Date: September 25, 2007
To: Mr. Jim Heaney
From: Timothy L. Barnes, RG
Re. Western Snowy Plover Habitat Restoration Area Environmental Assessment for New River Area of Critical Environmental Concern, EA OR128-06-01
Cc. Mr. Paul Flanagan, Ms. Michelle Caviness, WSPHRA ID Team, Dr. Jon Allan, Dr. Paul Komar, File

Following is the FINAL review and write-up of the geology/geomorphology for the Western Snowy Plover Habitat Restoration Area Environmental Assessment for New River Area of Critical Environmental Concern, EA OR128-06-01. This document incorporates the New River Health EA OR128-03-11 Geological/Geomorphologic Review", completed July 31, 2003. This document provides the background and basis for reviews, research and interpretation of work done on this present EA.

The preceding draft version received comments from Dr. Jon Allan, Geomorphologist for DOGAMI and Dr. Paul Flanagan, Myrtlewood Resource Area Manager. This final document incorporates suggestions provided by the reviewers.

Thank you for this opportunity to be of service. As always, if there are any questions, comments, or concerns, please call me at extension 405.

Sincerely,

Timothy L. Barnes, RG
District Geologist
BLM
Coos Bay District

1.0 INTRODUCTION

The Western Snowy Plover Habitat Restoration Area Environmental Assessment for New River Area of Critical Environmental Concern (WSPHRAEA) goal is to analyze a range of reasonable alternatives to balance the Western Snowy Plover habitat restoration project on 178 acres of the Habitat Restoration Area (HRA) with the protection of the New River estuary resource. The restoration activities have included alteration of the European beach grass controlled foredunes within the HRA since 1998. Other activities affecting the foredune include artificial breaching projects which allow discharge from New River to impact the foredune form.

The purpose of this report is to analyze the geologic and geomorphologic impacts of previous operations (as existing conditions) as well as potential impacts of the proposed alternatives. Earlier reviews of the project area (Barnes, 2003; Komar *et al*, 1999; Komar *et al*, 2001) have described littoral and eolian processes of the area. These reviews have indicated increased potential eolian sand impacts as well as littoral sand mobilization and inundation risks to westward areas due to previous activities.

There was no watershed analysis covering the New River Area. Therefore, no watershed analysis review was completed for this document.

During the completion of this study, the following resources have been reviewed:

- Historic aerial photography from 1932 and 1997 to present.
- Numerous professional publications.
- Review of geologic map of the project areas.
- Review of maps and information gathered in the project files.
- Site visits to the project sites and sediment sources
- Consultation with Dr. Paul Komar, Emeritus Professor, Oregon State University, and Dr. Jon Allan, Coastal Geomorphologist, Oregon Department of Geology and Mineral Industries.

Dr. Allan and Dr. Komar have provided comment, guidance, studies, reviews, and personal discussion relating to this project, regarding site specific and regional coastal processes. Models provided in this report have been provided by these individuals or are based upon their extensive research, publications, and insight.

The project consists of BLM-managed lands along the New River Spit (or foredune), located at T. 30S., R. 15W., Sections 3, 10, 15, 21, 22, and 28.

Three alternatives have been proposed for analysis. These alternatives are based on previous research and observations, designed to meet the requirements of the values and objectives of the numerous governing plans and laws. They are as follows:

Alternative 1—No Action

Alternative 1 would maintain the original management strategy outlined in Environmental Assessment (EA) No. 128-00-03 (Appendix A). Improvement of the Western Snowy Plover (plover) HRA would continue on up to 100 acres per year under the existing 2000 Environmental Assessment (EA). Heavy equipment would be used to remove European beach grass and sand. The material would be deposited on the beach within the tidal zone where ocean currents would destroy the beach grass and redistribute the sand along the beach. An untreated fifty foot vegetative buffer strip would be maintained along the west side of New River to avoid impacts to the river (i.e. major sand input). Native seed would be spread. This alternative would lower the foredune to create open sandy conditions for nesting and wintering plovers and allow ocean overwash into the HRA to occur.

Alternative 2—Discontinue Habitat Restoration

Alternative 2 would discontinue plover habitat restoration. No on-the-ground habitat restoration would be conducted within the plover HRA. European beach grass and sand would not be removed and the area would be allowed to return to pre-HRA conditions. Symbolic signing would continue to be erected from March 15 to September 15 during the plover breeding season as per the U.S. Fish & Wildlife Service's Biological Opinion recommendations or until the Critical Habitat Unit (which includes the HRA) is undesignated.

Alternative 3—Adaptive Foredune Management

Alternative 3 would restore and maintain up to 100 acres per year within the 139 acre plover HRA. This alternative would be accomplished by using heavy equipment to move European beach grass and sand from within the existing HRA eastward to eventually create a 25 to 31 foot tall foredune the length of the HRA. To accomplish this, the HRA would be managed as three segments: the northern boundary to the Croft Lake breach; the Croft Lake breach to the New Lake breach; and the New Lake breach to the Hammond breach. Within each segment approximately 50% of the foredune length will be used as a 100 foot wide buffer along the river and the remaining 50% would be tapered west to establish a centerline foredune (see Figure 9). The buffer would be contoured with dunes of varying heights for a more natural appearance, and stabilized by the growth of naturally-occurring European beach grass and native plants that would be seeded and or planted.

The final buffer elevation of 25 to 31 feet would be equivalent to a 10 to 100 year wave run up as estimated by State of Oregon Department of Geology and Mineral Industries Extreme Wave and run-up models. These elevation estimates are utilized to minimize the possibility of a major wave run up reaching New River (see introduction and geology section in Chapter 3) through manipulation of the elevation of the sand dunes adjacent to the river. The angle of repose for sand is roughly 33 degrees (approximately 65% or a little over 1:1.5). A full elevation of 31 feet would leave a foot print at 0 elevation of at least 93 feet (31 X 1.5 X 2 (both sides)). As the elevation is at its current lowest point of about 15 feet, the foot print would be at least 48 feet, and reduce with higher base elevations. The HRA would be seeded and/or planted with native plants. Informational signing would continue to be erected from March 15 to September 15 during the plover breeding season as per the U.S. Fish & Wildlife Service's BO 1-7-05-F-0324.

2.0 SITE GEOLOGY

The bedrock geology underlying the New River Spit area consists of Jurassic Otter Point Formation (Ramp, 1977) and possibly Eocene Roseburg Formation (Phillips *et al*, 1982), later defined as Siltez River Volcanics and/or the Umpqua Group by others. The Otter Point Formation consists of sandstone, siltstone, mudstone intermixed with metasediment and metamorphic rock within a mélange. The mapped Roseburg Formation consists of sandstone with siltstone and mudstone. The surficial geology of the project area is comprised of Quaternary sand forming the beach and accompanying dune field. The sediment on the southern portion of the spit is coarse, predominantly derived from Blacklock Point and adjacent sea cliffs. Blacklock Point is mapped as ultramafic rock containing serpentinite and peridotite. The sea cliffs directly north of Blacklock Point have been mapped as containing Pleistocene marine terrace sediments (Komar *et al*, 1999; Komar *et al*, 2001).

The New River Spit is located within the Bandon Littoral Cell. The cell is demarked and bound by Blacklock Point to the south and Cape Arago to the north. The total longshore length of the cell is approximately 27 miles. The littoral cell is essentially a closed system, with little to no migration of sands beyond the bounding points of the cell (Komar *et al*, 1999; Komar *et al*, 2001). Initially emplaced sand of the Bandon Littoral Cell has similar identification characteristics as the sands of the Coos Bay Littoral Cell (Peterson, 2004-personal communications).

Erosion of Blacklock Point and the sandstone cliffs north of the point (to Floras Lake) currently supplies beach sediment to the southern portion of the spit (Komar *et al*, 1999). This material is coarse grained sand and pebbles. In general, sea cliff erosion in the Bandon area is minimal because tectonic uplift exceeds sea level rise, giving a net decline in sea level. However, the current platform of the wave-cut terrace on which the depositional material of the beach, spit, and stabilized dune face rests is currently below sea level (Peterson, 2004-personal communication). Erosion from the sea cliffs is due to groundwater movement as opposed to wave action (Komar, 1997).

3.0 GEOMORPHOLOGY

Two separate, but interrelated, geomorphologic processes occur to form and shape a sediment dominated beach and its associated dunes. These processes are littoral and eolian. The littoral process is the mechanism that delivers eroded sediment to the beach face. The eolian process is the mechanism that mobilizes the beach sediment, not reincorporated by the littoral process, inland. The littoral process creates, molds, and removes beaches, spits, and headlands. The eolian process creates and mobilizes the ridges, dunes, dune fields, and deflation plains.

3.1 Eolian Process

Numerous dune fields exist along the Oregon Coast, including the Coos Bay Dune Sheet, located north of Coos Bay. A dune field exists at New River, which is part of the Coquille River South/Fourmile Dune sheets identified by Cooper (1958, as found in Beckstrand, 2001). Numerous studies have been completed on the eolian process of sand migration. The necessary components for dune formation are abundant sand (i.e., high sediment input), wind, and a favorable terrain. Other ingredients that play important roles in dune-forming include water and vegetation. The impacts of man by the alteration of these components have an influence on the sand migration process (Lund, 1973). The coastal dune fields are within two miles of the ocean shore with most immediately adjacent to sand beaches. Dunes along the Northwest coast were formed by winds blowing sand inland from the beaches (Komar, 1997), and from the Pleistocene low sea-level dune plains (Beckstrand, 2001; Peterson *et al*, 2006).

Three episodes of dune advance in the Coos Bay dune sheet and other dune fields have been documented (Cooper 1958 as found in Komar, 1997)). The earliest is represented today by a strip of thoroughly vegetated dunes that in most places achieved the greatest landward advance. The second advance generally terminated westward of the first, and its present condition ranges from complete stabilization to still vigorous activity. The third episode is represented by the large areas of active dunes that until recently had open access to the ocean beaches that supplied them with sand. The landward edges of these dune fields are well defined by the presence of precipitation ridges with steep slip faces that slowly invade and bury adjacent vegetation, including forested areas. The precipitation ridge often blocks stream drainage ways, creating barrage ponds and lakes (Komar, 1997).

The eastern face of the migrating dune, called the precipitation ridge (Cooper, 1958 and found in Komar, 1997), will migrate several feet a year by the accumulation of sand along a slope on the inner boundary of the active dune belt. Because both winter and summer wind patterns are landward, sand supply is provided year-round (Lund, 1973). This migration of sand is sufficient to cover existing forests as well as other vegetation (Lund, 1973; Komar, 1997).

Rates of sand movement are not well studied. Along the dune field north of Coos Bay, dune advancement has been measured at 6 to 18 feet per year (Alt and Hyndman, 2001). Generalized sand accumulation within a mineral material sales area in Florence Oregon provides an accumulation of approximately 17 inches per year over 4.55 acres. This is a total of 10,277 cubic yards of accumulation per year. Rates of movement are dependent on storm events, area of entrainment, grain size, vegetation, and moisture.

Water and vegetation reduce the rate at which sand shifts (Lund, 1973). In many areas dunes are being actively molded by winds while in other areas vegetation now covers formerly mobile dunes (Komar, 1997). Where eolian sand moving across a smooth surface meets an obstruction, the carrying velocity is lost behind the obstruction. This causes the sand to be deposited. Such evidence can be seen in summer at many places along the dry sand part of the beach where sand is accumulating on the lee side of a log or some other object. Native vegetation and natural debris have naturally stopped enough sand to create a low beach ridge, but much of the sand was able to move past the ridge and enter the dune-building activity behind the shore (Lund, 1973).

However, as described by Lund (1973):

> *"… with the introduction of European beach grass on the West Coast, the conditions along the shore underwent a pronounced and rapid change, and in the past 25 or 30 years* ***a foredune has built up along the shore that has effectively shut off movement of sand from the beach at all but a few places along the Oregon coast****…"* (**emphasis added**)

The newly created foredune is a ridge of coalesced hillocks superimposed on an earlier, low beach ridge. The hillocks nearest the beach stop most of the sand and continue to grow while the ones farther from the beach stay about the same size or grow slowly. During winter storms, waves reach the base of the foredune ridge and erode it back to an abrupt edge. Thus in places, banks with vertical faces several feet high are formed which become and additional obstacle to the inland migration of sand, increasing the effectiveness of the foredune as a barrier (Lund, 1973).

With the foredune staving the supply of sand to the dunes along most of the Oregon coast, the interior dunes are now consuming themselves. The inland migration of a dune is thus limited in supply by the western part of the dune field behind the foredune. The body of sand in this dune migration, identified by the foredune to the west and the base of the precipitation ridge to the east, is roughly wedge-shaped in cross section, with the thick edge of the wedge on the landward side (precipitation ridge). Hence for every foot of advance made by the front, the thin western edge must recede several feet. The migrating portion of the dune field is thereby becoming narrower. As the dune field narrows at the expense of the western sand supply, a deflation plain forms and expands. The deflation plain is caused by the vertical removal of loose sand to the point that the summer groundwater table is reached. The moisture saturation increases the entrainment force needed to move the sand, and, thereby, increasing its stability in wind velocities. As erosion stops, vegetation propagates in the deflation plain. This zone at the western edge of the active dune belt or field thereby demarks the end of dune activity (Lund, 1973).

As a local example of this process, the implications have been studied in the Coos Bay Dune Field. Komar (1997) observed that the introduction of European Beach grass in the Coos Bay Dune Field created a foredune to build up at the back of the beach. This foredune then cut off the inland movement of sand from the beach to the dunes. As described by Komar (1997):

> *"…Introduction of European beach grass had an unforeseen adverse consequence on the Coos Bay dune sheet. A hundred years ago these dunes existed as an unvegetated sand surface that extended from the ocean shore to the precipitation ridge at its landward edge. Sand was free to blow inland from the beach to supply material for the continued growth of the dunes. However, the European beach grass introduced during the 1930s in other areas of the coast quickly spread to the Coos Bay dunes and began to grow in the*

> *dunes immediately landward from the beach. These dune grasses captured sand blowing inland from the beach, resulting in the growth of high foredunes that have cut off the supply of sand to the large inland dunes. The impact was noted first in the area immediately landward of the foredunes…, where the ground level was lowered to the water table. This in turn permitted the growth of shrubs and other vegetation atypical of dune areas. The aerial extent of the active dunes has decreased substantially, and there is concern regarding their long-term preservation…"*

However, when stabilizing vegetation is removed from the dunes, the mobilization of sand can be reinitiated. As described by Komar (1997):

> *"…When Europeans first settled the Clatsop Plains south of the Columbia River in the nineteenth century, the extensive dune fields were covered by dense grasses (Hanneson 1962). The settlers' livestock ate the grasses, and overgrazing soon reactivated the dunes. By the 1930s, some 3,000 acres of sand had become mobile again…, and blowing sand covered roads and homes…"*

Remobilization of sand, as well as delivery of "new" sands, to the New River beach system is possible. These processes are a result of vegetation manipulation, sediment supply (sand), littoral drift, wind energy, and storm recurrence and intensity (Allan, 2006 Personal Communications).

