Characterization. Coastal Geologic Services for San Juan County and the Puget Sound Partnership.

- Of the 200 parcels with shoreline armoring in case study areas, only nine had SMP approval and 12 had HPAs;
- A small field sample of permitted docks and bulkheads revealed that more than 50% were out of compliance with permit conditions, which resulted in encroachment into sensitive areas;
- Most bulkhead repairs resulted in an increased footprint and that up to one-third of bulkheads were constructed on properties without a main structure;
- There was an inverse relationship between shoreline setbacks for residential structures and shoreline armoring;
- Armor impacts were disproportionately affecting priority areas like feeder buffs and forage fish spawning beaches and structures were being installed low enough on the beach to impact forage fish spawning habitat; and
- armored shorelines experienced a greater loss of vegetation, including forest cover and overhanging vegetation.

In addition, landowner surveys revealed that landowners felt that a lack of enforcement resulted in a lack of fairness.

The Initiative ultimately made the following management findings:

- Most of the effort occurs in the permit process, with little or no effort on up- front technical assistance or after-the-fact inspection and compliance.
- There are too many different overlapping processes/agencies.
- There is a lack of confidence that permit compliance will lead to meaningful on the ground results which leads to poor compliance (e.g. Less impact, less unpermitted).
- Permit processes are not easily publicly available or searchable.
- The permit record doesn't account for what's happening on the ground,
- The permit count and details differ between the county and the state.
- The lack of permit specificity limits inspection effectiveness/compliance review.
- Limited inspection is happening.
- Low compliance was found from this case study review.
- Current regulatory protection programs are turning people off and our education and incentive programs are not meeting the needs of the ecosystem or shoreline property owners.
- There is a lack of accountability to ensure that people and government successfully carry out their responsibilities in a way that results in ecosystem protection.
- A coordinated system for tracking and monitoring shoreline permitting is needed.

Consequently, the Initiative made the following four key recommendations for the County and State:

1. Fairly and consistently enforce the regulations;
2. Require inspections before and after construction;
3. Collaborate to jointly administer their regulations; and
4. Implement code enforcement inspection and monitoring programs.[39]

Puget Sound Marine and Nearshore Grant Program: effective regulation and stewardship investment area grant summary (2011-2015)[40]

This project undertook a detailed analysis of 14 grant funded projects in the effective regulation and stewardship investment area of the Puget Sound Marine and Nearshore Grant Program.

Findings relevant to shoreline armor include:

- A signficant amount of shoreline development is occuring without permits.
- Violations of permit conditions is common.
- Improved enforcement of existing regulations is critical to Puget Sound recovery.
- Local governments need assistance to effectively enforce shoreline regulations.
- Non-regulatory technical assistance incentive programs can reduce impacts of armor as well as demand for new armor.
- Economic valuation of ecosysem services can help demonstrate that protection is more efficient than restoration.
- Forage fish spawn habitat may be especially vulnerable to rising seas and planning for solutions, especially related to infrastructure such as roads is needed.

[39] San Juan Initiative. 2008. San Juan Initiative Protection Assessment Nearshore Case Study Area Characterization. Coastal Geologic Services for San Juan County and the Puget Sound Partnership.
[40] Kinney, A., T. Francis and J. Rice. 2015. Puget Sound Marine and Nearshore Grant Program Analysis of effective regulation and stewardship findings. Puget Sound Institute, UW Tacoma.

Shoreline Permitting Effectiveness through T.A.C.T (2015)[41]

This project built on the San Juan Initiative and included local shoreline permit review for armoring in Kitsap and San Juan Counties, a WDFW analysis of HPA permits, and stakeholder and regulator interviews. This project's principal purpose was to objectively review and assess the *effectiveness* of existing shoreline stabilization permitting programs *in achieving a balance between applicant needs and protection of nearshore resources,* and to initiate improvements in those permitting processes (Kitsap County, San Juan County, and WDFW 2015).

The TACT report found that, "despite extensive shoreline regulations and provisions designed to minimize ecological impacts of construction along Puget Sound shorelines, implementation of and compliance with these requirements is lacking in enough instances to cause concern (Quinn et al. 2007; Carman et al. 2010). Even where compliance and implementation rates are high, post-construction monitoring (when it occurs), rarely captures the extent of ecological impacts. Where evaluations have occurred, a disparity has been noted between compliance with/implementation of construction provisions and the preservation of fish and wildlife resources."

Summary results by topic area are provided below:

Regulatory review findings:

- Coordination between WDFW and local jurisdictions needs improvement, especially related to site inspections, formal notification of permit activity, and permit tracking.
- Lack of formal review process or standardized data entry results in duplicative efforts as well as missing information.
- Differences in permit tracking between and within agencies limit efficient location and comparison of information. Key metrics should be standardized across the state.

Stakeholder interviews resulted in the following recommendations:

- Consistency in regulatory interpretation.
- Additional training, examples, and information on emerging soft shore stabilization technologies.

Tracking and Monitoring findings that prevent assessment of project compliance with permit conditions or ability to protect fish life:

- Projects are being installed in priority habitats (1/4 on forage fish spawning beaches).

[41] Barnhart, K., S. Key, and P.E. Dionne. 2015. Shoreline Permitting Effectiveness through T.A.C.T. Final *Report*. Kitsap County, San Juan County, and Washington Department of Fish and Wildlife.
Key, S. 2013. *T.A.C.T. Troubleshooting Report, Attachment A*: *Results of an Analysis of the San Juan Initiative's Measures of Success.* San Juan County Department of Community Development, Friday Harbor, WA. Deliverable to the Marine and Nearshore Grant Program.
Dionne, P.E., H. Faulkner, W. Dezan, K. Barnhart, S. Key, and T. Quinn. 2015. Tracking and Monitoring of Marine Shoreline Stabilization Permits Final Report. Habitat Program, Washington Department of Fish and Wildlife, Olympia, WA.

- Projects lack basic location information like tidal elevations.
- More than half of projects were built longer, taller, or more waterward than authorized.

Overall recommendations:

1. Improved staff training for permit reviewers and guidance for permit review.
2. Coordination of permit conditions between local and state agencies with a goal of achieving no net loss.
3. Standardized information required in application materials as well as in permit tracking databases.
4. Communication (formal and informal) about active permits and conditions between agencies.
5. More direct communication with stakeholders (landowners, consultants etc.).
6. Increased capacity for site visits prior to project authorization and afterward to ensure compliance with permit conditions.
7. A constructive format for sharing regulatory effectiveness results and advancing implementation of recommendations.

WRIA 9 Marine Shoreline Monitoring and Compliance Project, 2014 and 2019[42]

In 2014 and 2019, managers at the King County Department of Natural Resources conducted boat-based shoreline monitoring to evaluate the success of salmon recovery habitat restoration efforts by identifying new, expanded, and replaced armoring. Both phases of this investigation found that installation of new armor was outpacing armor removed through restoration actions and that overall permit compliance was low.

The study concluded that:

- Permitting rates for new armor in 2016 and 2018 were low, at 29% and 0%, respectively, for local permits and 14% and 0%, respectively, for HPAs.
- Limited outreach activities in unincorporated King County in 2014 did not appear to affect compliance rates there in 2016 and 2018.
- There was a net increase in armoring at the same time that the Puget Sound Partnership reported a decrease in armoring based on HPAs, indicating that using permit numbers as a proxy for constructed armor "does not accurately represent the net change in shoreline armoring and underestimates the amount of new armoring going in throughout Puget Sound."[43]

[42] King County. 2014. *The WRIA 9 Marine Shoreline Monitoring and Compliance Pilot Project*. Prepared by Kollin Higgins, Water and Land Resources Division.
K. Higgins, WRIA 9 Marine Shoreline Monitoring and Compliance Project Phase 2 Final Report (2019), *available at* https://your.kingcounty.gov/dnrp/library/2019/kcr3021/kcr3021.pdf (last visited May 11, 2022).

- Jurisdictions likely are not meeting the no net loss of ecological function standard.
- Compliance with local government regulations is higher than with WDFW HPAs.

The study therefore recommended:

1. A new study to evaluate why landowners are obtaining permits at low rates.
2. A comprehensive assessment of compliance rates across Puget Sound to better estimate the actual net change in shoreline armor.
3. Study by local jurisdictions to evaluate whether permitted actions are achieving no net loss under their SMPs.
4. Improving the structure of permit systems to better ensure coordination between state and local permits to improve regulatory compliance.
5. Similar shoreline compliance surveys on a biennial basis.[44]

2018 Hydraulic code compliance assurance program pilot, Hood canal (2018)[45]

This compliance assessment for shoreline structures included a change analysis using boat-based marine surveys and aerial photo review, linked to a review of the HPA records. Key findings were that 65% of observed changes in shoreline modification conditions were not able to be linked to an associated HPA authorization. Despite limitations in the ability of the project to identify large numbers of permitted changes on the ground, the project identified a strong need for additional monitoring to follow shoreline status and trends and regulatory gaps and inconsistencies and to improve long term management.

Current State of Shoreline Permitting in Puget Sound. Puget Sound Partnership 2022[46]

The PSP Local Integrating Organization's Collective "Building collective commitment to priority shoreline permitting solutions" project included three key elements: literature review, key informant interviews, and practitioner workshop.

