OREGON INTERNATIONAL PORT OF COOS BAY
WRDA SECTION 204(F) PROPOSED CHANNEL MODIFICATION
COOS COUNTY, OREGON

BASELINE EELGRASS SURVEY – SEPTEMBER 2023

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1.0 BACKGROUND & SITE HISTORY

1.1 BACKGROUND AND INTRODUCTION

The Oregon International Port of Coos Bay (the Port) proposes a Pacific Coast Intermodal Port (PCIP) project at Coos Bay, Oregon. The PCIP consists of integrated elements that would link freight arriving by container ship to the Oregon International Port at Coos Bay to Class 1 rail networks in Oregon. The in-water component of the project includes the deepening and widening of the existing federal navigation channel from the entrance channel through river mile 8.2 and the construction of turning basins at river miles 5 and 8 (Figure 1). The channel improvements are intended to facilitate the safe and efficient passage of deep draft vessels that would call at the Port. The project is proposed by the Port under the authority granted by Section 204(f) of the Water Resources Development Act of 1986 (as amended).

The Coos Bay estuary supports two species of eelgrass, common eelgrass (*Zostera marina*), and the introduced dwarf or Japanese eelgrass (*Zostera japonica*). Eelgrass is a seagrass and is considered an Essential Fish Habitat (EFH) Habitat Area of Particular Concern (HAPC) under the Pacific Coast Groundfish Fishery Management Plan (Pacific Fishery Management Council 2022). Beds of common eelgrass are also considered by the Oregon Department of State Lands (DSL) to be Aquatic Resources of Special Concern (ARSC) (DSL 2023). Dwarf eelgrass or Japanese eelgrass, considered by the DSL to be non-native but not necessarily invasive, is recognized by DSL to perform similar aquatic ecosystem functions as does *Z. marina*. This is due to the importance of such habitats for fishes, mollusks, and other invertebrates, providing forage for migrating geese, and for the ability of *Z. marina* and *Z. japonica* to stabilize sediment and sequester nutrients.

The planned channel improvements have the potential to adversely affect marine resources within Coos Bay though direct impacts and secondary effects associated with channel bank layback, elevated turbidity during dredging, and changes in hydrology associated with expanding capacity of the channel. As a result, information collection is necessary to support evaluation of potential effects. Permitting requirements of the proposed dredging include the determination of density and extent of eelgrass within the project area.

Merkel & Associates, Inc. (M&A) was contracted to prepare and implement a survey plan to perform an eelgrass survey within areas that could undergo direct or indirect disturbance from the channel modification as described above as well as within reference areas that are outside of the areas of potential affect (APE) from the proposed action. Because of the dynamics of eelgrass and the shoals within Coos Bay that can alter the eelgrass distribution over time, coupled with aging historic data on eelgrass distribution in the bay, a broad survey coverage was undertaken to determine the distribution of eelgrass within and adjacent to the project area. Surveys were conducted within the project areas within suitable depths to support eelgrass, areas adjacent to the project area, and selected natural reference areas. The eelgrass survey serves to establish a baseline for project analysis and determining potential for impact and possible needs for compensatory mitigation of eelgrass impacts. Surveys will be used in conducting impact analysis comparing pre-construction surveys to post-construction surveys following the assessment methods of the California Eelgrass Mitigation Policy (CEMP, NOAA Fisheries, West Coast Region 2014).

Regional Locator Map

Port of Coos Bay WRDA Section 204(F)
Proposed Channel Modification
Coos County, OR

Figure 1

1.2 OBJECTIVES

The objectives of this survey were as follows:

- Collect sufficient survey baseline data from the project area and natural reference areas to determine the spatial distribution, areal extent, percent vegetated coverage, and shoot density of eelgrass pursuant to standards of the CEMP (NOAA Fisheries 2014).
- Document the distribution of other vascular submerged aquatic vegetation (SAV) habitat within the area of potential effect of the project.
- Collect baseline data from separate oyster lease areas that contain eelgrass habitat but are not actively leased presently.
- Prepare an eelgrass survey report to include a description of the eelgrass beds and any other rooted SAV habitat. Include in the report, maps, habitat photographs, tables, and graphs as applicable to meet the requirements for an eelgrass baseline report.
- Prepare a map of canopy kelp, rocky reef, and other resources of interest that are incidentally encountered during the surveys.
- Note any non-mappable resources observed during the surveys (e.g., native oysters, federally-listed species, state-listed species, marine mammals).

The present survey serves to provide a baseline for planning and analysis of potential eelgrass impacts, and mitigation but it does not include any impact analyses or mitigation planning itself. Further, this baseline is not intended to serve as the basis for impact assessment. Under the CEMP, a regimented assessment protocol is employed that considers changes in eelgrass spatial and density metrics from pre- to post-construction periods, and, where appropriate, further integrates two annual post-construction surveys following construction to evaluate potential indirect or operational impacts that may develop following project completion. The details of future analysis, survey requirements, and mitigation are beyond the scope of the present survey effort.

1.3 EELGRASS SURVEY PLANNING

1.3.1 Eelgrass Distribution in Coos Bay

A review by Sherman and DeBruyckere (2018) found several datasets for eelgrass distribution in Coos Bay. The most recent survey referenced included a 2016 study by South Slough National Estuarine Research Reserve. Others include older but more comprehensive surveys conducted by spectral image classification of 2005 aerial photos (Clinton et al. 2007). These prior investigations provide a good indication of the overall distribution of eelgrass within Coos Bay; however, they are aging. Further, the mapping that has been completed was not intended for use in impact evaluation and as a result, it is not detailed enough nor current enough to support the project assessment needs. The prior surveys, and recent public domain aerial imagery, along with hydrographic survey data for Coos Bay provided context for planning eelgrass surveys. This context resulted in identification of a preliminary survey extent.

1.3.2 Project Survey Limits

For the purposes of the present surveys, channel improvements are considered to be the action that has been used to plan the surveys. Other action elements such as potential off-channel construction laydown areas, wharf improvements, or upland infrastructure activities and storm drainage that may

be needed, or mitigation areas have not been considered in the survey planning but may be evaluated using the survey results should potential effects occur within the surveyed areas.

For the purpose of defining the eelgrass survey envelope, four factors were considered. The first was proximal distance to the physical channel improvements, the second was minimal wave protection from inlet penetrating waves, the third was suitable depth ranges to support eelgrass, and the fourth was need for inclusion of natural reference sites outside of the potential influence of the project.

A base survey envelope was established as a 250-meter (820-foot) buffer extending outward from the physical channel and turning basin improvements (Figure 1). This was intended to reflect a conservative buffer from the project within which all potential for direct and indirect effects to eelgrass would be expected to occur. This buffer was derived from that applied to evaluate potential indirect effects under EFH consultation between the Army Corps of Engineers, U.S. Environmental Protection Agency, and National Marine Fisheries Service, Southwest Region for large scale operation and maintenance dredging in the San Francisco Bay area and associated dredged material placement (NMFS 2010). While the circumstances driving the 250-meter buffer in San Francisco Bay are substantially different than conditions in Coos Bay, most notably due to very fine sediments in San Francisco Bay compared to the coarser sediments of the Coos Bay project limits, this does provide an assessment envelope that is well suited to the baseline data collection presently needed.

A pre-survey meeting was held on September 6, 2023, with multiple resource and regulatory agencies with potential information to assist in enhancing the survey program. This meeting resulted in obtaining additional information on other surveys and research data availability. It also provided information on expectations of future phases of analysis and potential mitigation of impacts, noting the need for further development of the project description. During resource and regulatory agency coordination, there were some concerns raised by Chanda Littles of the Army Corps regarding potential for project effects to extend beyond the 250-meter buffer, including turbidity and vessel wake effects. Additionally, Shon Schooler of the South Slough National Estuary Research Reserve echoed this concern relating to wave energy and also raised specific questions about the status of eelgrass in the area of the inlet to South Slough that was beyond the initial survey limits. Based on these concerns, eelgrass survey and mapping were expanded beyond the initial planned survey area to provide a more comprehensive coverage of eelgrass beds in proximity to the proposed project and its surroundings.

The proposed channel improvements include channel work outside of the harbor in the Pacific Ocean approach and between the entrance channel jetties. These areas are too dynamic due to wave and surge energy to support eelgrass and thus have been excluded from eelgrass surveys.

Eelgrass is a marine plant and requires adequate light in the form of photosynthetically active radiation (PAR) to support positive growth. As a result, eelgrass is generally limited at its lower end by light. At its upper margin, eelgrass is generally limited by wave energy, or desiccation stress. Thom et al. (2003), postulated a lower elevation limit of eelgrass in Coos Bay near -0.5 m (-1.6 ft) MLLW based on conditions in 1998-2000. However, Rumrill and Sowers (2008) noted eelgrass depth distribution to extend down to approximately -2 m (-6.6 ft) MLLW at sites within South Slough. During drought periods, eelgrass typically expands to greater depths due to greater water clarity. Coos Bay has been in a multiyear drought since November 2019 according to the NWS Medford Forecast Office data for total accumulated precipitation versus normal at the North Bend Airport gage. These

conditions suggested that the depth range of eelgrass within lower Coos Bay may be greater than that previously reported. For this reason, a broad survey depth range was established from middle intertidal elevations down to -10 feet MLLW to guide initial survey effort distribution. The results of applying a maximum depth limit for eelgrass survey was the exclusion of the deeper waters along the central portions of the bay from focused survey. While the reported elevation range is accepted as a starting point for survey of eelgrass, the surveys were conducted in a manner that chased out the deeper margin of eelgrass, irrespective of the position of the -10-foot contour in bathymetric maps used to plan the survey.

1.3.3 Eelgrass Metrics

This survey will adopt eelgrass spatial and density metrics outlined in the CEMP. Under the CEMP, the vegetated areal extent of an eelgrass bed is defined as a physical space containing rooted eelgrass with a shoot density of one or more shoots per square meter located within 1 meter distance of other eelgrass shoots (NOAA Fisheries 2014; Shafer Nelson 2018).

The eelgrass metrics to be reported are as follows:

- **Vegetated Cover –** Vegetated cover is the tight boundary extent of eelgrass plants on the seafloor, prior to application of CEMP eelgrass bed definitions. The discrete mapping of plant boundaries is the basic building block for determining CEMP spatial metrics. As this metric is a steppingstone to areal extent, should eelgrass beds be encountered that are defined by sparse distribution of small plants, the mapping of vegetated cover will be omitted moving directly to mapping vegetated areal extent as described below.
- **Areal Extent –** The eelgrass areal extent is the quantified extent of the spatial distribution of the beds comprised of unvegetated and vegetated areas of the bed. The vegetated areal extent (VAE) is defined as areas within the spatial distribution that support at least 1 shoot per square meter of bottom. This is determined by performing a tight margin mapping of eelgrass plants present within the survey area and then buffering outward from the vegetated cover of plants by a distance of 0.5 meter such that any plant within 1 meter of another plant would be captured within the same contiguous vegetated areal extent boundary. The unvegetated areal extent is defined as the remainder of the spatial distribution that is not included in the vegetated areal extent.
- **Spatial Distribution (SD) –** The spatial distribution of eelgrass habitat is delineated by a contiguous boundary around all areas of vegetated eelgrass cover extending outward from the margins of plants by a distance of 5 meters. The resultant spatial distribution boundary of the eelgrass habitat is then clipped to remove areas that are determined to be unsuited to supporting eelgrass based on depth, substrate, or existing structures.
- **Percent Vegetated Cover –** The percent bottom cover within eelgrass habitat is determined by totaling the area of vegetated areal extent and dividing this by the total areal extent of the bed.
- **Shoot Density -** Shoot density is the mean number of eelgrass leaf shoots per square meter within mapped eelgrass vegetated cover. Shoot density should be reported as a mean ± the standard deviation of replicate measurements. The number of replicate measurements (n) is reported along with the mean and deviation. Shoot densities are

determined only within vegetated areas of eelgrass habitat; therefore, it is not possible to measure a shoot density equal to zero.

1.3.4 Eelgrass Survey Segments and Reference Sites

The proposed action extends for a distance of 9.25 miles along an estuary gradient within Coos Bay. Typically, such gradients may be expected to play a role in structuring eelgrass beds and lead to differing natural eelgrass variability at the upper end of the project than at the lower end. At the lower end, beds are more exposed to wave and swell energy penetration, experience more stable salinities, experience better tidal flushing, and occupy coarser sandy sediments. At the upper end of the channel, shallow flats are subject to greater thermal stress and seasonally depressed salinities, and a greater amount of fine sediment is generally present. In all areas of the estuary, shoals are influenced by tidal currents and winds, and to a lesser extent vessel wakes. Shorelines through the surveyed area ranged from steep rocky slopes, both natural and artificial, to broad mud and sandflats transitioning to marsh habitats. Several areas along the channel are defined by steep narrow beach faces transitioning rapidly to terrestrial vegetation. In a limited number of locations, bulkheads and wharves occur along the shore margin.

Because of the natural dynamics of eelgrass beds, the CEMP calls for using reference sites to evaluate how beds would be expected to naturally respond absent a project's influence. The effectiveness of applying reference sites to eelgrass change analysis is dependent upon selecting appropriate reference areas that are similar in characteristics to the eelgrass within the project APE (geography, elevation range, energy levels, substrate, etc.). This can be difficult for large projects occurring along environmental gradients. Further, it is important that the reference areas be of an adequate size based on the project scale to not be overly sensitive to localized small scale perturbations (e.g., ray foraging activities or localized vessel grounding).

To ensure appropriate natural reference site selection, the eelgrass survey area has been divided into multiple channel reaches as follows: 1) Coos Bay Ranges (including the Entrance Range and Turn and Coos Bay Inside Range), 2) Coos Bay and Empire Ranges, 3) Jarvis Ranges (to include the Lower Jarvis Range, Jarvis Turn Range, and Upper Jarvis Range A), and 4) North Bend Turn (including the Upper Jarvis Range B and portions of the North Bend Lower Range). Each of these four survey segments has been coupled with a 10-acre reference site. Reference sites are situated approximately 2 miles apart and are located outside of the 250-meter buffer around the physical channel improvements.

Reference sites are defined to include eelgrass beds on flats as well as those supporting the lower margins of beds that are likely to be defined by light levels or slope conditions. This has been done to ensure that reference beds exhibit similar characteristics as those that exist within beds more proximate to the channel and which include bed elements (e.g., deep bed edges) that are most susceptible to potential project effects. Each reference is paired with the channel segment adjacent to which the reference is located.

During the pre-survey coordination meeting, there was some concern raised regarding the potential for undersizing of reference sites with each being approximately 10 acres in total area. This was coupled with a concern expressed that a 250-meter (820 foot) buffer around the project may not fully capture project effects to eelgrass. Given the pre-survey uncertainties with respect to the extent and distribution of eelgrass, extent of project effects, and therefore appropriateness of scale and location of reference sites, no changes were made in the position of reference sites at this time. It would be

appropriate to narrow the future survey efforts to appropriately defined Areas of Potential Effect (APEs) within which specific project impacts are anticipated and adjust the reference sites accordingly. This baseline survey addresses preliminary APEs, rather than final APEs that will ultimately be required for analysis. The preliminary APEs are defined as 250 meters from the direct project dredging footprints. They are further segmented to include direct project footprints and maximum predicted stable slope areas, that occur fully within the 250-meter buffer envelope.

2.0 SURVEY METHODS

2.1 SPATIAL DISTRIBUTION SURVEYS

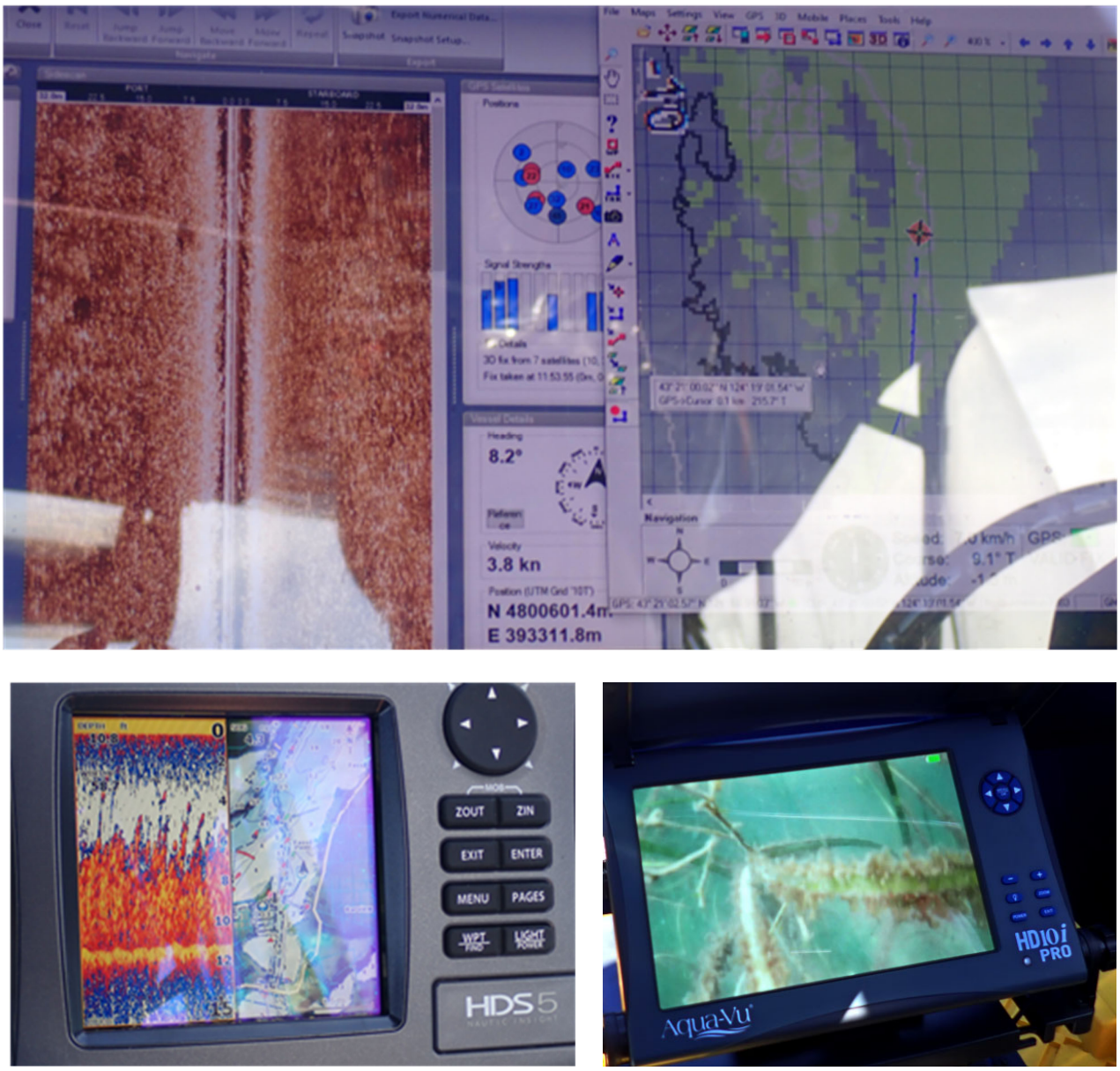
2.1.2 Sidescan Sonar Surveys

Eelgrass spatial extent data was collected using high frequency sidescan sonar, which provided an acoustic backscatter image of the seafloor within the project area. Interpretation of the backscatter data allowed for an assessment of the distribution of eelgrass. Sidescan backscatter data was acquired at a frequency of 450 kHz scanning out 31 meters on both the starboard and port channels for a 62-m wide swath. A rigid vessel mounted system with integrated motion sensors to control for heave, pitch, and roll; a sound velocity sensor for speed of sound correction; and a dual antenna global positioning system (GPS) and electronic compass were used to control for vessel position and yaw. This rigid integration of the sonar transducers with the positioning sensors provides significantly increased precision and accuracy over conventional towed sidescan sonar equipment.

The survey was conducted by running parallel transects that are spaced to allow for overlap between adjoining sidescan swaths. Survey swaths were navigated until the entirety of the survey area supporting eelgrass was captured in the survey report. All data were collected in latitude and longitude using the North American Datum of 1983 (NAD 83), converted to the Universal Transverse Mercator system in meters (UTM), and plotted on a geo-rectified aerial image of the survey area.

Post-collection data processing was completed by feeding sonar files into Chesapeake Technology SonarWiz mosaicking software to produce registered and layered mosaic image files. These files were then used to complete manual digitization of eelgrass boundaries in ESRI ArcGIS software. The boundaries plotted reflect the vegetated cover of eelgrass. In addition to this mapping, other features of interest including surfgrass (*Phylospadix* sp.), canopy kelp, and hard bottom habitat were also mapped when encountered. During completion of surveys, additional observations were made of any sensitive species or resources, such as marine mammals. Investigations were not conducted in a comprehensive manner but do provide some insight into the overall distribution of these resources in the bay.

Sonar surveys were also supported by use of a single-beam sonar operating at 200 kHz which provided information on presence or absence of eelgrass. Additional ground-truthing was completed by use of a towed video camera array that provided real-time visual observations that could then be annotated onto navigation data to support sonar analyses.

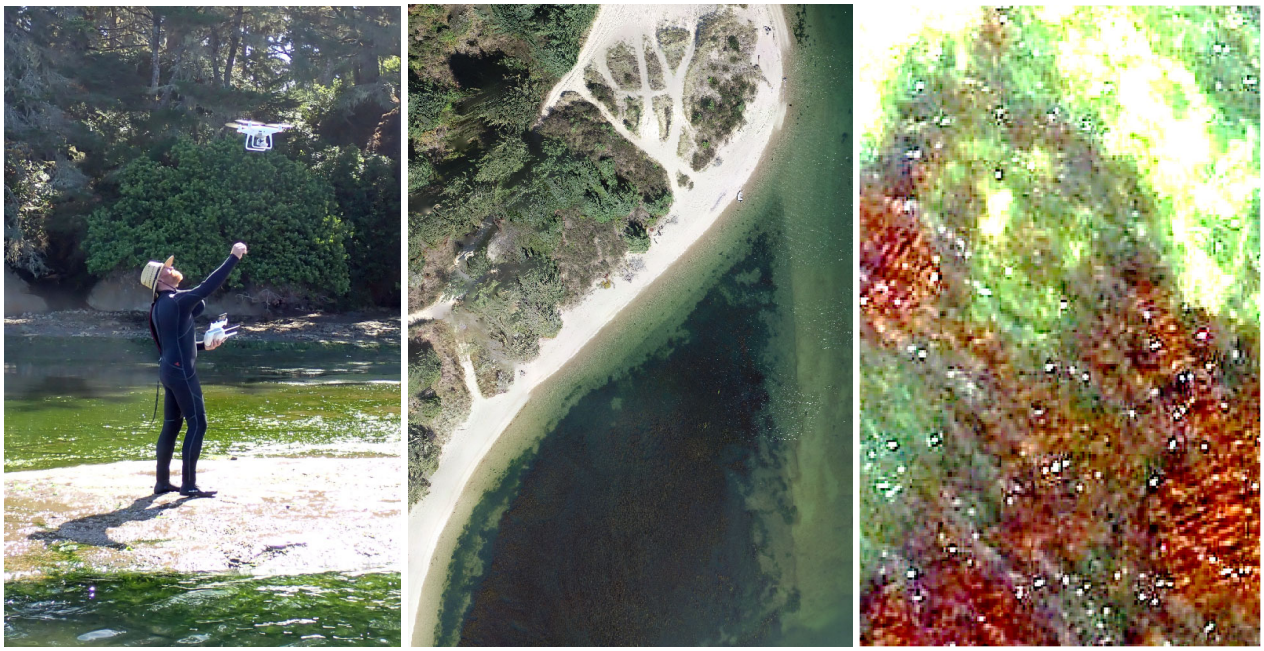


Sidescan sonar and navigation software (top) was used to track survey coverage over a survey chart with bathymetry and preliminary expected eelgrass derived from prior surveys. A single beam fathometer (bottom left) provided information for monitoring water depth and submerged hazards, while ground truthing eelgrass distribution during data collection. A towed video camera (bottom right) was deployed to spot-check sonar data.

2.1.2 Aerial Photography Surveys

Low-altitude true color aerial imagery of the Project Area was collected within lower Coos Bay including most of Hungryman Cove, Fossil Point, and Barview within the Coos Bay Range, as well as areas along the mouth of South Slough adjacent to Charleston Harbor on September 12 and 13, 2023. Flights further north within the project area could not be conducted due to airspace restrictions from the Southwest Oregon Regional Airport in North Bend. A DJI Phantom 4 Pro un-manned aerial vehicle (UAV) with a 20 mega-pixel (MP) camera was the imaging platform for the work. Automated flight control software was used to ensure the imagery was captured in a consistent manner with respect to flight altitude (300 ft) above ground level (AGL), front lap (75%) and sidelap (75%). Incorporating a higher image overlap ratio facilitates improved image alignment, and an enhanced ability to resolve partially or wholly submerged features that may be obscured by sun-glint, glare, or reflections off the water surface; these factors tend to reduce the useable extent of each image. Having the ability to mask out problem areas without sacrificing necessary overlap between adjacent images produces higher quality orthomosaics, based on the camera specifications of the Phantom 4 Pro and an altitude of 300 ft of approximately 3.0 cm/pixel (1.2 inches/pixel).

Aerial imagery was processed, color-corrected for exposure variation, mosaicked and orthorectified into a series of orthomosaics covering the Project Area using Structure from Motion (SfM) photogrammetry software (Agisoft Photoscan Professional). While the initial georeferencing of aerial imagery was driven by the onboard GPS associated with the Phantom UAVs which embed positional tags within each image's metadata, final post-processing georeferencing was completed by registration to fixed position features within the mosaic (e.g., navigational aids). Registered orthomosaic images were used to support digitization of eelgrass in waters shallow enough to accurately map bed boundaries. In deeper water boundaries were derived from the sonar mapping.



Aerial imagery was collected using a quadcopter UAV (left) with individual photos processed into an orthomosaic image (center). Following the mosaicking and registration process, spectral stretch algorithms were applied to illuminate eelgrass from macroalgae relying principally on red algal epiphytes on eelgrass that do not similarly colonize green algae.