3.2 Littoral Process

Littoral processes supply material to the beach face, circulate the sediment within the littoral cell, and are the cause of beach and dune alteration. Along the Oregon coast, waves tend to arrive from the southwest during the winter and from the northwest during the summer (corresponding to prevailing wind directions). As a result, there is a seasonal reversal in the direction of littoral drift (the longshore migration of sand due to the oblique breaking waves); north during the winter, south during the summer. The net littoral drift is the difference between these northward and southward sand movements (Komar, 1997), which, over several years has been close to zero. The seasonal cycle of the ocean wave process also tends to strip sand from the ocean beaches during the winter, storing it in off-shore bars, and re-depositing it during the summer (Orr and Orr, 2000).

In general and with a few exceptions, net littoral drift has been zero due to the large rocky headlands that extend sufficiently into deep water to prevent sand and coarse sediment migration around the ends of the headlands. On many coasts, sand spits grow in the direction of littoral drift. However, sand spits are documented in both north and south directions within a zero net drift littoral cell (Komar, 1997). However, anomalous conditions can create a predominant short term littoral drift, such as the El Nino event of 1982-1983. The 1982-1983 El Nino resulted in a net north movement of sand, with beach erosion occurring along the southern end of each littoral cell and beach growth or accumulation occurring in their northern ends (Komar, 1997).

The large storm events of the late 1990's may have temporarily affected the predominant net direction of littoral drift. In recent years, more sand has been shifted to the north and little evidence for a return of that sand to the south. Possible indications may have been observed by Allan (Barnes, 2007) in northern Oregon (Indications may also be present in cross section monitoring of the New River system (Barnes, 2007 as found in Appendix I)). Such a shift in the littoral drift may enhance net erosion of the southern portions of the littoral cell, until such time the sand is returned to the south.

For beaches to build, sediment must be provided from various sources within the littoral cell. The littoral process receives sediment from the erosion of shores and headlands as well as sediment supplied from riverine systems. However, Komar (1997) states that little sediment is provided to the beaches from estuarine systems, as much of the upland sediment is trapped within the estuarine basin.

The erosion mechanism of the littoral process is aided by a number of systems, individually or in combination, such as raising ocean levels, storm energies, upland landslides, rip current embayments. Due to erosion, the Oregon headlands are currently retreating (Orr and Orr, 2000). The littoral processes that supply sediment to create beaches, spits, ridges and dunes (foredunes) also supplies the energies needed to remove and reshape these features. Breaching and overwashes are common on spits and barrier islands along the east and Gulf coasts of the United States, where sea level is rising relative to the land. Natural breaching of well established spits along the Oregon Coast is not common. The Northwest coast is rising tectonically, and this probably accounts for the rarity of spit breaching (Komar, 1997).

However, Northwest spit erosion has been documented, such as the Nestucca Spit (Komar, 1997) and the Netarts Spit in 1939 (Komar, 1997). Komar (1997) reported the retreat of a hundred feet of foredune on Siletz Spit within three weeks during storms of the winter of 1972/1973. The major erosion event occurred in December 1972 as the storm produced wave heights of 23 feet. Erosion was limited to a small portion of the spit, determined by the presence of a rip current, allowing waves to reach the foredune through the embayment (Komar, 1992).

Although rip current embayments seldom produce much property erosion on their own, they play a major role in erosion because they eliminate the buffering effect of the beach. Storm waves pass through the deep water of the rip embayment and do not break, retaining their energy until they reach the land behind the beach. Thus, rip current embayments can control the center of attack by storm waves, focusing storm wave energy on a relatively small area. This type of erosion is commonly limited in extent to only 100 or 200 yards, this being the longshore span of a rip embayment that reaches the foredunes (Komar, 1992; Komar, 1997). However, the embayment can span up to 600 meters (nearly 2,000 feet) of shore length (Allan, 2007).

Referring to Siletz Spit during the winter storms of 1972/1973, Komar (1997) suggests that:

> "*…The variability in the amount of the erosion was controlled by the presence of rip currents…This process is particularly important on Siletz Spit because of the coarseness of the beach sand. Rip embayments are particularly deep and narrow on steep coarse-*

sand beaches. The rips and their embayments commonly precede the erosive storm waves rather than being produced by them. In this sense they set the stage for erosion, acting to direct the wave attack when a storm does occur…"

In review of Siletz Spit historic erosion, Komar (1997) determined that erosion was a continuous process, usually concentrated in 100- to 600-yard segments, indicating that rip current embayments played a role in it. Each erosion event was followed by a long period of foredune rebuilding. After erosion cut into a section of the foredunes, drift logs washed into the area, crisscrossing and trapping sand either washed there by the waves or blown inland by onshore winds.

The position of the rip currents change from one winter to the next, shifting the areas subject to maximum erosion. It may be several years before the embayment erosion returns to a specific spot, allowing that portion of the eroded shore to heal. At this time the rip currents and embayment locations can not be predicted. However, their locations can be observed during the late fall and early winter, allowing likely zones of erosion to be predicted if a major storm was to occur (Komar, 1997). Recreational users of rip currents (such as surfers) can identify the location of rip currents (Turowski, 2003 personal communication).

Storm energy provides the erosional force on a landform, many times assisted by embayments. The form and structure of the beach face and foredune has a major influence on erosion. Komar *et al* (1999; Komar *et al*, 2001) provide a model to predict foredune erosion. The model is defined as:

Eq. 3.2.1 $E_T + R > E_J$ (Komar *et al*, 1999; Komar *et al*, 2001)

where E_T is the measured tide, R is the run-up of the waves, and E_J is the toe elevation of the foredune (Figure 1). The foredune erosion model requires that the measured tide plus the run-up of the waves must be greater than the elevation of the foredune toe for erosion of the foredune. The run-up, R, is dependent upon the slope of the beach and defined as:

Eq. 3.2.2 $R=0.27(SH_{SO}L_O)^{1/2}$ (Komar *et al*, 1999; modified Komar *et al*, 2001)

Where R is the wave run-up ($R_{2\%}$ in Komar *et al*, 2001 is the 2% exceedance value of the elevation), S is the slope of the beach, H_{SO} is the deep-water significant wave height, and L_O is the deep-water wave length. Coarser grained sands maintain a higher angle of repose than fine grain sands, due to functions of the angle of internal friction (Easterbrook, 1993). The coarser the sands then the steeper the slope can be maintained (Easterbrook, 1993; Komar, 1997). The steeper the slope, the greater the wave run-up and erosion potential from wave energy on the beach (Komar *et al*, 1999; Komar *et al*, 2001; Komar, 1997).

However, their model does not take into account the stability or resistance of the dune due to the presence, or lack of, vegetation such as European Beach Grass. Komar, *et al* (1999) and Komar *et al* (2001) further states that the measured tides can be substantially higher that predicted, due to atmospheric conditions and oceanic conditions, and this enhanced level is often important to occurrences of coastal erosion.

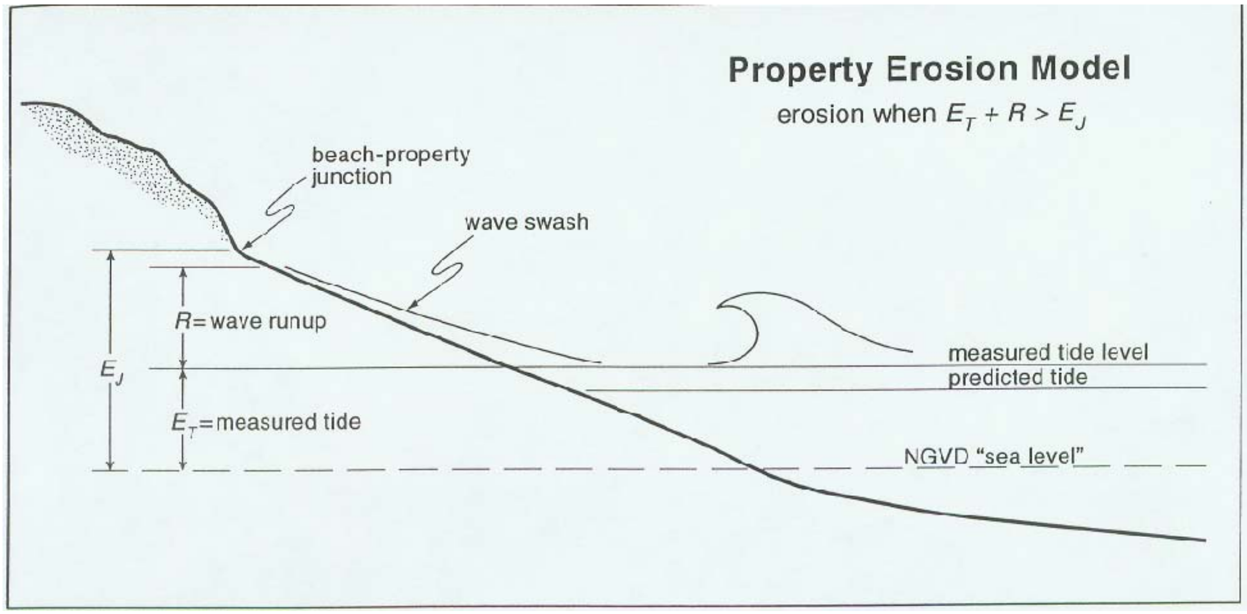

Figure 1. Dune Erosion Model From Komar *et al* (2001)

Where R + E_T meet or exceed E_J, erosion of the foredune will occur (Figure 1). Where R + E_J exceed the crest of the foredune, overwash of the dune itself will occur, with entrained sand being carried landward and scour occurring. Where the run-up exceeds the dune crest separating water bodies, ocean-side breaching can occur (Komar *et al*, 2001).

Utilizing the above equations (Eq. 3.2.1 and Eq. 3.2.2) to predict the ability of wave and littoral processes to modify dune and spit systems, specific systems and "time-stamped" functions can be designed. The spit and adjoining dune system (including deflation plains) will react and reflect to the dune elevation. As an example, if a desired dune, spit, and deflation plain is to mimic the those found in the year 1900, then the foredune elevation would be placed at the same elevation present in the year 1900. Overtopping, erosion, and sediment delivery over the dune would then alter the landward forms of the dune sheets. As such Allan (2004) suggested that the dunes at the Elk River Spit be placed at the 1967 elevation of 18 feet. This would return the dunes to the condition that was present before the introduction of European beachgrass. As such the associated landward dune system, deflation plain, and river would also mimic the 1967 form.

The foredune also provides a stabilizing "bank supply" or buffer, supplying material to mitigate wave processes during large storms, and rebuilt in the interim time between events. With this bank-supply material removed or reduced, erosion may continue into the beach face. Therefore it is possible that in areas where the foredune volume of sand is removed or low, erosion could result in a landward migration of that interface as beach material is removed by waves. This could also result in landward migration of stabilized foredunes as the stabilized beach face attempts to reach equilibrium with the landward-migrating reduced sand volume beach face (Allan, 2006-personal communications).

4.0 PROCESS AT NEW RIVER

A study was completed for the New River Spit by Komar *et al* (1999), and subsequently published in an international journal (Komar *et al*, 2001). One of the components of the study was to gather information on the physical conditions of the spit, specifically its stability. At the time of the study, the spit had not undergone any European beachgrass eradication projects. However, both artificial and natural breaching had occurred, specifically toward the southern end of the spit, for flood control.

As described in the Geology section, erosion of Blacklock Point and the sandstone cliffs north of the point (to Floras Lake) supplies beach sediment to the southern portion of the spit (Komar *et al*, 1999). This material is coarse grained sand and pebbles. The only contribution of sediment from New River itself is from the erosion of sand dunes and overwash sediment, a recycling of former beach sand. The principle loss of sand from the beach occurs when it is blown inland to form dunes, a process present along the New River Spit (Komar *et al*, 1999).

The New River Spit contains characteristics of a Dissipative Beach along the northern, finer-grained beach and characteristics of a Reflective Beach along the southern, coarser-grained beach. The Dissipative Beach tends to be more stable, responding less to major storms and undergoing smaller changes in elevations from summer to winter. The Reflective Beach tends to be less stable, changing rapidly in slopes and elevations during individual storms and from summer to winter (Komar *et al*, 1999).

The greatest change of the New River and Spit is the progressive migration of the mouth of the New River to the north, which has shifted its position by 2.9 miles in 30 years (Komar, *et al*, 1999), or an average of 0.16 km/yr [535 feet/year] (Komar *et al*, 2001). This corresponds to the explosive growth of dune vegetation during the last 100 years.

European beachgrass was first introduced to limited areas of the Oregon coast in 1915 to control dunes, but rapidly spread along the coast soon thereafter (Cooper, 1958; OCCDC, 1975; as found in Komar *et al*, 1999). It became established in the New River area in the 1930s (BLM, 1995; as found in Komar *et al*, 1999), and its effect on the stability of the spit has been significant. The creation and elevation of the foredune has served as a barrier to high tides and storms, increasing the stability of the spit where the foredune has not been cut away by breeching events (Komar, *et al*, 1999).

As described above, starvation of the dune sheet has resulted in the development of a continuous deflation plain. The sand was removed to the water table. The resulting deflation bowls and dune wetlands connected and separated in short time frames. As Floras Creek and the outlet of Floras Lake were deflected north by the over-sedimentation of the mouth and southern end of the spit by sediment supplied by Blacklock Point, the flows entered the expanding deflation plain. The river system incorporated the already existing deflation ponds, small outlets (such as New Lake), and wetlands, forming the existing New River. The expanding river system is not only directed by the expanding dunes into the self-created deflation plain, but it is also protected by the ever-growing foredune, creating a barrier to ocean overwash and wave action.

The river maintains greater protection in the older dunes, which have had time to grow in mass to extend above storm energy waves, than newer dunes to the north, which have not yet gained the mass and elevation to consistently protect the system from storms. However, given time, natural processes would eventually provide sufficient mass and elevation to the northern dunes to provide similar protection (Komar *et al*, 1999; Komar *et al*, 2001).

4.1 Monitoring

Initial dune elevations and profiles were measured with the completion of survey transects in June 2004. A second set of profiles, as well as longitudinal beach profiles (i.e., surveyed parallel to the shore) were completed in June 2005. The next annual set of spit cross section and beach longitudinal profiles were completed in October 2006.

The initial 2004 transects were linked to established channel cross-sections where available, using established bench marks. Where additional cross sections were needed, new benchmarks were established. These were surveyed and tied in by engineering staff using a Total Station. In addition to the transects, two stationary arrays were also surveyed and tied in to the existing benchmarks. These arrays were placed on the east side of the river, consisting of stationary rods, placed in three legs. The legs are oriented southwest, west, and northwest and are to be used to measure sand deposition and/or scour from these locations. The 2005 and 2006 cross-sections were measured using compass bearings based on the original survey and hip-chain distance measurements. The elevation was measured by laser level, correlating with the known elevation of the benchmark pins. The zero-foot of the distance measurement was the west bank benchmark pin used in the 2004 survey. The longitudinal dune profile distance and planar location was determined by GPS, with elevation taken by the same laser level system and benchmark pin elevations used in the cross section transects.

In addition, beginning in 2006, the easterly created buffer dune was also profiled. Both the longitudinal beach and buffer dune profiles measured the maximum and minimum crest and trough elevations of the sand accumulations, projecting a complete profile through the HRA.

The resulting elevation profiles were compared with Komar *et al* (1999) profiles completed in 1999. Comparison of these data provided information as to the current (as of October 2006) dune morphology, the change of the morphology by mechanical means, as well as the natural movement of the sand along the HRA.