The literature review was completed for the Puget Sound Partnership by Cascadia Development Group. A key finding of this recently completed literature review was that "shoreline armoring

[44] King County. 2019. WRIA 9 Marine Shoreline Monitoring and Compliance Project Phase 2 Final Report. Prepared by Kollin Higgins, King County Water and Land Resources Division. Seattle, Washington

[45] Faulkner, H., T.L. Scott, and R.L. Thurston. 2018. WDFW Hydraulic Project Approval Program Hood Canal Compliance Pilot – Puget Sound Marine Shoreline Surveys. Puget Sound Marine and Nearshore Grant Program, Washington Department of Fish and Wildlife. March 2019.
Cook, A.E., T.L. Scott, and R.L. Thurston. 2019. WDFW Hydraulic Project Approval Program Hood Canal Compliance Pilot - Final Report. Puget Sound Marine and Nearshore Grant Program, Washington Department of Fish and Wildlife. March 2019.

[46] Puget Sound Partnership and the Local Integrating Organizations. 2022. Building collective commitment to priority shoreline permitting solutions project. Cascadia Development Group and the University of Washington Evan's School for the PSP. Olympia.

continues to be built without permits, is under-permitted, or does not meet compliance requirements." [47]

Top recommendations for addressing this issue from the literature review include:

1. Increase monitoring using field-based survey methods.
2. Increase site inspections and interagency coordination.
3. Improve permit review procedures.
4. Evaluate compliance with the no net loss standard.

Key challenges identified in interviews include:[48]

- Government permitting processes: weak incentives, lengthy, complaint driven enforcement, jurisdictional constraint.
- Information Barriers: technical and permit process understanding by landowners limited, limits to government capacity, tracking and sharing of data between agencies.

Top permitting solutions from interviews:

1. Education: expanded technical training for govt staff and landowners.
2. Government capacity: permit system coordination, standardized applications, decisions and centralized tracking.
3. Monitoring: increase authority, monitoring, inspections and proactive enforcement.

The five emergent solutions from the regional workshop held in spring 2022 were:[49]

1. Strengthen enforcement- removals, fines etc.
2. Increased monitoring and regulatory analysis to inform enforcement.
3. Increased coordinated site visits with all agencies.
4. Expand shore friendly.
5. Training for contractors/consultants.

Recent Legislative, Budgetary, and Policy Changes Related to Shoreline Development

Identified below are recent changes that may affect armor installation and impacts, in addition to those recent changes to the Hydraulic Code and SMP noted above. It is not clear whether any of them will benefit shoreline ecological functions, but two of the budget items add staff to ensure compliance with permits, which may limit the number of new projects that are constructed in a location or size that violates their permit.

[47] ibid
[48] ibid
[49] Ibid, 48

Legislation

2021 – Bill 5273 establishes new armor replacement standards that could decrease impacts along armored shorelines if the project proponent permits the activity. The bill revises the Hydraulic Code, RCW 77.55.231, to require the use of the "least impacting technically feasible bank protection alternative for the protection of fish life" when replacing residential marine shoreline armoring. It directs people to assess site characteristics such as threats to major improvements and wave energy, and it establishes a preferential hierarchy for alternatives that ranges from least impacting, like removing the structure and restoring the beach, to most impacting, like replacing the structure with a similar structure. The new legislation created a loophole that will need to be monitored, defining "feasible" ambiguously as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

2021 – Bill 1382 establishes a four-year habitat recovery pilot program intended to streamline permitting for environmental restoration projects. To be eligible for the alternate review process, the project "must directly benefit freshwater, estuarine, or marine fish, or the habitat they rely on" and must be reviewed, approved, or funded by a program listed in the bill. Projects must also document their consistency with flood risk reduction and cultural resource protection requirements. Eligible projects are exempt from State Environmental Policy Act review and do not need to obtain any other local or state permits other than the permit established by the new legislation. The bill does not define "directly benefit" and does not expressly require that projects protect fish life or achieve no net loss of ecological functions.

Budget

2019 -- New Ecology positions to implement Orca Task Force recommendations related to armoring for forage fish habitat: one planner to coordinate with local governments and WDFW (e.g., MART,); one geo-tech (position not yet filled).

2021 -- Shore Friendly adopted into Estuarine and Salmon Restoration Program and capital budget. Shore Friendly programs engage landowners to consider armor removal and restoration on their property through incentives and assistance with permitting processes.

2021 – HPA Landowner Assistance – ~$1.2 million for DFW to hire four expert assistance biologists to meet with landowners before and during construction to provide technical assistance, to help landowners resolve risks, and to ensure that construction projects comply with HPA requirements. It is unclear whether this program will assist in protecting shoreline ecological functions, but it should help ensure that applicants comply with whatever conditions are placed in their HPAs as long as the applicant is willing to allow the biologist access to the construction site and the proponent goes through the permit process.

2022 – Ecology received $200,000 to update the shoreline oblique aerial photos that are part of the Coastal Atlas. These photos provide images of approximately 3,300 miles of marine shorelines and 1,000 miles of freshwater shorelines and can be used to detect shoreline changes at a coarse scale.

2022 – Ecology has been budgeted to add six new staff positions to improve compliance with local SMPs. Staff will work with counties and cities to improve local permit review systems and develop tools and training, building on state guidance and training webinars. One position will focus on formal enforcement.

Policy

2020 – On February 21, 2020, the Seattle District of the US Army Corps of Engineers announced that it would acknowledge its Clean Water Act Section 404 jurisdiction to the High Tide Line in tidal waters[50]. With this notice, the Seattle Corps raised its jurisdiction from Mean Higher High Water to a location higher on the beach that regularly experiences armoring. This revision brought armoring under scrutiny for impacts to orcas or salmon listed under the federal Endangered Species Act (ESA). The ESA requires consultation with NOAA Fisheries for projects that may adversely affect listed species, and NOAA Fisheries has created a conservation calculator that allows applicants to assess the value of nearshore habitat likely to be impacted by their projects so that they can propose compensatory mitigation. While this process continues to allow projects that impact shoreline functions in exchange for mitigation that may not successfully compensate for that harm, it does ostensibly attempt to address no net loss. In addition, a recent federal biological opinion will require mitigation sequencing for armor replacement through the U.S. Army Corps of Engineers federal review of bulkhead permits.[51]

Summary: Regional Context

Many of the findings from the San Juan County Armor Change Analysis and Regulatory Review are similar to results observed in related research efforts from across Puget Sound. Also, many of the same management implications and recommendations have been suggested for decades. A summary of relevant related research and key findings is provided below. While improved systematic monitoring of on-the-ground conditions is needed to evaluate change over time, many specific changes to improve regulatory compliance, effectiveness, and most importantly- conditions on-the-ground, are well documented and implementation is egregiously overdue. As shown in the table below, numerous studies have concluded that shoreline armoring regulations likely are not achieving no net loss, that a substantial amount of armoring is constructed without approval or in a manner that violates permit conditions, and that significant changes need to be implemented in the review process.

[50] U.S. Army Corps of Engineers Seattle District. 2020. Clean water act (section 4040) jurisdiction for tidal waters. Special Notice February 21, 2020 https://www.nws.usace.army.mil/Portals/27/docs/regulatory2/Public%20Notices/SPNs/20200221-HTL-SPN.pdf?ver=2020-02-21-162336-390

[51] Biological Opinion. NMFS WCRO-2020-01361 file:///C:/Users/My-PC/Downloads/noaa_27568_DS1%20(1).pdf

TABLE 19 Summary of related research and key findings

Study Name (right) Findings & Recommendations (below)	**WDFW 2007**	**WDFW 2009**	**San Juan Initiative**	**Puget Sound Grant Program**	**WDFW 2013-15**	**TACT**	**WRIA 9**	**Hood Canal 2018**	**Cascadia 2021**	**Recent legislation and budgets**	**Friends 2022**
Achieve no net loss?	No		No			No	No		Not sure		Not sure
Unpermitted development?			Yes	Yes			Yes	Yes	Yes		Yes
Violations of permit conditions common			Yes	Yes		Yes			Yes		Not sure
Need to include full, standardized project details in application					Yes	Yes					Yes
Need to conduct site inspections			Yes		Yes	Yes			Yes		Yes
Need improved monitoring and enforcement		Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Need better coordination between local and state government			Yes	Yes		Yes	Yes				Yes
Need consistent, fair application of rules			Yes			Yes			Yes	Yes	Yes
Improved mapping of on-the-ground conditions										TBD	Yes

Management Recommendations

Some common themes emerge from our study and from existing related research from around the region as key areas for improving compliance and policy implementation to improve outcomes for shoreline habitats and species - inspections, expert reports, inter-agency coordination, and suitable mitigation. The following management actions that can be achieved under existing policies should be given serious consideration to improve shoreline management outcomes:

Informational Outreach

While unlikely to fully resolve the noncompliance issues, public agencies could increase outreach to shoreline property owners to advise them generally of the requirement to contact public agencies prior to conducting work in the shoreline and also to describe the process for submitting local, state, and federal applications. This could occur through an insert to shoreline owners with property tax mailings or with informational packets to new purchasers of shoreline properties, or standard articles and advertisements in local papers to run after large storm events.

Increased Agency Shoreline Survey and Enforcement Presence

Regular observation and monitoring of shorelines is critical for effective shoreline management. Recent legislative efforts have considered charging Ecology with conducting comprehensive boat-based surveys of Puget Sound shorelines. WDFW has received increased funding to enforce whale-vessel distances, and could use the opportunity to photograph shorelines enroute to or from summer whale-watching areas in the San Juans. In addition, other agencies spend time on the water around the San Juans on a regular basis, and they could report new unauthorized armor construction if provided with a set of GIS maps showing the location and general attributes of existing armor.

Enforcement Penalties

While San Juan County has limited enforcement penalty authority, WDFW has the ability to levy much larger fines. WDFW could exercise this authority in a few limited instances to realize broader compliance generally. Enforcement penalties should apply to both private landowners and implementation contractors, and violations by contractors should be reported to any relevant licensing agencies.