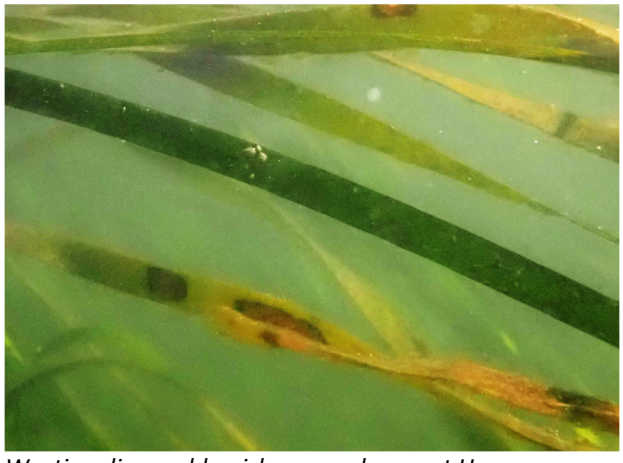
2.2 Ground Truthing and Shoot Density Data

Eelgrass bed densities were collected within the project area and reference sites. Reference sites were distributed within each of the four channel reaches. Potential project APE sampling was conducted within 250 meters of the project, typically in areas where the nearest encroachment of activities would be expected, or in areas where indirect effects may be most pronounced (e.g., maximum layback areas, or channel bends where wake or tug thrust effects may be most likely realized). Reference sites were selected beyond 250 meters from the direct project limits within each of the reaches.

Data were collected using a 0.25-meter quadrat distributed along four haphazardly aligned approximately shore normal transects across surveyed eelgrass beds at each location. Along each transect, density data were collected from the shallowest margin to the deepest margin of the sampling area by sampling five quadrats distributed roughly equidistant apart along the transect for a total of 20 density counts per site. Because the width and topology across the beds varied, the distance between sampling points was highly variable. For narrow fringing beds, the transect alignments were altered to extend the separation between sampling quadrats by crossing the fringing bed at an angle. This provided separation in sampling points, but also ensured that the full bed depth profile was examined.

Concurrent with eelgrass density data within the project and reference areas, additional metrics were assessed. These included extent of flowering as a percentage of the shoots present and canopy height for vegetative shoots. Flowering shoots were omitted in the canopy height measurements as these are typically much longer, extending well above the typical canopy top. It was intended that flowering shoots would be counted separately while conducting the density sampling. However, this turned out to be impractical due to the considerable canopy height. To undertake the density counts, a diver positioned themselves on the bottom and worked across the 0.25-meter quadrat to count shoots. At the base of the shoots, it was not possible to determine flowering shoots from vegetative shoots as differentiation typically occurred above the elevation where shoots were being counted. As a result, the shoot count was done without distinction of vegetative and flowering shoots and the percentage of flowering was estimated as the quadrat was lifted out of the bed by estimating the number of flowering shoots extending above the vegetative canopy within an approximate quarter square meter section of water. The approximate ratio of counted shoots to observed flowering shoots was then rounded to the nearest 5 percent, due to the imprecise nature of this estimation. In general, there was limited flowering observed across the sampled beds. At Fossil Point, sparse flowering was observed, but it was not within any of the sampled quadrats.

In addition to collecting plant metrics, overall plant health was assessed using leaf color and qualitative assessment of leaf turgor as indicators, along with evidence of wasting disease and epiphytic loading on the plants.



Wasting disease blemishes on eelgrass at Hungryman Cove.

3.0 RESULTS

3.1 EELGRASS SPATIAL DISTRIBUTION

All of the eelgrass observed during the present survey was common eelgrass (*Zostera marina*). While Japanese eelgrass (*Z. japonica*) is present in the Coos Bay Estuary, it was not observed in the surveyed areas. Eelgrass was identified along all channel reaches within the survey area (Figure 2). Individual range eelgrass beds are illustrated in Figures 3a-d. The eelgrass was typically distributed within shallow coves and channel side margins with considerable variability in the morphology being found along the lower bay. This included off channel inlets and bars, steep sandy beach slopes, and broad flats with variable depth drainage features across the larger flats. Some of the more proximate to the main channel beds exhibited evidence of high dynamism due to sediment movement and probably storm scour. The characteristics of dynamic beds include those that occur within sandy environments that exhibit wave influenced morphology, individual widely scattered clones rather than coalesced beds, and beds exhibiting erosion margins where rhizome mats are exposed above scalloped out pockets along channel edges. In general, evidence of greater dynamism was noted further up the bay than near the lower bay and across broad intertidal flats than within subtidal environments.

Overall, eelgrass within the surveyed area had a spatial distribution of 687.13 acres and a percent vegetated cover of 67.9 percent (Table 1). This means that the eelgrass beds within lower Coos Bay are predominated by larger coalesced beds that drive the ratio between vegetated areal extent and spatial distribution upward. As noted, most of the eelgrass is found along shallow margins of the bay, well removed from the federal channel. As a result, no eelgrass occurs within the proposed channel and turning basin improvements. However, eelgrass does occur within areas identified as within the maximum predicted stable slope crest, and within 250 meters of the proposed dredge areas. These have loosely been defined as the APEs for the project and are subject to future revision as project information is further developed. The CEMP spatial metrics for APE segments are provided in the table below along with those for defined reference sites.

Table 1. Summary of Eelgrass Spatial Extent Metrics – September 2023

Area	Vegetated Cover (acres)	Vegetated Areal Extent (acres)	Spatial Distribution (acres)	% Vegetated Cover (%)
Areas of Potential Effect				
Channel and Turning Basins	---	---	---	---
Max Predicted Stable Slope Crest	3.06	3.42	6.37	53.7%
250-m Buffer around Dredge Areas	65.73	70.35	105.23	66.9%
References				
Ref-1	2.28	2.58	4.76	54.3%
Ref-2	8.40	8.46	8.90	95.0%
Ref-3	3.27	3.51	5.26	66.8%
Ref-4	5.84	6.20	7.54	82.3%
Total Survey Area*	**436.79**	**466.24**	**687.13**	**67.9%**

*Includes areas of the survey area beyond those individually quantified in the table

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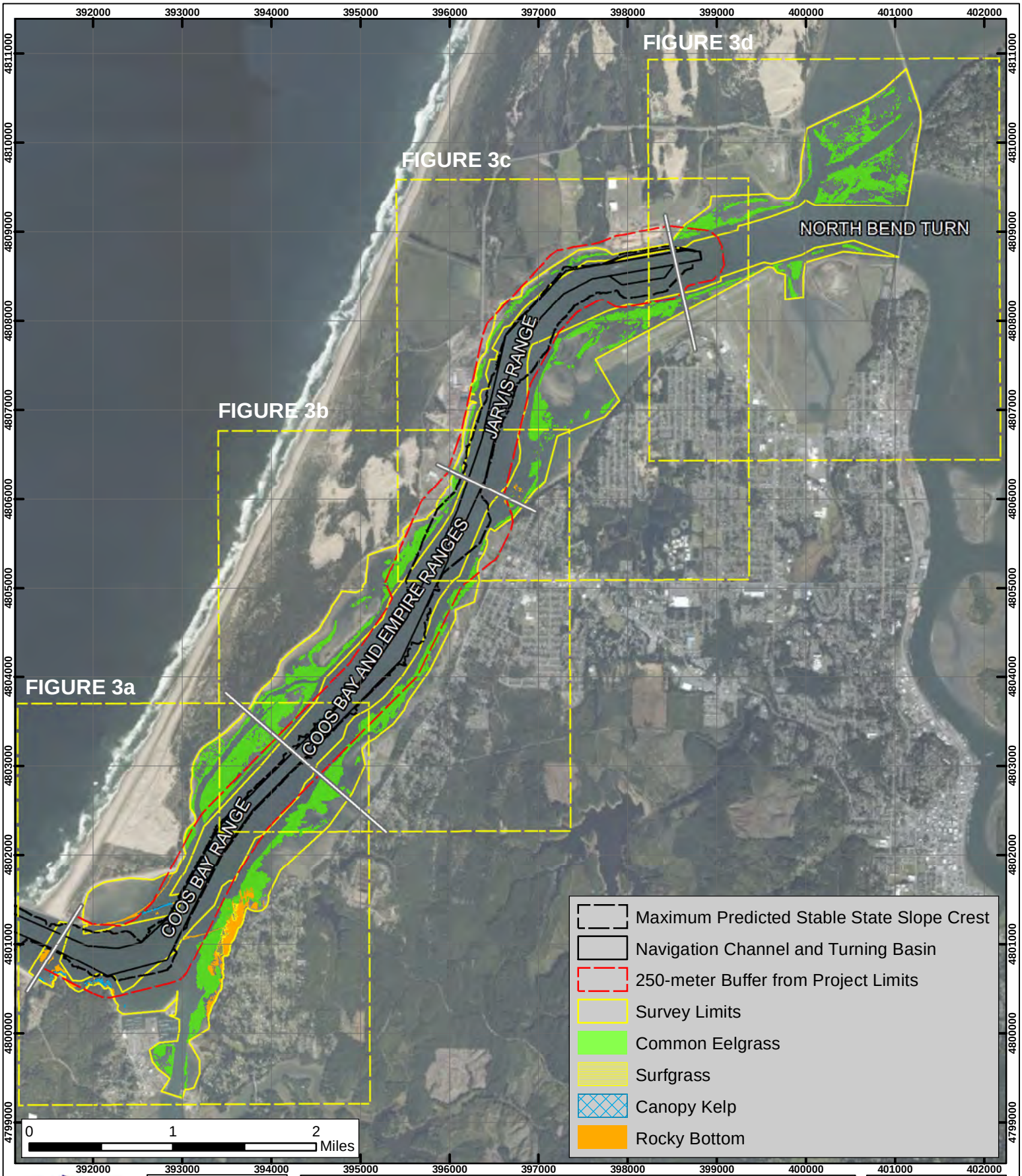

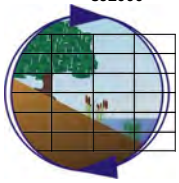

Eelgrass Habitat Overview Map - September 2023

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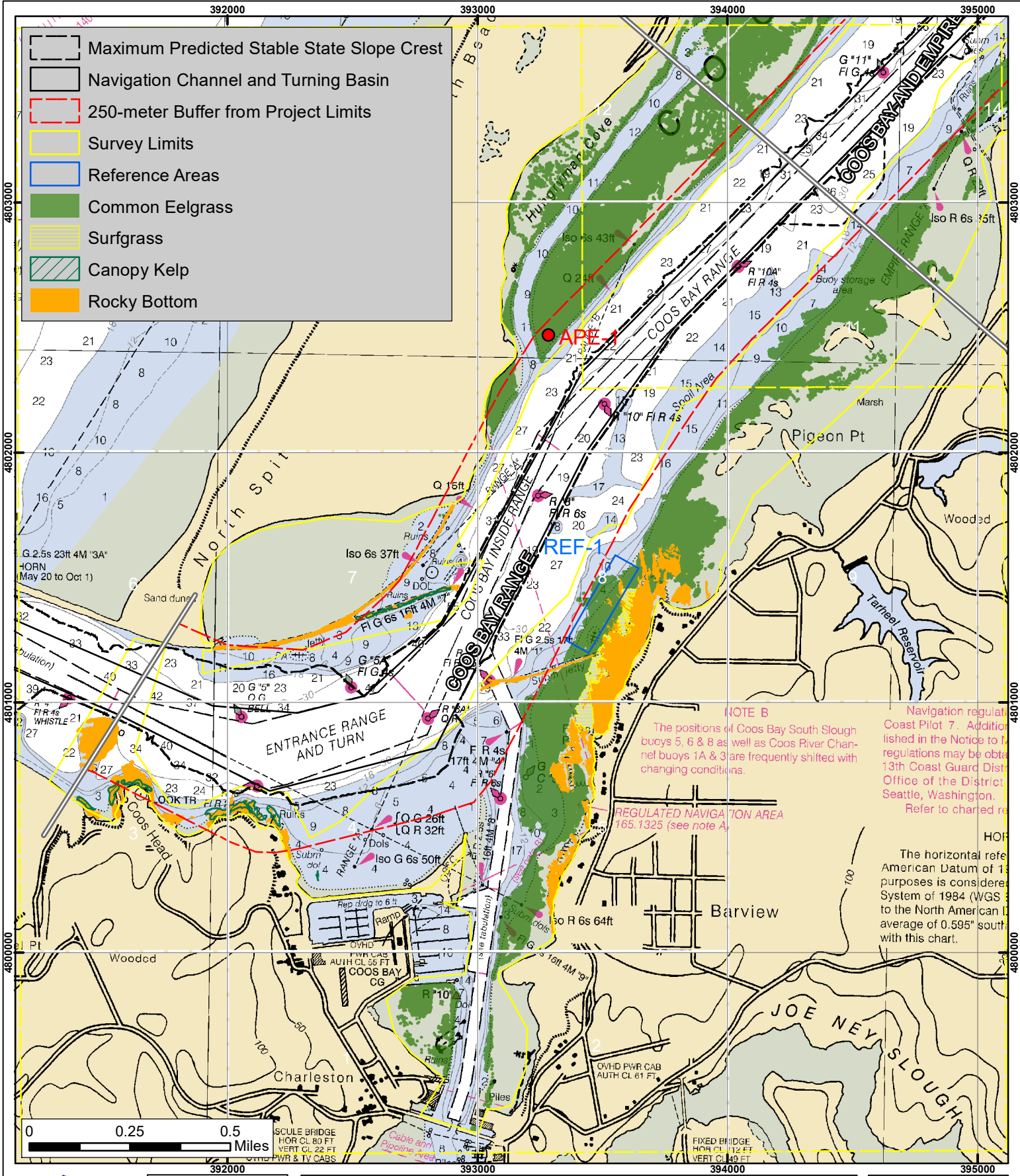
Coos County, Oregon

Figure 2

Merkel & Associates, Inc.



Coos Bay Range Eelgrass Distribution 2023

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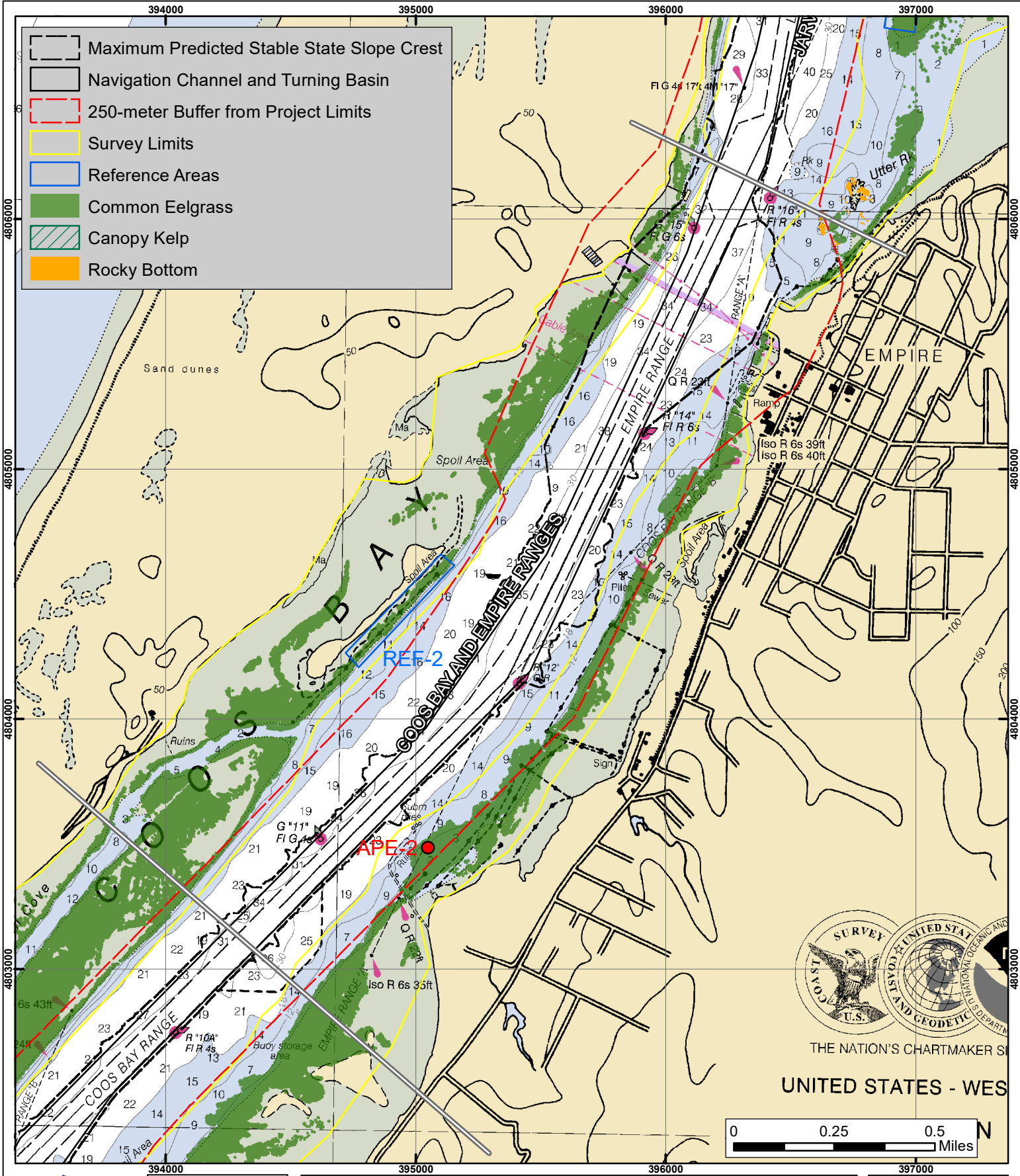
Coos County, Oregon

Figure 3a



Coos Bay and Empire Ranges
Eelgrass Distribution 2023
Port of Coos Bay WRDA Section 204(F)
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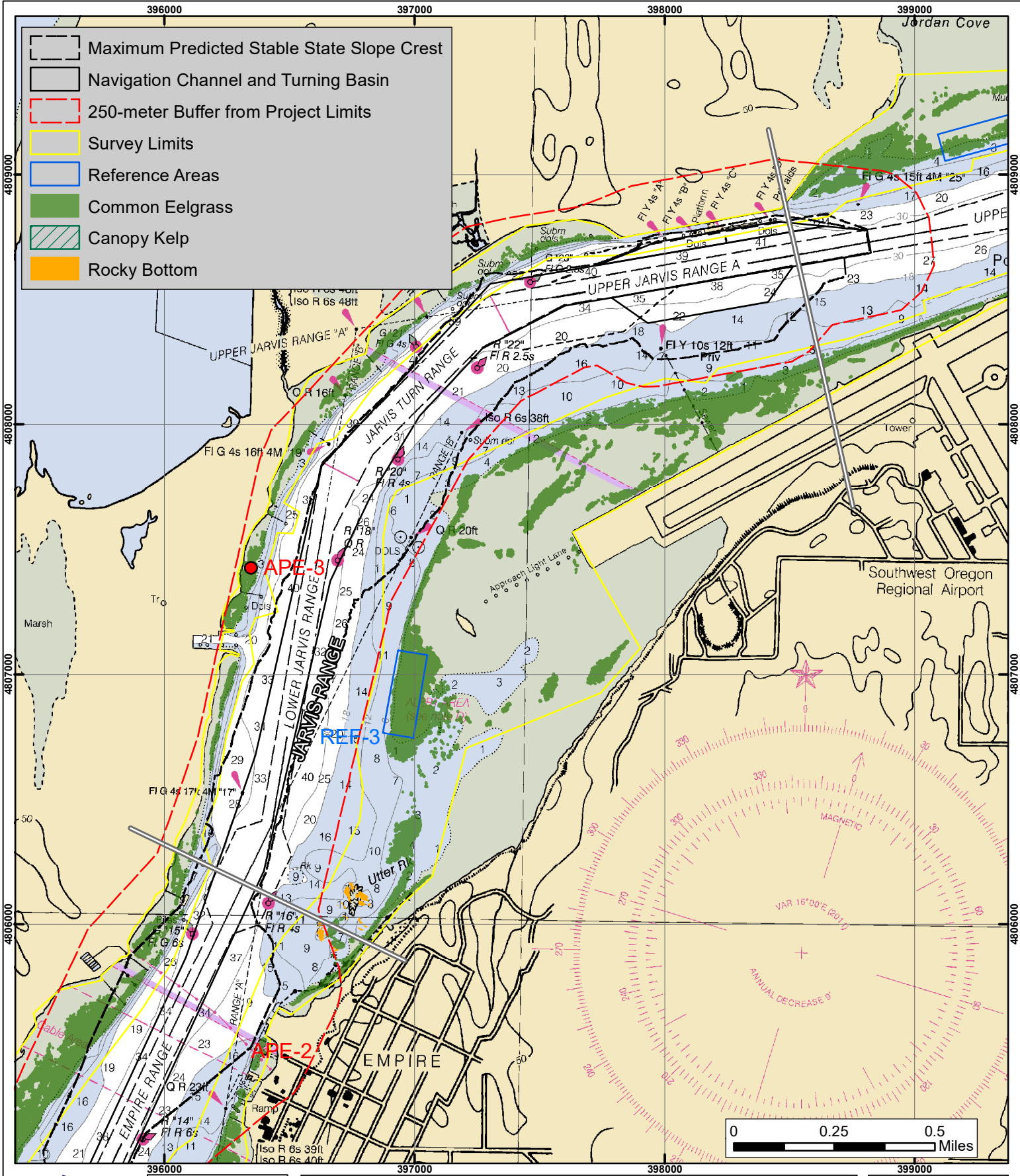
Coos County, Oregon

Figure 3b



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Jarvis Range Eelgrass Distribution 2023

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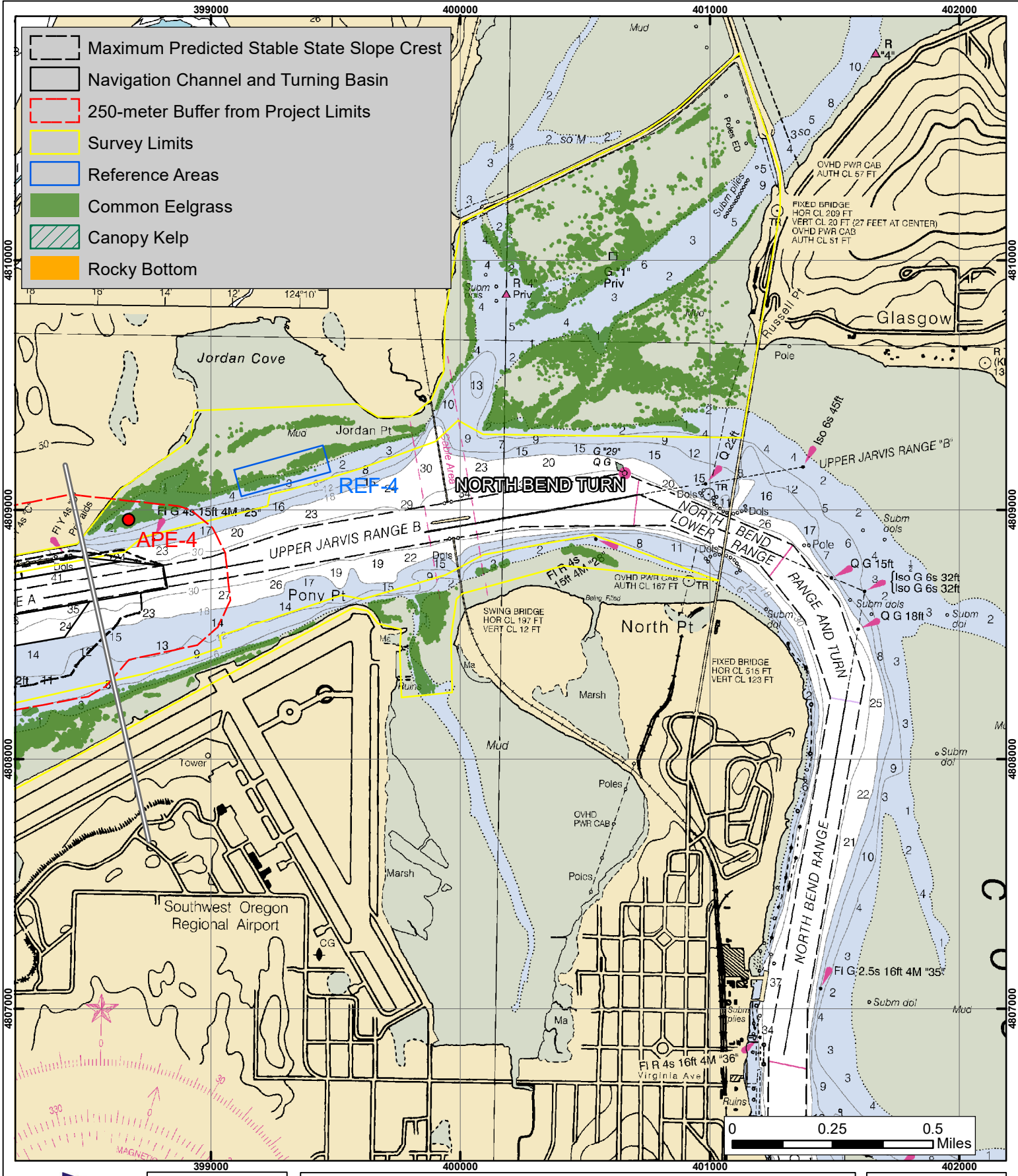
Figure 3c



North Bend Turn Eelgrass Distribution 2023

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Coos County, Oregon

Figure 3d

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3.2 EELGRASS DEPTH DISTRIBUTION

Eelgrass within lower Coos Bay is generally restricted to the intertidal and shallow subtidal environments. As noted previously, various estimates of lower depth limits have been posed within the Bay. For the present survey, it was possible to complete a wholistic analysis of eelgrass depth distribution using mapped vegetated eelgrass cover and the 2014 USACE NWP topobathy LiDAR digital elevation model (DEM): Coos Bay (OR) surface from the Army Corps of Engineers National Coastal Mapping Program. This DEM presents elevation in feet relative to the North American Vertical Datum of 1988 (NAVD88) and has a good resolution at 1-meter cell size. However, the bathymetric layer is aging and may not be representative in highly dynamic areas of the bay. Further, the LiDAR cleaning conducted at the time of topobathy layer production removed data from areas with poor water clarity and ground obscured portions of the bay. In general, this eliminated areas of the deep channel within the inner bay, but most importantly for the present analysis, it also resulted in the loss of several areas of dense subtidal eelgrass beds, most specifically in the lower portions of the estuary. Consideration was given to interpolative filling of the DEM surface voids prior to completing eelgrass depth analysis. This interpolation was not ultimately performed as it has its own issues with respect to the analyses performed.