The 2004 and 2005 profiles were compared to 100-year wave run-ups projected by Komar *et al* (1999), modeled for both El Niño and La Niña oceanic events. This gave an estimate of the total water levels which range from 18.05 to 19.25 feet, NAVD 88 (Barnes, 2003). These projections then determined the dune work accomplished in the 2005 season, which effectively limited lowering of the dunes to no less than 19.25 feet elevation (NAVD 88).

However, in the 1998-1999 winter, the Oregon coast experienced multiple storm events that produced wave heights that met or exceeded the elevations projected in Komar *et al* (1999). This necessitated a revision of the models, resulting in the projections of Allan (2006), described above and shown in Appendix II and Figure 2. The revised run-up elevations for 10-year and 100-year events projected by Allan (2006) have been compared with the 2004, 2005, and 2006 monitoring results. These are shown in Appendix III.

It is anticipated that monitoring will continue in the form of cross section transects and beach longitudinal profiles following the established bearings on an annual basis. The timing will be in late summer/early fall, to capture the greatest accumulation of the yearly summer/winter cycle.

Future tools for monitoring may include the use of LiDAR (Light Detection and Ranging) mapping systems. Dr. Allan has also proposed a complete monitoring plan (Allan, 2006b) for the littoral cell (Appendix IV). The proposal includes the use of survey, LiDAR, and sediment movement. Eolian transport is also to be measured in quantitative amounts beyond the use of the surveyed arrays. This would incorporate sediment trap systems based on Dr. Allan's colleague's design (Allan, 2006a; Allan, 2006b). Given the dynamic nature of the system, such monitoring plans are warranted.

4.2 Wave Run-up

In the Komar *et al* (1999) study, numerous cross section profiles of the beach, foredune, and deflation plain were mapped. This mapping was prior to plover habitat restoration projects. The foredune heights reach a maximum approximately mid-way along the length of the spit. These profiles document changes along the central portion of the spit. The report documents a number of foredune transgression and regression reversals, with periods of erosion cutting back the vegetation line (European Beach Grass), followed by longer intervals of dune rebuilding due to sand trapping by European beachgrass and, thereby a seaward shift of the vegetation line. The net effect had been a seaward shift in the position of the dune vegetation line, ranging between 50 to 100 feet. This expansion of vegetation indicates the stabilization of the migrating sand that once fed the dune field to the east. However, profiles at the south end of the spit showed net landward shifts in the positions of the foredune vegetation line (with one profile showing no vegetation at all). The profile with no vegetation is positioned in the primary zone of historic breaching, accounting for the absence of an elevated foredune and vegetation. The other transects were affected by the northward migration of the breach during the winter months.

Komar *et al* (1999; Komar *et al*, 2001) notes there is a progressive increase from north to south in the elevations of the toe of the foredunes (marked by the stabilizing presence of European beachgrass), ranging from about 10 feet NGVD in the north to 22 feet NGVD to the south. This is due to the presence of coarser beach sediment allowing for greater elevation gain in wave run-up. The greater run-up allowed by the steeper slope (discussed above) allows the surf to reach higher up the slope and foredune, creating an inhospitable environment for the European beachgrass, limiting plant growth within that zone. Wave run-up during storms will achieve greater elevations at the south end of the spit than at the north (Komar *et al*, 1999; Komar *et al*, 2001).

In determining the stability of the spit, Komar *et al* (1999, Komar *et al*, 2001), modeled maximum wave run-up elevations relative to erosional features on the foredune. This model was based on evaluated processes that had occurred through 1996 that gave a projection of 100-year projected extremes of El Niño and La Niña events of 18.05 feet and 19.25 feet respectfully (Komar *et al.*, 1999; Komar *et al.*, 2001; Komar and Allan, 2006). However, after data collection and conclusion of Komar, *et al.* (1999), a series of storms occurred in February and March of 1999 that exceeded the projections for the 100-year deep-water significant wave height. Analyses indicated that the increase in storm-wave conditions were part of a 25-year increase in measured wave heights and periods. This measured increase in wave height and period has led to revised estimates for projected extreme wave conditions for the Pacific Northwest (Komar *et al.*, 2001; Komar and Allan, 2006).

Whereas Komar *et al.* (1999) projected 100-year deep water significant wave height of 30.5 feet, a single event in February 1999 gave a maximum deep-water height of 32.7 feet with a period of 20 seconds (NOAA, 2006). A March 1999 gave a maximum deep water wave height of 46.1 feet with a period of 14.29 seconds (NOAA, 2006). Utilizing these projections, Allan (2006) has created an Extremal Significant Wave Height Distributions chart depicting run-up elevations for a 0.08 percent beach slope (Allan, 2006). This is similar to the New River system, which has beach slopes ranging between 0.04% and 0.10%. Estimations of exceedence were graphically created, as shown in Figure 2 and Appendix II. The resulting run-up elevations estimates are:

Table 1. Estimated Exceedence Event Waver Run-up Elevations

Estimated Exceedence Event Projection	Estimated Elevation of Wave Run-Up	Estimated Variance of Prediction
100-Year	31.50 feet	+/- 1.54
50-Year	30.50 feet	+/- 1.44
40-Year	30.20 feet	+/- 1.44
30-Year	29.90 feet	+/- 1.35
20-Year	29.04 feet	+/- 1.35
10-Year	28.05 feet	+/- 1.25

The projected difference between the 100-Year Projection and the 10-Year Projection is 3.45 feet. The possible variance difference (difference between the maximum 100-Year Projection and the minimum 10-Year Projection) is 6.24 feet

Figure 2. New River Run-up Year Exceedance Estimates, modified from Allan (2006)

Since the Komar *et al* (1999) study, aggressive manipulation of the foredune has occurred within the HRA. The BLM began removal of European beach grass and dune manipulation in 1998 by burning and mechanical means. Initial treatments were limited to approximately 24 acres. Follow-up treatments included subsoiling the re-sprout. Beginning in 2000, heavy machinery was used to treat up to 100 acres per year by removing European beach grass and manipulating the dune form. The effect was a lowering of the foredune elevation, with deposition of the material onto the beach face. This has occurred on a yearly basis, with areas previously treated being retreated, and the elevations lowered further.

The dune manipulation was not monitored until 2004, with no documentation or knowledge of how much volume was being manipulated or what elevation loss was occurring. Reviews completed for the New River Health Project raised concerns of the impacts from both eolian and littoral processes potentially propagated by the manipulation (Barnes 2003). Recommendations based on these concerns initiated a monitoring project of dune cross sections, longitudinal profiles along the crest of the manipulated HRA, and eolian deposition/deflation arrays.

Komar *et al* (1999; Komar *et al*, 2001) profiles indicated unaltered dune crest elevations as shown in Table 2.

Table 2. Profile Elevation Maximums from Komar *et al* (1999, Komar *et al*, 2001)

Profile Name	Location (see Appendix III)	Elevation
Komar 1	Most Northern	26.1 feet
Komar 2	Nearest the HRA-southern end	33.8 feet
Komar 3	Near Bono Ditch	40.9 feet
Komar 4	Most Southern	32.9 feet

Current elevations, based on the 2006 survey, indicate HRA elevations ranging from approximately 15 feet in the northern end to 20 to 25 feet in the southern portion. However, the southern portion has overwashes with elevations of approximately 14 feet. Using the nearest Komar *et al* (1999; Komar *et al*, 2001) profile to the HRA, Komar 2, the difference between the altered dune and unaltered dune elevation ranges from 18.8 feet of lost dune elevation in the northern HRA to 8.8 feet of lost dune elevation in the southern HRA. Currently, all of the HRA elevation is below all of the projected Year Exceedance Estimates (Figure 2, Appendix II and Appendix III).

Based on modeling and observations, both Dr. Komar and Dr. Allan agreed that dune elevations of 31.50 would protect the New River system from detrimental overwashing during an event. However, this height would probably be excessive for planning purposes. In reality, the New River system would be amply protected by designs for a constructed dune with an elevation of 25 feet, and then allow the dune to build naturally. This is due the wide beach face separating the New River system from the ocean processes. Such a face would reduce the energy of incoming wave swash, decreasing run-up heights (Komar and Allan, 2006 personal communication).

4.3 Eolian

While under immediate influences of the littoral process, the New River Spit does not escape the dynamics of the eolian process. Review of aerial photographs show the mobility of sand within the New River Spit and the subsequent stabilization and starvation of the dune field. The lakes east of the New River Spit are dune impounded features (barrage lakes), formed by the blocking of drainages from migrating dunes.

Croft Lake/Muddy Lake (not separate in the 1932 aerial photographs) show signs of fill and vegetative encroachment. Fill appears most likely due to migrating sands. The 1932 aerial photographs also show active dune fields west of Croft Lake and the proto New Lake. The point where the active dune field stops to the south is also the terminus of the New River northerly flow. Review of the 2002 aerial photographs indicates that the active dune field west of Croft Lake and a distinguished New Lake are nearly stabilized with vegetation. Little bare sand is visible. In the 1932 aerial photograph, the active dune sheet extended to New Lake. While the imagery is not clear, it appears that there is little vegetation on the beach and New River is not well defined this far north. The lake is not well defined and appears to be have been greatly influenced by the sand migration. The 2002 aerial photograph shows New Lake well defined, with the dune field mostly vegetated to New River, hence being stabilized. However, it appears that New River does not have distinctive channels at this point. The 2002 aerial photograph also shows that the foredune vegetation has been removed, similarly to the location where New River loses its channel and directly west of the former active dune field.

As stated earlier, a dune field is supplied sediment from the beach sands. When that supply is disrupted, the dune will remove sand from the eastern edge of the disruption and can create a deflation plain. The deflation plain will expand as the dunes within the dune field migrate. The dune will continue migration until there is no more sediment to supply it or there is a change in wind climatology. As sediment supply is reduced to the precipitation ridge and the dune, vegetation will encroach, stabilizing the dune. This process appears evident in the historic aerial photography of the New River Spit.

However, as proposed by Komar (1997), stabilized dunes (both dune fields and foredunes) can be reactivated. Komar provides the example of the Clatsop Plains cited earlier in this report. Komar *et al* (1999) further cite the eolian process on the New River Spit in their report. Because the net littoral drift within the Bandon Littoral Cell has been approximately zero, the principle loss of sand from the beach occurs when it is blown inland to form dunes. This inland delivery of sand, without vegetative stability, supplies sediment to the western edge of the migrating dune wedge, infilling the former deflation plain and its subsequent river channel. Observations of point bars and river sheet flow adjacent to the altered dunes of the HRA and unaltered sparse vegetated new dunes along the northern portion of the New River provide evidence of this process (Allan, 2006-personal communications).

As stated above, volumes of sand moved by eolian processes varies greatly from site to site, dependent on wind regime, storms, vegetation, etc. Estimates of volume movement can be made from Department of Agriculture Soil Survey and observation of other systems. However, accurate volumes of movement at New River have not been completed. As such, sand movement monitoring plans, including LiDAR analysis, have been proposed (Allan, 2006b)

4.4 Tectonics

Long-term tectonic and catastrophic seismic events could have impact on the New River Spit. Currently, tectonic uplift of the North America Plate at the New River Spit site matches (Peterson, 2004-personal communication) exceeds the current rise in ocean levels by 0.7 millimeters per year (Komar *et al*, 1999). This small amount of rise may have little impact on the spit. However, the tectonic rise is believed to be the result of plate binding within the Cascadia Subduction Zone. Historic records show that every few hundred years the binding releases, resulting in a Cascadia event tectonic movement (Komar *et al,*1999; Priest, 1995b; Peterson *et al*, 1997). This movement can result in a subsidence of the North American Plate of several feet, effectively “raising the sea level” along the spit, allowing for erosion, overwash, and relocation eastward of the beach.

Other tectonic events such as tsunamis can deliver a series of waves related or unrelated to plate subsidence. These tsunamis, whether from a Cascadia Event, other distant plate movements, or submarine landslides, may deliver waves with sufficient height and energy to overtop the spit, relocating sand and dune and creating breaches. Such effects were witnessed on the New River Spit from tsunamis delivered by the 1964 Good Friday Earthquake in Alaska (Komar *et al*, 1999). The spit, at the proposed breach site, has been mapped to be 1.3 miles within the tsunami run-up boundary (Priest, 1995a).

5.0 INTERPRETATIONS

When European Beach Grass was established in the New River area during the 1930s (BLM, 1995, as found in Komar *et al*, 1999; BLM Aerial Photographs, 1932), the stability of the spit was greatly impacted. The migrating sand was trapped in the grass, enhancing the growth of the foredune crest elevation. With the migrating sand being trapped by the foredune, no sediment was available for the dune field and the self-feeding and stabilization process of the dune field was initiated.

With the trapping of the migrating sand, the vegetation line advanced between 50 to 100 feet seaward and created a deflation plain behind the foredune, allowing New River to extend its length to the north by 2.9 miles within 30 years.

The European Beach Grass, and its accompanying foredune, have both protected New River from breaching by the ocean processes and facilitated its growth to the north by the starvation of the dune field, creating the deflation plain in which it can flow. As the introduction of beach grass has extended the New River and its associated dune field ecosystem, so the alteration of the current European beachgrass environment and foredune structures may again alter the adjacent ecosystems.

While the New River Spit, and New River itself, may be a unique resource, its existence, alterations, and dynamics have been created and continue to be modified through a combination of littoral and eolian processes common to the northwest coast. Utilization and/or alterations of those processes could have significant impacts to the spit and riverine systems. With the removal of European beachgrass, the stability of the spit may be further compromised, exacerbating the dynamic conditions currently operating on the spit, including eolian forces mobilizing the foredune and littoral forces molding the beach face.

Komar *et al* (1999) states, for the New River Spit, it is assumed that "if the tide plus wave run-up is to wash over the tops of the dunes, it would do so in the areas of lowest dune elevations." The removal of beach grass in itself has lowered the elevation of the foredune by up to 18.8 feet. If the dune elevations are sufficiently lowered, general overwash may become normal, adding sediment to the deflation plain, infilling the New River channel, creating a sand plain in its place, and creating a system of multiple breaches, as was present prior to the establishment of European beachgrass.

Three years of monitoring within the managed HRA have shown that the created elevations are below projected 10 year and 100 year run-up elevations (28.05 feet and 31.50 feet respectively). These reviews, as well as information from other studies, indicate that the cyclic replacement of sand from ocean to beach are not matching that removed by natural and artificial processes, resulting in changes to the spit geomorphology.

Removal of the stabilizing European Beach Grass may reactivate the eolian process of sand and dune migration. The migration of sand from destabilized beach faces to migrating dune fields has been well documented in studies previously cited in this document. Historical aerial photographs also document this process previously along the current New River Spit. Deflation plains are the result of the loss of migrating sands to feed the dune field. The stabilization of the New River area by European Beach Grass may have removed the sand source from the dune fields to the east and, thereby, caused the dunes to feed on themselves, creating a deflation plain which has since been vegetated and occupied by New River itself.