Site Inspections

While documentation of final ‘as built’ conditions through photo submittal or an agency site visit isn’t always a required condition of either a state or local shoreline authorization, the paucity of information in the record on what, where and how the new hard armor was installed makes tracking the impacts of these activities as required under the SMP virtually impossible. Evidence in the permit records of notification of project completion was limited and there was no evidence that post construction site inspections occurred outside of the limited number of enforcement cases, and these inspections occurred prior to, not following issuance of the permits. Thus, site inspections should occur for each new armor application, both before and after construction, and should be documented with photographs to record what was built. Both WDFW and Ecology received funding

in recent budgets to increase site inspections of constructed shoreline modifications. Permission for property access to conduct site inspections should be included as permit conditions. Follow-up site inspections and documentation may lead to increased compliance with permitted armor locations and dimensions.

Inter-agency Coordination

Evidence of inter-agency coordination was limited to enforcement cases, with no inter-agency coordination associated with permit reviews prior to construction. This resulted in multiple permits issued by only one agency, and WDFW issuing permits for armor without any SEPA review in several instances. All agencies involved in reviewing armor applications should coordinate with each other as soon as an application is submitted. Ideally, the County, WDFW, and the Corps would create a single application document, such as a revised Joint Aquatic Resources Permit Application, and would coordinate with each other to share resources for review and ensure that issuance of a permit in one venue did not undermine or interfere with another agency's application review process. This coordination would benefit from an associated policy change that aligned agency review deadlines that currently vary widely from WDFW's 45-day deadline to the County's unlimited local review.

Informed Agency Review of Applicant Reports

Although not directly discussed in earlier portions of this report, inaccurate consultant reports can cause delays in application review and processing, cause inefficiencies for all parties involved, and lead to un- or under-represented ecological impacts. Examples of key issues identified in the detailed review of application materials include:

- inaccurate location of the ordinary high water mark ("OHWM") and wildly inaccurate scales on plans and especially cross sections;
- habitat reports that omit any analysis of project impacts on identified habitats and species at the site; and
- inconsistent, incomplete or inaccurate assessments of the threat and nature of erosion at the site.

We have observed a heavy deference toward those reports by the local permit review agencies that may be staffed by employees with limited expertise in reviewing these reports. It would benefit those agencies to ensure some basic training of staff, such as the ability to interpret cross sections to ensure that they are likely accurate and to vet OHWM locations depicted on site plans. For example, site plans occasionally depict the OHWM elevation seaward of the Mean Higher High Water mark, a location where it would virtually never be found. In addition, the improved inter-agency coordination recommended above could share expertise across agencies. Agencies would also benefit from increasing the level of contracted third-party review of more technical application materials. San Juan County has already commenced engaging third parties for some geological reports. As the umbrella agency for implementation of the Shoreline Management Act for all local jurisdictions, the Washington Department of Ecology could develop standard permit application, checklist and associated planner and regulator trainings to improve consistency and effectiveness.

Automatic Removal of Unauthorized Development

To disincentivize the construction of impermissible unauthorized armor, an agency that discovers unpermitted armor should, in the absence of cultural resources, to require its removal and return to a natural state as a matter of course. Coupling this with a 5-year moratorium on an application for armoring at that site likely would ensure greater pre-construction compliance. This approach is particularly necessary to address the current process – in those infrequent instances where a governmental agency chooses to enforce against armor constructed without approval, they typically direct the landowner to apply for approval. Since the landowner has already constructed their armor, there is no incentive to pursue approval at an efficient pace, and these application processes therefore can span many years while the structure causes ecological impacts. Even where an agency commences a process to remove the armor, they typically require a new permit application to do so, and landowners have little incentive to process that approval efficiently.

Confirmation of Enforcement Response

While this project uncovered three instances in which armor was apparently required to be removed, the lack of timely removal as situations move from enforcement to languish in the permit process and lack of any evidence of compliance with that directive is concerning. Agencies should require post-removal reporting with photographs of the site and a clear timeframe for removal should be required as part of enforcement actions. As of May 2022, none off the unauthorized armor slated for removal had been removed.[52]

Mitigation Reporting

While agencies required compensatory mitigation in some instances in conjunction with armor approval, none of the files contained evidence that the applicant had implemented the mitigation projects. To ensure that mitigation occurs, applications must first contain detailed mitigation plans with performance benchmarks and regular reporting of progress. Approvals for armor should include requirements that the applicant ultimately submit information to demonstrate that the armor successfully achieved the performance benchmarks set for it. Moreover, compensatory mitigation should be designed to compensate for the impacts caused by the armor by directly replacing the functions lost. Site inspections should be a regular aspect of agency monitoring of mitigation implementation.

Impact Tracking

Although the SMP requires San Juan County to establish a cumulative impacts matrix that tracks impacts from authorized development, County records indicate this has never been developed. Such a mechanism would provide a valuable tool both for visualizing overall impacts countywide and for tabulating the amount of compensatory effort necessary to mitigate them. Ecology could assist this process by developing a standardized template for tracking impacts as well as regionally collected mapping/photo/monitoring information to be used.

[52] Whitman T. 2022. Personal communication with San Juan County code enforcement officer James Finn and shoreline planner Colin Maycock. Friday Harbor.

Policy Recommendations

Policy actions should provide clearer direction and greater incentives both for complying with existing rules and consummating shoreline protection.

Increased Disincentives

Penalties for noncompliance with the SMP are woefully inadequate for deterring violations. With the value of shoreline properties in the San Juans averaging in the millions, a $500 fine does not disincentivize constructing armor without a permit. By increasing the value of the fine, or by declaring each day a separate violation, San Juan County could increase penalties under the SMP so that they are meaningful enough to discourage unpermitted construction. In addition, contractors who install armor should be required to ask for all valid permits before beginning construction, and meaningful penalties should be levied against contractors who fail to do so. Other steps for improved enforcement should include clear, publicly-available tracking sheets for enforcement actions and standard deadlines for landowner compliance as well as increased resources for monitoring, enforcement and compliance outreach and engagement with contractors and landowners.

Require Inter-agency Communication

The Rules and the SMP should be revised so that neither WDFW nor San Juan County commences review of an application for armor (or other shoreline development) until the applicant certifies that they have submitted an application to both entities or the agencies could be required to notify each other upon receipt of permit applications. This would assist in coordinating review of the proposal and also would help ensure that SEPA review occurs for each proposal.

Unified JARPA

While a unified Joint Aquatic Resources Permit Application that applies to all agencies with shoreline permitting authority may not require a policy change, amendment of existing procedures to coordinate the review process for all agencies involved likely would. The most effective change likely would involve extending the WDFW deadline and establishing a local deadline coterminous with that WDFW's deadline.

Require Armor Removal

The Rules and SMP should be amended to expressly require the removal of unauthorized structures absent highly unusual and sympathetic circumstances. Such a legislative change would need to include standard deadlines for achieving the work once the agency completed its investigation and issued its notice to comply, plus assurances such as bonding and site inspections to confirm timely removal. This would avoid the current incentive to construct armoring without approval and then to use subsequent years or decades to seek after-the-fact approval of the armor while it remains in place. The current system encourages approval of inappropriate armor as its existence becomes an increasingly established fact on its own.

While enforcement authority likely already empowers WDFW and counties to require the removal of an impermissible and unauthorized structure, the Rules, and SMP should be amended to expressly require the removal outcome absent highly unusual and sympathetic circumstances.

Require HPAs for All Armor

The Rules should be revised to direct WDFW to first enforce against unauthorized armor and then to process after-the-fact applications for the armor itself. WDFW interprets the Code at present to preclude it from issuing an after-the-fact HPA for armor; rather than requiring armor removal, WDFW typically issues an HPA for actions intended to mitigate for adverse impacts from the unpermitted armor. This process circumvents the usual public review of the armor and insulates the violator from the possibility of having to demonstrate compliance for the armor construction or defend against an appeal where the armor contravenes the Rules, in a sense rewarding violators and incentivizing violations over regulatory compliance. By requiring the typical application process, the unauthorized armor would undergo standard regulatory review and benefit from the Code's and Rules' ecological protections.

Simplify Shoreline Permitting

At this time, the Rules and SMP set forth very similar bulkhead requirements and agency jurisdictions. Significant efficiencies could be achieved if the permit requirement under the Code were eliminated for marine hydraulic projects like bulkheads by: (1) folding worthwhile Hydraulic Code regulations into SMPs; and (2) coordinating between local planners and WDFW marine biologists and geologists where smaller counties and cities that do not have in-house expertise to fully review permit applications.

Confirm Permit Status at Time of Sale

Formal requirements for compliance at the time of property sale or transfer of ownership are used in other applications such as septic system inspections, upgrades, and vacation rentals. For example, unpermitted accessory dwelling units are known 'sticking points' to successful sales in the San Juans and the relatively recent implementation of requirements for on-site septic systems have resulted in vastly improved compliance. Rules should be updated to ensure that all shoreline structures, including armor, must be compliant as the property changes hands.

Conclusions and Next Steps

Armoring impedes and disrupts the sediment supply and transport processes that form and maintain beaches and nearshore habitats across the San Juan Islands and the greater Salish Sea.[53] In addition to directly burying spawning habitat, the presence of hard armor can cause beaches to steepen and coarsen over time, degrading substrate utilized by beach-spawning forage fish, with broad impacts for the entire marine ecosystem.[54] Armored beaches also typically have less vegetation, wrack, and large woody debris which all lead to changes in beach microclimate that are known to negatively impact surf smelt egg survival.[55]

The 2019 mapping and change analysis demonstrates that more new armor is being installed than being removed: 1.8 miles were installed and 0.3 miles were removed in the study decade (2009-2019). Results also show that new armor continues to be constructed along feeder bluffs and forage fish spawning habitats, despite policies and codes aimed at protecting these beaches from new armor. In addition, most armor continues to be installed below ordinary high water and nearly half of all armor was located below mean higher high water, where impacts to coastal processes, habitats, and species are greatest. These armor-installation trends limit the net effect of restoration efforts, as declines in shoreline habitat continue to outpace gains.