The distribution of eelgrass was assessed across the available topobathymetric surface by classifying eelgrass into 1-foot elevation bins. Figure 4 displays the depth distribution of eelgrass within the survey area. The elevation bins are represented with the maximum value such that 0 in Figure 4 reflects -1 to 0 ft NAVD88. In exploring the data and omitted areas as described above, the depth distribution presented is believed to underestimate the shallow subtidal eelgrass between about -1 and -3 feet. It also is believed to over-estimate the higher elevation eelgrass due to changes in shoreline elevation within active sand flats, most notably near the airport and on North Spit across from Empire.

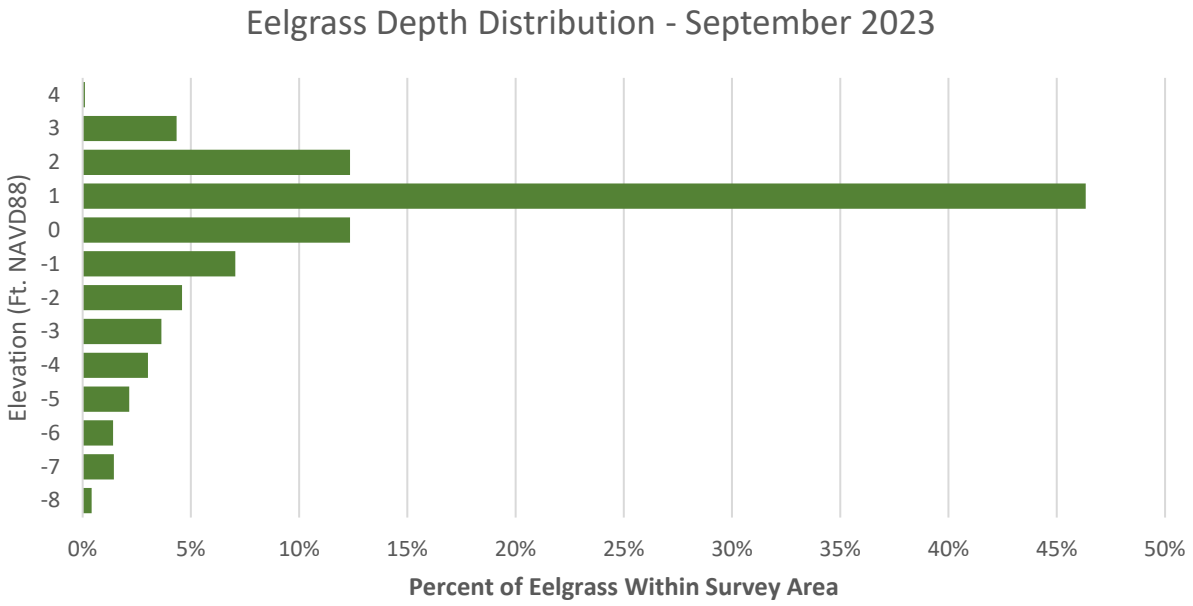

Figure 4. Eelgrass Depth Distribution in Lower Coos Bay

3.2.1 Coos Bay Range

The lower segment of the survey area occurs over the Coos Bay Range, including portions of the Entrance Range and Turn, and South Slough Channel confluence (Figure 3a). This area includes large eelgrass beds at Fossil Point and Pigeon Pont, as well as Hungryman Cove. Many of the eelgrass beds within this range are subtidal, well coalesced, and dense. The beds at Fossil Point may be subject to some mechanical damage due to penetrating wave conditions down the entrance channel. Notably, this damage may result in boundary shifts between rocky reef supporting macroalgal and surfgrass communities and eelgrass as sand is filled in and stripped off the rock platform by wave energy. Further north on the east side of this bay segment at Pigeon Point, eelgrass extends across shallow flats and becomes more open in bed architecture with a more ephemeral eelgrass character on the higher flats that are more removed from the channel. These flats would be expected to suffer greater seasonal thermal stress than areas more proximate to the deepwater of the channel.

3.2.2 Coos Bay and Empire Ranges

The Coos Bay and Empire Ranges segment of the study area are dominated by intertidal eelgrass and fringing beds along the channel margin (Figure 3b). The lower end of this reach continues to include portions of Hungryman Cove extending northward from the Coos Bay Range. The west side of the reach supports broad flats that were historically used as spoils areas for dredged material and which now support Clam Island and sandflats dominated by intertidal eelgrass. Along the east side of the reach, lower natural flats support eelgrass. The waterfront at Empire Landing also supports scattered beds of eelgrass.

3.2.3 Jarvis Range

The Jarvis Range segment of the study area is dominated by the Airport Flats on the eastern, inside bend of the bay and a narrow, steeply sloping margin along the western, outside bend (Figure 3c). The Airport Flats support predominantly intertidal eelgrass, with some subtidal eelgrass within deeply incised drainage courses extending onto the flats. Along the outer bend, the shoreline has been partially stabilized by a number of pile groin features that have allowed development of some shallower sloping shores that support eelgrass within intertidal and very shallow subtidal margins. However, where the distance between groins is greater, the shorelines are typified by steep beaches that drop into deeper, fast-moving water. These areas generally lack eelgrass, but when present, it is restricted to a narrow fringing bed near mean lower low water (MLLW).

3.2.4 North Bend Turn

The North Bend Turn commences near the upper end of the proposed project and includes Jordan Cove and the mouth of North Slough and Haynes Inlet (Figure 3d). The survey area was bounded on the north by the Trans-Pacific Lane causeway and on the east by the McCullough Memorial Bridge on the Coast Highway. This area includes a narrow fringing band of eelgrass along the steep shoreline of the eastern end of the airport runways. It is otherwise dominated by eelgrass associated with shallow flats and channels at the mouth of Jordan Cove, and on the confluence bar between the main Coos Bay channel and the northern arm of the bay. This region of the bay supports broad intertidal sand and mudflats that support scattered eelgrass, principally at the lower elevations, and intermittent sparse aquaculture, typically slightly higher, but with some elevational overlap.

3.2 EELGRASS DENSITY

For each channel reach described above, densities were sampled within the 250-meter buffer area identified as the preliminary APE. Sampling locations are noted in Figures 3a-d and methods for sampling are described previously. Within each channel reach, the APE and associated reference site were evenly sampled to collect a total of 20 densities. This resulted in a total sampling of 160 shoot density counts. The means and standard deviations of densities within each station are provided in Table 2 along with other observational data collected. All eelgrass observed was determined to be in good overall health with good green coloration and turgor to the leaves. This suggests that plants were not light or salinity stressed, although other factors can affect color and turgor in eelgrass.

During the course of survey, considerable shed leaf wrack was encountered on the water surface. This suggested that seasonal dieback had already commenced at the time of the survey. Although it is not believed to have influenced the distribution or detectability of eelgrass during the survey, it may have had some influence on lowering shoot densities at the time of the surveys.

Table 2. Eelgrass Shoot Density – September 2023

Station	Site	Mean (shoots/m^2)	±1 SD (shoots/m^2)	n	Canopy Height (m)	% Flowering Shoots	% Epiphytic Loading	Wasting Disease Evidence
APE-1	Hungryman Cove	107.6	20.0	20	1.6-2.1	5%	20-30%	minor
APE-2	Bay Point Landing	99.2	43.8	20	1.4-1.9	10%	40%	minor
APE-3	Southport Lumber	152.0	51.9	20	0.7-1.6	0%	30-40%	minor
APE-4	Jordan Cove	103.2	38.1	20	1.0	0%	30%	minor
APEs	**All APEs**	**115.5**	**44.9**	**80**				
Ref-1	Fossil Point	116.8	43.9	20	1.5-2.2	<5%	10-20%	minor
Ref-2	Clam Island	100.0	41.4	20	0.8 -1.5	0%	20-30%	minor
Ref-3	Airport Flat	140.8	43.2	20	0.6-1.3	0%	70-80%	minor
Ref-4	Jordan Cove	113.6	41.3	20	1.0	0%	40%	minor
Refs	**All Refs**	**117.8**	**44.2**	**80**				
Total	**Lower Coos Bay**	**116.7**	**44.4**	**160**				

Densities observed throughout the survey area were generally comparable to prior density measurements within Coos Bay at varying locations (Thom et al. 2003; Helms 2019). Thom et al. (2003) found eelgrass mean shoot densities within lower Coos Bay from 1998-2001 ranging between approximately 75 and 200 shoots/m^2 and an average density throughout Coos Bay of 115 shoots/m^2 with a generally declining density along a gradient from the estuary mouth to North Bend with even lower densities between approximately 40-90 shoots/m^2 being found within inner Coos Bay at

Cooston Channel. The highest densities observed by Thom et al. were found at Fossil Point and ranged between approximately 150 and 200 shoots/m^2 with an increasing density trend between 1998 and 2001. However, data reported in Helms 2019 that was derived from an OSU/Seagrant monitoring from 2015-2018 revealed lower densities at Fossil Point with a decreasing trend from approximately 170 falling into a range of approximately 100-120 shoots/m^2.

While the densities from the present survey were generally similar to those of prior investigations, it is important to note that the September 2023 densities were collected across the full vertical range of the eelgrass beds within the sampled areas. Typically, this depresses the overall density due to lower shoot density at the lower margins of the beds, and it also increases the variability in densities from those collected within one elevation segment, such as intertidally, within beds. The collection of data across the full elevation range of the bed also tends to increase the average shoot length over intertidal sampling due to inclusion of the typically lower energy subtidal environment. Further, the seasonal timing of the surveys is at the end of the recognized high growth season and leaf shed was noted during the surveys. This may suggest that lower densities could have been encountered than would have been the case slightly earlier in the season.

4.0 OTHER RESOURCES OF INTEREST

The present work was focused on completion of an eelgrass survey within lower Coos Bay. However, it was noted that the means and methods of completing this survey would allow for collection of ancillary data for other resources of interest to project analysis and regulatory review. This section is intended to summarize the observations and mapped information collected beyond that of the focal intent of the investigations. The information provided should not be considered exhaustive as efforts were not made to provide full survey coverage for these resources and the survey approaches were not optimized for these resources.

4.1 ESSENTIAL FISH HABITAT HABITAT AREAS OF PARTICULAR CONCERN (HAPC)

Habitat Areas of Particular Concern (HAPC) are defined within the Essential Fish Habitat (EFH) designation under the Pacific Coast Groundfish Fishery Management Plan (FMP, Pacific Fishery Management Council [PFMC] 2022). HAPC includes estuaries, rocky reef, canopy kelp, seagrass, and areas of interest. Within the mapping area and scale of the work conducted, three of these HAPC types were encountered and mapped.

4.1.1 Rocky Reef

In accordance with the FMP, rocky reefs may be composed of bedrock, boulders, or smaller rocks, such as cobble and gravel. Typically, these reefs are considered nearshore or offshore resources; however, they may occur within enclosed bays and estuaries as well. Within the survey area 55.20 acres of rocky reef was mapped. This includes natural bedrock outcrops from Coos Head, found along the entrance channel at the outermost portion of the survey area (Figure 3a), as well as along the shoreline of Fossil Point within the Coos Bay Range. Bedrock reef also occurs at Utter Rock at the transition between the Empire and Jarvis Ranges (Figure 3c).

In addition to these natural rock features, there are considerable armor-stone structures existing within the lower reach of Coos Bay, particularly in the Coos Range segment of the bay (Figure 3a). These are generally large federal navigation improvements to maintain the deep draft navigation channel by tuning tidal flows and sediment transport characteristics. These features include

submerged jetties extending from Log Spiral Bay and Fossil Point. These features are prominent rises on the bottom extending from sand bottom as deep as -44 feet up to crest elevations as shallow as -4 feet NAVD88. These submerged jetties were noted to attract considerable attention from sport fishermen during the survey period. No effort was made to map or inventory other non-natural armoring or small-scale subtidal revetment features such as present along armored shorelines.

4.1.2 Seagrass

This report focuses on the distribution of eelgrass within lower Coos Bay. All of the eelgrass encountered and mapped in this investigation was common eelgrass (*Zoster marina*). Japanese eelgrass was not encountered as it typically occurs higher on the shoreline and in more protected environments than were the focus of the present investigations. This species may be present within the higher flats and quiescent sloughs within the surveyed area, but it was not encountered during the surveys.

Scouler's surfgrass (*Phyllospadix scouleri*) was noted to occur on the bedrock sloping platform of Fossil Point (Figure 3a). This area supports surfgrass from the lower intertidal down to subtidal elevations. In some instances, the surfgrass is separated from eelgrass by algal covered rock, while in other instances the surfgrass interdigitates with eelgrass in a complex array of ridges and troughs that intermittently support sand or are scoured clean by penetrating waves that break against this shoreline. A total of 5.05 acres of surfgrass was mapped in this area; however, it is expected that the extent of surfgrass may vary considerably over long-cycles due to thermal stress and sand sour and burial influences. Surfgrass may also be present at Coos Head, but it was not noted or sought in this area.

Widgeon Grass (*Ruppia maritima*) is a brackish water seagrass species that is generally found in the oligohaline to mesohaline reaches of estuaries and within tidal creeks. The conditions favoring presence of *Ruppia* were not present within the survey area, and this species was not encountered.

4.1.3 Canopy Kelp

Canopy kelp within Coos Bay is limited to bull kelp (*Nereocystis luetkeana*). A total of 3.51 acres of canopy kelp was noted within the bay. This was predominantly associated with the bedrock bottom at Coos Head within the entrance channel (Figure 3a). Most of the canopy kelp was found in small, tightly aggregated beds adjacent to the shoreline. Additional notable stands of bull kelp were observed on the submerged jetty extending outward from Log Spiral Bay. Small canopy kelp patches were also found on a segment of submerged pipe off the beach at Alaska Packer Road. Other bull kelp was limited to individual or a few stipes near the Fossil Point shoreline.

4.2 THREATENED AND ENDANGERED AND SPECIAL INTEREST SPECIES

Surveys that were conducted had a very low potential of encountering threatened or endangered species due to the nature of the survey work conducted. As a result, no species listed as threatened or endangered were encountered.

Special interest species including Olympia oysters (*Ostrea lurida*) were not observed during the course of the survey or ground-truthing work. This does not intend to suggest an absence, but rather reflects the nature and purpose of the investigations undertaken and the distribution of survey effort within soft-bottom habitat that is not suited to supporting this species.

Bull kelp bed located at Coos Head within Coos Bay – September 2023.

4.3 MARINE MAMMALS

During the course of the surveys conducted, observations of marine mammals were recorded. As the survey was not focused on marine mammal inventories or enumeration, the observations should be considered only with respect to species encountered and general distribution patterns and should not be considered species counts or otherwise considered to be formal surveys.

Two species of marine mammal were noted during the surveys. These included the phocid harbor seal (*Phoca vitulina*) and the otariid Stellar sea lion (*Eumetopias jubatus*). Only two observations of sea lions were made within the lower bay (Figure 5), while harbor seals were observed in relative abundance throughout the lower bay with diminishing observations being made further up the bay within the survey area and in the channel areas beyond the surveyed margins of the bay. In most instances the observed animals were swimming or foraging within an area when observed.

A notable observation was the presence of a moderate size seal haul-out on the upper end of Clam Island (Figure 5). This haul-out held between 10 and approximately 70 seals during multiple survey passes made along this area over the course of a week. The haul out area is intertidal and thus was only used during mid to low tides, although during higher tides, seals were observed further up on the beach on the margins of the supratidal Clam Island.

Harbor seals hauled out on an intertidal bar north of Clam Island – September 2023.

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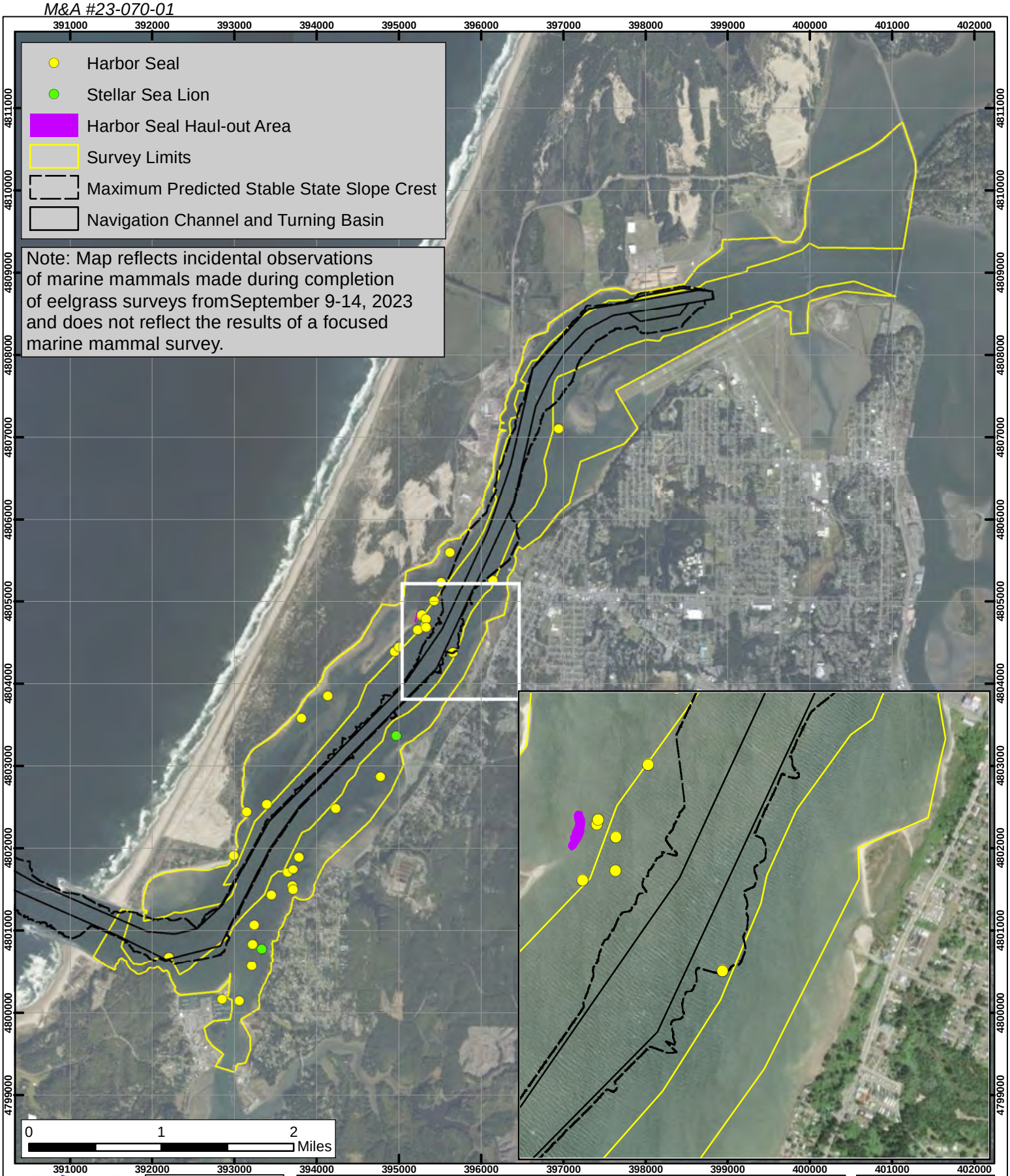

Marine Mammal Observations - September 2023

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Figure 5

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5.0 SPATIAL DATA DELIVERABLES

This report is accompanied by a spatial data set deliverable containing eelgrass, mapped along with CEMP spatial metrics, other mapped habitat features, and marine mammal observations. This deliverable has been submitted under separate cover to David Miller and Associates. Spatial data has been provided in an ESRI ArcGIS readable format.

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Appendix 1. Eelgrass Map Book – September 2023

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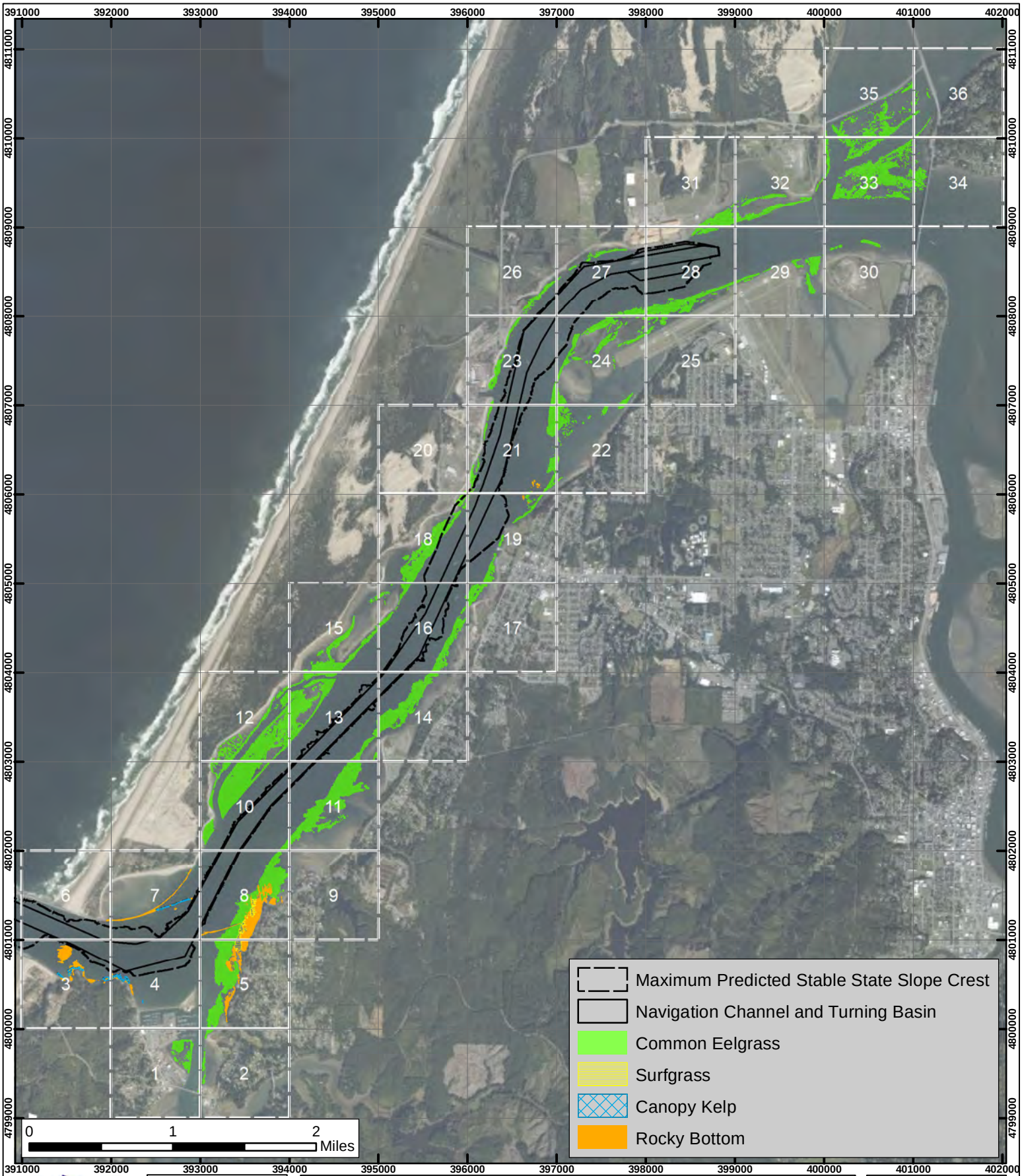

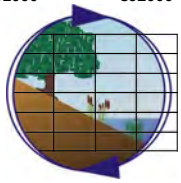

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Eelgrass Map Book Overview Map - September 2023

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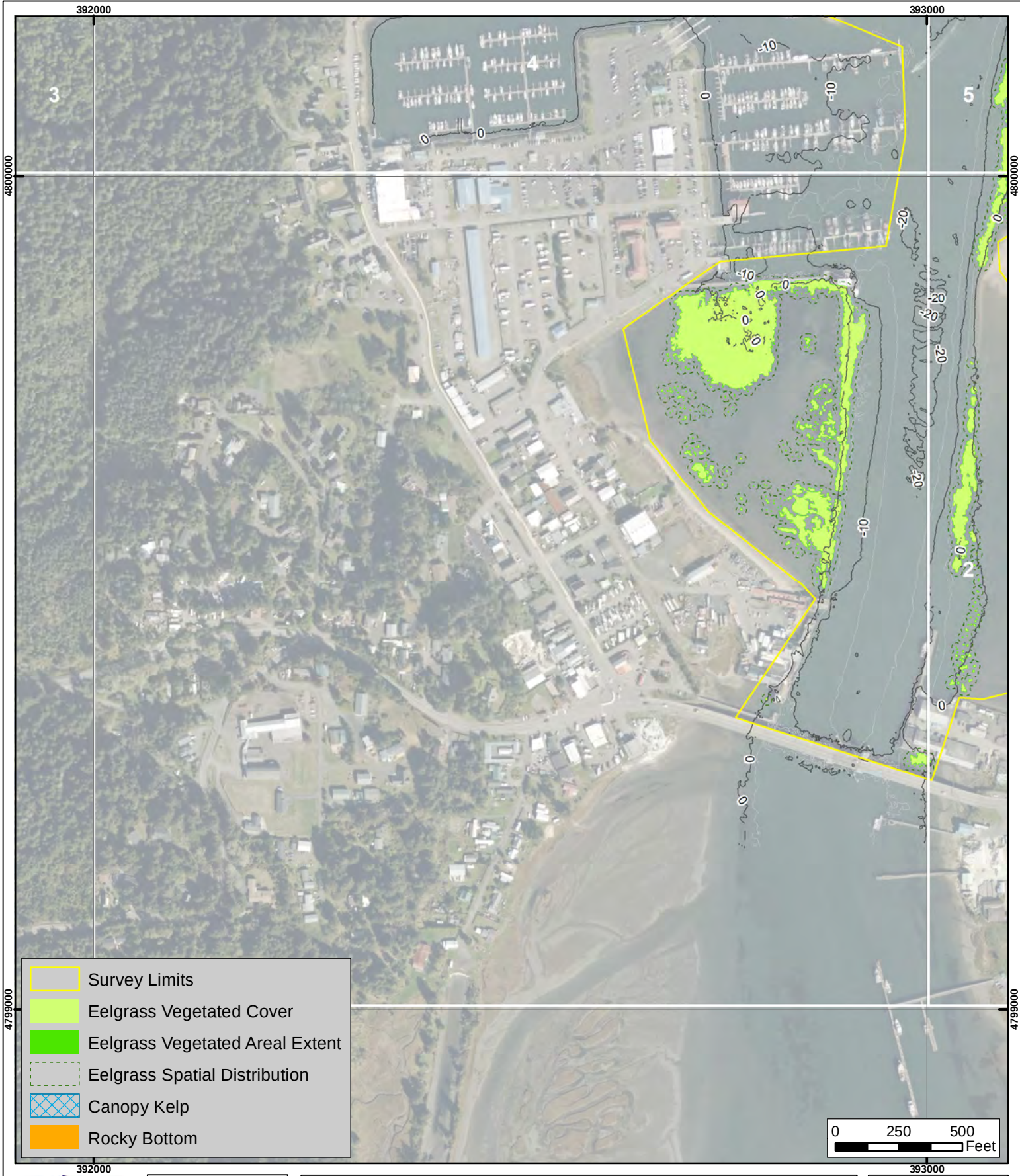