The migrating sands and dunes block drainages forming series of small lakes. Such lakes were historically evident in the New River area. If sand migration is reactivated by removal of the European beachgrass allowing wind blown sand to migrate landward and wave-delivered inland migration of sand through overwash, it is possible that the New River Spit will be breached in multiple areas and the drainage will be blocked, possibly forming a series of temporal lakes and streams. This would mimic the pre-European beachgrass system

As a design feature, other approaches (Allan, 2004) have used historical morphological information to guide the process of dune lowering. The adjoining systems then conform to the renewed dynamics, reaching that time-stamp equilibrium. As such, if the New River dune elevations are placed at a pre-European beachgrass level, the adjoining New River ecosystem may alter to the one present before European beachgrass. That system was without a river, but a series of wetlands, bogs, ponds, and multiple outlets.

Large unknowns in current littoral and eolian processes make quantification of current actions impossible. Trends that have been observed in monitoring and observation (sediment plumes from overwashes in the managed HRA area) may be temporary and not representative of current cycles. However, as other observations and current research indicate, they may also be part of the current cycle. Dynamics and possible changes in systems are too recent, too near the beginning of the change, to create firm predictions. It is because of this uncertainty that monitoring plans should be initiated and incorporated with companion studies being conducted by others.

Because of the unknowns associated with the current littoral and eolian process impact on both the natural and managed portions of the New River system, the listed alternatives have to be analyzed according to high risk to low risk. Every action within a dynamic system has risk of impacts to adjoining systems. The choice of action produces a management of risk, not an elimination of risk. The three alternatives are reviewed on the potential of risk of impact to the current New River ecosystem. The risk of impact to the New River ecosystem may be inversely related to the impact to the Snowy Plover Habitat (Figure 3). The three alternatives can be compared to the East-West placement of the buffer dune.

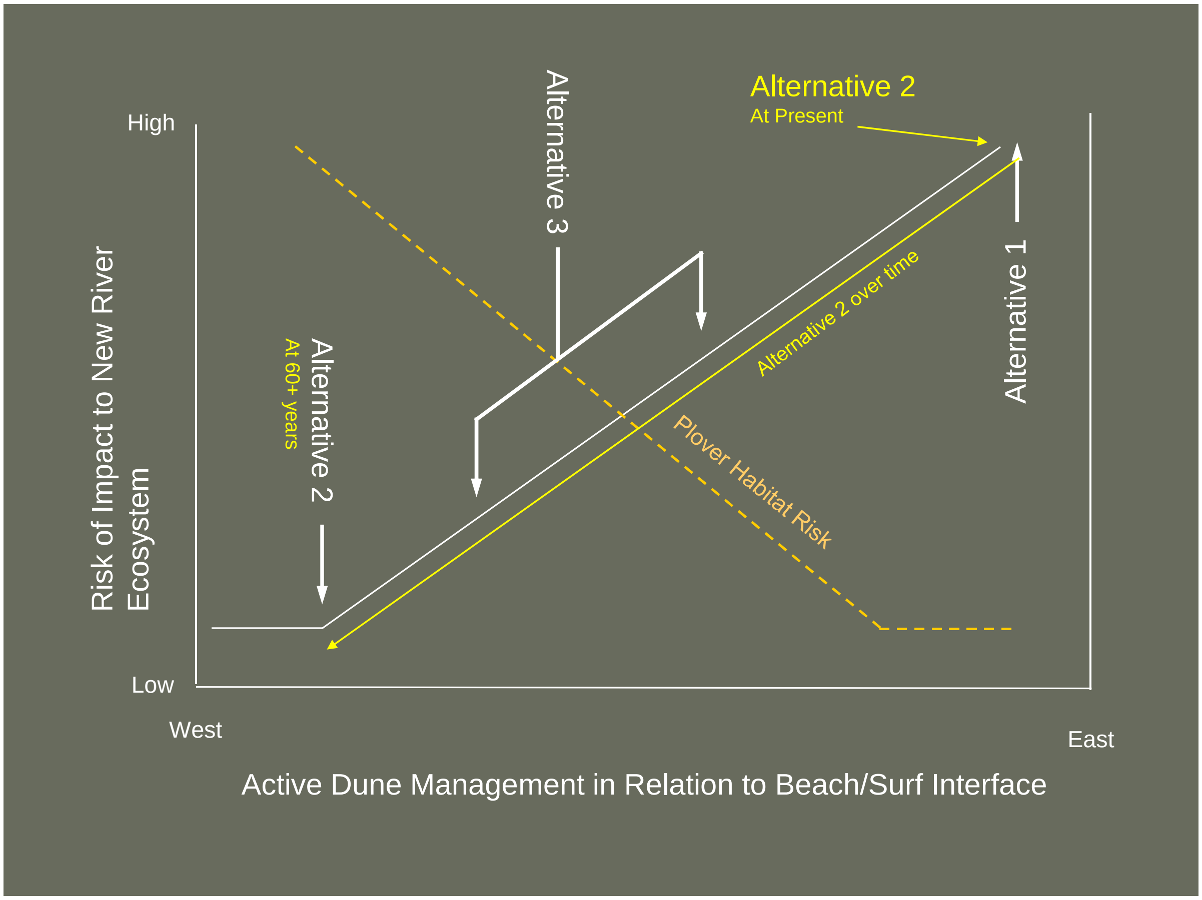

Figure 3. Alternatives' Risk Assessment. Modified from Barnes (2007).

Alternative 1, with no or a minimal buffer dune located to the eastern edge of the spit, lack of vegetation, and continued reduction of spit elevation would create a high risk of impact to the river system by overwash deposition of sand, eolian deposition of sand, and change of beach/surf interface by westward migration due to system grading. Currently, over 2.5 miles of the HRA are 16.5 feet or more below the elevations for the 100-year waver run-up projections. This gives a potential of a continuous overwash and infilling of river length behind the spit. Eolian deposition and activation of sand movement will continue within this area, delivering sand into the deflation plain and river channel. This will result in chronic infilling of the river, resulting in channel form that results from low flow/high sediment regimes, with a possibility of eutrophication of the system behind the HRA, eventually transforming the system from river to dune marsh.

Alternative 1 has the greatest amount of risk to the current New River ecosystem. However, this alternative provides the greatest amount of open-dune habitat available to the plover, giving Alternative 1 the least amount of risk to plover objectives (Figure 3).

Alternative 2, allowing the system to re-establish its foredune growth with no management actions, would create the least amount of risk of impact to the river system. This alternative would not allow for the construction of an artificial new dune, but rely on historically established natural processes to continue. Because of the management activities already completed on the HRA, the amount of risk is time dependent, with the risk being high in the short term but progressively lowering as European beachgrass is established, material is trapped and historic foredune growth and elevations are re-established. With sufficient time (within 60 years under pre-1997 deposition regimes) the dunes could obtain their original pre-management elevations and width. The risk of Alternative 3 would be inverse to the Alternatives risk-slope portrayed in Figure 3 over time, with risk in the present being high and the risk at 60 plus years being low. The unknown variables in the time dependent risk analysis is the actual recurrence interval of storms equal to or greater than those of the late 1990s, volumes of sand movement over open and reestablished dune systems, and if summer deposition of sand by the littoral cycle is indeed diminishing. Each of these variables would present less risk to the current New River system as time progresses.

Alternative 2 would have a greater risk than Alternative 1 in the near future. However the risk would adjust to the least amount of risk over time, similar to the risk experienced by the unaltered dune systems (which will have some, but low, risk in a natural system). However, this alternative will eventually provide the least amount of open-dune habitat available to the plover, giving Alternative 3 the greatest amount of risk in for plover objectives (Figure 3).

Alternative 3, while not providing the least amount of risk as a developed Alternative 2 at 60+ years, greatly mitigates and reduces the risk to the river system associated with Alternative 1. The proposed dune elevations meet or exceed the anticipated wave run-ups projected for 10-year to 100-year storm events. The width of the spit also provides protection from sustained overwash (Allan, 2006 personal communications; Komar and Allan, 2006 personal communications). The placement of the dune and the revegetation of the dune to river by European beachgrass and native vegetation will reduce the possibility of sand delivery to the river by eolian process, including saltation where the particle is “bounced” by and from other particles, giving it a travel in air component. Artificial construction of the dune would reduce the time dependent risk associated with Alternative 2. Possible westward migration of the beach/surf interface by system grading would be minimized from Alternative 1, with dune “bank” material available to supplicate wave energy demands, although not at the current interface. Because of unknown variables of a dynamic system, if this alternative is implemented, it should be done in conjunction with an established monitoring plan.

Alternative 3 would not eliminate risk, nor exasperate risk, of impacts to the current New River system, in comparison with the other two alternatives. If coupled with an active monitoring plan and short review times, impacts of this alternative on the current New River system would be mitigated and manageable. Likewise, while this alternative does not provide the most open-dune habitat available to the plover as available in Alternative 1, it does not eliminate all habitats that may occur in Alternative 2. As with risk to the existing New River system, if coupled with active monitoring and short review times, the impacts of this alternative on plover habitat would be mitigated and manageable (Figure 3).

Any alternative implemented should be done so in conjunction with an active monitoring plan as proposed by Allan (2006). Because of the dynamics of the system, including both the geologic (littoral and eolian) and biological cycles, the Environmental Assessment should be revisited and reviewed within a short time frame to capture new information, new conditions, and changes in the dynamic systems creating this unique landscape.

6.0 RECOMMENDATIONS

Based on research and field observations, the following recommendations are made.

1. Alternative 3 provides the best opportunity to meet the needs of open-dune habitat for Plover and maintaining the current New River ecosystem.

2. This and associated Environmental Assessments should be revisited and reviewed within five (5) years (unless an earlier review is warranted) to address new information gained by literature, research, and monitoring; assess new conditions in littoral cycling; assess eolian impacts; and confirm ecosystem species needs.

3. Implement the littoral cell monitoring plan proposed by the Oregon Department of Geology and Mineral Industries (Allan, 2006), as shown in Appendix III

4. Review project, and cease if appropriate until review is complete, if monitoring and/or observation indicates that cyclic process have altered or additional impacts to the dune system are present.

7.0 ENVIRONMENTAL ASSESSMENT SUGGESTED TEXT

Based on the proceeding research and discussion, the following verbiage is suggested for the Environmental Assessment.

Other items, as described in Section 6.0 Recommendations, could also be included as bulleted points where appropriate.

Chapter 3-Affected Environment verbiage could include:

<u>3.5 Geology</u>

The bedrock geology underlying the New River Spit area consists of Jurassic Otter Point Formation (Ramp, 1977) and possibly Eocene Roseburg Formation (Phillips *et al*, 1982), later defined as Siltez River Volcanics and/or the Umpqua Group by others. The Otter Point Formation consists of sandstone, siltstone, mudstone intermixed with metasediment and metamorphic rock within a mélange. The mapped Roseburg Formation consists of sandstone with siltstone and mudstone. The surficial geology of the project area is comprised of Quaternary sand forming the beach and accompanying dune field. The sediment on the southern portion of the spit is coarse, predominantly derived from Blacklock Point and adjacent sea cliffs. Blacklock Point is mapped as ultramafic rock containing serpentinite and peridotite. The sea cliffs directly north of Blacklock Point have been mapped as containing Pleistocene marine terrace sediments (Komar *et al*, 1999; Komar *et al*, 2001).

The New River Spit is located within the Bandon Littoral Cell. The cell is demarked and bound by Blacklock Point to the south and Cape Arago to the north. The total longshore length of the cell is approximately 27 miles. The littoral cell is sediment contained, with no or minimal migration of sand sediment beyond the bounding points of the cell (Komar *et al*, 1999). Initially emplaced sand of the Bandon Littoral Cell has similar identification characteristics as the sands of the Coos Bay Littoral Cell (Peterson, 2004-personal communications).

Erosion of Blacklock Point and the sandstone cliffs north of the point (to Floras Lake) currently supplies beach sediment to the southern portion of the spit (Komar *et al*, 1999). This material is coarse grained sand and pebbles. In general, sea cliff erosion in the Bandon area is minimal because tectonic uplift exceeds sea level rise, giving a net decline in sea level. However, the current platform of the wave-cut terrace on which the depositional material of the beach, spit, and stabilized dune face rests is currently below sea level (Peterson, 2004 personal communication). Erosion from the sea cliffs is due to groundwater movement as opposed to wave action (Komar, 1997).

The New River Spit contains characteristics of a Dissipative Beach along the northern, finer-grained beach and characteristics of a Reflective Beach along the southern, coarser-grained beach. The Dissipative Beach tends to be more stable, responding less to major storms and undergoing smaller changes in elevations from summer to winter. The Reflective Beach tends to be less stable, changing rapidly in slopes and elevations during individual storms and from summer to winter (Komar *et al*, 1999).

Establishment of European beachgrass in the 1930s facilitated starvation of the dune sheet, resulting in a continuous deflation plain. The sand was removed to the water table. The resulting deflation bowls and dune wetlands connected and separated in short time frames. As Floras Creek and the outlet of Floras Lake were deflected north by the over-sedimentation of the mouth and southern end of the spit by sediment supplied by Blacklock Point, the flows entered the expanding deflation plain. The river system incorporated the already existing deflation ponds, small outlets (such as New Lake), and wetlands, forming the existing New River. The expanding river system is not only directed by the expanding dunes into the self-created deflation plain, but it is also protected by the ever-growing foredune, creating a “sea-wall”.

The greatest change of the New River and Spit is the progressive migration of the mouth of the New River to the north, which has shifted its position by 2.9 miles in 30 years (Komar, *et al*, 1999), or an average of 0.16 km/yr [535 feet/year] (Komar *et al*, 2001). This corresponds to the explosive growth of dune vegetation during the last 100 years.

The BLM began European beach grass removal and dune manipulation in 1998 by burning and mechanical removal. Initial treatments were limited to approximately 24 acres. Follow-up treatments included subsoiling the re-sprout. Beginning in 2000, heavy machinery was used to treat up to 100 acres per year by removing European beach grass and manipulating dune form. The effect was a lowering of the foredune elevation, with deposition of material into the beach face. This has occurred on a yearly basis, with areas previously treated being retreated. Dune elevations have been lowered from pre-management elevations up to 33.8 feet elevation to current elevations as minimal as 15 feet. Modeling predicts storm energy overwash elevations ranging between 28.05 feet to 31.50 feet. Open-dune areas experience sand migration due to eolian process.

Chapter 4-Environmental Consequences verbiage could include:

<u>Geology</u>
(Refer to Figure 1 – Alternatives risk)

<u>Alternative 1: No Action Alternative</u>

Direct and Indirect Impacts:

Alternative 1, with no or a minimal buffer dune located to the eastern edge of the spit, lack of vegetation, and continued reduction of spit elevation would create a high risk of impact to the river system by overwash deposition of sand, eolian deposition of sand, and change of beach/surf interface by westward migration due to system grading. Currently, over 2.5 miles of the HRA are 16.5 feet or more below the elevations for the 100-year waver run-up projections. This gives a potential of a continuous overwash and infilling of river length behind the spit. Eolian deposition and activation of sand movement will continue within this area, delivering sand into the deflation plain and river channel. This will result in chronic infilling of the river, resulting in channel form that results from low flow/high sediment regimes, with a possibility of eutrophication of the system behind the HRA, eventually transforming the system from river to dune marsh.

Alternative 1 has the greatest amount of risk to the current New River ecosystem. However, this alternative provides the greatest amount of open-dune habitat available to the plover, giving Alternative 1 the least amount of risk to plover objectives (Figure 1).