These project results demonstrate that a large amount of new armor is occurring outside of the permit system. Problems with this situation extend well beyond basic fairness issues as the regulatory process is where potential impacts to cultural and ecological resources and coastal processes are identified and then avoided or mitigated. It also calls into question the ability of jurisdictions to utilize the permit record to say anything meaningful about reality, such as the reliance on state HPA permits to track the armor indicator and local jurisdictions to track the cumulative impacts of development. Even for permitted sites, increased rigor and consistency of the permit process-from application materials through review and post-project tracking of construction and mitigation were all identified as opportunities where significant improvements should be made to improve outcomes for marine shorelines.

Unfortunately, this study brings to light the failure of the current regulatory system to effectively address the ongoing establishment of unauthorized shoreline armoring. Agencies need to be provided with adequate funding, authorization, and direction to pursue shoreline monitoring and active enforcement of regulations. Enforcement measures need to include required removal of unauthorized armoring, accountability for contractors who install projects in violation of the law, and meaningful penalties for property owners.

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[53] Johannessen, J. and A. MacLennan. 2007. Beaches and bluffs of Puget Sound. Puget Sound Nearshore Ecosystem Partnership Report No. 2007-04. Published by Seattle District U.S. Army Corps of Engineers, Seattle, WA

[54] Johannessen, J. and A. MacLennan. 2007. Beaches and bluffs of Puget Sound. Puget Sound Nearshore Ecosystem Partnership Report No. 2007-04. Published by Seattle District U.S. Army Corps of Engineers, Seattle, WA
Dethier, M.N, J.D. Toft, and H. Shipman. 2016. Shoreline armoring in an inland sea: science- based recommendations for policy implementation. Conservation Letters. DOI: 10.1111/ conl.12323

[55] Rice, C. 2006. Effects of Shoreline Modification on a Northern Puget Sound Beach: Microclimate and Embryo Mortality in Surf Smelt (Hypomesus pretiosus). Estuaries and Coasts. Vol. 29, No. 1. p. 63-71

Results of this project, along with other related regional research conducted over the past decade, all clearly demonstrate that meaningful changes are needed to improve the effectiveness of local (not just in San Juan County) and state shoreline management and protection programs including:

- interagency coordination;
- tracking of on-the-ground conditions;
- proactive compliance and enforcement efforts;
- improved consistency and rigor within the permit process, including inspections; and
- expanded education of landowners, contractors, shoreline managers and the general public.

The importance of regulatory protection cannot be overstated if Washington is to retain what remains of its shoreline ecosystem health. Net gains in habitat quality or quantity from restoration cannot occur without regulatory programs protecting against new ecosystem impacts, including tracking unauthorized actions.

The remaining healthy and natural beaches in San Juan County provide irreplaceable habitat to several important types of small fish in the Salish Sea, representing the foundation of the marine food chain. Without these beaches, the fish that depend on them cannot survive, and the entire food web suffers, including our imperiled salmon and orca. With over 90% of waterfront parcels in San Juan County in private, residential ownership and a significant portion of waterfront parcels still undeveloped, human population growth and impacts of a changing climate are expected to further increase demand for hard shoreline armoring. Having a significant commitment to putting improved effectiveness of protection systems in place immediately, is essential to achieve marine ecosystem recovery and resiliency in the Salish Sea.

Friends of the San Juans conducted this research in order to assess whether current legal protections for our shorelines are functioning well. Unfortunately, the answer is a resounding *NO*, and immediate action is warranted. As the Salish Sea loses its healthy beaches one by one, the entire marine ecosystem slowly suffers a death by a thousand cuts. The implications go well beyond environmental concerns, including impacts to our economy, our culture, and our way of life that will resonate far into the future. Friends of the San Juans looks forward to working with decision-makers, regulators, contractors, and shoreline landowners to explore and implement the many solutions proposed here.

Date: **Recorder:**

Time:

Location (survey region):

Armoring

Waypoint #: _____

Length: _____

Class: 0-25 ft 26-50 ft 51-75 ft 76-100 ft Over 100 ft Over 150 ft Over 200 ft

Toe Elevation (where bottom of structure intersects beach at the most waterward point)

Distance above water line: _____ Time: _____ OR

Toe of structure below current water line: Time: _____

Tidal Elevation	Code (circle 1)	Indicator(s) Waterward of Structure
Above Extreme High Water (Upland)	U	Presence of upland vegetation, fewer halophytes, low gradient, waterward storm berm, Presence of driftwood or Large Woody Debris (LWD)
Ordinary High Water Mark to Extreme High Water (Dunegrass area)	D	Presence of dunegrass and other halophytic vegetation, low gradient, presence of LWD and beach wrack
Mean Higher High Water to Ordinary High Water Mark	H W	Presence of LWD, beach wrack deposits, patches of halophytic vegetation, higher gradient
Mean Sea Level to Mean Higher High Water	↓ H W	Waterward beach is generally bare, higher gradient, signs of waves battering structure
Below or at Mean Sea Level	S L	Higher gradient, coarser mid-beach sediment composition, signs of waves battering structure, *Fucus* sp or barnacles growing on structure

Armoring Associated with (circle all that armor is directly associated with):

Bulkhead Beach Access Dock Boat Ramp Gabion Basket Stormwater Outfall Road

Road End Breakwater Jetty Groin Boathouse House

Other (circle and describe): _____

Armoring Material (circle all that apply):

Wood Creosote Wood Large Rock (rip rap) Small /Medium Rock

Concrete Other (circle and describe): _____

Armoring Condition (circle 1)

Good (clearly intact) Poor (clearly degraded)

Unknown

Condition unknown? Check one below

In between condition? ____

Low quality methods but not degraded?____

Other:

Field Notes/Comments (if applicable, check and describe for all armor records):

Environmental conditions limiting (wind, glare, shade,…):

Equipment issues:

More than 1 image taken for this site:

If armor is a Groin please answer the additional questions:

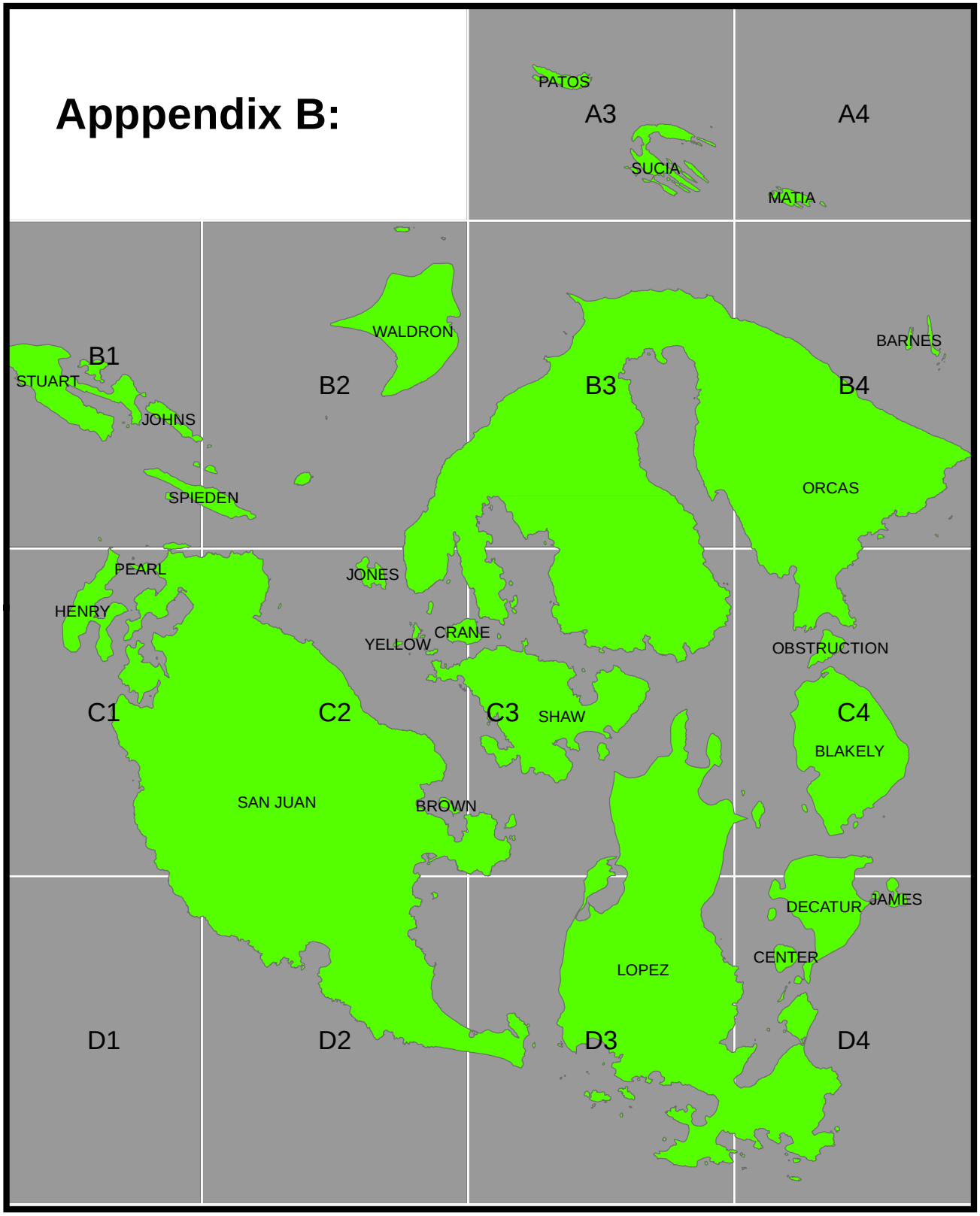
Beach Elevation: (where the most landward portion of the structure intersects the beach)