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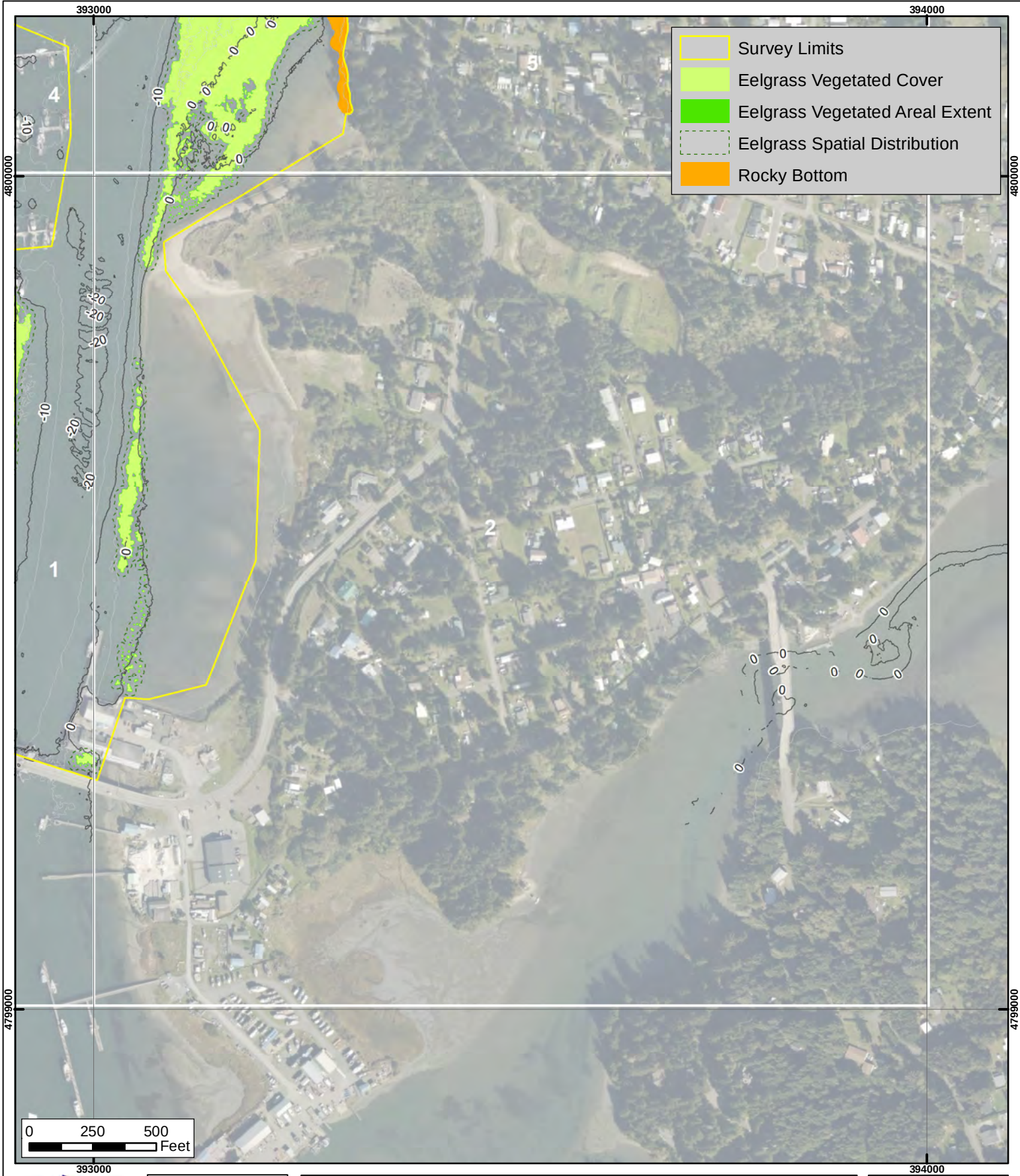

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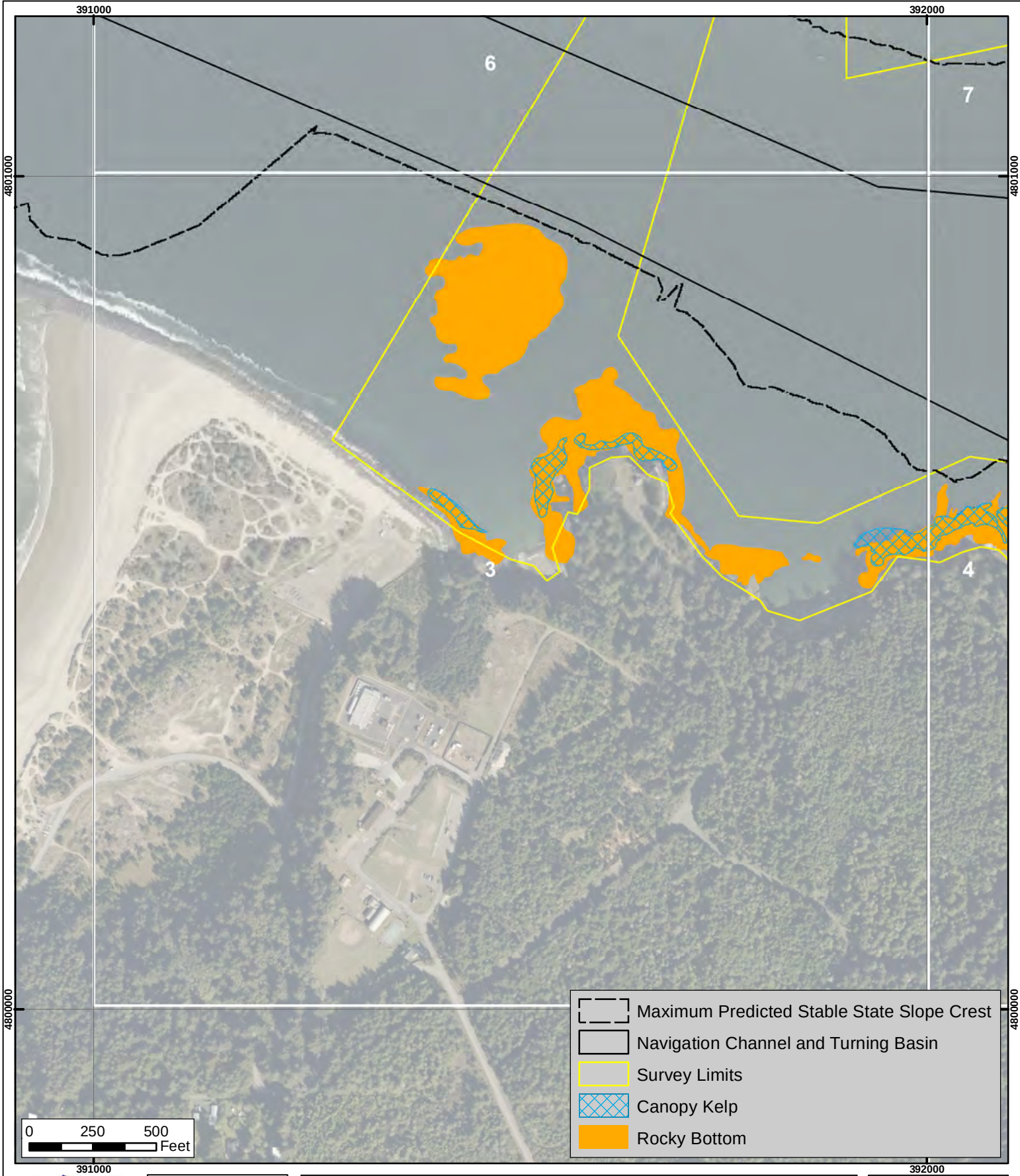

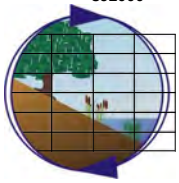

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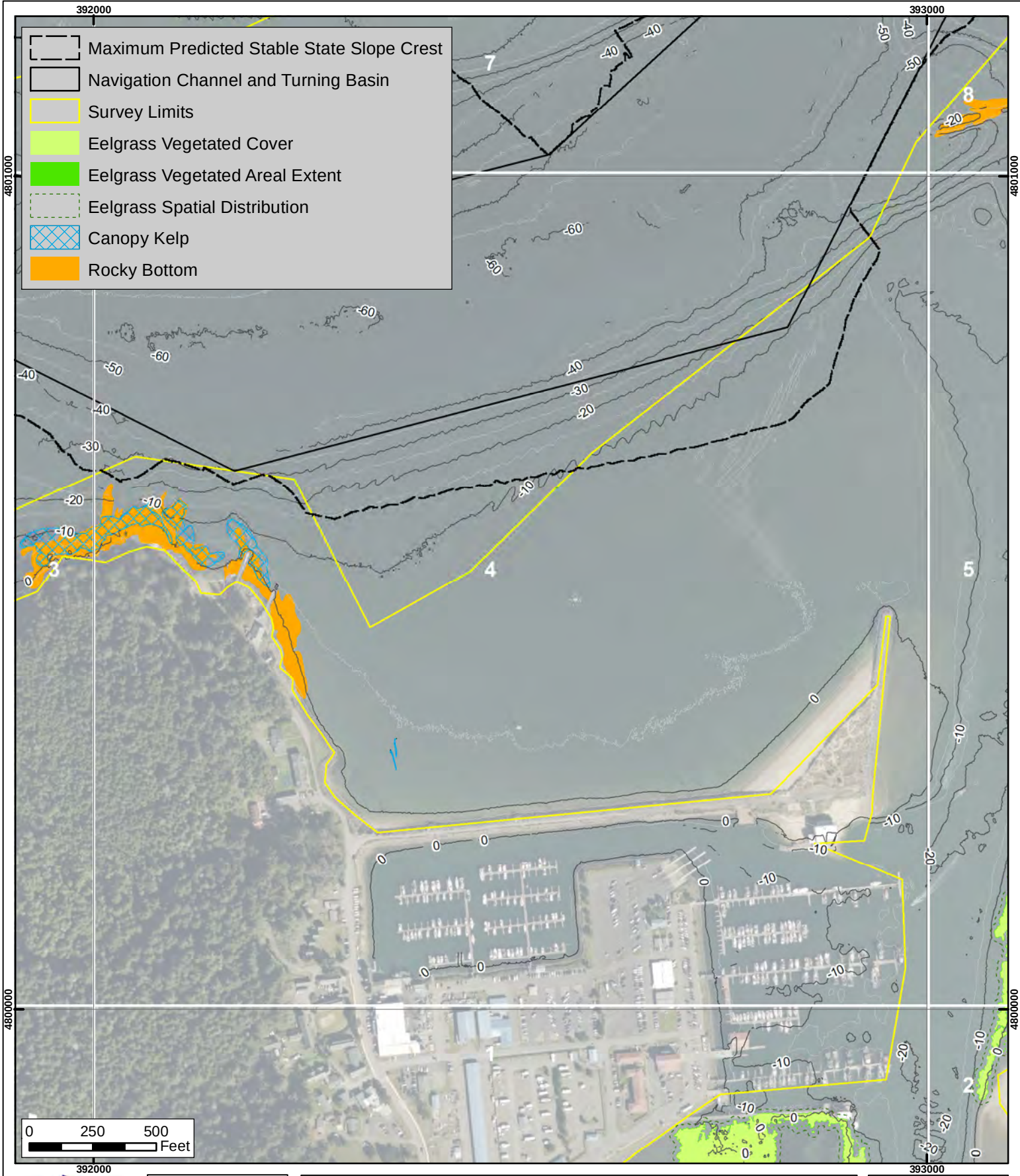

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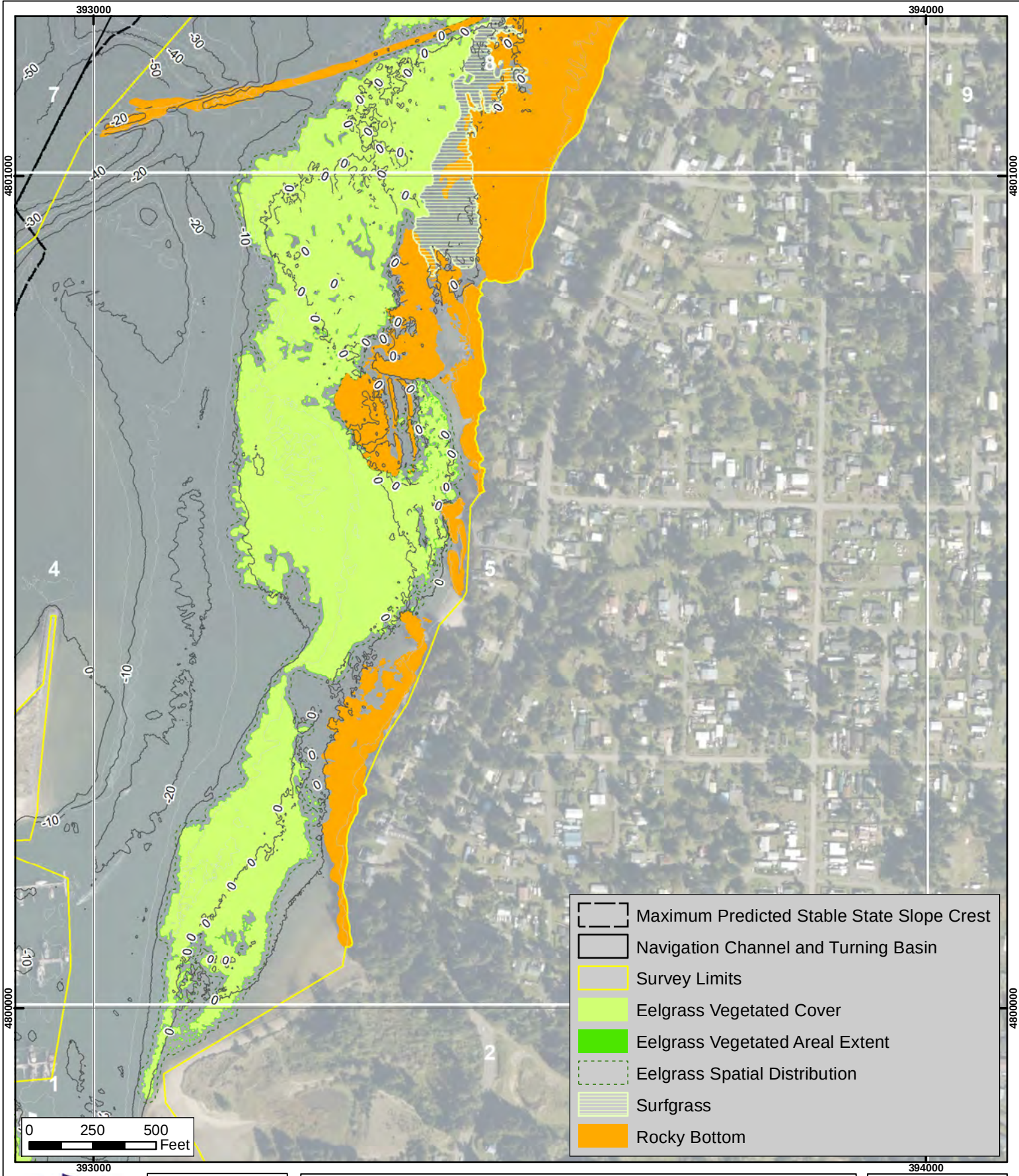

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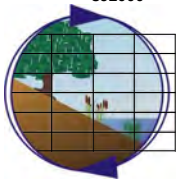

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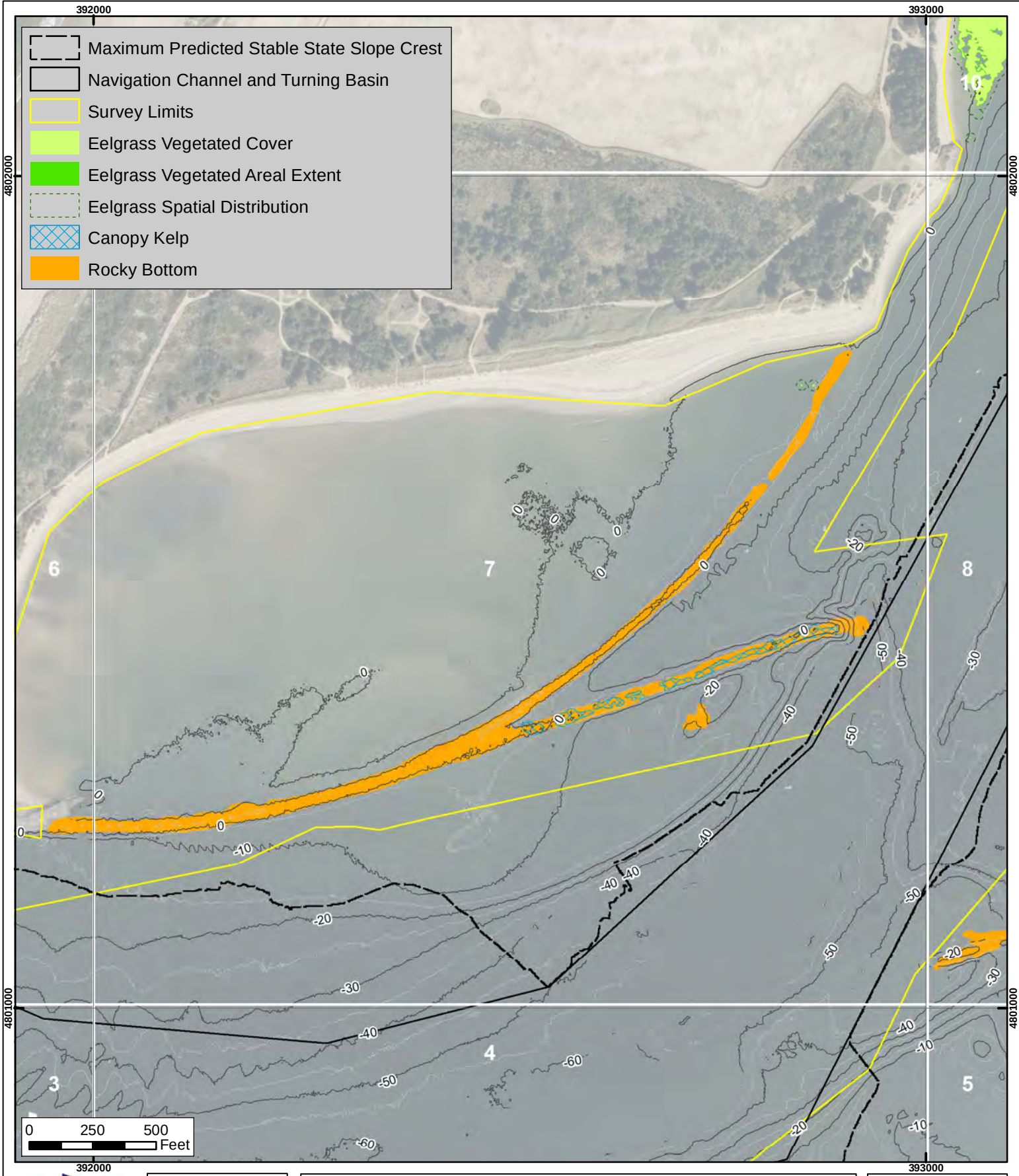

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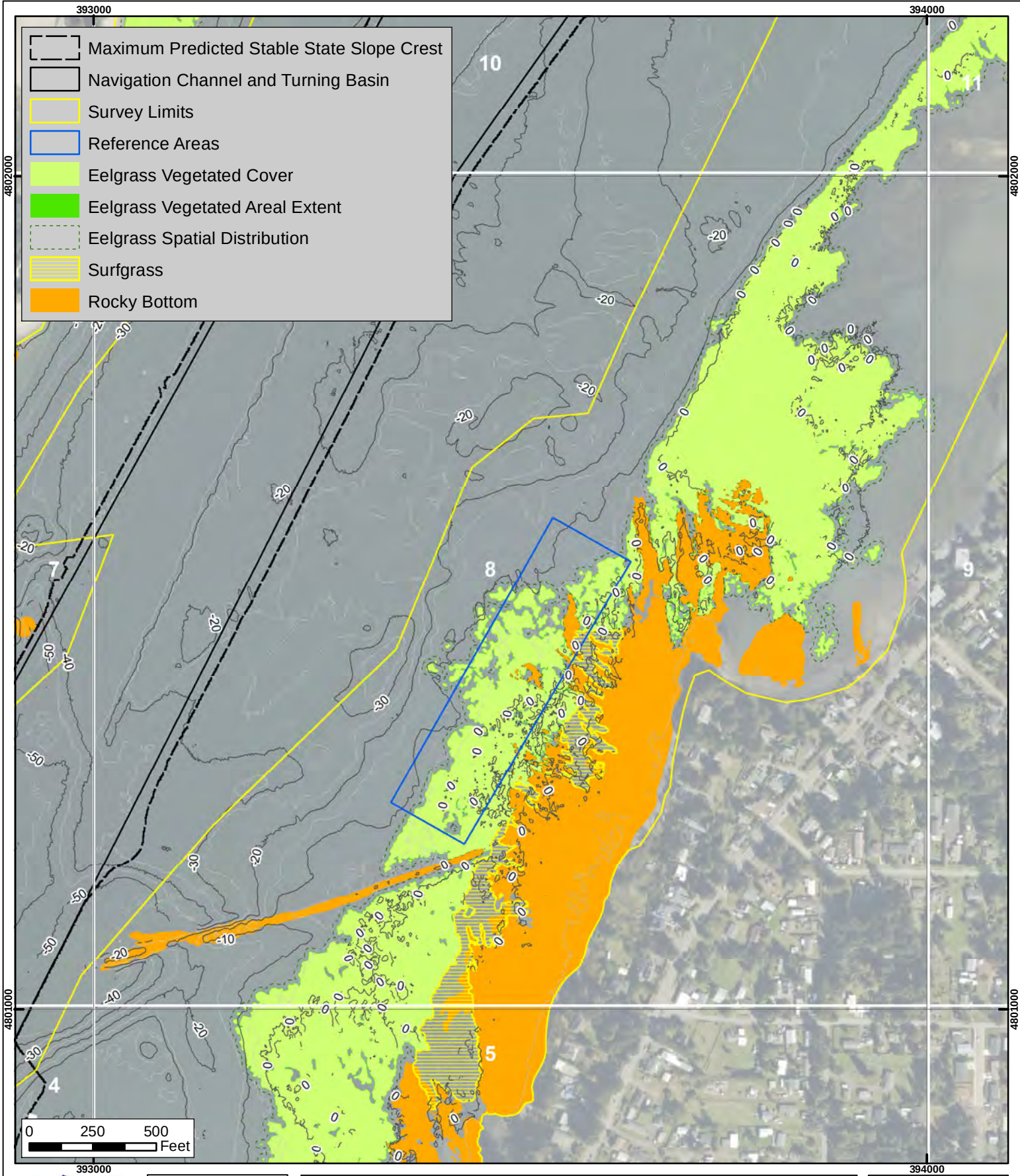