Cumulative Impacts:

Cumulative impacts could include the loss of the New River system adjacent to the HRA and north to the current mouth. While reactivation of active dune sheets is unlikely, eolian deposition could cause burial and alterations of ecosystems and environmental communities east of the current New River location. Grading of the beach/shore interface could cause a long-term inland adjustment of that interface.

<u>Alternative 2-Discontinue Habitat Restoration</u>

Direct and Indirect Impacts

Alternative 2 would not allow for the construction of an artificial new dune, but relay on historically established natural processes to continue. Because of the management activities already completed on the HRA, the amount of risk is time dependent, with the risk being high in the short term but progressively lowering as European beachgrass is established, material is trapped and historic foredune growth and elevations are re-established. With sufficient time (within 60 years under pre-1997 deposition regimes) the dunes could obtain their original pre-management elevations and width. The risk of Alternative 3 would be inverse to the Alternatives risk-slope portrayed in Figure 3 over time with risk in the present being high to risk at 60 plus years being low. The unknown variables in the time dependent risk analysis is the actual recurrence interval of storms equal to or greater than those of the late 1990s, volumes of sand movement over open and reestablished dune systems, and if summer deposition of sand by the littoral cycle is indeed diminishing. Each of these variables would present less risk to the current New River system as time progresses.

Alternative 2 would have a great risk comparable to that of Alternative 1 with the near future. However the risk would adjust to the least amount of risk over time, similar to the risk experienced by the unaltered dune systems (which will have some, but low, risk in a natural system). However, this alternative will eventually provide the least amount (to none) of open-dune habitat available to the plover, giving Alternative 3 the greatest amount of risk in for plover objectives (Figure 1).

Cumulative Impacts

Cumulatively, this alternative would allow the geomorphologic process to continue that created New River, continuing the ecosystem as is present. Sand migration and overwash will be managed over time by the growing foredune system. The New River ecosystem would obtain the stability and function existing before HRA manipulation and management.

Alternative 3-Adaptive Foredune Management-Proposed Action

Direct and Indirect Impacts:

Alternative 3, while not providing the least amount of risk as an unaltered system, greatly mitigates and reduces the risk to the river system associated with current conditions. The proposed dune elevations meet or exceed the anticipated wave run-ups projected for 10-year to 100-year storm events. The width of the spit also provides protection from sustained overwash. The placement of the dune and the revegetation of the dune to river by European beachgrass and native vegetation will reduce the possibility of sand delivery to the river by eolian process, including saltation where the particle is “bounced” by and from other particles, giving it a travel in air component. Artificial construction of the dune would reduce the time dependent risk associated with Alternative 3. Possible westward migration of the beach/surf interface by system grading would be minimized from Alternative 1, with dune “bank” material available to supplicate wave energy demands, although not at the current interface. Because of unknown variables of a dynamic system, if this alternative is implemented, it should be done in conjunction with an established monitoring plan.

Alternative 3 would not eliminate risk, nor exasperate risk, of impacts to the current New River system, in comparison with the other two alternatives. If coupled with an active monitoring plan and short review times, impacts of this alternative on the current New River system would be mitigated and manageable. Likewise, while this alternative does not provide the most open-dune habitat available to the plover as available in Alternative 1, it does not eliminate all habitats that may occur in Alternative 2. As with risk to the existing New River system, if coupled with active monitoring and short review times, the impacts of this alternative on plover habitat would be mitigated and manageable (Figure 1).

Cumulative Impacts:

This alternative would provide a very specific balance of ecosystems, meeting the needs to protect this portion of the river and create open-dune habitat. Cumulatively, this alternative would allow the geomorphologic process to continue that created New River, continuing the ecosystem as is present. Sand migration and overwash will be managed by the enlarged buffer system. However, this alternative should be reviewed on a short time frame to consider any new information gained from research, monitoring, and/or observation.

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APPENDICIES

Appendix I
US Fish and Wildlife Service Presentation
April 5, 2007

Slide 1

Slide 2

Bandon Littoral Cell

Two sources of sediment in the system
North-Coquille River
South-Blacklock Point and adjacent sea cliffs

These are the sea cliff (looking from Blacklock Point)

Slide 3

The sands north are fine grained

Sands from Blacklock point are coarse grained, called MaFic

These sea cliffs are composed of Pleistocene sandstones, gravels, and conglomerates.

Point out layering

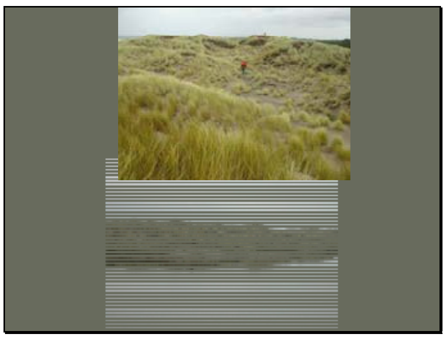
Slide 4

European Beachgrass first took hold in the 1920s at New River. It was first introduced along the west coast as a stabilizer to reduce sand movement. It does its job very well.

Slide 5

As the dune stabilizes, it starts starving the inland portion of the dune sheet. The wind creates deflation holes within the dunes, removing the loose sand and lowering points within the dune sheet. Until it reaches the water table. The wind can not remove sand grains from the saturated sands. So the deflation points start to expand and combine

Slide 6

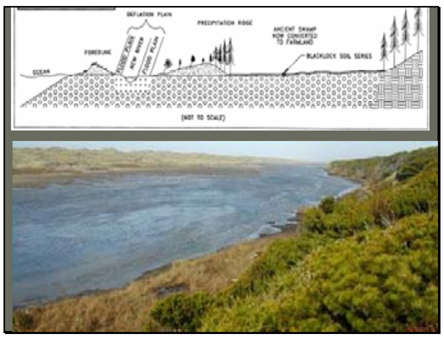


The dunes build up by combination of sediment supply and European beachgrass (EGB), becoming higher than the river systems, creating a levee system

Slide 7

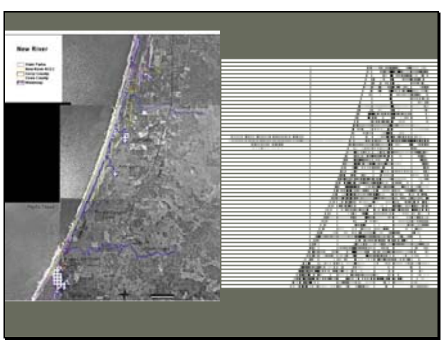
The stream continued north, as the EBG and sediment entrapment continued. The combination of dune deflation plain growth allowed the river to advance beyond anything in its way.

Slide 8



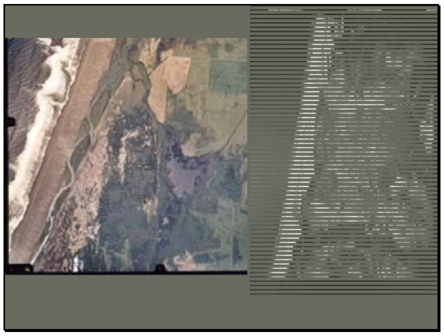
Until they start to form a deflation plain. This deflation plain system is what New River flows through as a deflation plain river.

Slide 9



Compare current extent of the river to 1936.

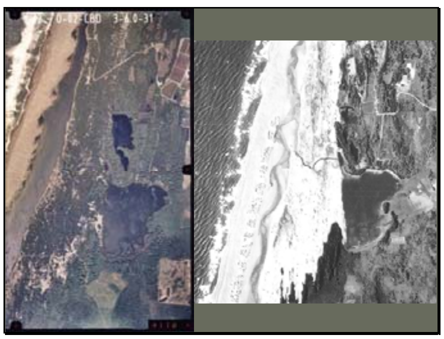
Slide 10



New Lake, also a Barrage Lake

2002 vs. 1943
Note sand placement and vegetation stabilization.

Slide 11



Croft and Muddy Lake
2002 vs. 1943

Slide 12

European beach grass extends to the surf line, stabilizing what was once active dune sheet and the supply source to the dune systems to the east.

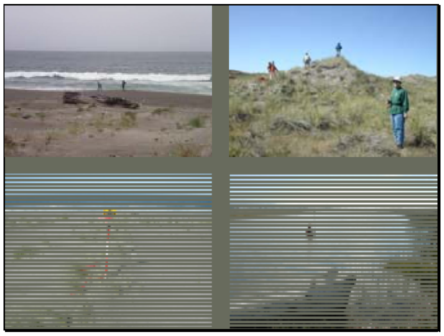
Slide 13

Where there is a lack of stabilizing vegetation, the dune system again begins to become active.

Advancing again, to where systems driving west meet systems driving east.

This creates a precarious balancing act for managing the systems

Slide 14

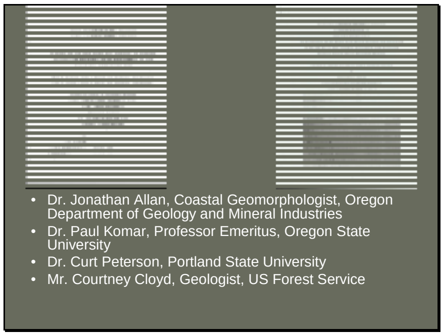


BLM has embarked on a set of studies and monitoring to keep track of this balance. Measuring and studying the geomorphology of the New River system.

Slide 15

Scientists with Oregon State University and DOGAMI have been performing extensive studies on dune stabilization and movement, including a comparable project at Elk River

Slide 16

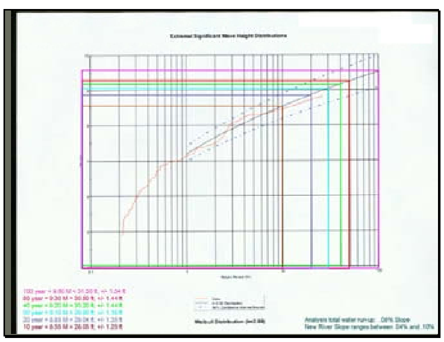


Who we are working with

Slide 17

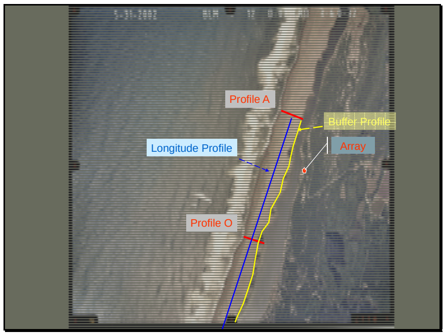
DOGAMI has submitted a proposal for littoral cell monitoring, similar to the Elk River system

Slide 18



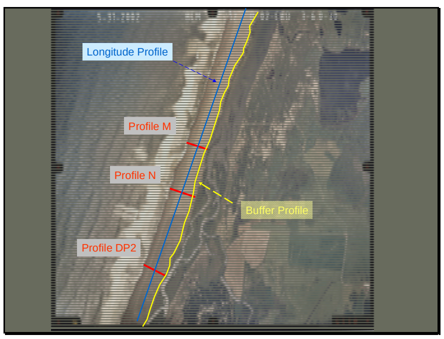
Research result in Run-up models based on frequency

Slide 19



A, B, O

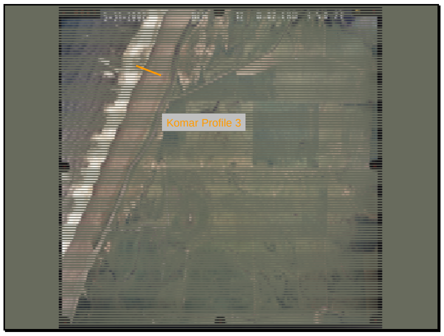
Slide 20



M, N, DP2

Slide 21

Slide 22



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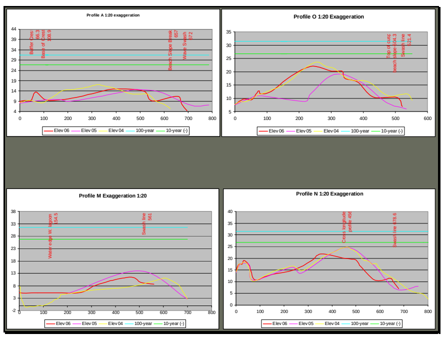
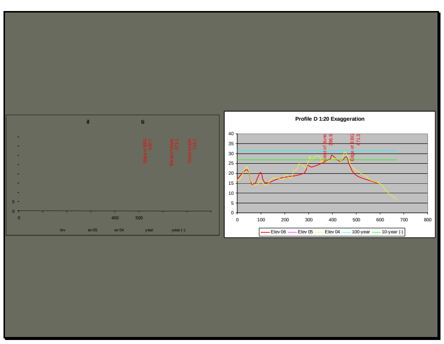


Dr. Allan recommends 25 feet based on width of the spit

Slide 24



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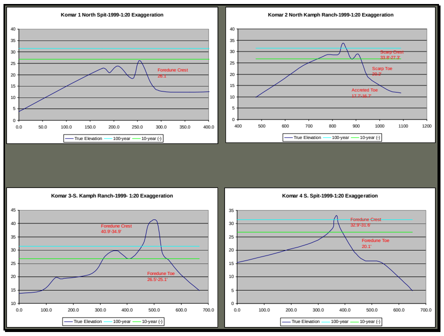
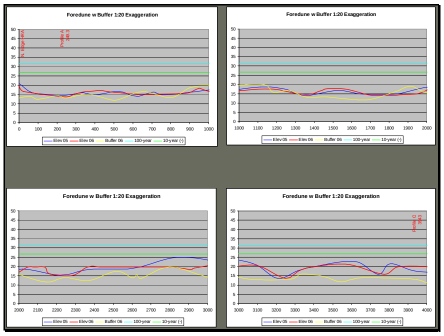


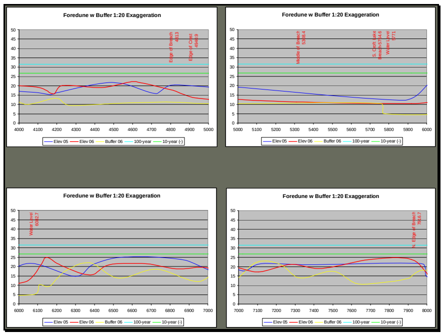
These show original dune form

Slide 26



Longitude North to south

Slide 27



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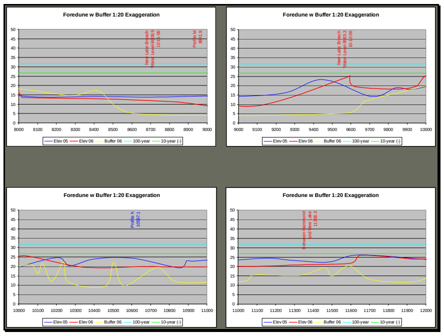

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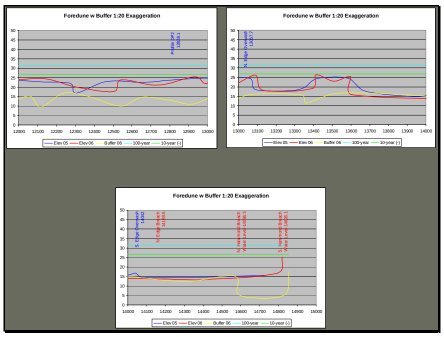

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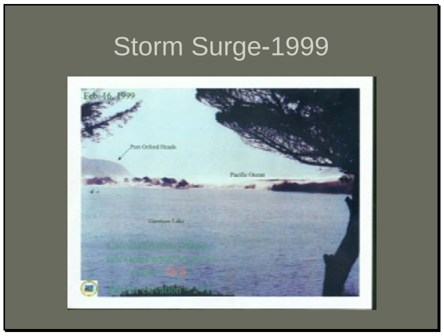


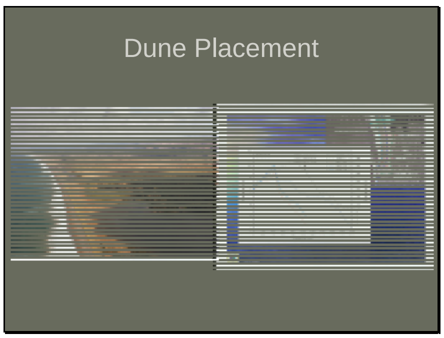
1st concern: Overwash

Original data from Komar based on 100 year events before 98-99. That winter, multiple “100-year” events occurred.