Top of the structure intersects the beach _____ feet above the water line: OR

Top of Structure intersects the beach below the current water line: _____

Tidal Elevation		Indicator(s) Waterward of Structure
Above Extreme High Water (Upland)	U	Presence of upland vegetation, fewer halophytes, low gradient, waterward storm berm, Presence of driftwood or Large Woody Debris (LWD)
Ordinary High Water Mark to Extreme High Water (Dunegrass area)	D	Presence of dunegrass and other halophytic vegetation, low gradient, presence of LWD and beach wrack
Mean Higher High Water to Ordinary High Water Mark	HW	Presence of LWD, beach wrack deposits, patches of halophytic vegetation, higher gradient
Mean Sea Level to Mean Higher High Water	↓HW	Waterward beach is generally bare, higher gradient, signs of waves battering structure
Below or at Mean Sea Level	SL	Higher gradient, coarser mid-beach sediment composition, signs of waves battering structure, *Fucus* sp or barnacles growing on structure

Apppendix B:



Shoreline Armor Mapping and Change Analysis for San Juan County, Washington 2009 to 2019

MAP BOOK

Friends of the San Juans

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

A4

B2

San Juan County, Washington
June 2022

B3

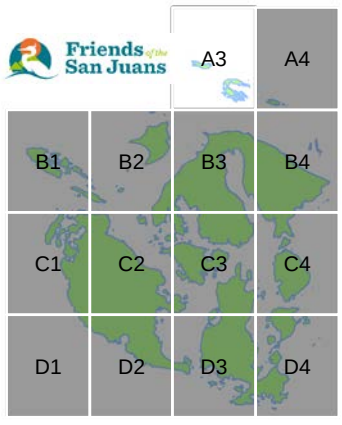
1 0.5 0 1Miles

B4

N

Legend

- New Hard Armor (present in 2019; not 2009)
- Existing Hard Armor (present in 2009 and 2019)
- Removed Hard Armor (present in 2009; not 2019)
- Forage Fish Spawning Sites (FSJ & WDFW 2021)
- All Feeder Bluffs (PIAT Shoreforms 2013)
- All Pocket Beaches (PIAT Shoreforms 2013)



A3

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

A3

B3

B4

San Juan County, Washington
June 2022

1 0.5 0 1Miles

N

Legend

- New Hard Armor (present in 2019; not 2009)
- Existing Hard Armor (present in 2009 and 2019)
- Removed Hard Armor (present in 2009; not 2019)
- Forage Fish Spawning Sites (FSJ & WDFW 2021)
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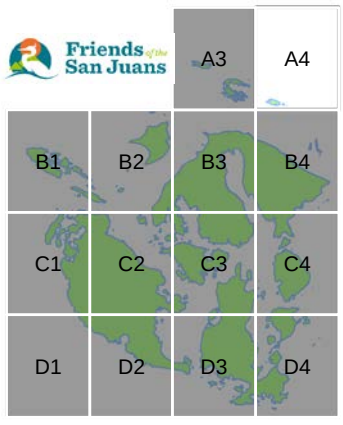

A4

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

B2

San Juan County, Washington
June 2022

C1

1 0.5 0 1Miles

C2

N

Legend

- New Hard Armor (present in 2019; not 2009)
- Existing Hard Armor (present in 2009 and 2019)
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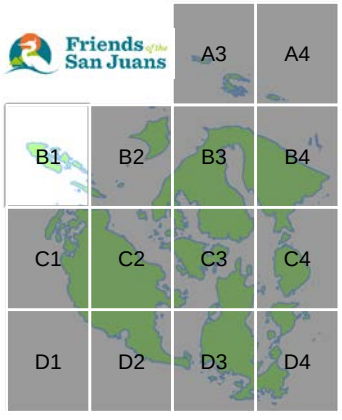
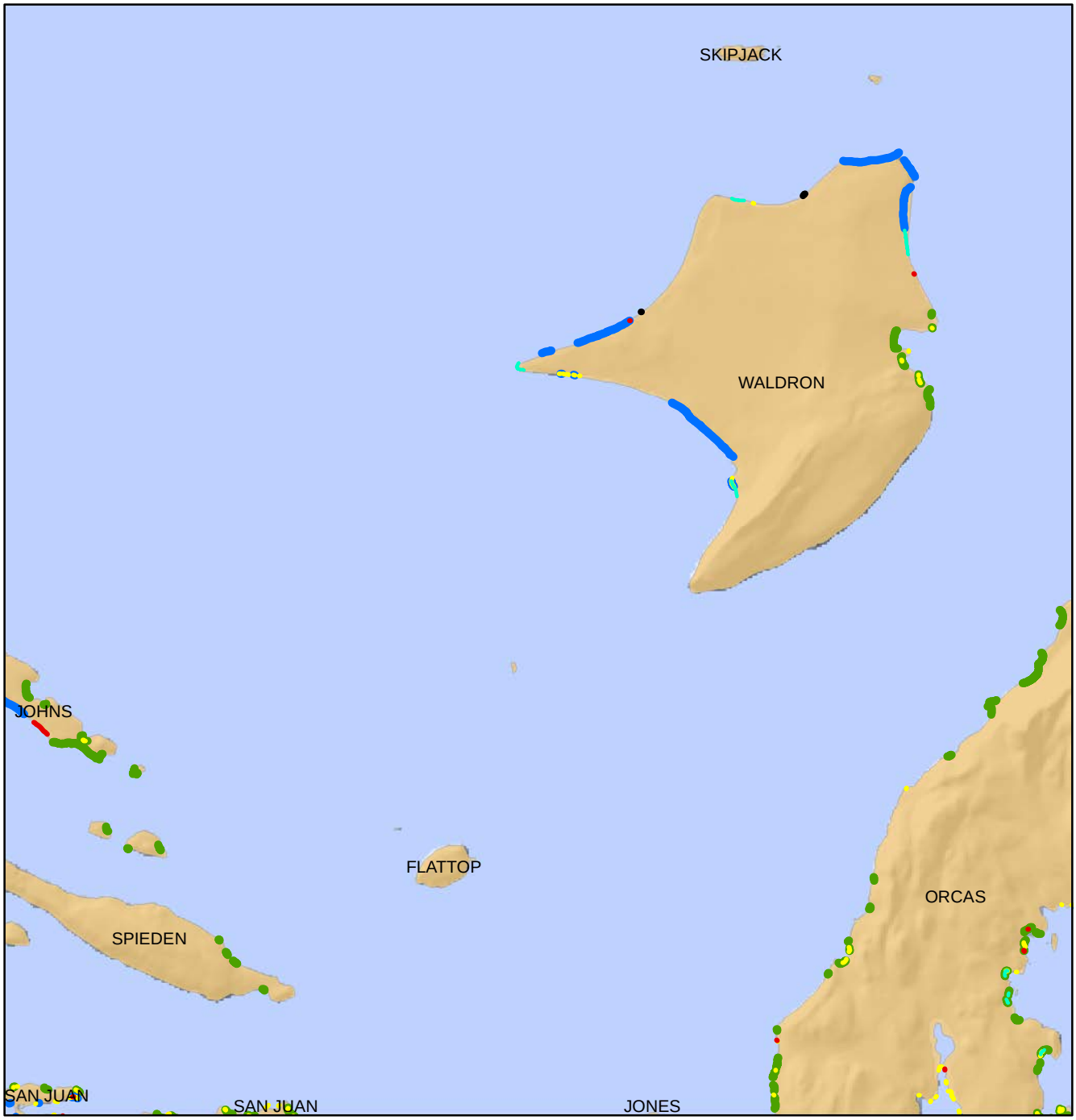