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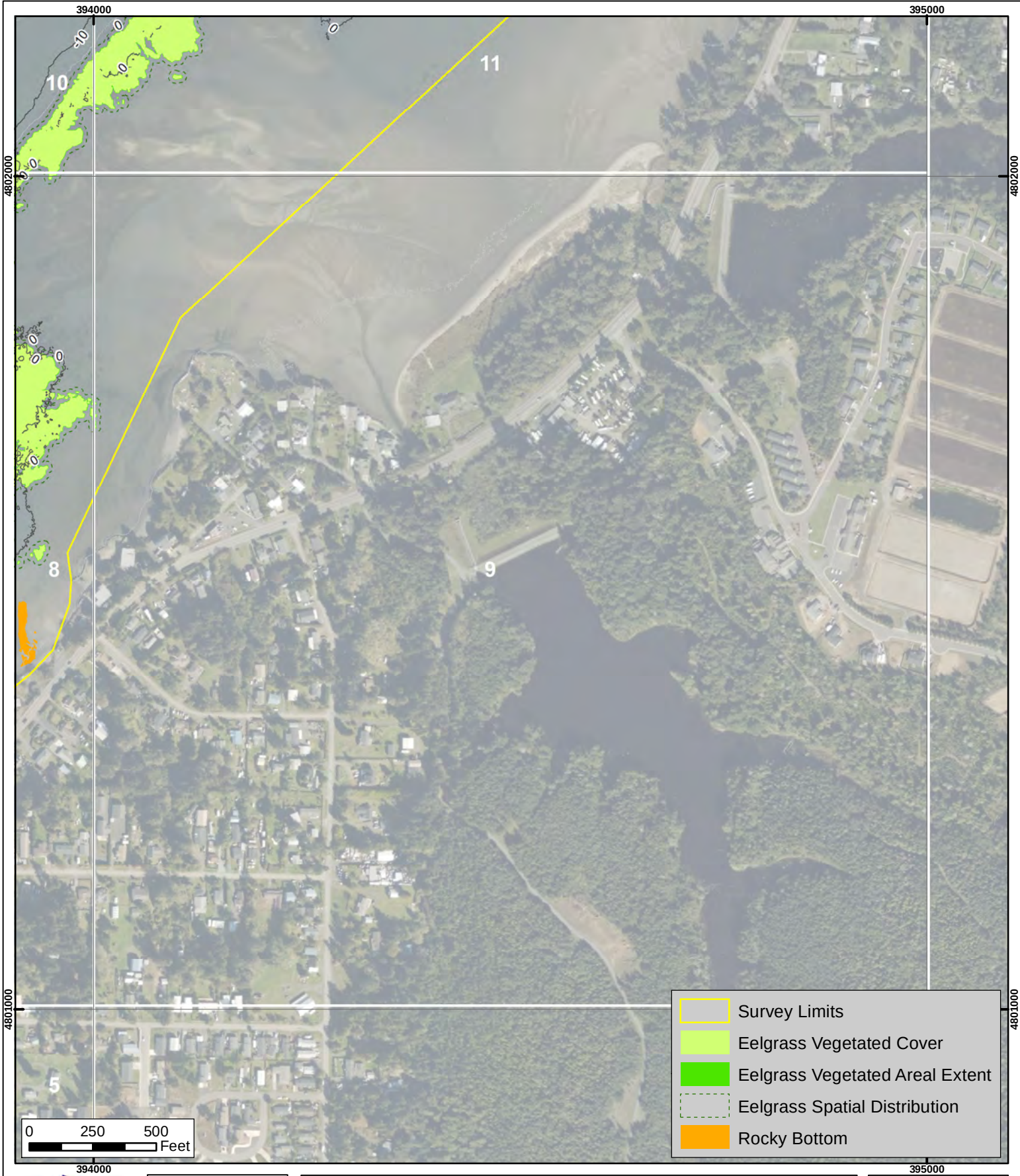

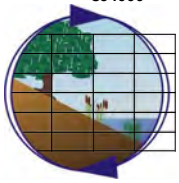

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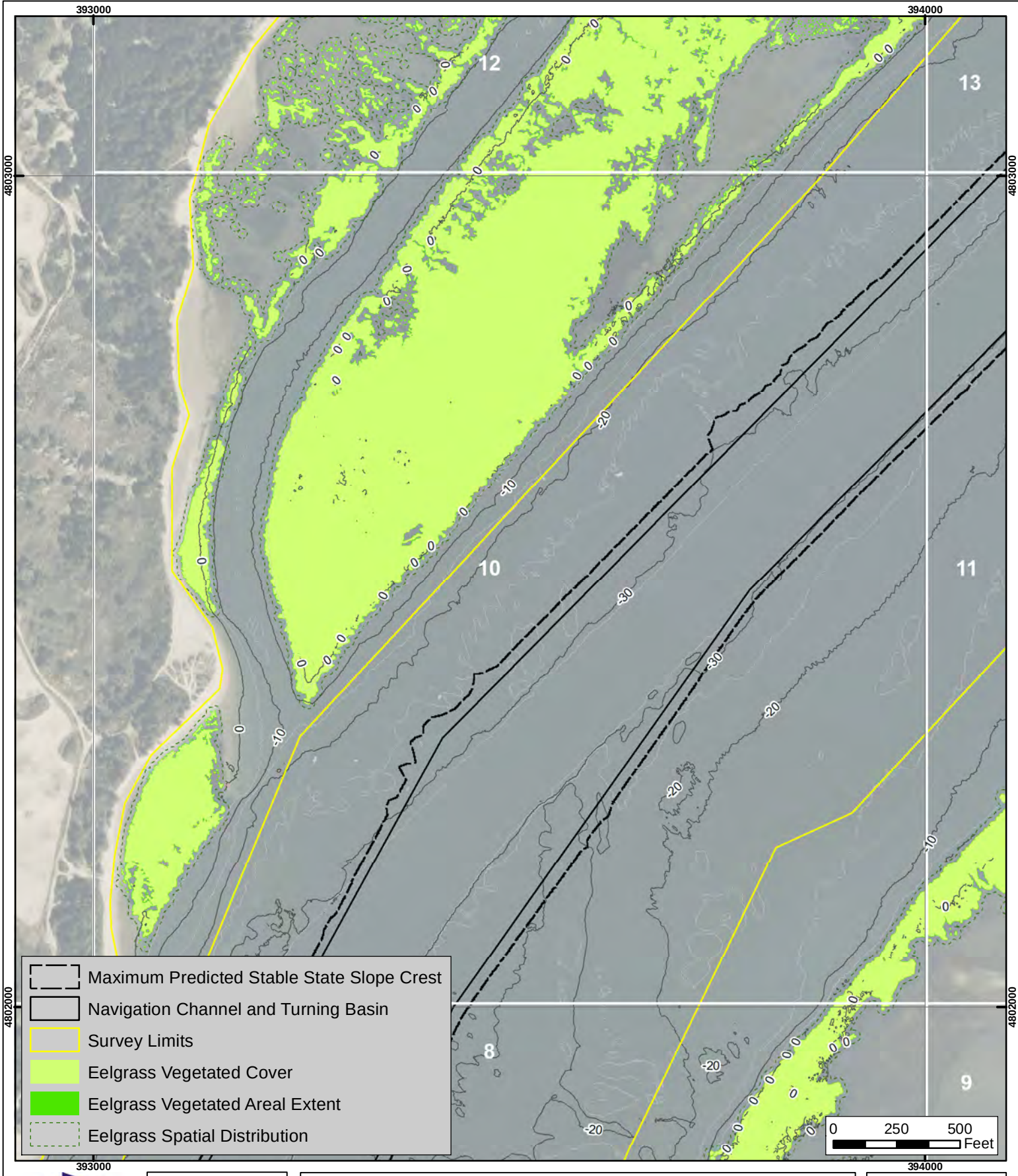

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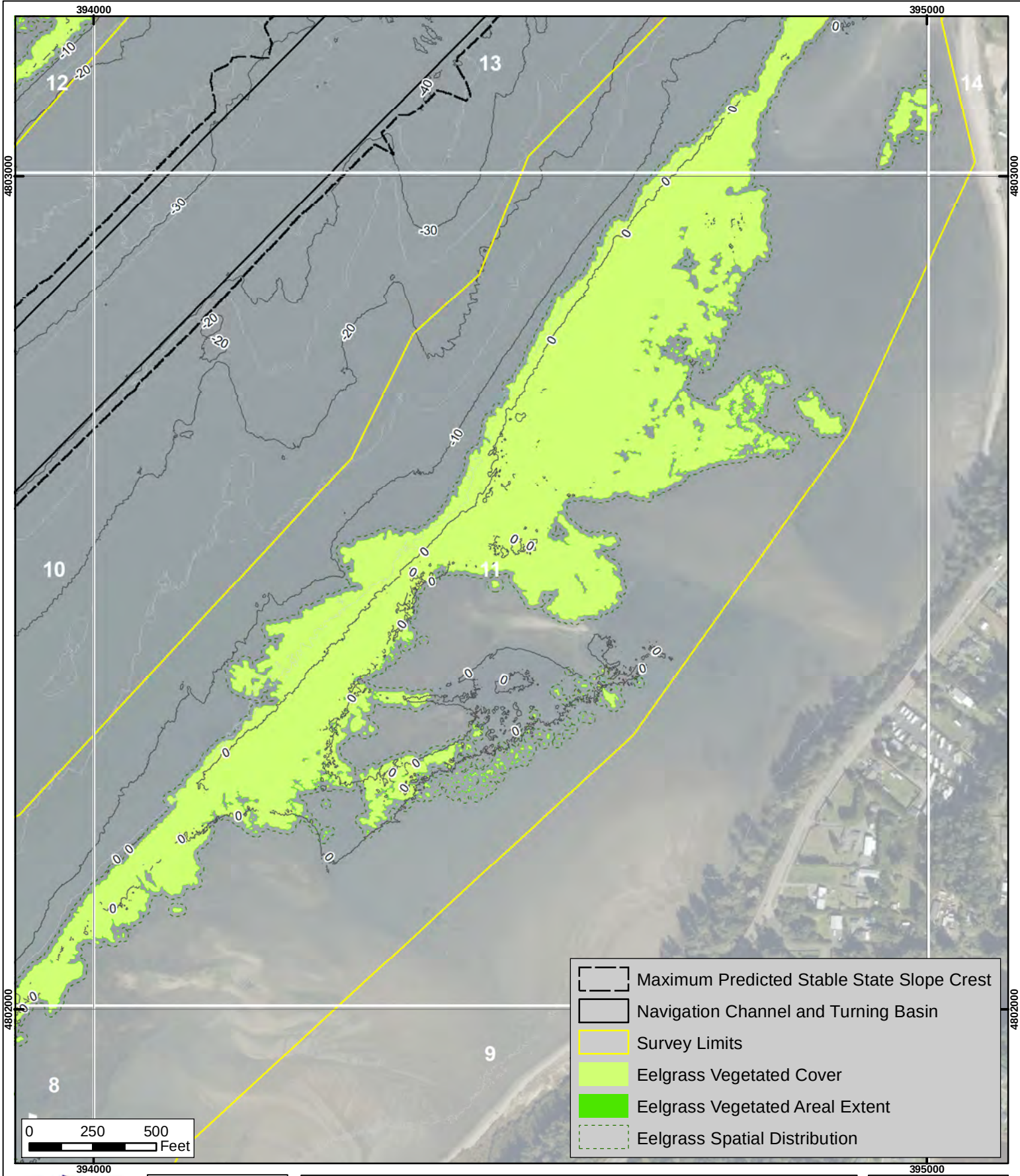

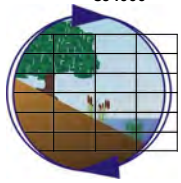

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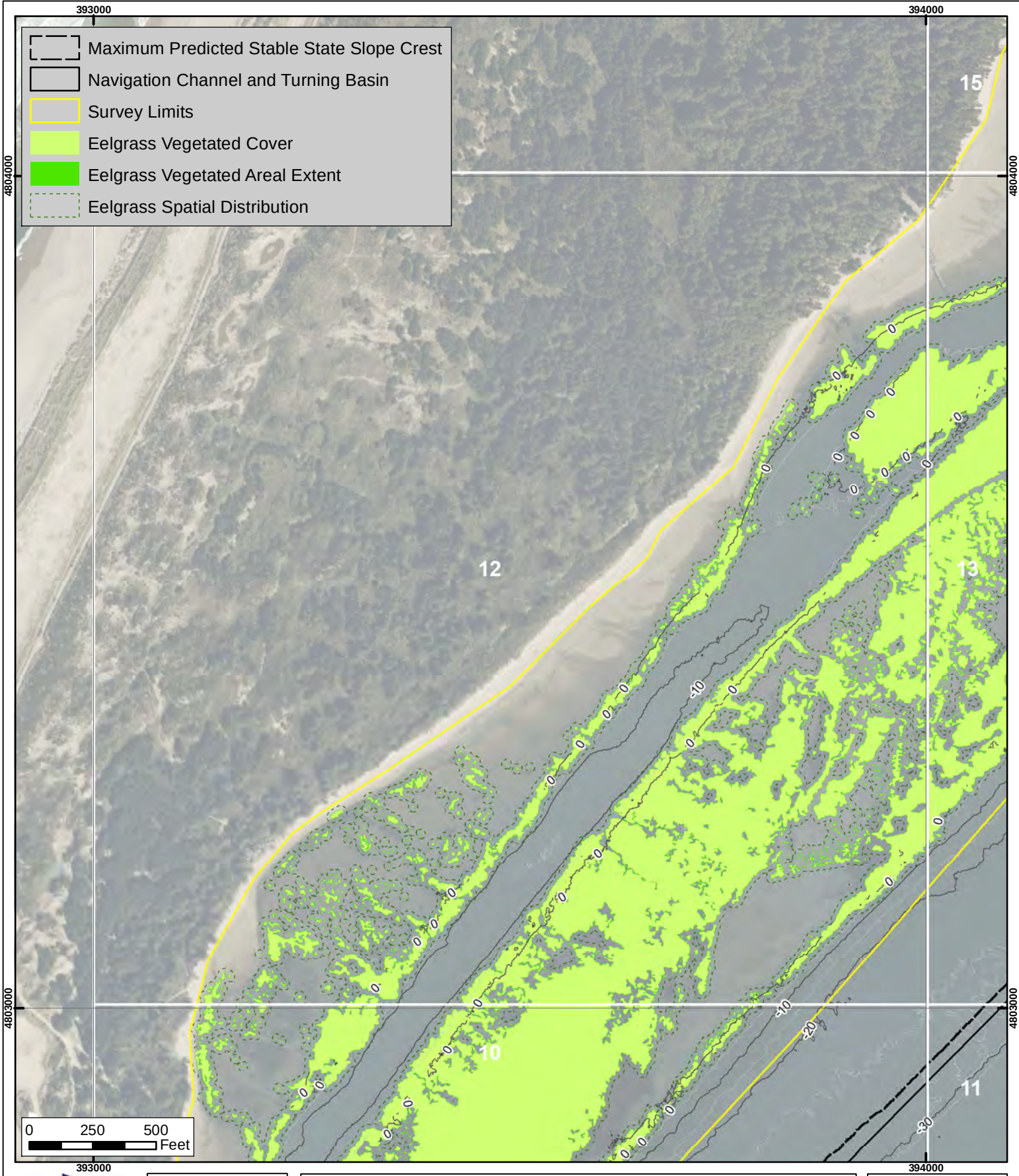

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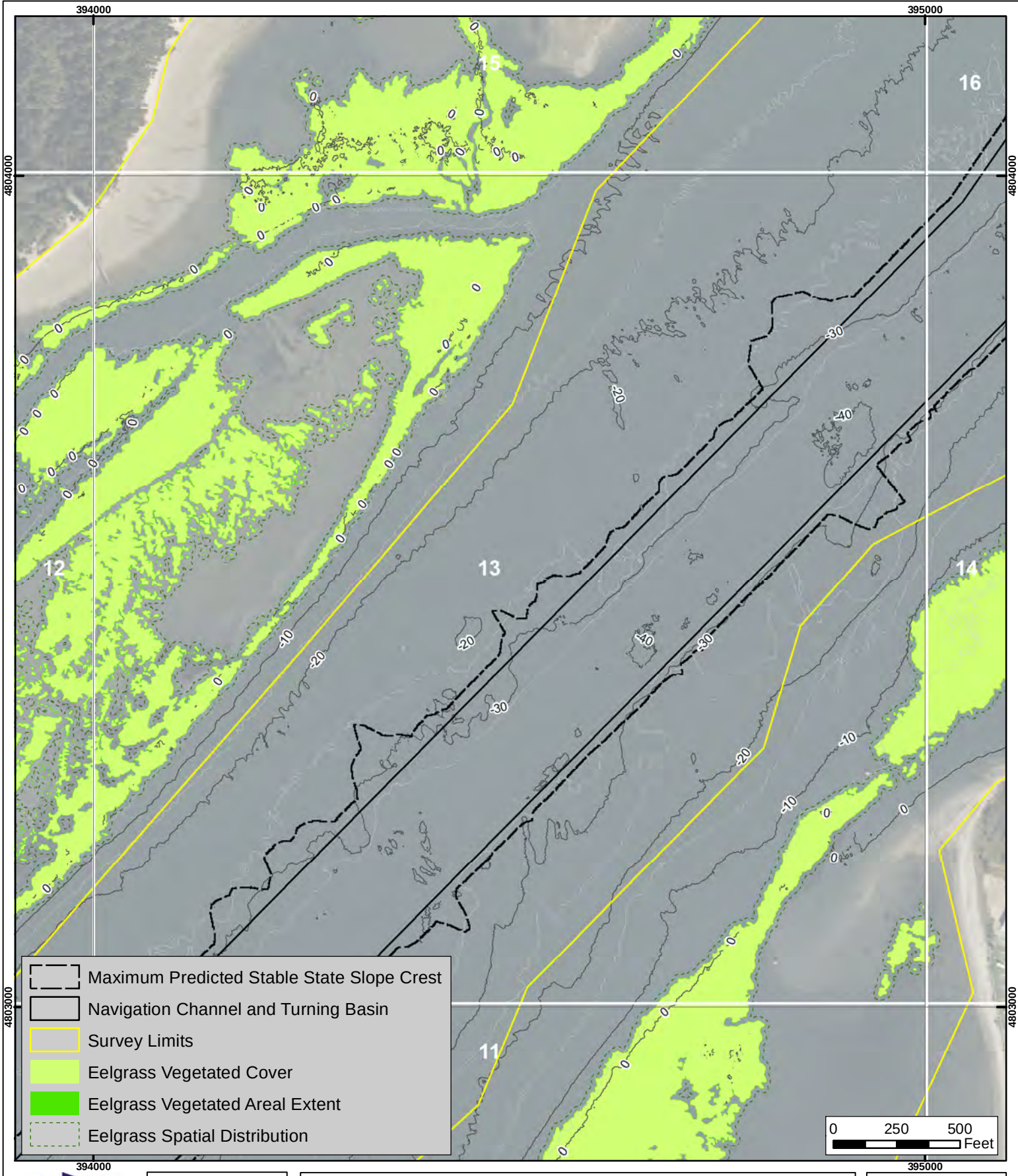

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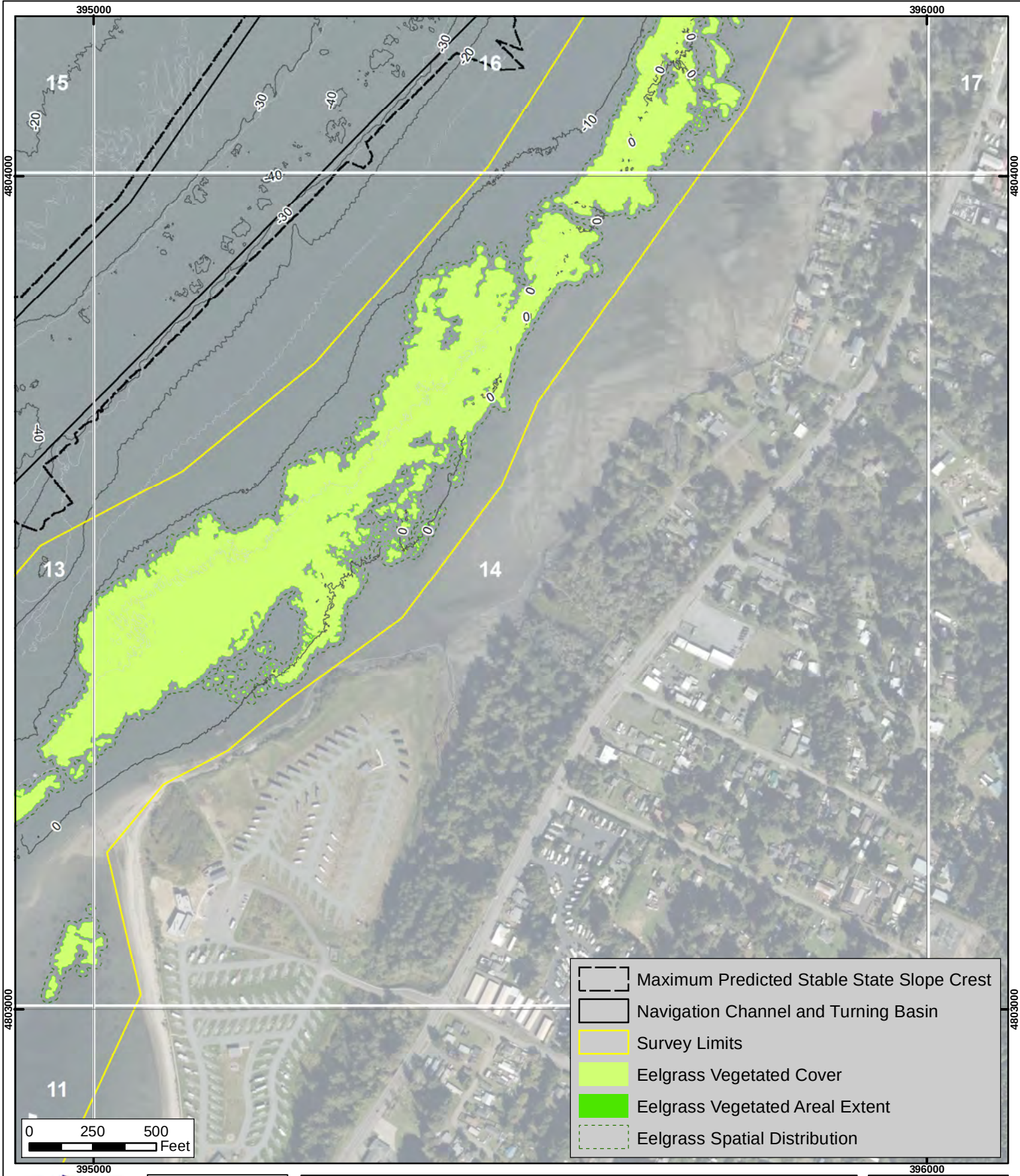

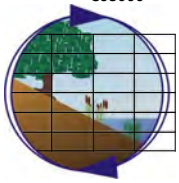

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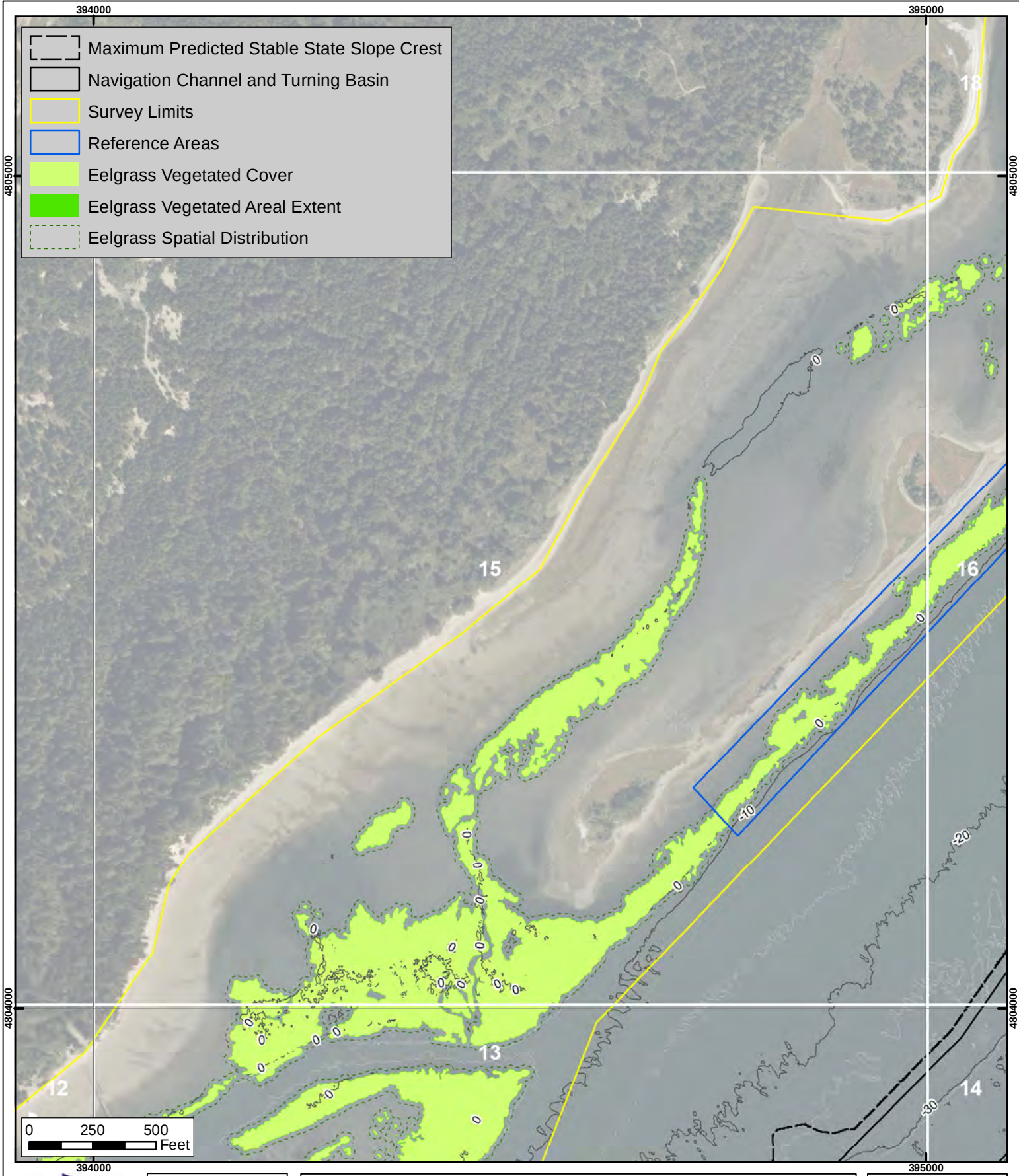

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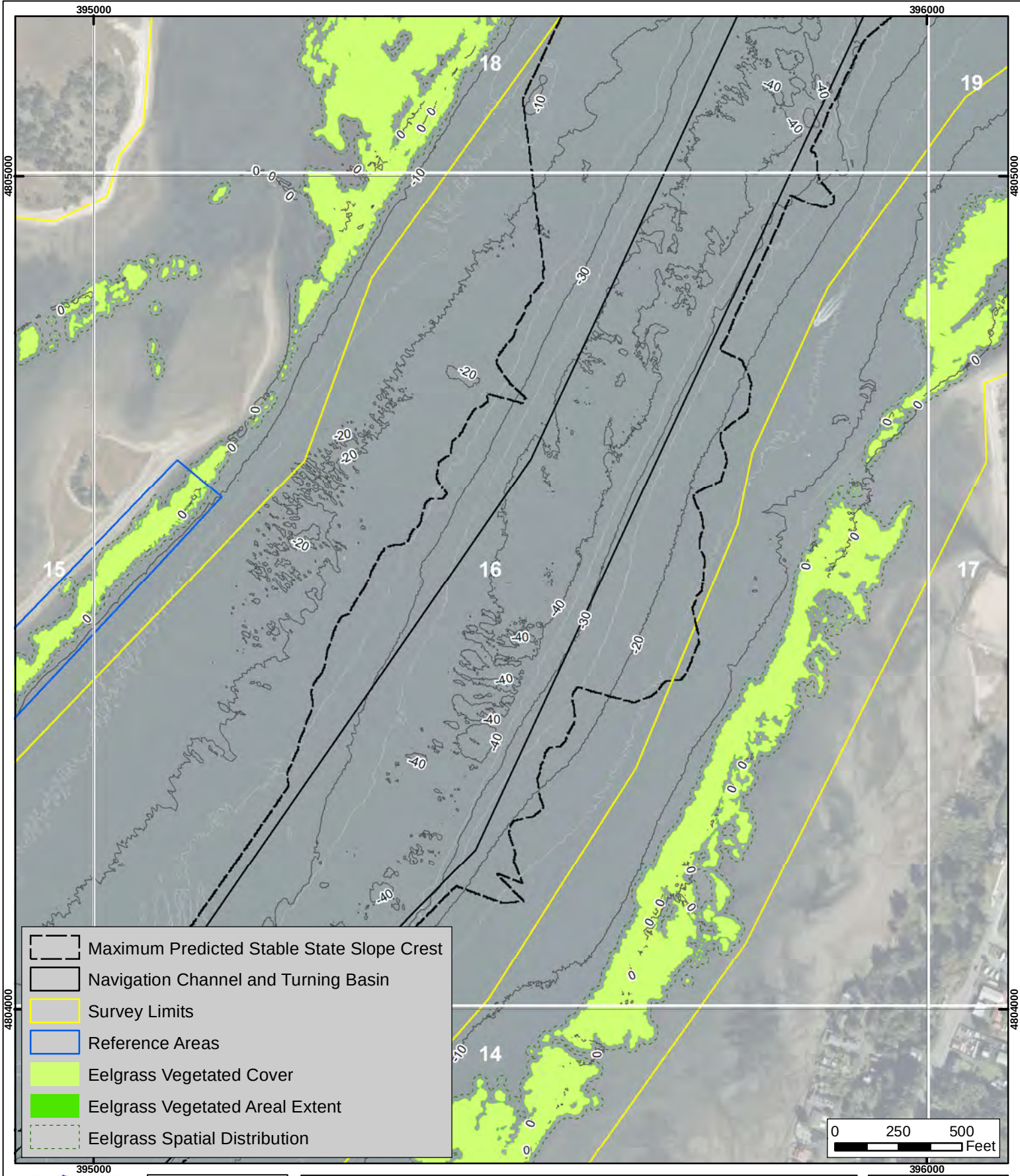
Merkel & Associates, Inc.