Models recalculated

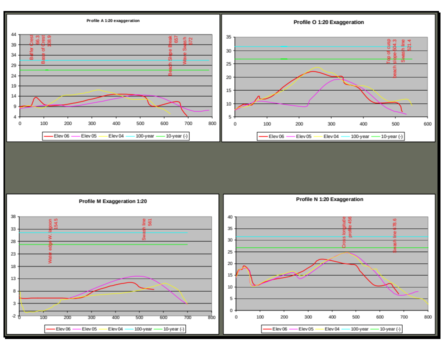
Slide 31

Slide 32



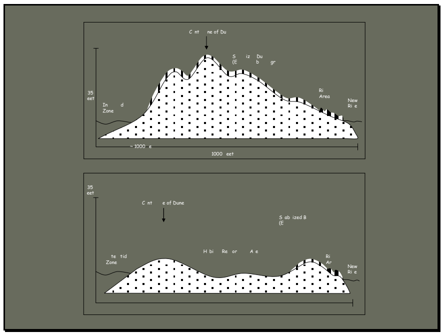
2[nd] Issue-Shore form

Slide 33



Point out possible retreat Too short of time to infer trend from this cross section alone

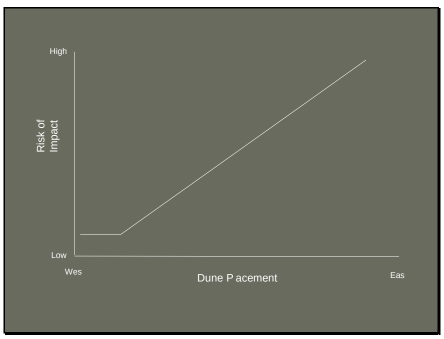
Slide 34



Natural system of dune growth allows bank storage of sand to recycle

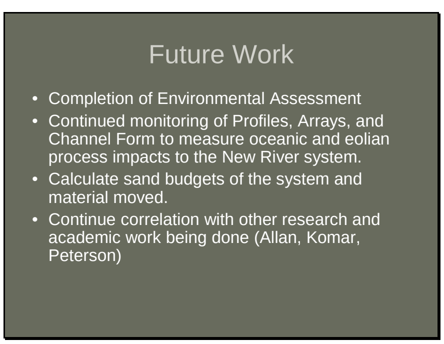
Current removes the storage, allowing increased erosion of the beach.

Slide 35



Dune Placement Risk

Slide 36



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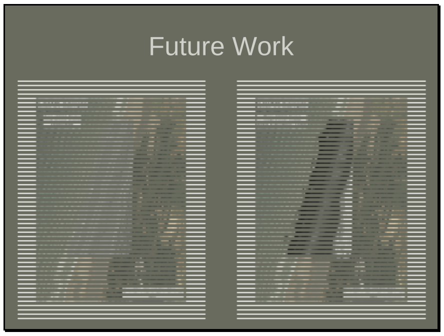
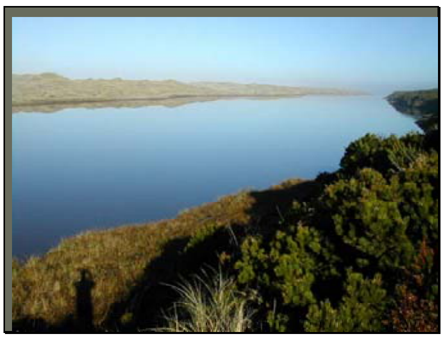


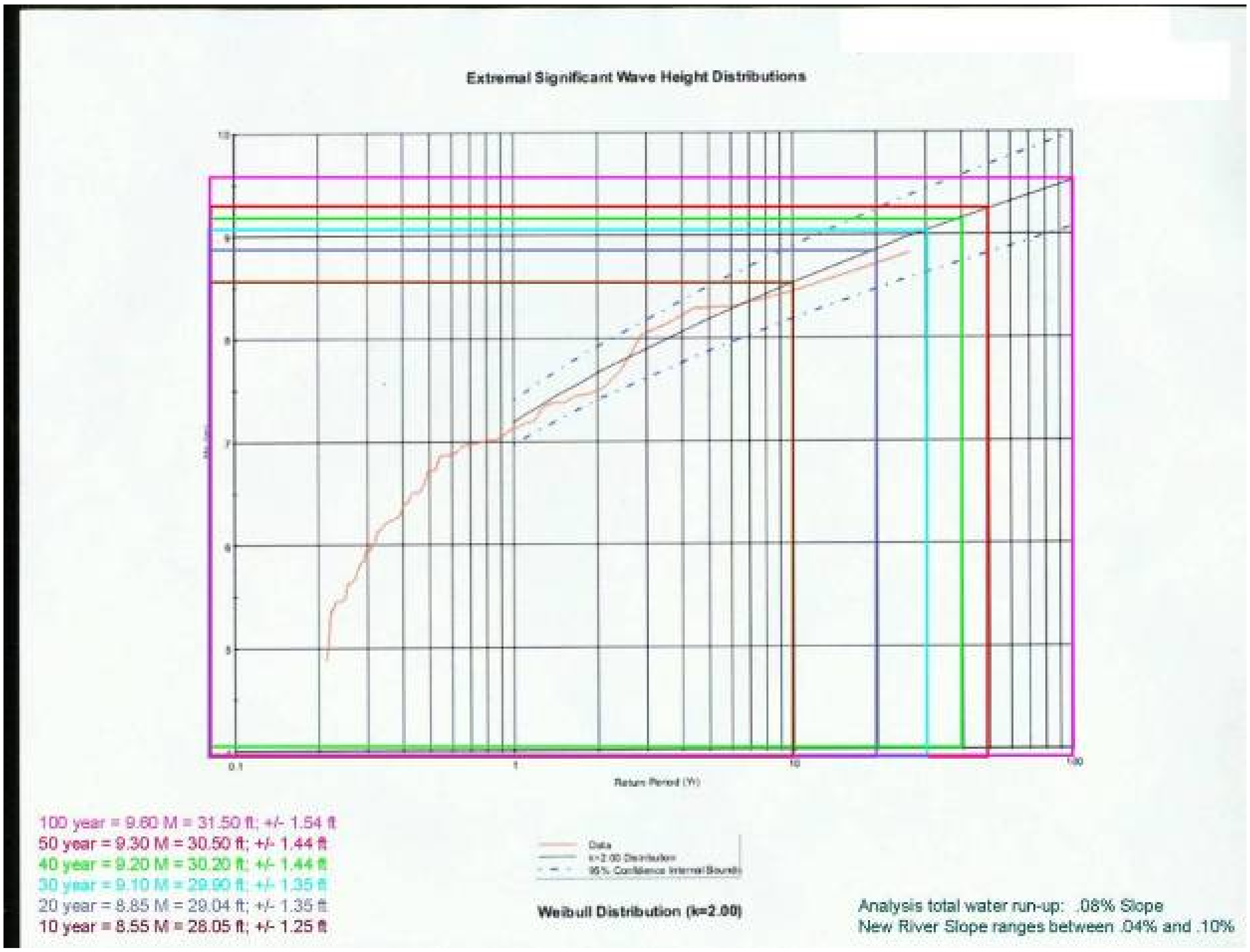
Use of LiDAR

Slide 38



Thank you and are there any questions.

Appendix II
New River Run-up Model, modified from DOGAMI

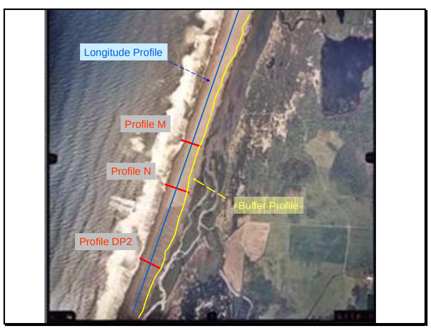


Appendix III
Beach Monitoring Profiles, 2006

Slide 1

A, B, O

Slide 2

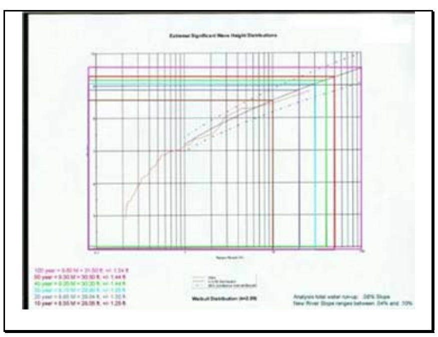


M, N, DP2

Slide 3

Slide 4

Slide 5



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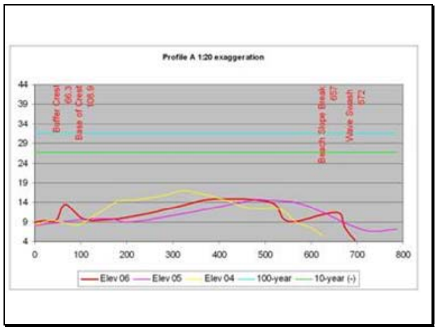

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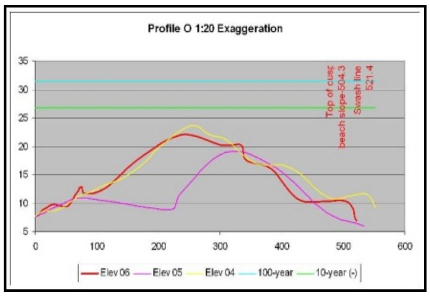

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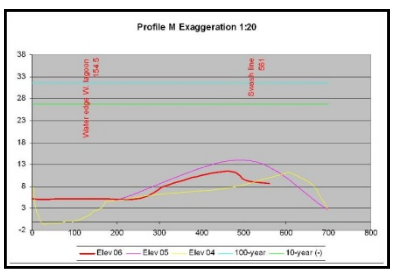

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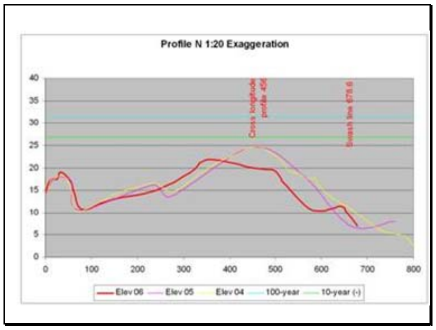

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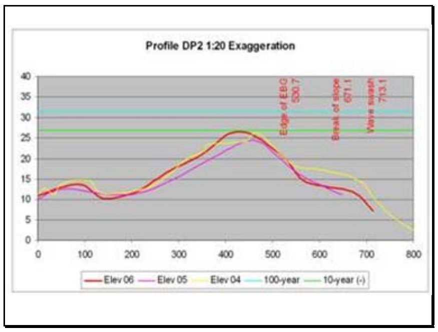

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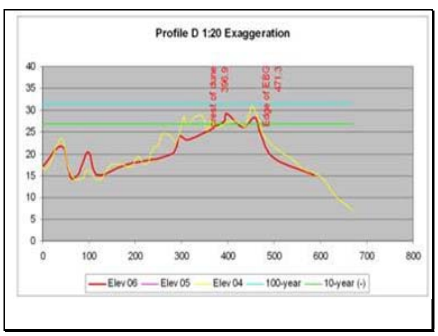

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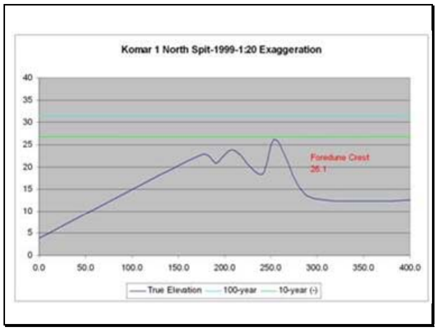

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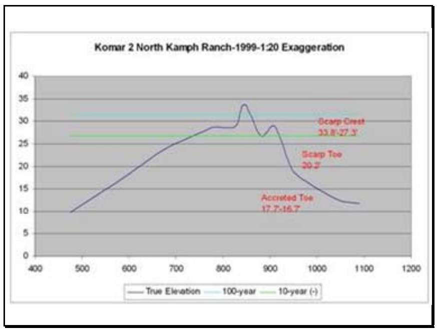

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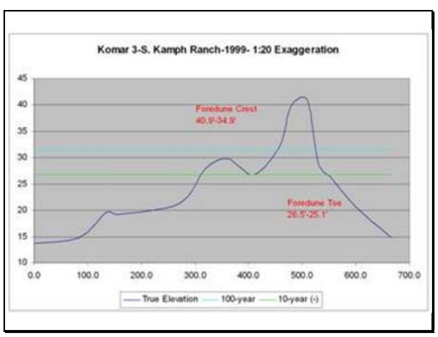

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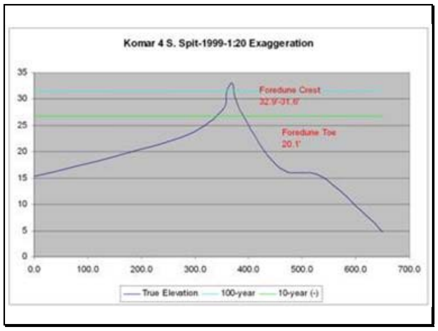

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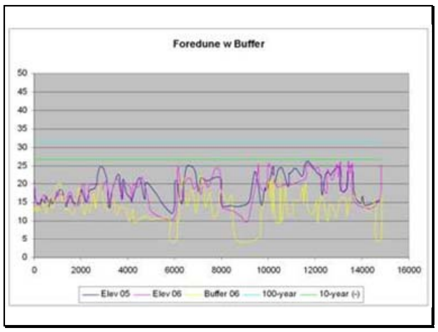

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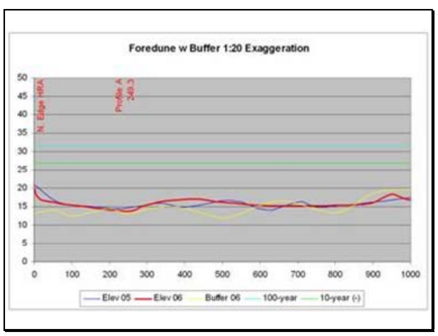

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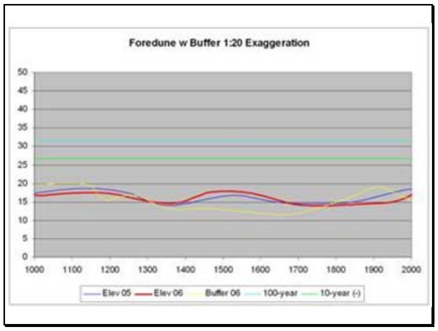

