Executive Summary

In the mid 1990's, residents in the vicinity of the mouth of Connor Creek and its outlet to the Pacific Ocean began to experience dramatic erosion of their properties as the mouth of the creek began to migrate rapidly to north. This area is a rural unincorporated community within Grays Harbor County lying midway between Ocean City and Copalis Beach. Historically the mouth had meandered north and south dependent on the time of year and weather conditions, but stayed primarily in a general area of about one-fourth to one-half mile in width. Some man-made interventions to the south created a condition that eliminated capability for a southern meander, which may have precipitated the steady migration of the creek mouth northward. Whatever the cause, it began to erode substantial amounts of property and to sever access to the ocean, first private, then public access.

In 1997, the community requested assistance from the County. In response, the County formed a flood control zone district and commissioned a study and analysis to determine if anything could be done to correct this problem. An initial analysis was completed by the County and a proposal was developed to relocate the mouth of the creek to its historical location. At the time of this work, the mouth had migrated approximately one and one-half miles north and was showing no signs of stopping. Today the mouth is approximately two miles north of the historic location and still moving. The County approached the resource agencies in the initial effort, but the agencies took the position that this was a natural phenomenon and estimated that it would most likely not continue and would cause little to no adverse effect. The County and District attempted to answer agency questions before trying to obtain permits. The community's resources were exhausted prior to applying for permits.

Now, four years later as the mouth continues to migrate north and is at risk of conjoining with the mouth of the Copalis River, which could have significant adverse impacts on the environment and the community, the County and the District elected to initiate further studies to provide a Natural Resource Assessment, Regulatory Issues Summary, and a Preliminary Engineering report.

Using the first effort for baseline information, Grays Harbor County and their consultant have developed the analysis, assessment, and this report, which expands the analysis of physical processes, and has developed alternatives for review by the community and resource agencies to address the problem.

If natural processes continue without interference, Connor Creek could breach the narrow barrier spit or, if winter flows remain low and northward migration continues, could join with the Copalis River. Only 600 feet of land separates the two streams at this time, which is less than the average annual migration distance. The capture of Connor Creek by the Copalis River could result in routing the creek water in the Copalis approximately 8,000 feet farther downstream before exiting to the ocean than in the current condition. The risk of flood overtopping of the Connor Creek barrier could greatly increase in the configuration of the joined streams. The source of floodwater is both precipitation runoff from the drainage basin and wave runup and overtopping of low elevation areas of the barrier. The concern about flood overtopping of the barrier that has grown to such length and has developed narrow, low areas is that it is vulnerable to breaching and eroding a new mouth located upstream from its current mouth, abandoning the old mouth, and starting the northward migration of the new mouth again. That is a common event at other unstable tidal inlets. Erosional damage would intensify at properties as the mouth migrated northward again and re-exposed the properties to the forces of ocean waves and surges.

The preliminary engineering study quantified the probability of occurrence of the barrier spit breaching under the condition of Connor Creek in its current location, and with Connor Creek joined with the Copalis River. The study completed numerical hydraulic modeling of Connor Creek flows to calculate water surface profiles, and compared their elevations with that of the barrier crest. Flows of the 2-, 25-, and 50-year floods were modeled. The water volume resulting from storm wave runup and overtopping of the low barrier was added to the creek flow near its downstream end. Most likely locations of breaching were identified from comparison of barrier crest and water surface elevations. Flooding events that would overflow the barrier crest with specified flow depths were identified from the modeling. Sand transport analysis identified the depth and velocity of flow that would erode the sand making up the barrier, which was assumed to initiate breaching of the barrier. The study showed that a breaching event has approximately a 20 percent chance of occurrence in any year with Connor Creek in its current location. If Connor Creek joins with the Copalis River, the annual probability of breaching increases to greater than 50 percent.

Structural alternatives were developed to the concept level to respond to these risks of property loss and damage. One of four approaches to dealing with the creek mouth can be followed. The approaches are to take no action or to stabilize the mouth in the 1987 location, stabilize the mouth in the current location, or stabilize the mouth in an

intermediate location. Various structural alternatives could be applicable to one or more of the approaches. The structures' applicability, advantages, disadvantages, and construction cost are summarized in the table on the following page.

The alternative judged to have the optimal engineering performance, permittability, and function for controlling erosion is termed the composite migration corridor. That alternative consists of a "soft" solution to erosion by constructing sand-filled geotextile containers to limit the range of natural creek mouth migration. They will be partially buried, to form the channel side if the creek migrates to the structure. The geotextile containers will be layered with plantings appropriate to the environment, to provide a more natural appearance as well as biological benefit. The seaward tips of the geotextile containers will be armored with rock to prevent damage from ocean waves and debris. The seaward limit of construction would be approximately the mean higher high water line. A concept sketch of the composite migration corridor is shown in Figure A-6 in Appendix A.

Comparison of alternatives

Engineering Approach	Advantages	Disadvantages	Possible Structures	Construction Cost
No Action	Depending on location of breach, wetlands would be preserved.	High likelihood of barrier breaching. Renewed property erosion after breach occurs. Structures could be lost after breaching. Depending on location of breach, wetlands could be lost.	Pedestrian bridge	$ 140,000
Creek mouth fixed in 1987 location	Prevent joining with the Copalis River. Eventually gain beach access for all property to north of mouth. Prevent property erosion associated with breach of barrier.	Loss of wetlands.	Rock dike	$ 2,220,000
			Geotube dike	$ 910,000
			Wooden pile wall	$ 240,000
			Vegetated bank	$ 930,000
			Rock dike channel migration corridor	$ 2,960,000
			Composite migration corridor	$ 2,070,000
			Single buried rock barrier	$ 1,006,850
Creek mouth fixed in current location	Prevent joining with the Copalis River. Preserve wetlands.	Increased erosion of property at mouth location. Risk of barrier breaching must be managed. Beach access limited to bridges.	Rock dikes	$ 2,220,000
			Geotube dikes	$ 910,000
			Pedestrian bridge	$ 140,000
			Barrier reinforcement	$ 1,090,000

Creek mouth fixed in intermediate location.	Regain beach access for properties to the north. Preserve wetlands to south of mouth.	Beach access to south of mouth limited to bridges. Risk of barrier breaching must be managed. Increased property erosion at mouth location.	Rock dike	$ 2,220,000

Creek mouth fixed in intermediate location.	Regain beach access for properties to the north. Preserve wetlands to south of mouth.	Beach access to south of mouth limited to bridges. Risk of barrier breaching must be managed. Increased property erosion at mouth location.	Rock dike	$ 2,220,000