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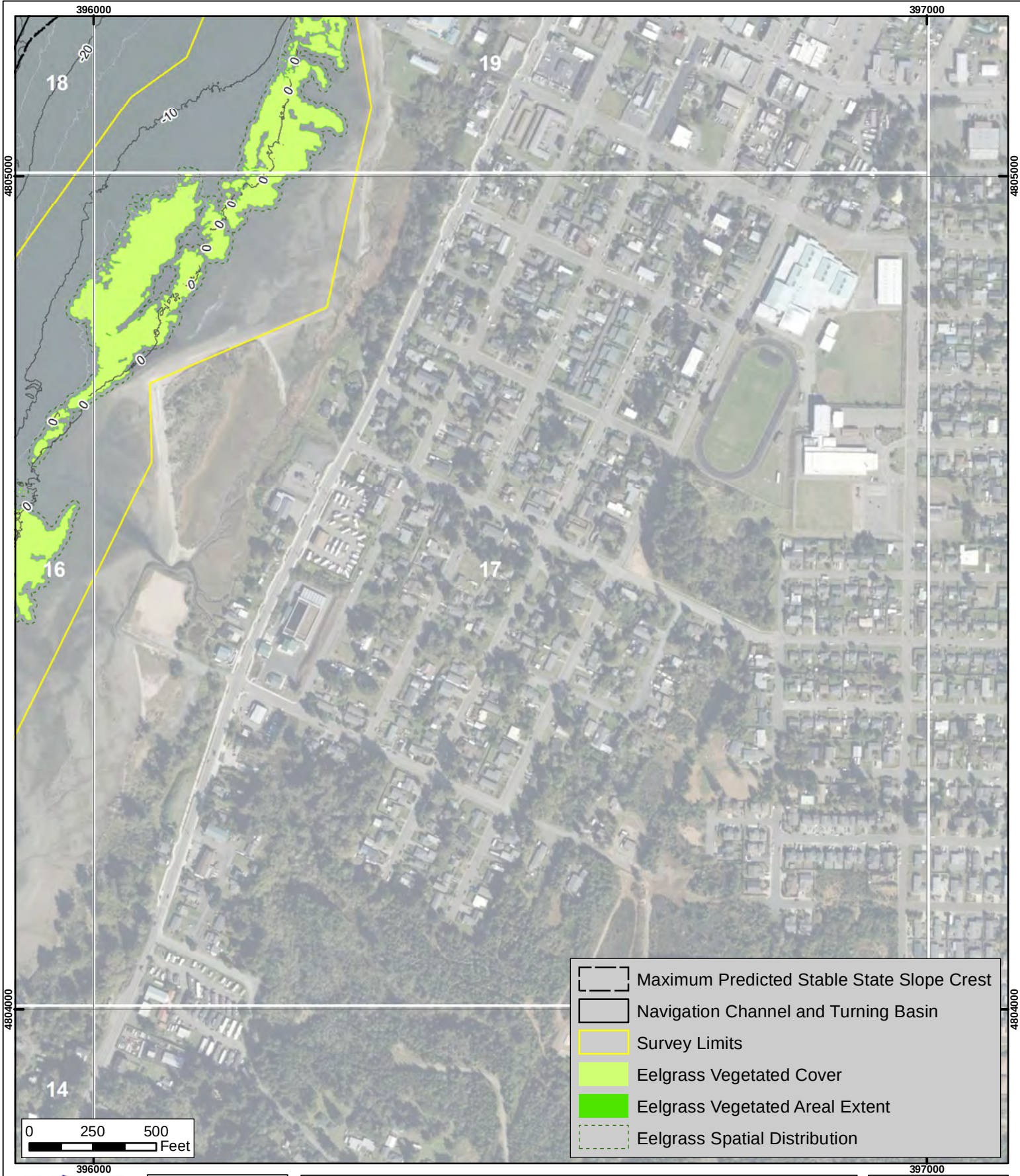

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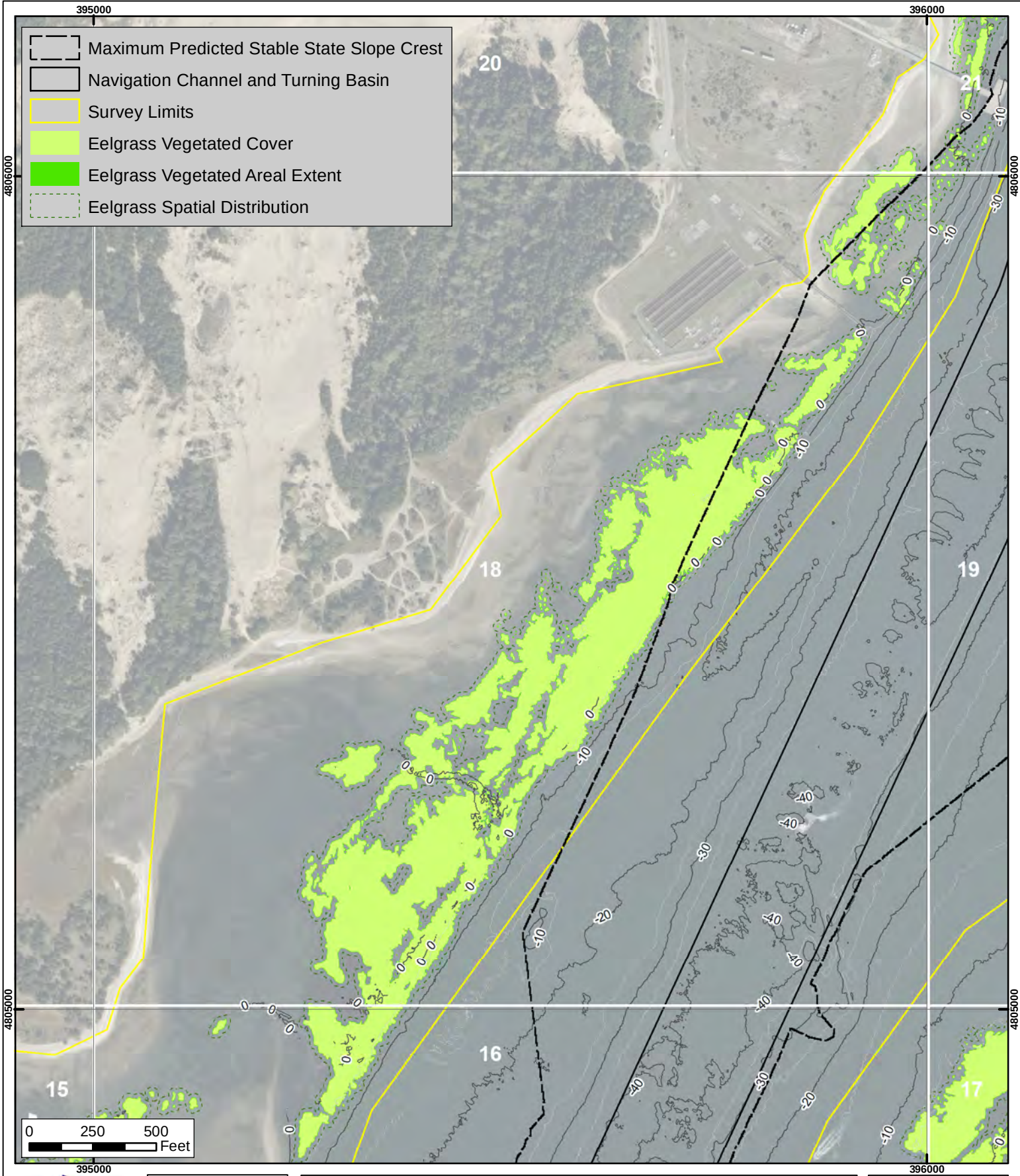

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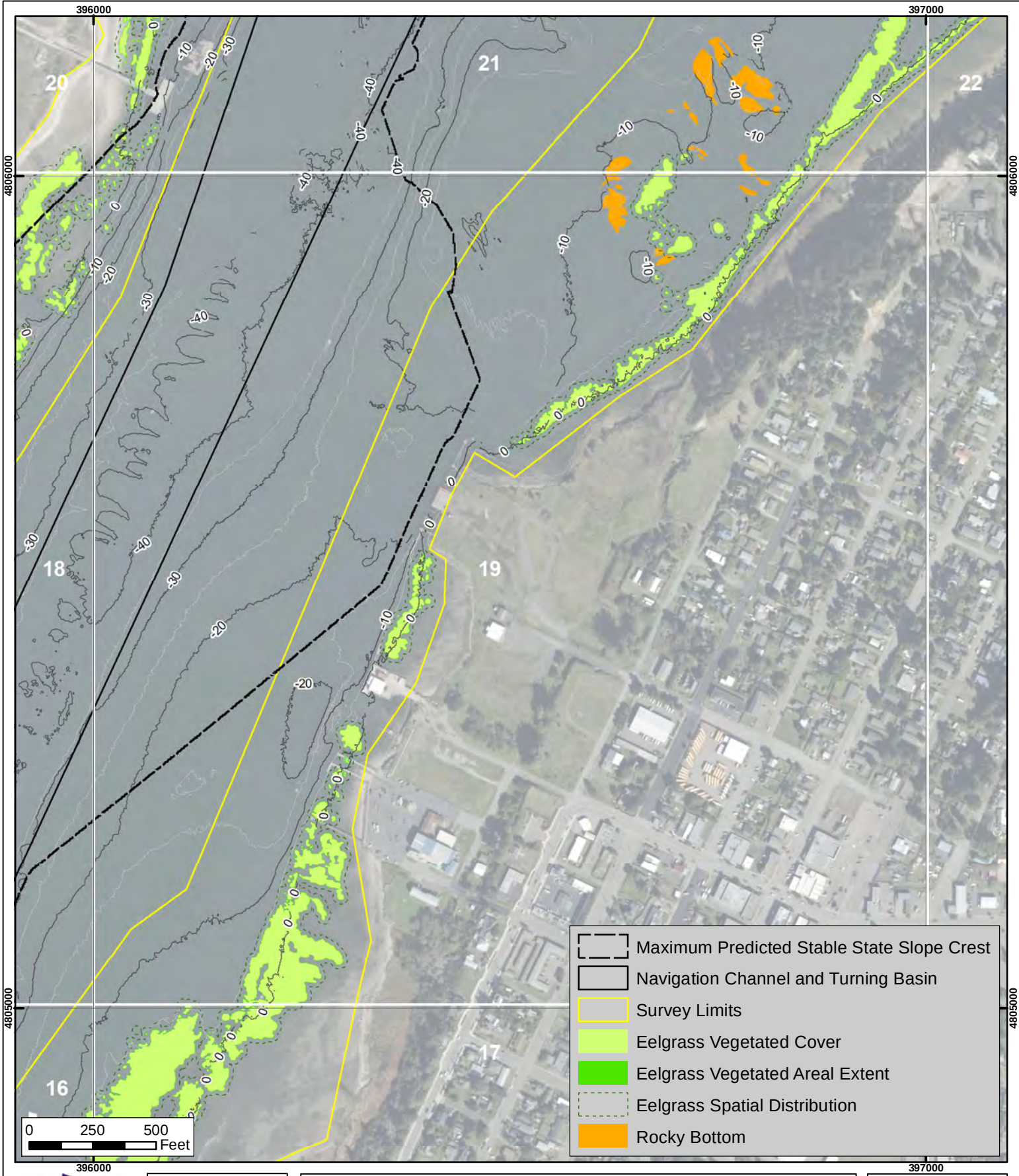

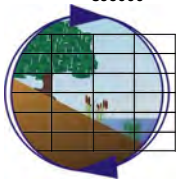

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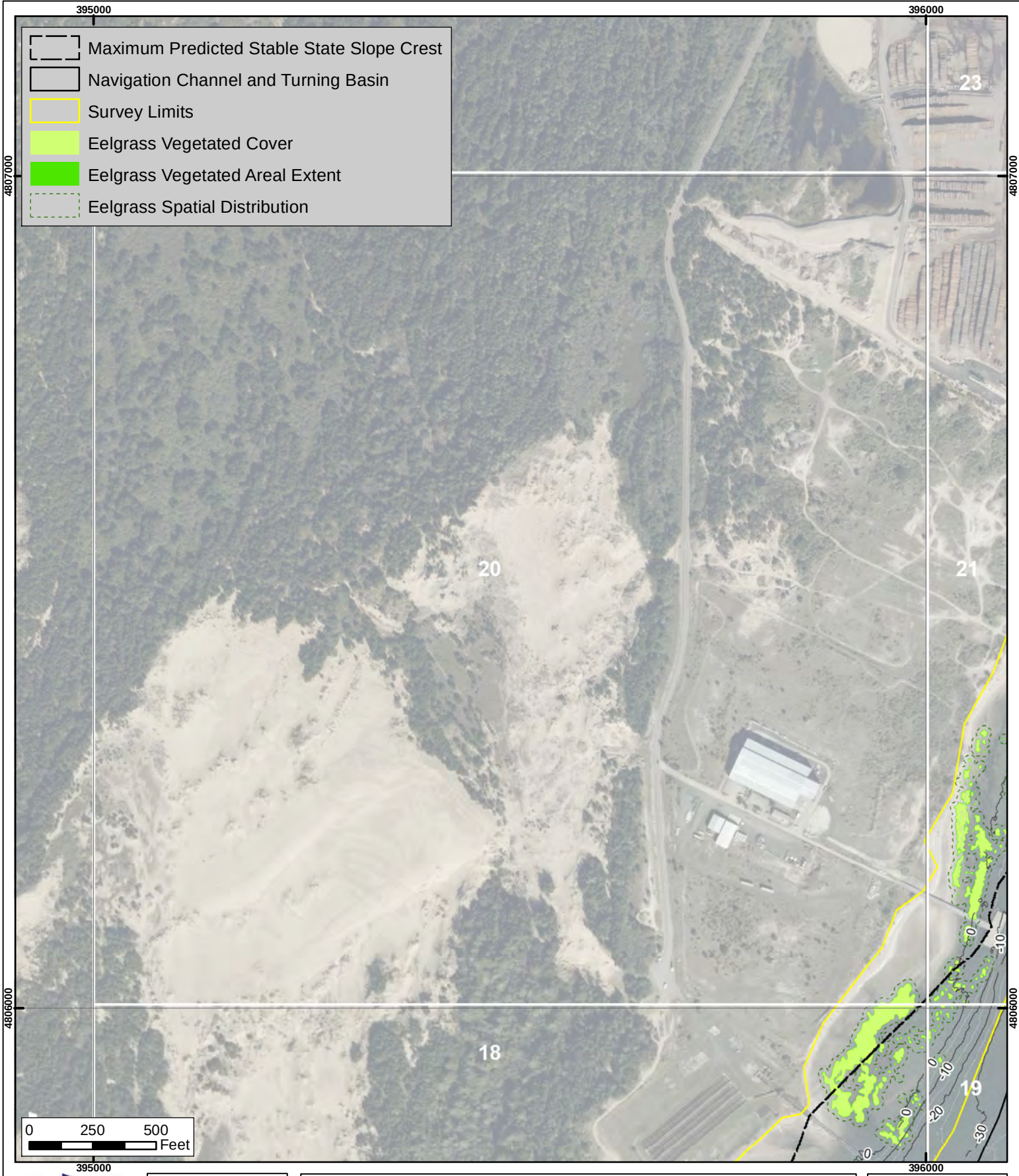

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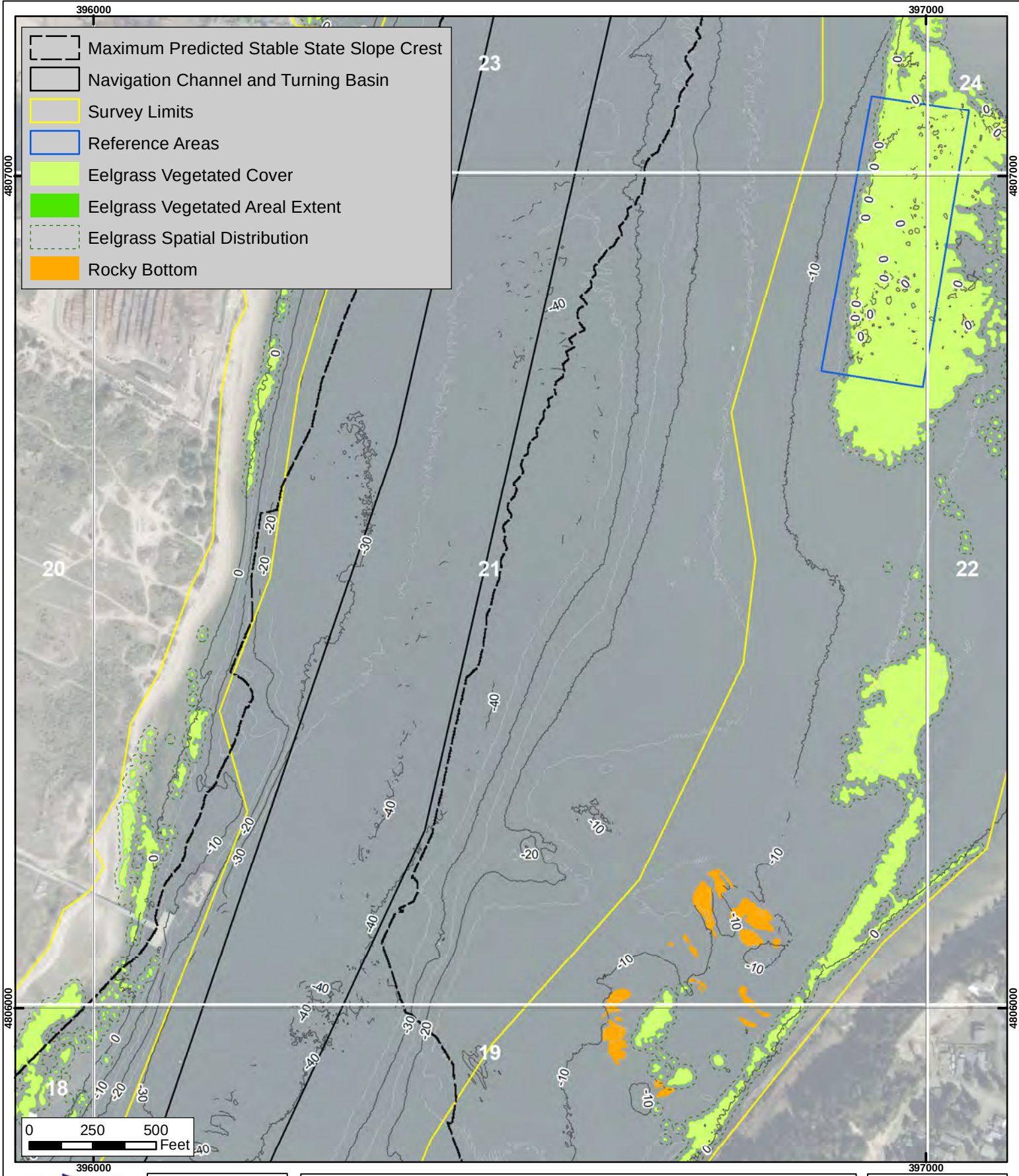

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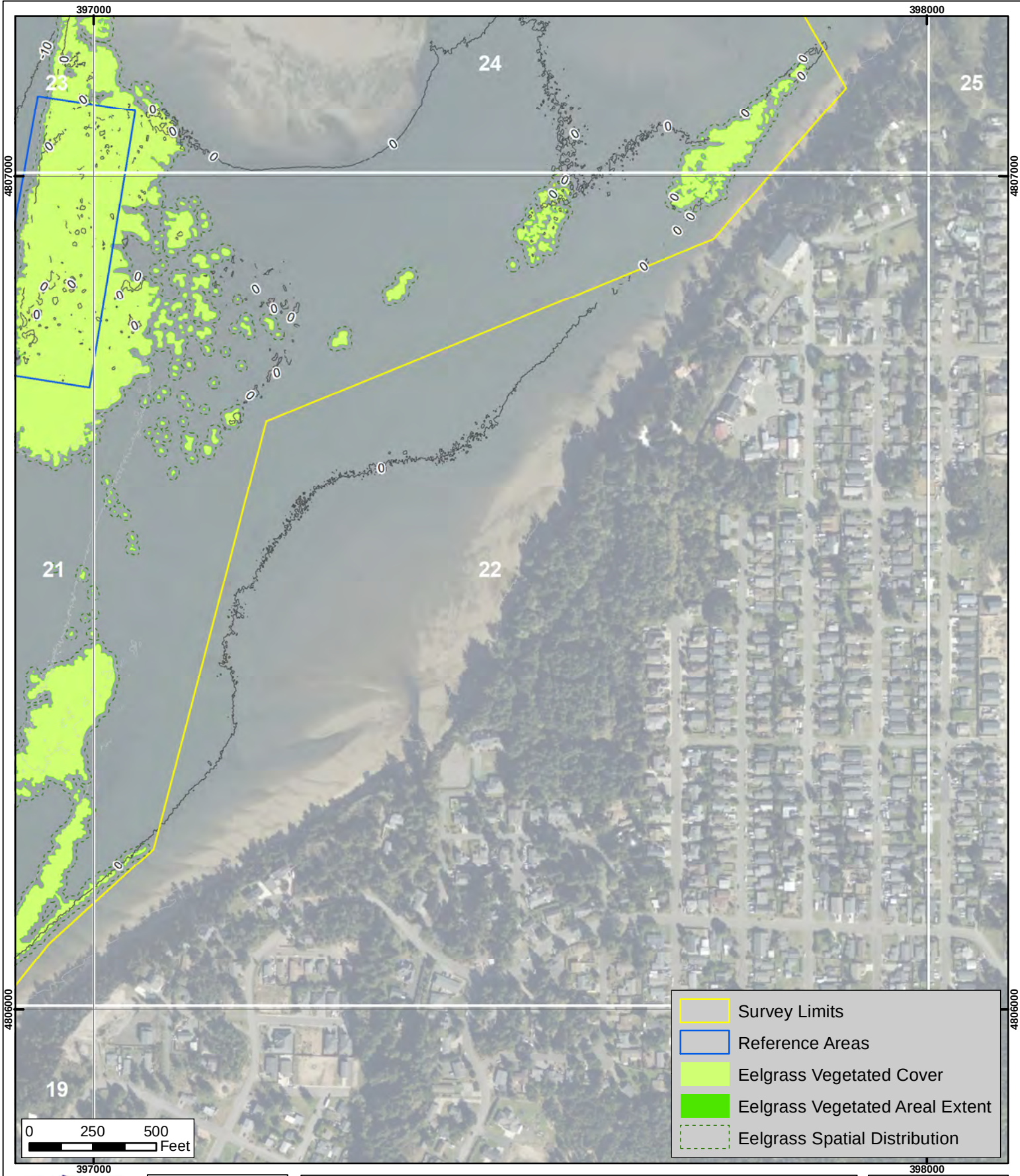