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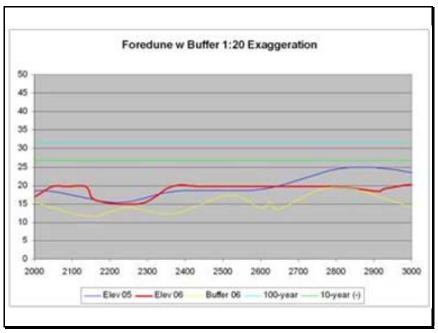

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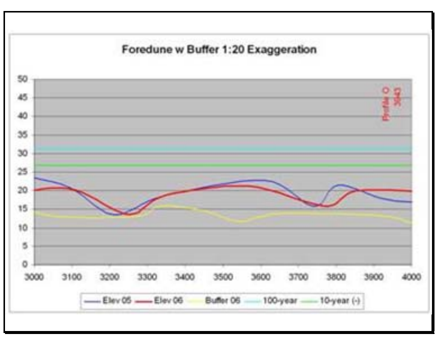

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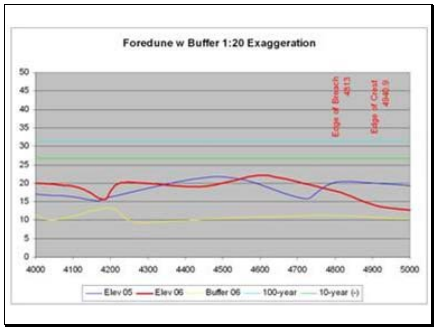

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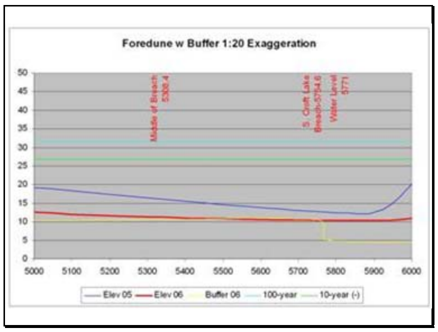

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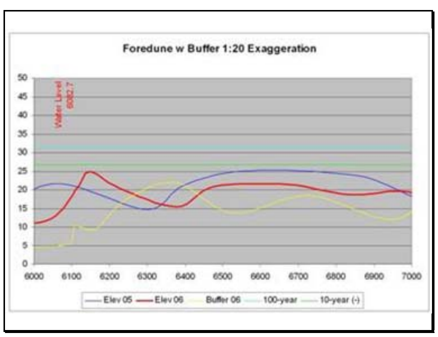

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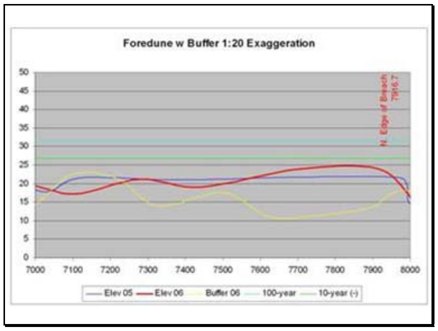

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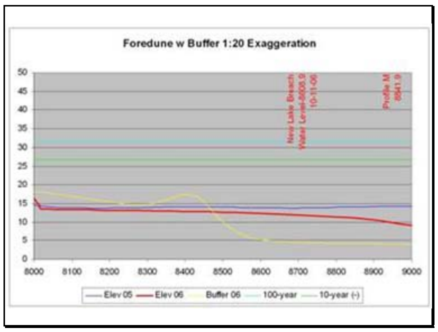

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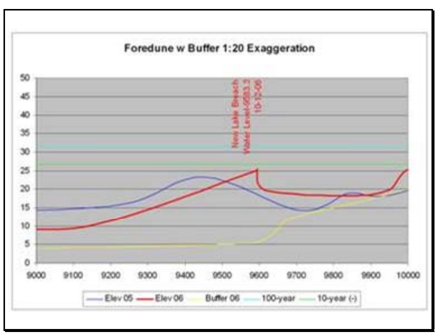

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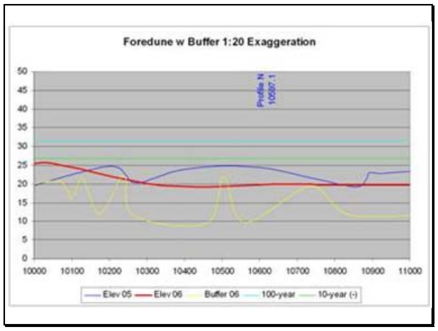

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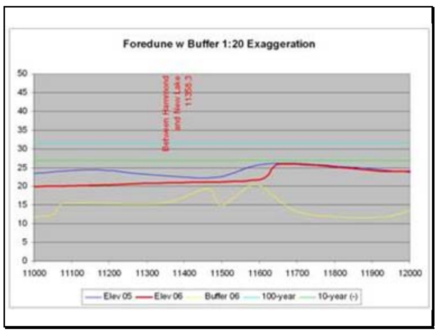

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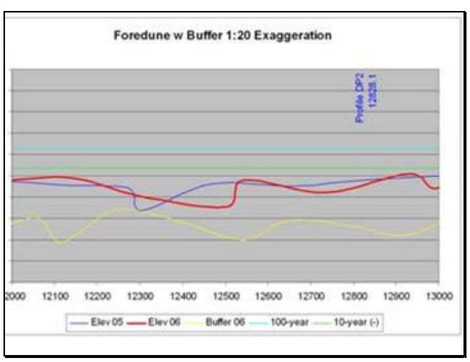

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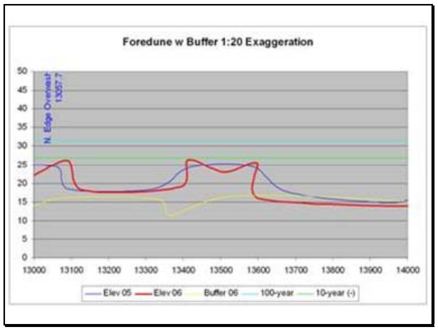

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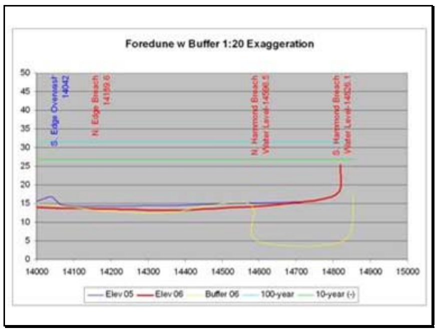

Appendix IV
DOGAMI Proposal to Develop a Beach Monitoring Program for the New River Spit, Southern Oregon Coast

Proposal to Develop a Beach Monitoring Program for the New River Spit, Southern Oregon Coast.

The New River is located on the southern Oregon coast, within the Bandon littoral cell, which extends from Cape Blanco in the south to Cape Arago near Coos Bay (Figure 1). The total length of shore contained within this littoral cell is approximately 45 km (28 miles), with the New River area confined to the southern half of the cell (i.e. south of Bandon, north of Cape Blanco). The New River and its coastal hinterland has been described as one of the last remaining wild places along the Oregon coast, characterized by a diverse range of habitats, interconnected network of rivers, small streams and lakes, and limited human use (BLM 2004). As a result, the New River has been classified as a “special status” area known as the New River Area of Critical Environmental Concern (ACEC), which is managed by the Bureau of Land Management (BLM). The total land area now under BLM control is 1,356 acres of land (BLM 2004). The significance of its “special status” classification reflects the fact that the New River area and its uplands contain important habitat for a variety of endangered birds, including the Western Snowy Plover, Peregrine Falcon, Bald Eagle and Aleutian Canada Goose, unique plant communities, important wildlife habitat, and several historic/cultural sites.

The New River is protected by a 14.5 km (9-mile) long barrier spit, comprised of a mixture of both coarse sediments (granules to pebbles) and fine sands. As a result, the barrier spit is typified by a generally steep beach face that is generally intermediate to reflective of wave energy using the morphodynamic classification of Wright and Short (1983). Analyses of similar beach types at Agate Beach near Port Orford to the south has revealed that such beaches can be extremely dynamic so that they are capable of responding rapidly to varying wave conditions. For example, our analysis of the beach response at Port Orford has revealed that Agate Beach exhibits horizontal shoreline excursions that average some 60 m (180 ft) between summer and winter(i.e. seasonal response), while the storm response is often much greater (up to twice as much). Komar (2001) observed that the most significant change to the New River barrier spit is the progressive northward migration of the spit tip over time, with the mouth having shifted to the north by some 4.7 km (2.9 miles) in the last 30 years alone. Along much of its length, the frontal foredune is well vegetated with European beach grass (*Ammophila arenaria*), which over time has led to the development of a prominent high dune with elevations that may reach as much as 10 - 14 m (33 – 46 ft) high.

Since 1998, the BLM has developed a dune management program to “rehabilitate” portions of the New River spit in order to re-create an open dune environment, characteristic of the area in the 1940s and 1950s. The impetus for this dune management strategy is to improve the habitat along the spit for the Western Snowy Plover and a variety of rare, native plant species.

The Pacific coast population of the Western Snowy Plover (Charadrius alexandrinus nivosus) is listed as threatened under the Endangered Species Act. Western Snowy Plover breed primarily on coastal beaches from southern Washington to southern Baja California. They breed and winter along the Oregon Coast, which is located at the more northern extent of their range. The birds are currently found at nine sites along the south central Oregon Coast between Cape Blanco and Heceta Head. However, they were historically found at more than 20 sites along the coast from Pistol River to the Columbia River. Current estimates indicated that about 110 birds breed in this area and about 70 birds are present during the winter.

Snowy Plover typically nest in flat, open areas having sandy or saline substrates, where vegetation and driftwood are usually sparse or absent (USFWS, 2001). They start breeding behavior as early as February but initiate nests between March 15 and September 15 with most nesting activity occurring in June (Castelein et al. 2000). The eggs are laid directly on the sand in a shallow scrape or depression lined with beach debris. The nests are placed above the wrack line within several hundred meters of the water.

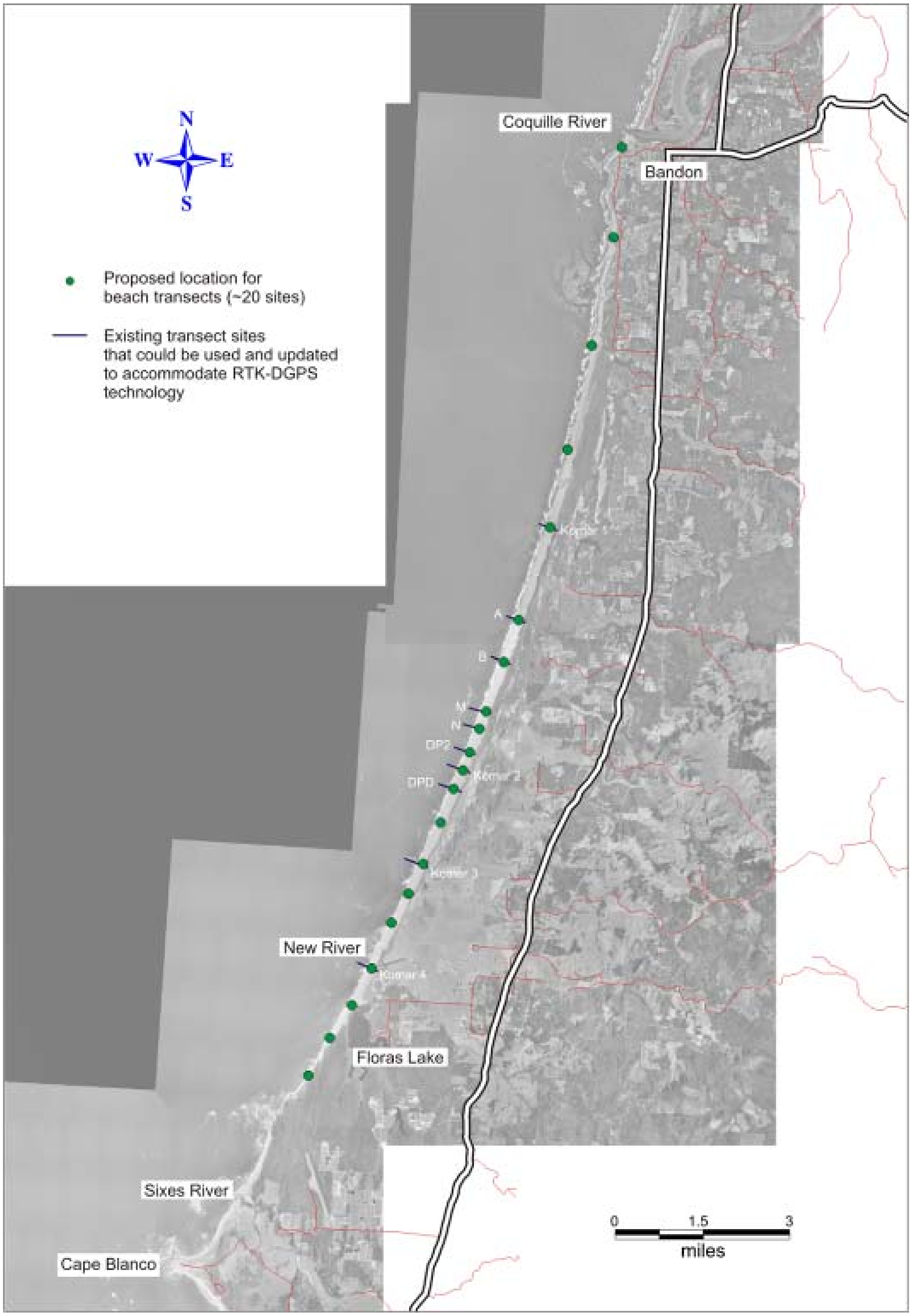

Figure 1 Map of the New River Spit and proposed beach monitoring sites

The proliferation of European beach grass along the New River spit (and elsewhere along the Oregon coast) has resulted in an overall decrease in the habitat preferred by the Western Snowy Plover, and is generally recognized as one important factor contributing to their overall demise in recent years. In order to improve Snowy Plover breeding habitat, the BLM and the US Fish and Wildlife Service (USFWS) have instigated a program of vegetation removal and foredune lowering to increase the incidence of wave overwash during winter storms. This process creates the large, bare sand areas that the birds prefer. According to the BLM (2004) some 160 acres of European beach grass have been removed to date.