B1

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019



San Juan County, Washington
June 2022

1 0.5 0 1Miles

N

Legend

- New Hard Armor (present in 2019; not 2009)
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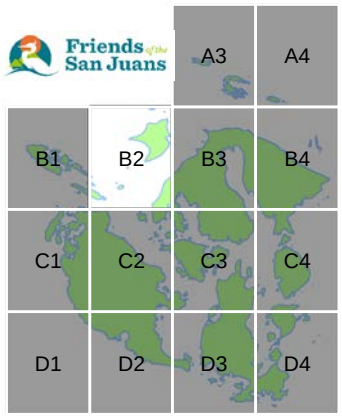
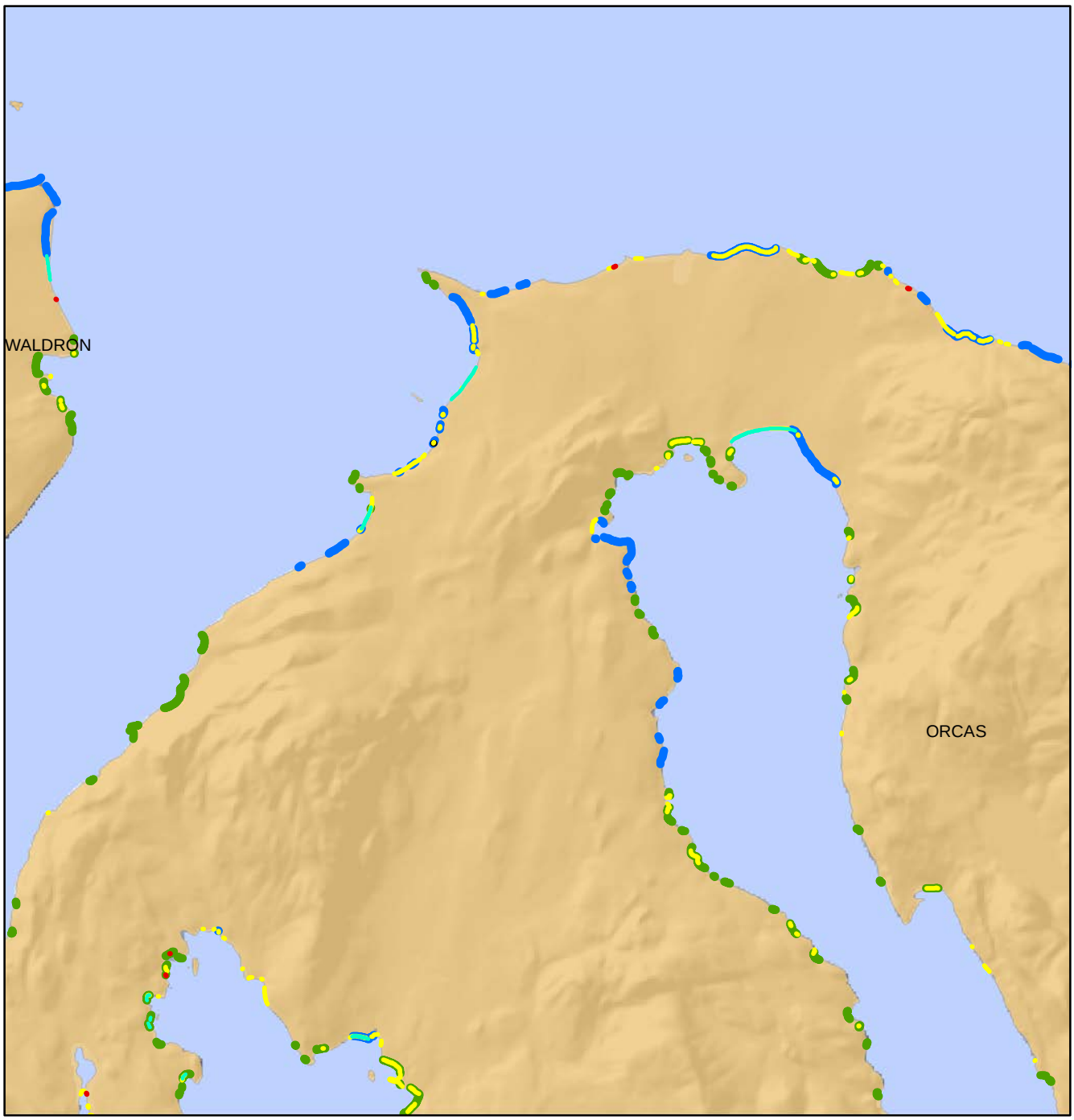


B2

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019



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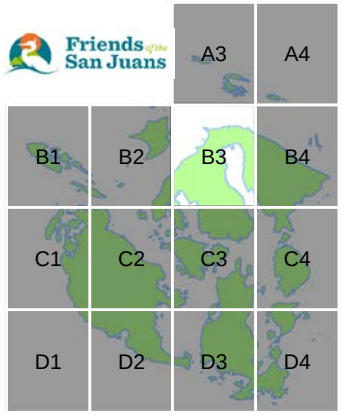
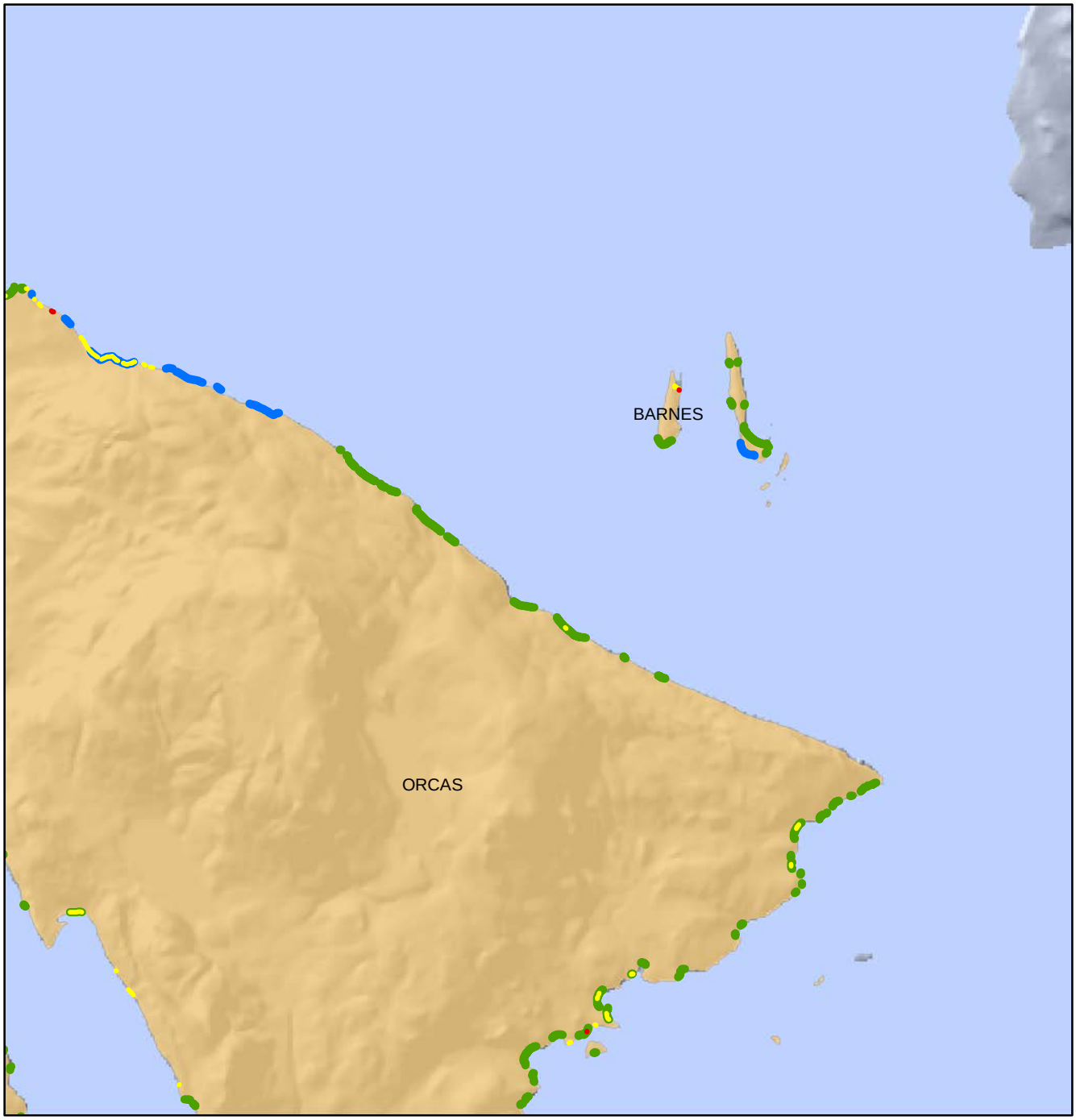


B3

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

A3 A4



B3

C3 C4

San Juan County, Washington
June 2022

1 0.5 0 1Miles

N

Legend

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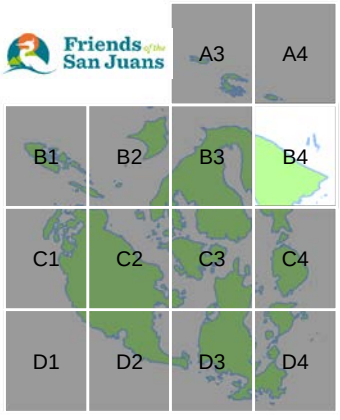

B4

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

B1 B2

C2

San Juan County, Washington
June 2022

D1

1 0.5 0 1Miles

D2

N

Legend

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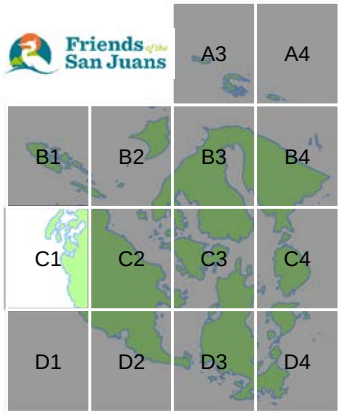

C1

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

San Juan County, Washington
June 2022

1 0.5 0 1Miles

N

Legend

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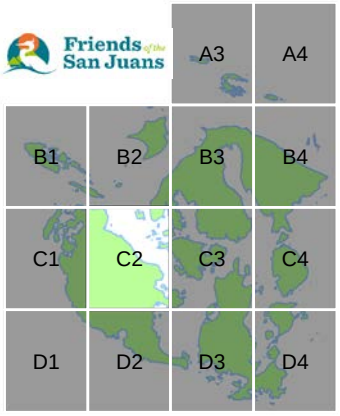
C2



Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

Legend

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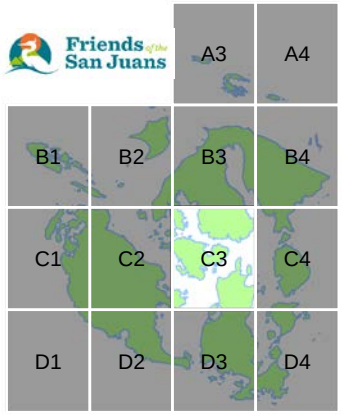

C3

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

San Juan County, Washington
June 2022

1 0.5 0 1Miles

N

Legend

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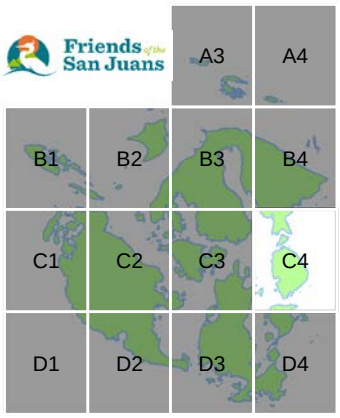

C4

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

C1 C2

D2

San Juan County, Washington
June 2022

1 0.5 0 1Miles

N

Legend

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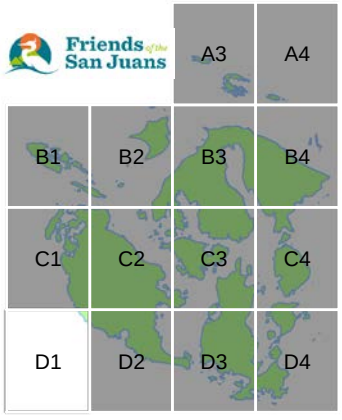

D1

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

C1 C2 C3

D1 D3

San Juan County, Washington
June 2022

1 0.5 0 1Miles

N

Legend

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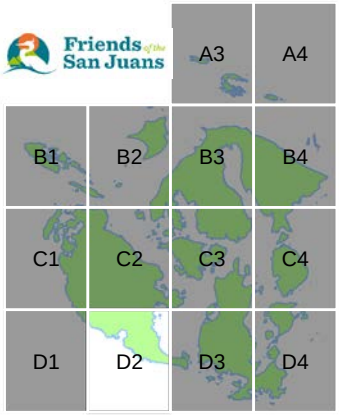

D2

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

San Juan County, Washington
June 2022

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Legend

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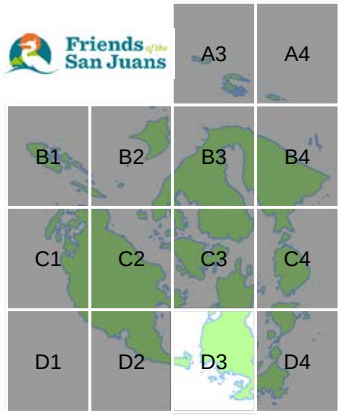

Shoreline Armor Mapping and Change Analysis for San Juan County 2009 to 2019

C3 C4

D3

San Juan County, Washington
June 2022

1 0.5 0 1Miles

N

Legend

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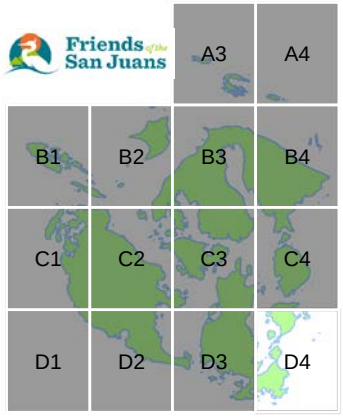
D4



Appendix C.

Washington State and San Juan County Armor -- Legal and Policy Framework

Understanding the legal and policy frameworks in place during the study timeline (2009-2019) is important context that informs the development of specific management recommendations associated with compliance and permitting effectiveness. The following sections: (1) describe the local and state regulatory regimes that apply to armor construction and the enforcement of unauthorized shoreline development; (2) relate these regimes to the regulatory compliance and review findings; and (3) explore management implications and recommendations.

Armor application and approval requirements under the Hydraulic Code and Shoreline Management Act.[1]

The construction of marine shoreline armor along public waterways is regulated by federal, state, and local laws.

Federal: The U.S. Army Corps of Engineers (Corps) oversees armor development as part of its responsibility to govern dredging and filling of navigable waters under the Clean Water Act and to protect species listed under the Endangered Species Act.

State: Washington's Hydraulic Code (Code) requires anyone who wishes to construct armor along marine shorelines to first obtain a Hydraulic Project Approval to ensure the protection of fish life.

Local: San Juan County's Shoreline Master Program (SMP), a regulatory system promulgated and implemented in partnership with the Washington Department of Ecology under the SMA, likewise requires either a shoreline substantial development permit or a letter of exemption before armor may be constructed. The SMP requires applicants to demonstrate that their project will result in no net loss of shoreline ecological functions, and that the structure is necessary to prevent shoreline erosion from undermining upland development at imminent risk of failure (i.e. within 3 years).

Due to the limited involvement of the U.S. Army Corps of Engineers in shoreline armoring cases in San Juan County during this study period as well as constraints in obtaining permit records from them in a timely manner, the regulatory assessment was limited to State (WDFW Hydraulic Project Approval) and local (Town of Friday Harbor permits or San Juan County shoreline) armoring review. The text below discusses the applicable requirements of the Code and SMP, including changes in those regimes that occurred between 2009 and 2019.

[1] While federal laws also apply to shoreline armor constructed at and seaward of the high tide line, this memorandum does not discuss applicable federal oversight because the US Army Corps of Engineers did not acknowledge until 2019 its responsibility to review armor at the higher beach elevations where most of it is constructed in the San Juans.

Washington State Hydraulic Code

The Code, Chapter 77.55 RCW, and Hydraulic Code Rules (Rules), Chapter 220-660 WAC, establish a permit system by which the Washington Department of Fish & Wildlife (WDFW) generally must ensure that nearshore development is designed and constructed to protect fish life. The Code states that:

> in the event that any person or government agency desires to undertake a hydraulic project, the person or government agency shall, before commencing work thereon, secure the approval of the department in the form of a permit as to the adequacy of the means proposed for the protection of fish life.[2]
>
> A hydraulic project involves the "construction or performance of work that will use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh waters of the state."[3] The permit, a hydraulic project approval (HPA), may not "be unreasonably withheld or unreasonably conditioned," but WDFW can deny an HPA to "protect fish life."[4]

To obtain an HPA, an applicant must submit a complete written application that contains: (1) general plans; (2) complete plans and specifications for the proposed construction; (3) complete plans for the proper protection of fish life; and (4) notice of compliance with any applicable SEPA requirements.

Until July 27, 2019, the Code contained a section, RCW 77.55.141, that expressly addressed armoring for single-family residences.[5] WDFW processed single-family bulkheads under RCW 77.55.141 and related regulations and bulkheads for other purposes under RCW 77.55.021 and related regulations.

Single-family residence bulkheads until 2019.

Under RCW 77.55.141, WDFW was directed to issue an HPA for a bulkhead or rock wall for single-family residences if it met the following conditions:[6]

- the waterward face of the structure was no further seaward than 6 feet from the Ordinary High Water Line;
- replaced or repaired bulkheads must be constructed in the same alignment as the existing bulkhead, but could be installed directly seaward of the existing structure;
- the bulkhead could not result in the permanent loss of critical food fish or shellfish habitats; and

[2] RCW 77.55.021(1).
[3] RCW 77.55.011(11).
[4] RCW 77.55.021(7)(a).
[5] State of Washington, SSHB 1579, 66th Legislature, chapter 290, Laws of 2019; RCW 77.55.141 (repealed effective 7/27/2019).
[6] RCW 77.55.141(2).

- timing of bulkhead construction would be limited to protect critical habitats like migration corridors, rearing and feeding areas, and spawning habitats.

WDFW took the position that it could not impose the general requirement to protect fish life in addition to these criteria, and thus did not require such armoring to achieve no net loss.

All bulkheads going forward, and non-single-family residence bulkheads until 2019.

WDFW can deny a bulkhead if the application does not demonstrate that it would protect fish life and achieve no-net-loss.[7] Since at least 2009, the Rules have required an HPA prior to construction of a hydraulic project and have required mitigation measures to ensure that bulkheads achieve no net loss.[8] The Rules also have required an applicant to demonstrate that:

- they are proposing installation of the least impacting technically feasible option; and
- the bulkhead would not result in the permanent loss of surf smelt or Pacific sand lance spawning beds.

WDFW published a significant update to the Rules on July 1, 2015,[9] and since that time an applicant has also been required to show that:

- a new bulkhead would be constructed at or above the Ordinary High Water Line; and
- the application has been prepared by a qualified professional, provides evidence of erosion, and includes a site assessment, alternatives analysis, and design rationale that assesses the erosion threat to structures.[10]

In addition, WDFW at that time could require beach nourishment for hard structures and plans that showed the proximity of the bulkhead to fixed benchmarks.[11]

Enforcement of hydraulic project without HPA.

The Code and Rules establish compliance procedures for violations, including construction of a hydraulic project without approval.[12] The Code directs WDFW first to attempt to achieve voluntary compliance by offering information and technical assistance to the violator and by identifying a means to bring the development into compliance.[13] However, WDFW may ultimately issue a correction request, a stop work order, a notice to comply, or a notice of civil penalty.[14] WDFW may issue a stop work order if the violation is serious enough that it could

[7] RCW 77.55.021; WAC 220-660-370. Until 2019, this applied to only non-single-family residential bulkheads.
[8] WAC 220-110-030(1), -280 (repealed 2015); WAC 220-660-040, -080.
[9] WSR 15-02-029, Order 14-353 (permanent rules of WDFW).
[10] WAC 220-660-370.
[11] WSR 20-11-019 (WDFW amendment of Rules consistent with SSHB 1579).
[12] RCW 77.55.410; WAC 220-660-480.
[13] RCW 77.55.410(1).
[14] RCW 77.55.410(2).

cause significant harm to fish life and immediate cessation is necessary to avoid more harm.[15] Where a stop work order is not necessary to prevent continued harm or avoid significant new harm to fish life, WDFW may issue a notice to comply.[16] Where a person constructs a hydraulic project without first obtaining an HPA, or fails to comply with a stop work order or notice to comply, WDFW may levy a civil penalty of up to $10,000 per violation.[17] The Rules provide a method for calculating the penalty. Last, it is a gross misdemeanor to conduct a hydraulic project without an HPA, and criminal penalties may apply.