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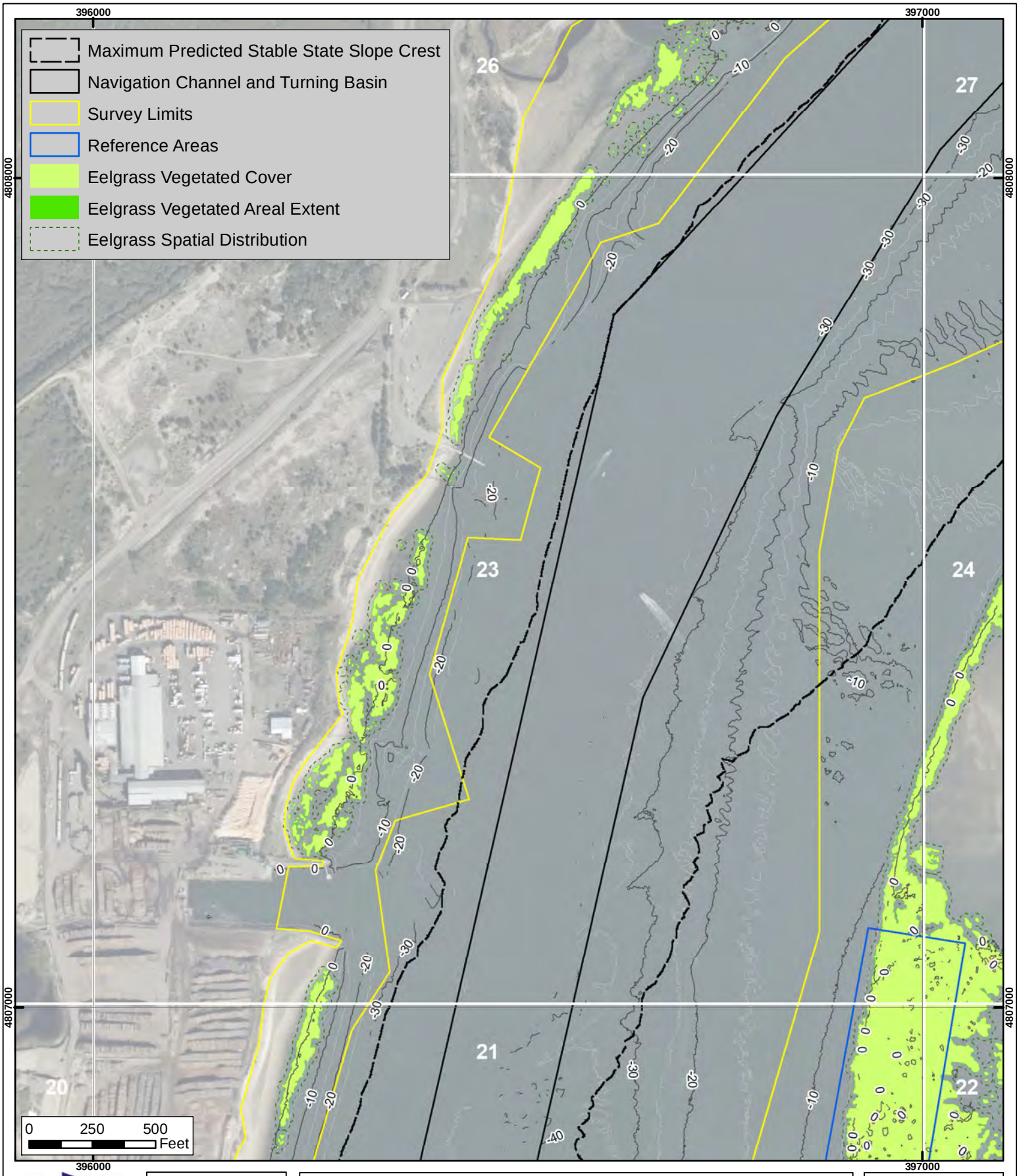

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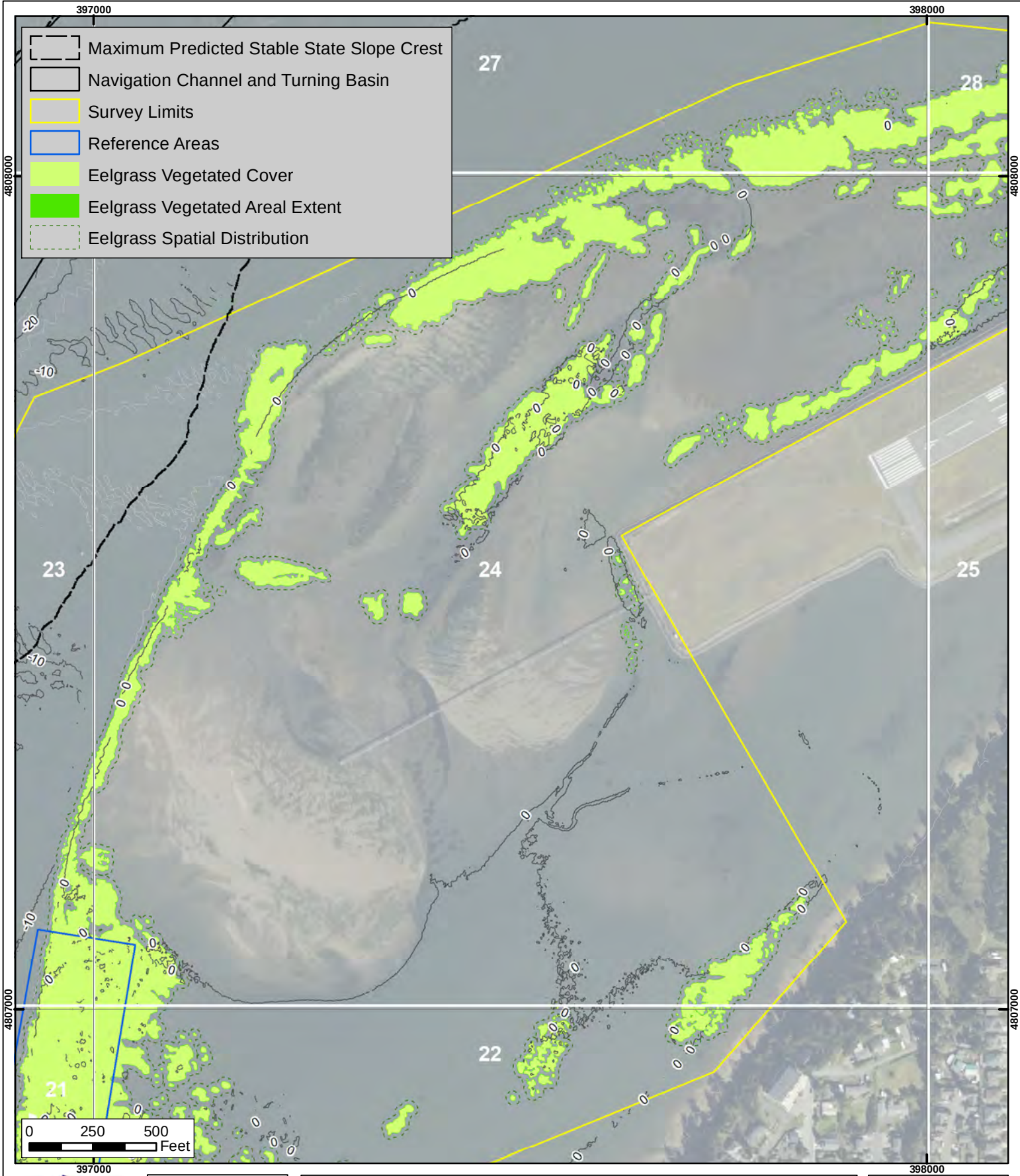
Merkel & Associates, Inc.



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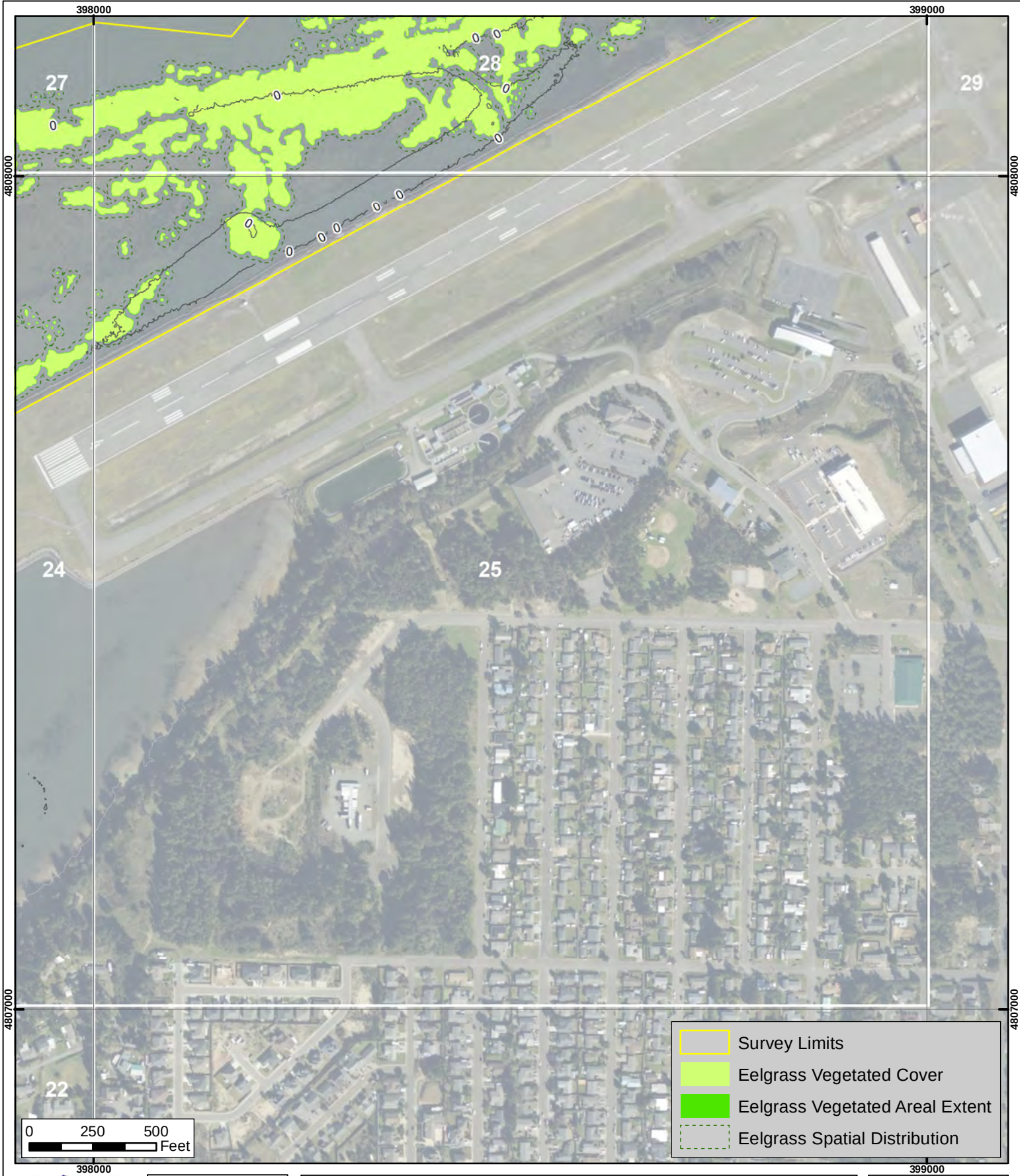

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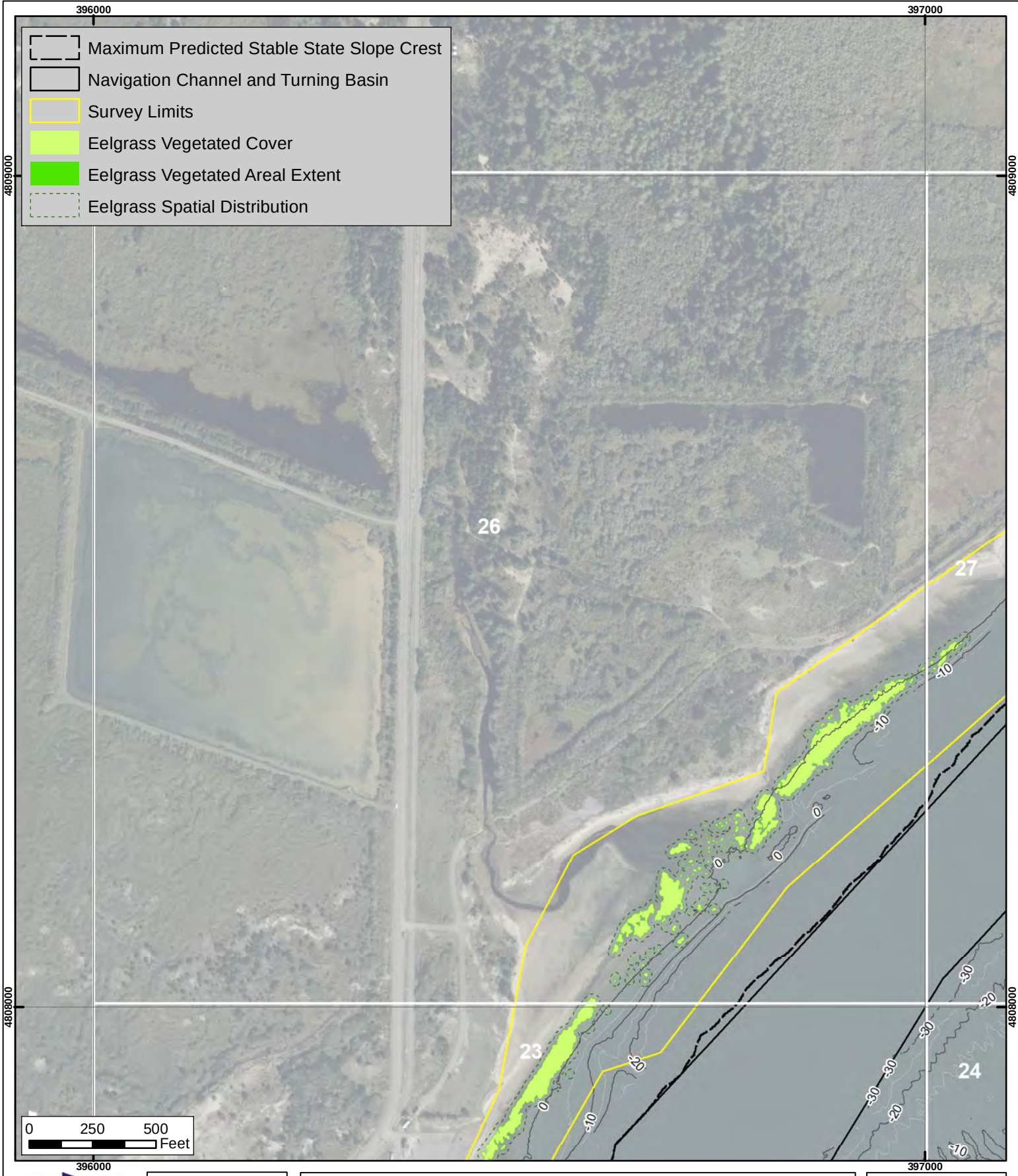

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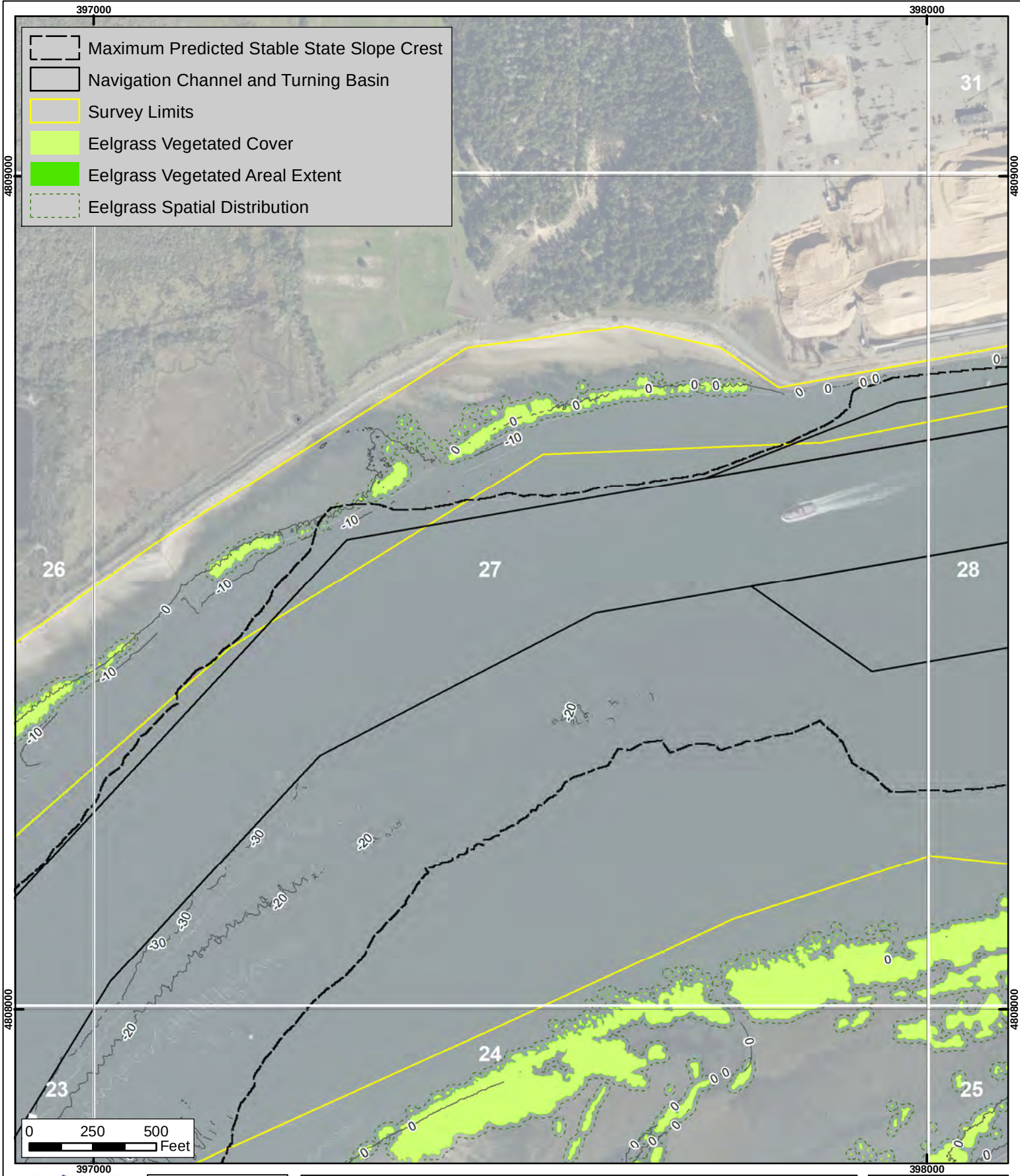

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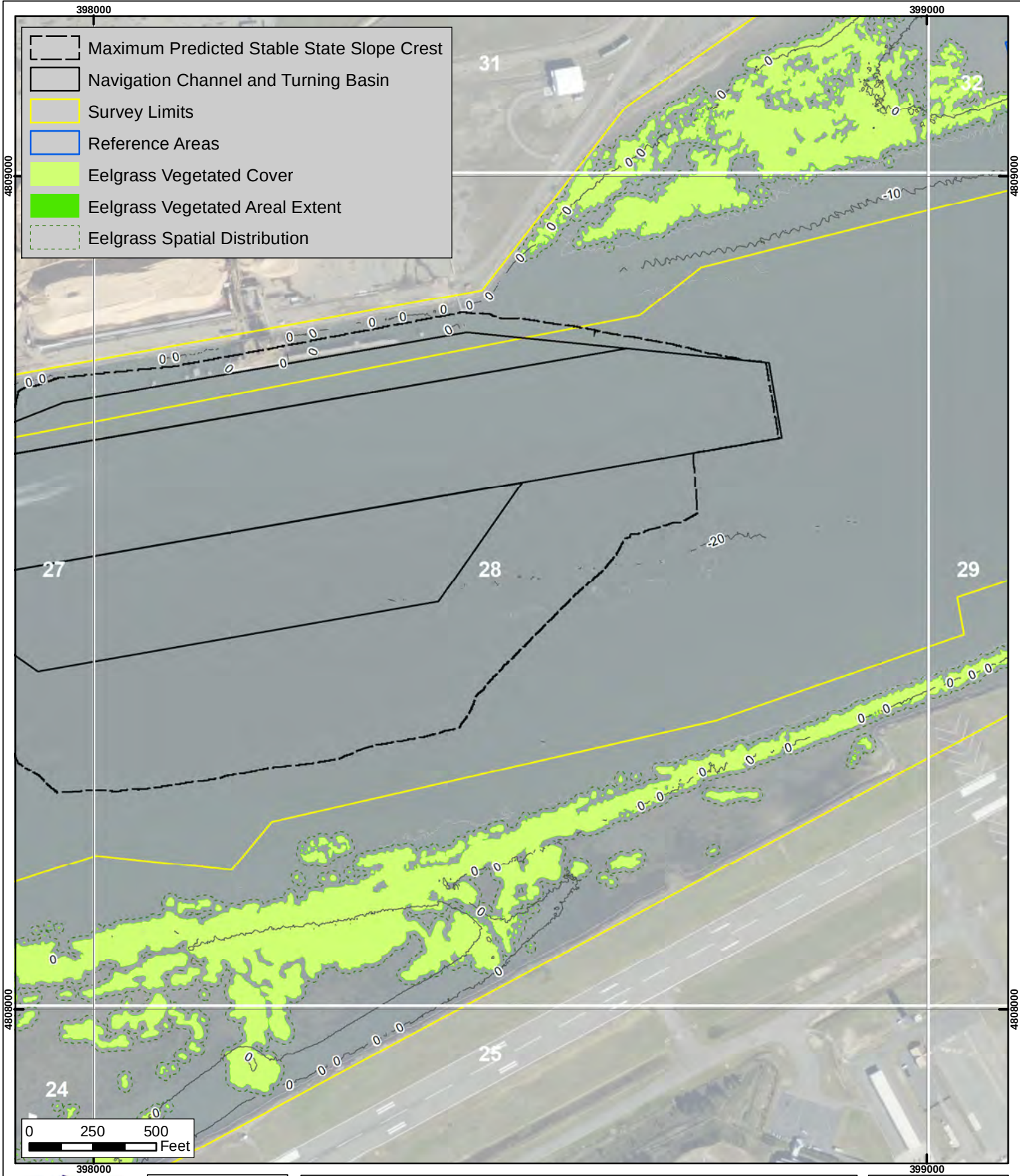

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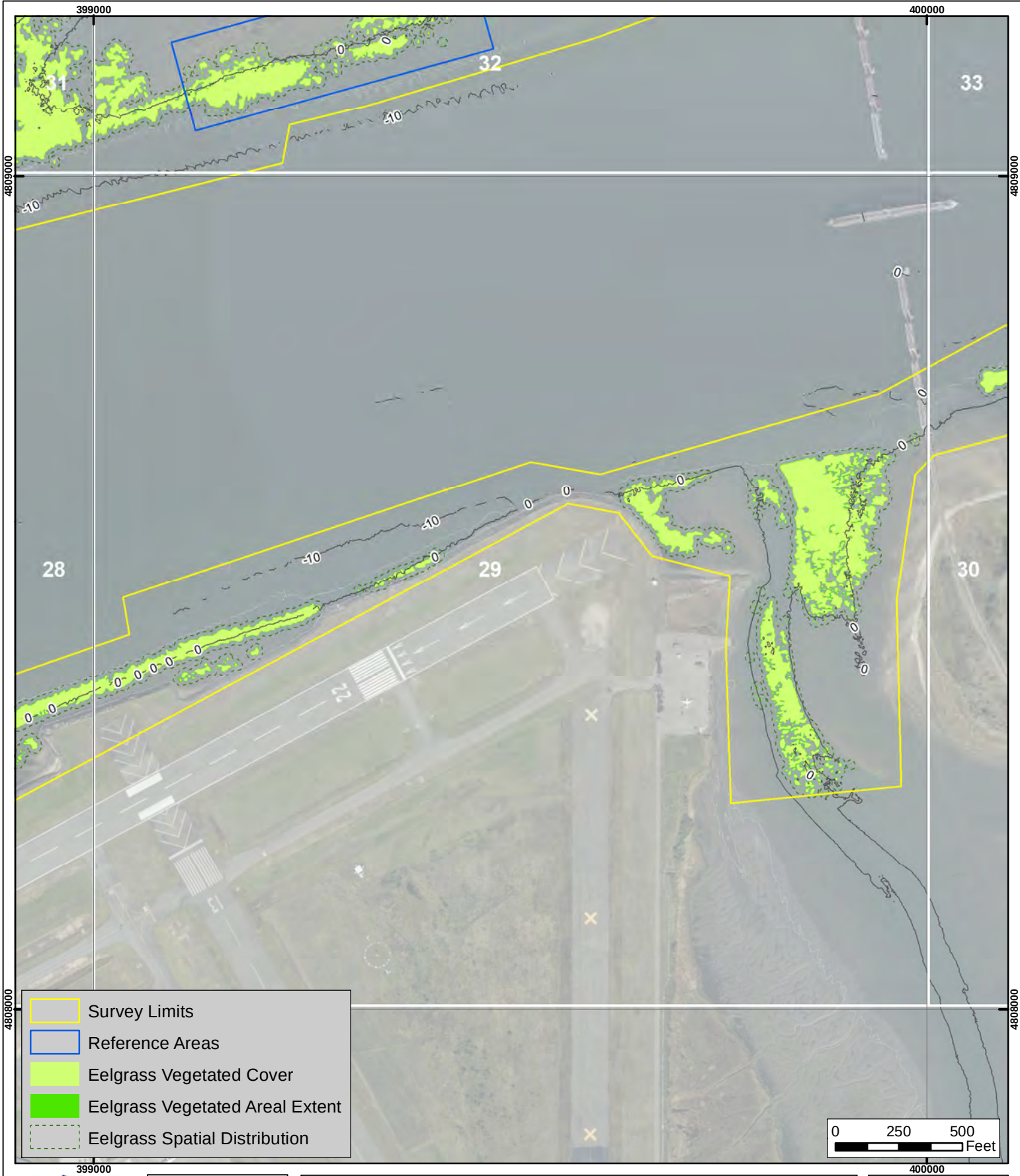