The likely short and long-term impacts of dune scalping on the ocean beach littoral system as well as with respect to the future stability and viability of the New River remain uncertain. For example, there is qualitative information that indicates a significant decrease in the depth of the river (including the development of point bars) adjacent to dune areas that have been actively scalped and laid bare, while areas of dune that have remained untouched show no apparent aggradation in the river channel. Such a response implies that sand is more easily entrained and transported landward towards the river in those areas that are exposed compared with vegetated areas. Furthermore, this process if left unchecked may begin to inhibit the natural flow regime of the New River causing it to breach more frequently in the south. Furthermore, the BLM is presently exploring a proposal to realign the existing foredune further to the east, placing it immediately adjacent to the New River. Should such activities occur, it is probable that this reconfiguration of the beach and dune morphology could exacerbate sediment infilling in the New River, while also affecting the sediment budget that is required by the ocean beach littoral system to maintain the shoreline close to its existing envelope of variability. As a result of these uncertainties, the Oregon Department of Geology has developed a proposal to undertake some additional studies on the New River Spit to begin to document the larger-scale response of the littoral system in an effort to provide sufficient high-quality information on the dynamics of the region that may be used to more effectively manage both the fluvial and coastal environment. To this end we propose the following:

1) Establish a dedicated long-term beach and shoreline monitoring network along the entire littoral system (i.e. from Blacklock Point in the south to Bandon in the north). Figure 1 identifies the approximate locations of the monitoring network, which would include some 20 beach profile stations. Note: the area managed by the BLM would be characterized by a relatively dense survey network comprised of both existing survey lines with some new sites.
2) Beach surveying would be undertaken using Real-Time Kinematic Differential Global Positioning System (RTK-DGPS) technology. Ideally the surveys would be undertaken on a quarterly basis. However, given that portions of the beach are periodically closed to people, we recommend a minimum of bi-annual surveys (i.e. late winter (~March/April) and late summer (~September/October). We also recommend including one additional survey interval following a major storm (washover) event.
3) An additional option might also include surveys of a specific contour elevation (e.g. the 3 m or 4 m contour elevation, relative to the North American Vertical Datum of 1988). However, the latter will be strongly dependent on having vehicle access to the beach, the beach state (particularly its steepness), tidal elevation, and the presence of breaches.

4) DOGAMI would also undertake a detailed analysis of all existing Light Detection and Ranging (LIDAR) data for the area (this is limited to the 1998 and 2002 LIDAR flights flown by the USGS). DOGAMI would provide the following:
    a. Establish virtual GIS beach cross-sections spaced at 50 m intervals (or some other pre-determined interval) along the entire littoral cell (Blacklock Point to Bandon);
    b. Assess volumetric changes within various shoreline compartments; and,
    c. Develop contour maps of the area.

    As subsequent LIDAR flights are flown in the future (e.g. the US Army Corps of Engineers is proposing flying LIDAR in 2008), additional analyses may be performed to compare those measured results with changes identified by the earlier 1998 and 2002 LIDAR data, thus providing an important baseline as to how the area is changing over time. Such analysis will be supplemented by data derived from the beach surveying.
5) Complete a written report document the various results from the study.

We also recommend undertaking some additional monitoring efforts that could be attached to the above proposed plan, which would greatly improve our overall understanding of sediment movement in the New River area. In particular, we strongly encourage the BLM to consider undertaking bi-annual cross-sectional surveys of the New River channel at each of the beach transect sites located immediately adjacent to the river (i.e. several of the sites identified in Figure 1). In addition, we recommend the BLM pursue efforts to measure the volume of sediment that is being transported by aeolian processes adjacent to the river itself (it is quite apparent from my field visit to the site that there are significant quantities of sand being transported across the dune towards the river channel). From a management perspective, it is important to quantify the volume of such transport. In order to achieve this, we recommend establishing both vertical and horizontal arrays of sediment traps along those areas that have been actively scalped and lowered (i.e. areas with limited to no vegetation present) with several control sites located landward of unmodified portions of the dune. The sediment traps may be constructed from PVC pipe and are typically located on an arm enabling the traps to swivel and face the prevailing wind. Sediment that travels into the pipe is prevented from leaving by a fine mesh screen located near the back of the pipe, which causes the particles to drop down into a collecting jar. Accordingly, the jars can be periodically replaced by simply unscrewing them from the rest of the trap, and replacing the jar with a new one. The sample can then be returned to the office for additional analysis (e.g weighing, grain-size analysis, volume calculations etc.). The advantage of this type of system is that it is both simple and inexpensive to construct. DOGAMI staff can assist BLM staff with the design, construction and installation of the traps if BLM decides to adopt such an approach.

Attached with this document is a proposed budget to perform the LIDAR analysis, the beach surveying, and report writing.

Proposed Budget:

		Amount[1]
PERSONNEL		
Jonathan Allan – Undertake field surveys, data reduction & analysis, analysis of coastal processes (wave run-up, water levels etc.), LIDAR analysis, and reporting – 1.25 months.		$XXXXX
Deb Schueller		$XXXX
OPE COSTS (49.5% Agency Personnel)		$XXXXX
	Total Personnel	**$XXXXX**
TRAVEL		
Travel (mileage 44.5 cents/mile) ~300 miles		
- 3 trips (Travel to Bandon littoral cell from Newport)		$XXX
- Per diem (1 people, $60/day lodging & $39 M&IE, 12 days)		$ XXXX
	Total Travel	**$ XXXX**
MISCELLANEOUS COSTS		$ XXXX
Material and supplies, and report release		
Total Miscellaneous		**$ XXXX**
SUB-TOTAL		**$XXXXX**
INDIRECT COSTS (19.5%)		**$XXXX**
TOTAL		**$XXXXX**

Note: If Tim Barnes is not available for surveying, the costs increase to ~$20,500 to accommodate a field assistant.

1 Prices masked by Tim Barnes in Report Preparation

Appendix V
Meeting Summary with Dr. Komar and Dr. Allan
March 9, 2006

Date: March 30, 2006
To: WSPHRAEA ID Team Members
From: Timothy L. Barnes, RG
Re. Summary of Discussion with Dr. Paul Komar, Professor Emeritus Oregon State University and Dr. Jonathon Allan, DOGAMI, Regarding Beach Morphology of New River
Cc. File, et al

A meeting was conducted on March 9, 2006 with Dr. Paul Komar, Professor Emeritus of Oregon State University and Dr. Jonathan Allan, Coastal Geomorphologist, Coastal Section Leader, Oregon Department of Geology and Mineral Industries, Coastal Field Office. The intent of the meeting was to discuss processes present at New River ACEC (specifically within the Habitat Restoration Areas [HRA]), review research completed by Dr. Komar, review work previously submitted by BLM, and discuss the geomorphologic impacts of alternatives proposed by BLM. Both Dr. Komar and Dr. Allan have reviewed these notes. Their comments are included.

The meeting was conducted at Dr. Komar's residence south of Depot Bay. Dr. Komar received an overview of the project at New River, the work completed, and BLM's reasons for management actions that included both breaching and dune manipulation. Dr Komar expressed some concern about the use of Orr and Orr (2000) estimates of shore erosion rate of two feet per year. That estimate may be too great and too generalized.

Both Dr. Komar and Dr. Allan questioned if the returns gained in habitat justified the risk to the systems done by dune alterations. The estimates presented in Dr. Komar's original work on New River were low. The La Nina events should not be emphasized. While the 1998-99 winter storms was our most severe in terms of intense storms and high wave conditions (La Nina events), wave conditions are lower and the denser cold water of the event actually depresses the mean sea level. Therefore, planning should utilize an episode event (such as 100-year event storms) as opposed to planning for separate El Nino/La Nina events.

To this end, Dr. Allan had previously created an Extremal Significant Wave Height Distributions that depicted total water run-up elevations for a 0.08% slope. Based on this projection, the anticipated wave run-up height for a 100-year storm event could be 9.60 meters (31.50 feet). Both Dr. Komar and Dr. Allan agreed that dune heights of 31.50 would protect the New River system from detrimental overwashing during an event. However, this height would probably be excessive for planning purposes. In reality, the New River system would be amply protected by designs for a 50-year event run-up height (roughly a 25-foot high dune), and allow the dune to build naturally. This is due to the wide beach front separating the New River system from the ocean and littoral systems. Such a front would reduce the energy of incoming surges, decreasing run-up heights.

Dr. Komar and Dr. Allan reviewed the proposed alternative of relocation of the centerline of the dune from the naturally occurring European beachgrass dominated dune. The location would be on the eastern margin of the former foredune footprint. This alternative would build both naturally and artificially (by deposition of any sands graded from the HRA) sand dunes adjacent to the New River riparian areas.

This relocated dune would be allowed to revegetate and stabilized with European beachgrass. The height the dune would be allowed to "grow" to a predetermined episodic elevation (i.e. 25-foot height). Growth of the dune to that predetermined height would happen over a series of years through natural trapping of windblown sands and the placement of "grubbed" European beachgrass removed from the managed habitat areas.

The area west of the relocated foredune would be available for Plover Habitat Management, with mechanical and non-mechanical removal of invasive European beachgrass. A minimum elevation would be determined of which the managed beachfront elevation could not go below.

Both Dr. Komar and Dr. Allan had concerns with this alternative. A high risk exists with this alternative in that, without the protection of a westward foredune, the shoreline form may be altered. This would be caused by the undercutting and removal of open sands exposed to run-up as well as the grading of adjoining natural, non-managed, European beachgrass dominated dunes to the north and south of the managed HRA. Natural systems will attempt to achieve equilibriums. If the HRA dune system is artificially located and maintained to the east, the natural system will attempt to equalize this by relocating (through non-mitigated wave energy) natural dunes eastward.

Dr. Komar and Dr. Allan suggested another alternative. This alternative would allow the foredune to develop the foredune closer to the beach shore, within the center or western edge of the original footprint. This would allow the dune centerline to initially capture littoral delivered and aeolian transported sands early, allowing a build-up near the former foredune locations. A westward dune location would mimic the natural dunes, minimizing grading of the system. Open sands for plover habitat could then be maintained east of the dune, between the lee side and the riparian zone of New River. This alternative would be discussed with the wildlife biologists and the project ID team.

At the conclusion of the meeting, Dr. Allan stated that he would be sending a copy of the storm event video, providing and estimate for littoral drift sand movement monitoring, and contact Ron Shipp about LiDAR questions. Both Dr. Komar and Dr. Allan expressed an interest in staying informed about the progress of the project, with opportunity for site visits in the future.

Thank you for this opportunity to be of service. As always, if there are any questions, comments, or concerns, please call me at extension 405.

Sincerely,

/S/ Timothy L. Barnes, RG

Timothy L. Barnes, RG
District Geologist
BLM
Coos Bay District

Appendix VI
Meeting Summary with Dr. Allan
December 1, 2006

Date: December 4, 2006
To: WSPJRAEA Team
From: Timothy L. Barnes, RG
Re. Summary of Discussions, New River Field Trip, Friday December 1, 2006
Cc. File

Dr. Jonathan Allan, Coastal Geomorphologist, Coastal Section Leader, Oregon Department of Geology and Mineral Industries (DOGAMI), Coastal Field Office, and Tim Barnes, Coos Bay BLM, participated in a field trip to the New River Habitat Restoration Area (HRA) on Friday, December 1, 2006. The purpose of the site visit was to allow Dr. Allan an on-site familiarity of the management actions, natural processes, and current condition of the foredune area and a former breach. The field review occurred via pedestrian survey and kayak in the northern portion of the HRA to the Croft Lake Breach (opened in December 2004).

The review did not formulate any new problems or theories for Dr. Allan, but did confirm some of his previous concerns with the management activities.

- Current elevations would allow generalized overwashing in storms as large as the 1998-1999 systems. Such overwashing could place a great deal of sand into the New River system. Designed run-over elevations do not need to be at the 100-year event scale (31.50 feet), but at less, possibly ~25 feet (5-10 year scale). This would allow some overwashing (a natural occurrence), but minimize the risk of a total loss of the system.

- There is a large aeolian sand movement at the site. This was indicated by the recent burial of European beachgrass (EBG) at the northern edge of the HRA, in the unmanaged dunes. Other sites along the coast have shown up to three feet or greater of burial. Such volumes as indicated by the burial of the EBG on site are not limited to the northern end of the HRA, but common throughout all of the open sand. As such, similar volumes of sand are likely being transported into the river (and possibly beyond), becoming a supply to the river's bedload. This is indicated in the river system by the unchannalized "sheet-flow" characteristics of the river in the unstabilized and new dune sections of the foredune as opposed to the channalized characteristics of the river in the stabilized and older dune sections of the foredune.

- Based on the observed movement of sand, Dr. Allan suggested utilizing an aeolian sediment monitoring system developed by one of his colleagues currently working in Australia. The system is very simple and will give a quantitative measurement of sand transport. The collection stations should be set at various locations on both the east and west side of the river along both vegetated (control sites) and unvegetated reaches of the river. These would give a more accurate measurement of sand movement than the current arrays that have been established. Dr. Allan will contact his colleague and request information on the designs.

- The proposed location of a buffer dune may add additional sand to the river, especially if the dune is not stabilized. The unstabilized dune would act as a sediment source for both aeolian and oceanic processes to the river system. Beyond a sediment source itself, the dune could act as a "ramp" in the saltation process of sand movement (where particles move by a combination of bouncing and floating), increasing the volume of sand movement. To reduce the risk of the dune enhancing sand movement, it must be stabilized, initially with artificial methods such as jute and/or coconut matting, and eventually with aggressive, sand-holding vegetation.

- The location of the proposed centerline may have impacts to the total geomorphology of the local shoreline. The typical conceptual model of coastal response is one of erosion in the winter followed by beach and dune rebuilding in the summer. However, since the extreme winter storms of the late 1990s, much of the coast exhibits little evidence of post-storm recovery. This means that some sections of the coast remain in a degraded state making them more susceptible to the effects of future storms (Note: this condition may be reflected in this year's monitoring of the New River Spit, which indicates lower beach elevations and landward recession of the mean shoreline position). Maintaining an artificial centerline to the east, built from material in the original foredune centerline (material stored by the oceanic process during the summer, to be utilized in erosion during the winter) could "starve" the littoral system, by reducing the volume of sediment needed by the ocean to counteract the effects of large wave events. Waves and currents would then utilize material directly from the beachface, which could cause the beach to migrate inland, as well as begin erosion and removal of the unmanaged foredunes to the north and south of the HRA. Dr. Allan suggested that to reduce this risk, the centerline of the buffer dune should be approximately center of the spit itself (it was discussed that this may not be adequate for plover restoration. The discussion focused primarily on the geomorphological impacts.).

- Reoccurring, consecutive breach openings may create a new permanent mouth to New River, especially in combination with other processes.

- In summary, the management activities have re-created a dynamic system that was in place and controlled the surf interface, foredune creation, deflation plain, and inland sand deposit before the river was there. Current management of open sand and breaching could cause the river to infill with sand completely to the north (the HRA area), forming a sand plain, and create a new mouth to the south at a reoccurring breach. Inland sand deposition from the sand plain in highly vegetated areas would probably not reactivate a dune sheet, although there may be some sand accumulations. Continued removal of sand from the oceanic systems could result in an easterly migration of the surf interface. The aeolian and oceanic sand intrusion impacts into the river may be temporarily reduced by dredging of the river or a strategically placed breach. However, the infusion of sand will continue.

Dr. Allan will put together a proposal for dune monitoring that can be performed by DOGAMI. This proposal will include transects through the focus area of the New River ACEC as well as other areas north and south. The study area would extend from Cape Blanco to Bandon. If such a monitoring approach is desirable, it would be advisable to invite other stakeholders to participate, in both the program and the costs. This project would be an outstanding opportunity for Graduate study. As such, we will look at the BLM policy for graduate funding.

Dr. Allan would be available for another site visit with other specialists, to understand better all of the resource values associated with the project.

Thank you for this opportunity to be of service and to offer suggestions on the analysis. As always, if there are any questions, comments, or concerns, please call me at extension 405.