San Juan County Shoreline Master Program.

In 1971, the Washington State legislature enacted the SMA in response to the "recognition that the shorelines are fragile and that the increasing pressure of additional uses being placed on them necessitated increased coordination in their management and development."[18] The primary purpose of the Act is "'to protect the state shorelines as fully as possible.'"[19] Contrary to the general rule of strict statutory construction, the SMA "is to be broadly construed in order to protect the state shorelines as fully as possible."[20]

Under the SMA, San Juan County and the Washington Department of Ecology (Ecology) first adopted an SMP in 19XX that established policies and regulations to govern shoreline development like bulkheads.[21] Since then it has been updated multiple times. SMP policies for bulkheads promote ecological, geological, and aesthetic protection.[22] SMP regulations prohibit their unauthorized construction and provide strict conditions for approval.[23] Under the SMP, armor constructed for the sole purpose of protecting a residence can be approved through the more streamlined exemption process, whereas all other armor construction requires a shoreline substantial development permit.[24]

At the end of 2012, San Juan County adopted critical areas regulations that supplemented the SMP's bulkhead application requirements and that were incorporated into the SMP in 2016 when the County conducted a broader SMP update.[25] Prior to these regulations, bulkheads for single-family residences did not need to satisfy all substantive review criteria. After 2012, the County required bulkheads for residences to meet all code criteria, though they could still be approved through the exemption process. The sections below discuss the approval standards

[15] WAC 220-660-480(5).
[16] WAC 220-660-480(6).
[17] WAC 220-660-480(7), (8).
[18] RCW 90.58.020; *Buechel v. Dep't of Ecology*, 125 Wn.2d 196, 203, 884 P.2d 910 (1994).
[19] *Lund v. Dep't of Ecology*, 93 Wn. App. 329, 336-37, 969 P.2d 1072 (1998) (quoting *Buechel*, 125 Wn.2d at 203).
[20] RCW 90.58.900; *Buechel*, 125 Wn.2d at 203.
[21] Chapter 18.50 San Juan County.
[22] San Juan County Comprehensive Plan § 3.5.D.
[23] San Juan County 18.50.030.D; 18.50.350 - .420.
[24] San Juan County 18.50.040.D.C (citing WAC 173-27-040(2)(c) (single-family residence bulkhead exemption)); 18.50.050, .060.A.
[25] *See* San Juan County Ordinances No. 29-2012 (Dec. 3, 2012) and No. 01-2016 (April 5, 2016).

that applied to armor from 2009 to 2019, as well as the County's code enforcement rules, which similarly underwent a significant update in 2013.

Pre-2013 bulkhead regulations.

Prior to 2013, the SMP established the following restrictions for all armor requests:

- Bulkheads were permitted on marine feeder bluffs "only where (a) a clear and significant danger to established development exists and (b) there is reasonable cause to believe that the bulkhead will in fact arrest the bluff recession and will not seriously disrupt the feeder action or the driftway";[26]
- Bulkheads were prohibited for any purpose if they would cause significant erosion or beach starvation;[27] and
- Bulkhead design was required to be consistent with WDFW standards unless it would harm the shore process corridor and operating system.[28]

In addition, the SMP prohibited the construction of residential structures that would require bulkheads at the time of construction or in the foreseeable future.[29] However, the San Juan County Department of Community Development (DCD) did not uniformly deny bulkhead applications submitted shortly after, and that were associated with, new construction of residential structures.[30]

In addition to the generally applicable requirements above, applications for armor that wasn't associated with single-family residences had to demonstrate that:

> nonstructural shoreline protection, restoration, or modification techniques have been shown to be ineffective and it can be shown that one or more of the following conditions exists:
>
> - Serious erosion is threatening an established use on the adjacent uplands;
> - A bulkhead is needed and is the most reasonably method of stabilizing an existing beach condition;
> - There is a demonstrated need for a bulkhead in connection with water-dependent or water-related commerce or industry in an appropriate environment; or
> - A bulkhead is the most desirable method for stabilizing a landfill permitted under this master program.[31]

[26] San Juan County 18.50.210.A.4 (repealed by San Juan County Ordinance No. 01-2016).
[27] San Juan County 18.50.210.A.8 (repealed by San Juan County Ordinance No. 01-2016).
[28] San Juan County 18.50.210.A.6 (repealed by San Juan County Ordinance No. 01-2016).
[29] San Juan County 18.50.330.B.2.
[30] *See e.g.*, PSJ000-12-0019, PSJXMP-15-0028.
[31] San Juan County 18.50.210.A.2 (repealed by San Juan County Ordinance No. 01-2016).

The SMP did not define "serious erosion," "threatening," "established use," or "needed."[32]

Post-2013 bulkhead regulations.

The 2013 Critical Areas Ordinance update added strict restrictions on the construction of new shoreline armoring, which were subsequently refined by the 2016 SMP update and continue to strongly discourage the construction of new armor today.[33] First, San Juan County expressly incorporated a no net loss standard.[34] Second, armor may be constructed only where necessary to protect existing primary structures and appurtenant development from shoreline erosion where there is a risk of damage in the near future.[35]

Applications for new armor must include a geotechnical report prepared by a qualified professional that "demonstrates the need for [the armor]" and that assesses the erosion rate at the site and shows that shoreline erosion is not being caused by upland drainage issues.[36] The report must also assess alternatives to hard or soft armor, such as relocating a structure, correcting groundwater or drainage issues, and assessing the feasibility of soft armor.[37]

The SMP distinguishes between "hard" and "soft" armor and authorizes the former where damage to a structure listed above is expected within three years and the latter where the structure is in danger from shoreline erosion.[38] Hard armor means "shore erosion control structures and measures composed of hard surfaces, arranged with primarily linear and vertical or near-vertical faces that armor the shoreline and prevent erosion."[39] Soft armor means "shore erosion control structures and measures that maintain or enhance ecological functions composed of primarily natural and semi-rigid or flexible materials, bioengineering tailored to site-specific natural conditions, and vegetation, organized in a nonlinear, sloping arrangement, that dissipates wave energy and minimizes erosion in a way that is similar to natural shoreline processes."[40]

In addition, the SMP establishes an overarching hierarchy for armor that requires an applicant to demonstrate that each of the following is not feasible before moving to the next type of measure:

- leave the shoreline undisturbed, install drainage controls, plant native vegetation, increase setbacks, or relocate structures;
- use soft structural measures like flexible defense works constructed of natural materials, beach nourishment, protective berms, vegetative stabilization; and

[32] *Id.*
[33] The SMP labels armor as "structural shoreline stabilization measures."
[34] San Juan County 18.35.130.G.1.b.; San Juan County 18.50.350 - .420, 18.50.350.E (no net loss).
[35] San Juan County 18.50.350.A.
[36] San Juan County 18.35.130.G.3.e.; San Juan County 18.50.420.A.1, A.2.
[37] San Juan County 18.50.420.A.5.
[38] San Juan County 18.50.350.B., .350.C.,
[39] San Juan County 18.20.080.
[40] San Juan County 18.20.190.

- hard structures like sandbags, wood retaining walls, rock, or concrete.[41]

Ultimately, new armor for non-water-dependent development can be approved only where alternatives like relocation or reconstruction of existing structures are not feasible and less expensive than the proposed armor.[42]

Enforcement in San Juan County

In 2013, San Juan County revamped its enforcement ordinance to authorize the Department of Community Development (DCD) to levy penalties for violations of the SMP but decreased the amount of penalties that could be assessed. Prior to that date, the County could seek civil penalties of up to $1,000 per day if a violator chose not to comply with a corrective request from the County. In addition, criminal penalties were available if civil penalties were deemed incapable of ensuring compliance.

Beginning in 2013, DCD could levy penalties with the issuance of a notice of violation, but the amount of the fine decreased to the amounts in the following table:[43]

San Juan County violation penalty

Monetary Penalties for Notice of Violation	
Period of Violation	Monetary Penalty Per Period
Day 1 to Day 45	$500
Day 46 to Day 60	Add $1,000 (for a total of $1,500)
Day 61 to Day 90	Add $1,000 (for a total of $2,500)
Each week thereafter	Add $1,000

Please note that these penalties do not accrue daily, but as a flat amount for a violation lasting each of the periods identified above. Violations of stop work orders[44] and emergency orders can also accrue penalties.[45] In addition, a violation by a **contractor or other** professional who **is presumed to** know the SMP rules is subject to a flat $1,000 penalty.[46]

Like the Hydraulic Code, in general, the primary intent of SMP enforcement actions is to educate the public and to encourage voluntary correction of violations.

[41] San Juan County 18.50.360.
[42] San Juan County 18.35.130.G.3.e.ii.(B).
[43] San Juan County Ordinance No. 09-2013 (May 7, 2013); San Juan County C 18.100.090.
[44] San Juan County C 18.100.010.
[45] *Id.*
[46] San Juan County C 18.100.200.