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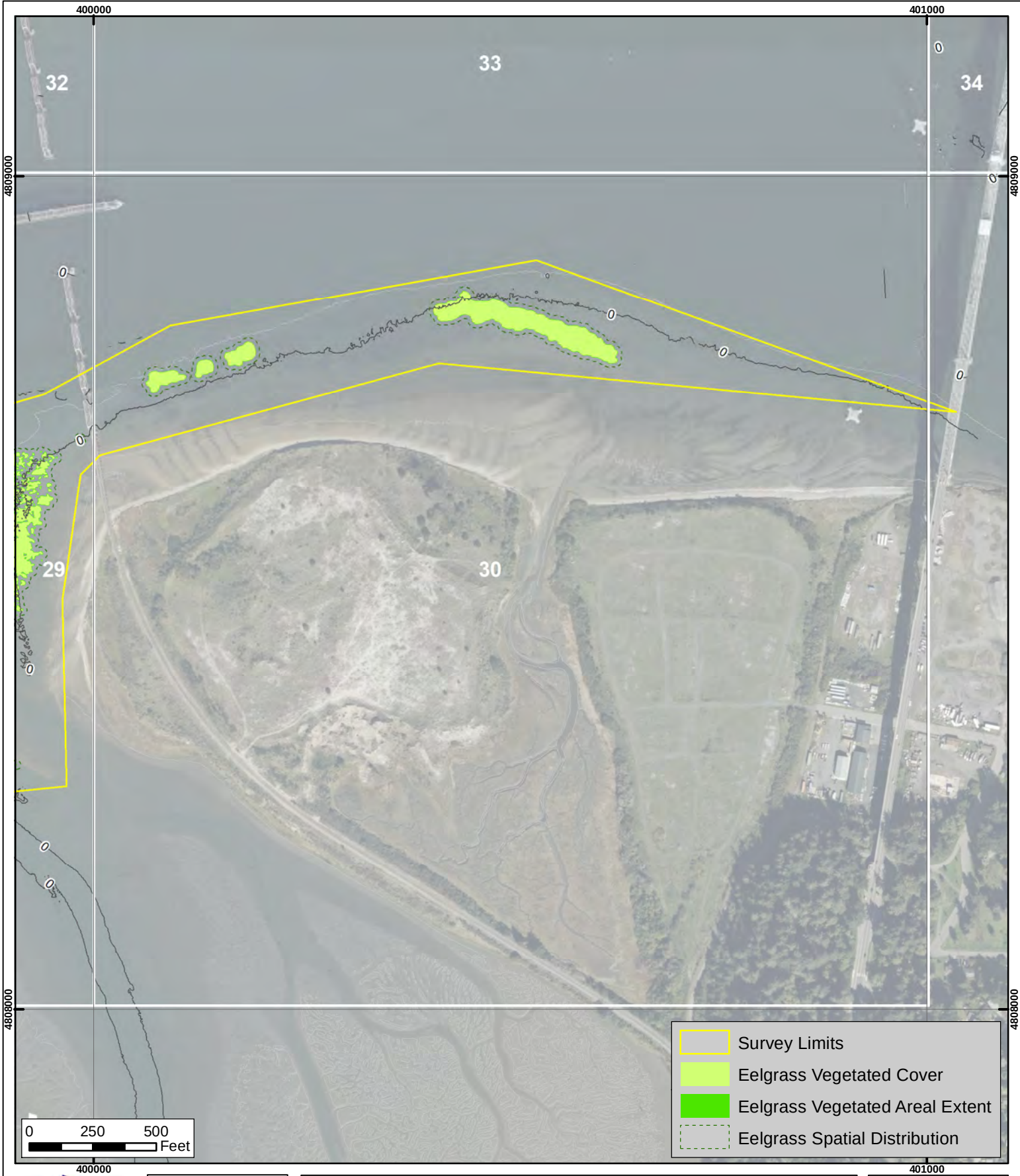

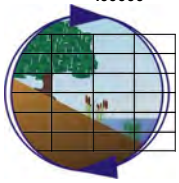

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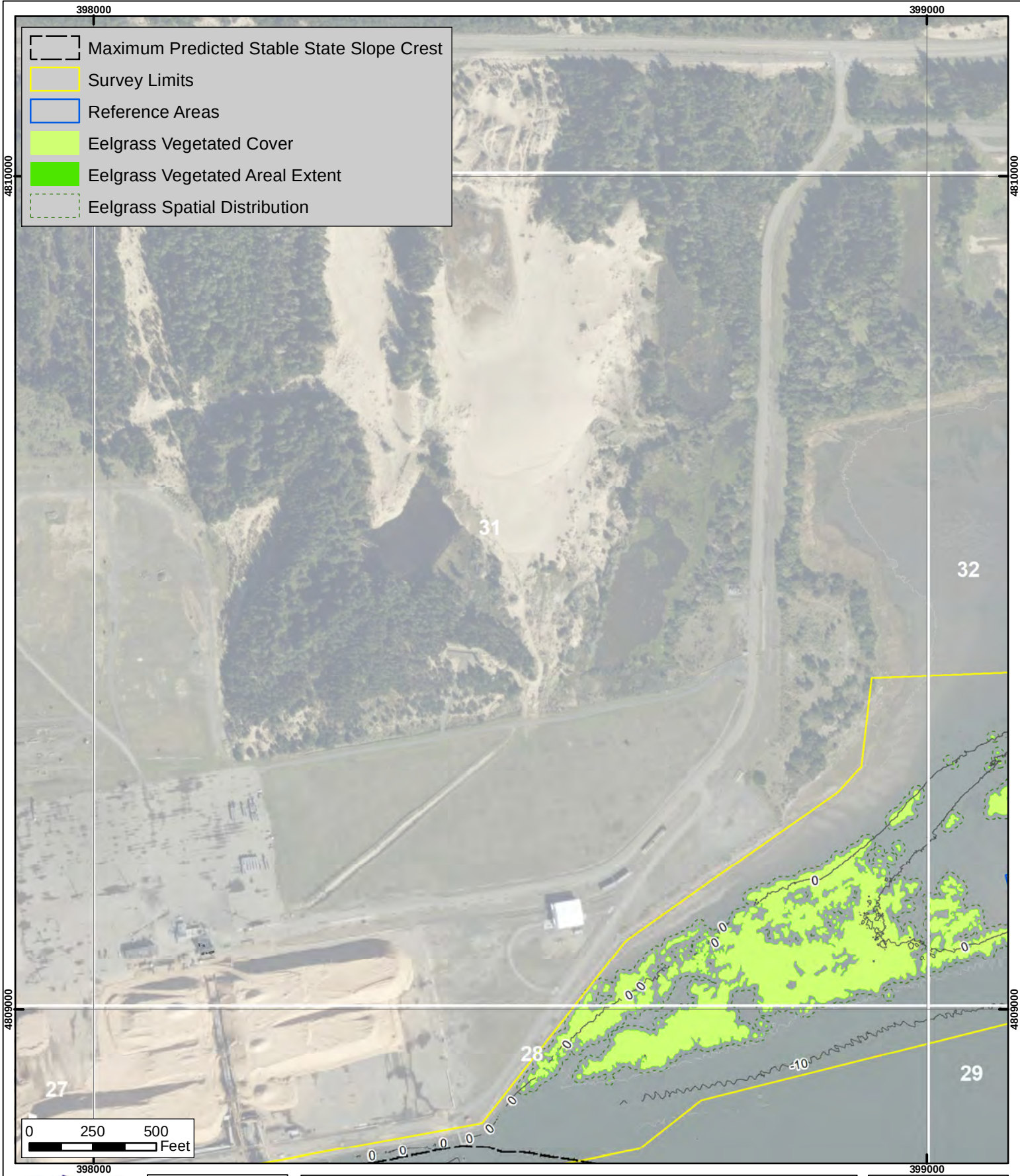

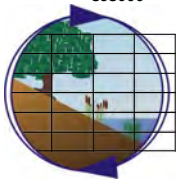

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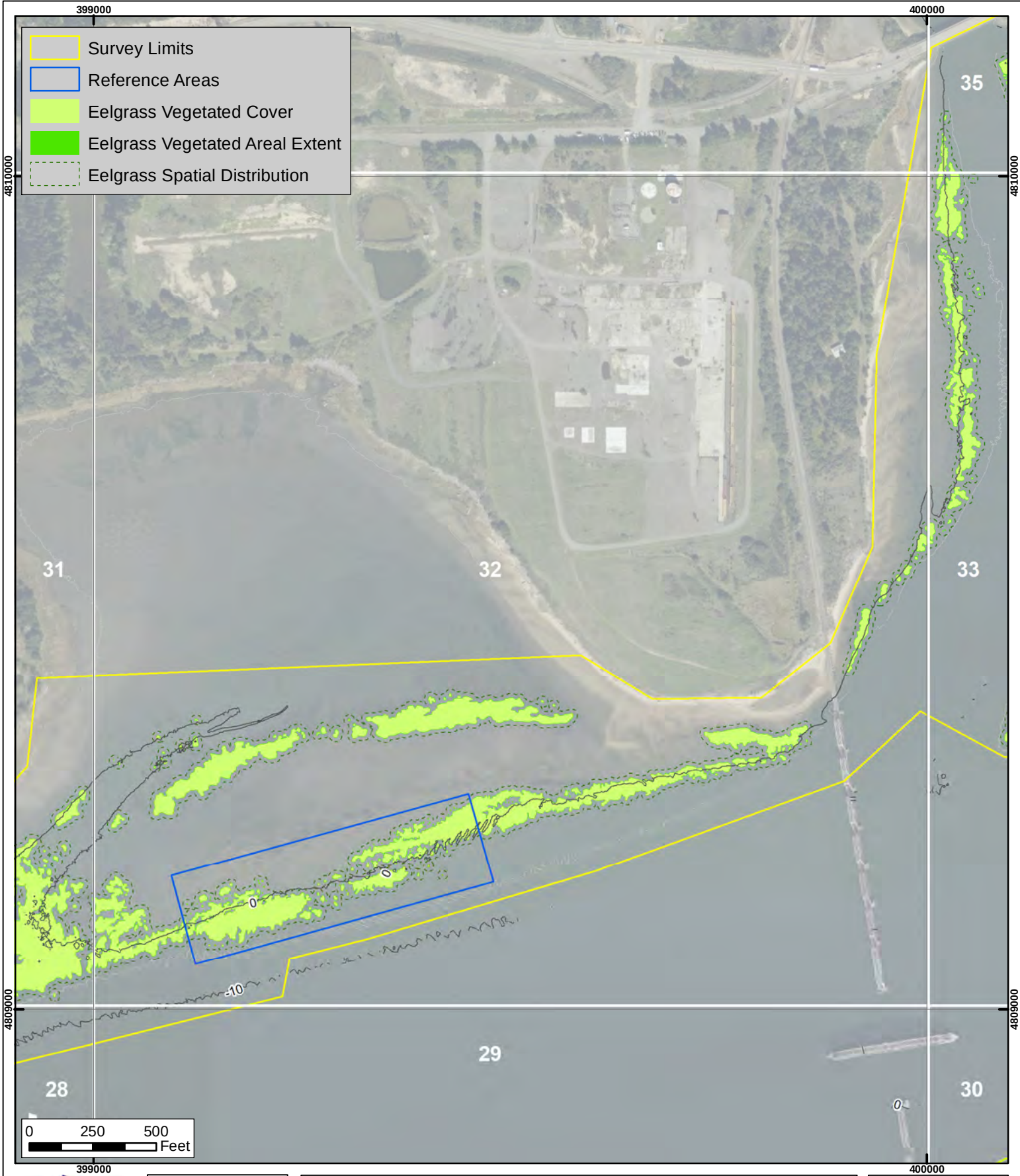

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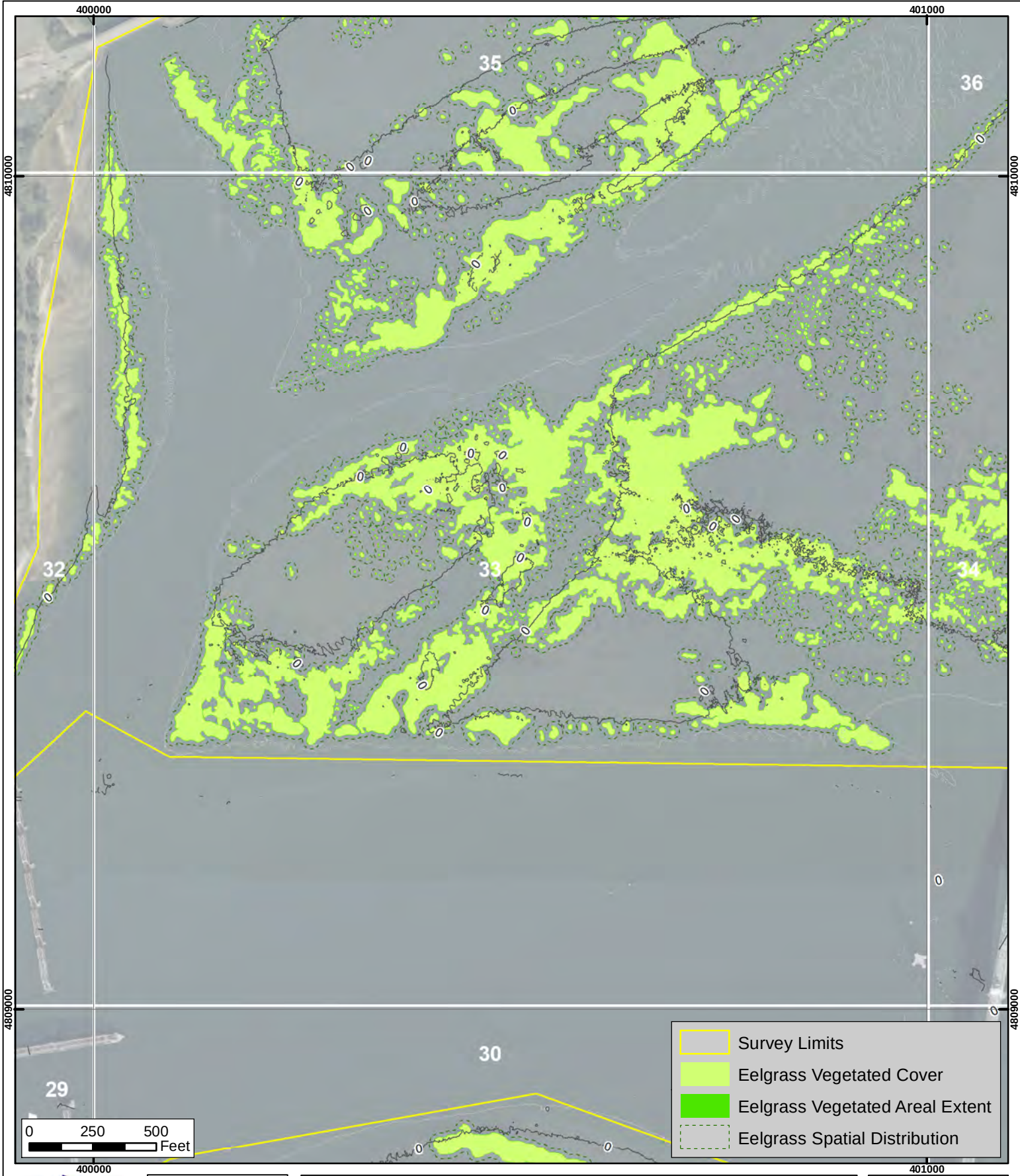
Merkel & Associates, Inc.



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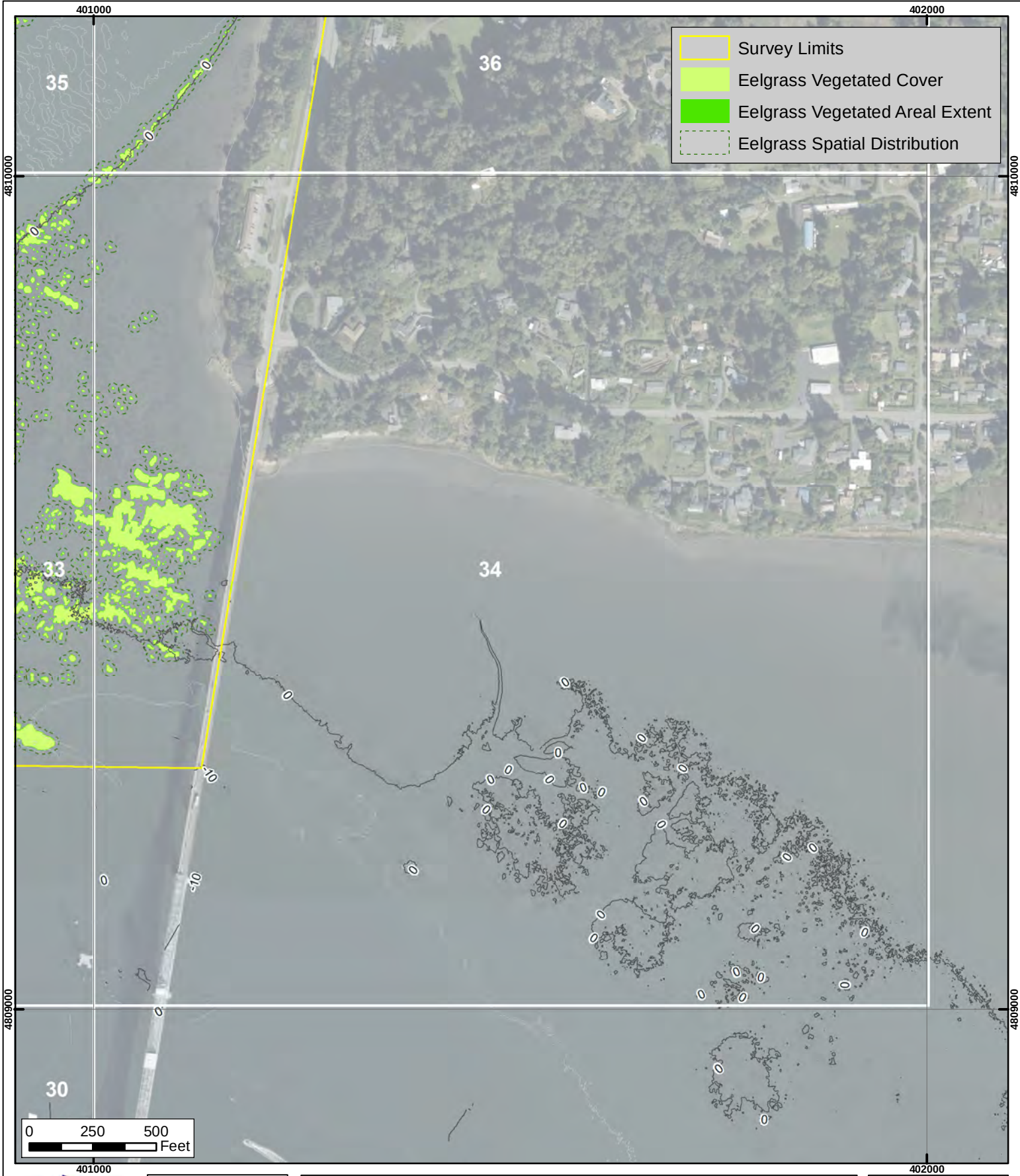

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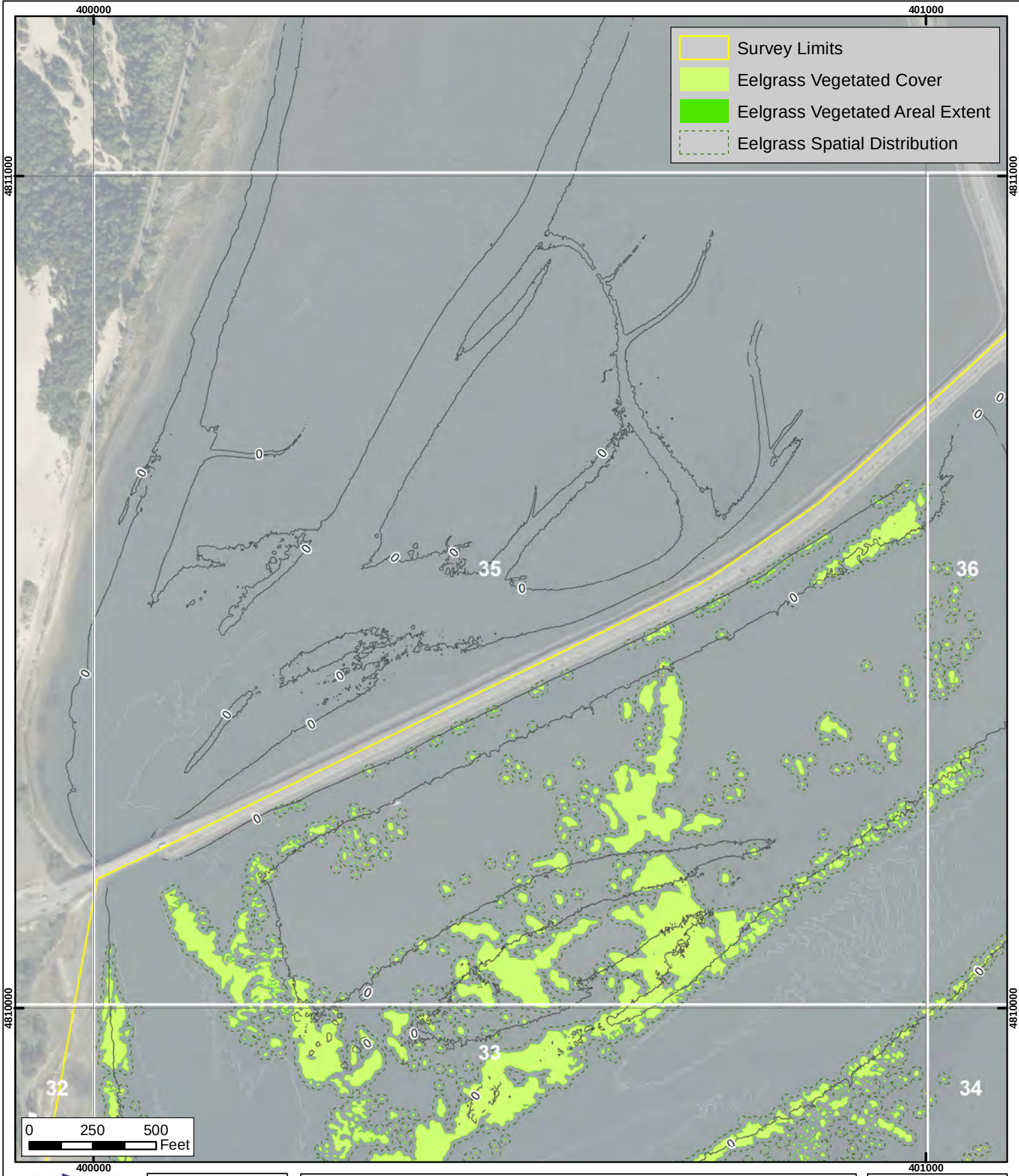
Merkel & Associates, Inc.



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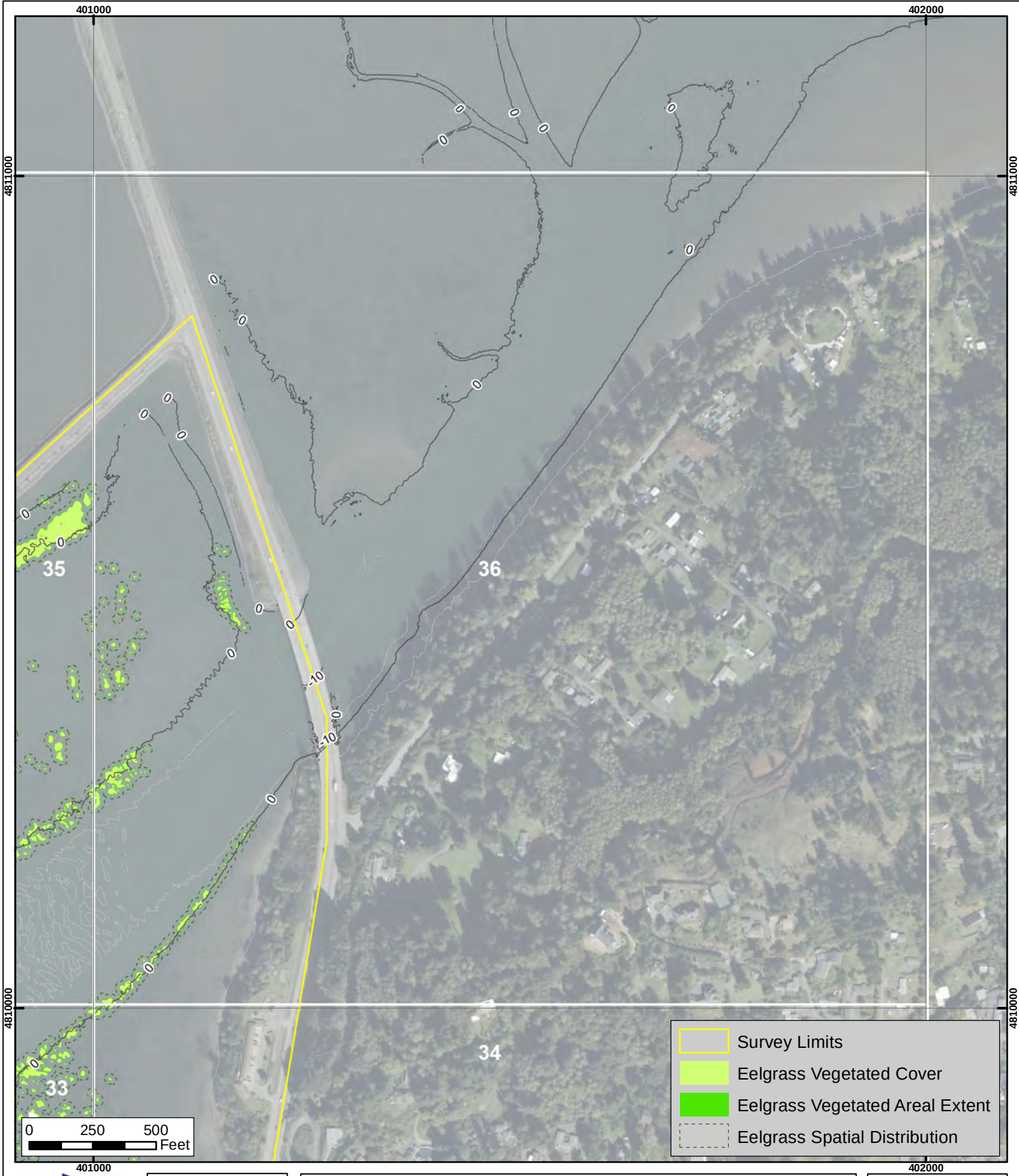

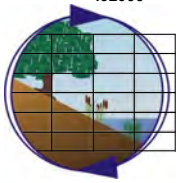

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