2016 Beach Condition and 5 Year Summary of the 2011 Nourishment Project

Nags Head Board of Commissioners Meeting

High Value Services
Sustainable Solutions
CSE
COASTAL SCIENCE & ENGINEERING

5 October 2016

Outline of the Presentation

1 – Review of Post-Project Monitoring Efforts

- Permit Requirements
- Scope of Work

2 – Project Performance

- Volume analysis methodology
- Monitoring results

3 – Five Year Summary

Part 1 – Review of the Post-Project Monitoring

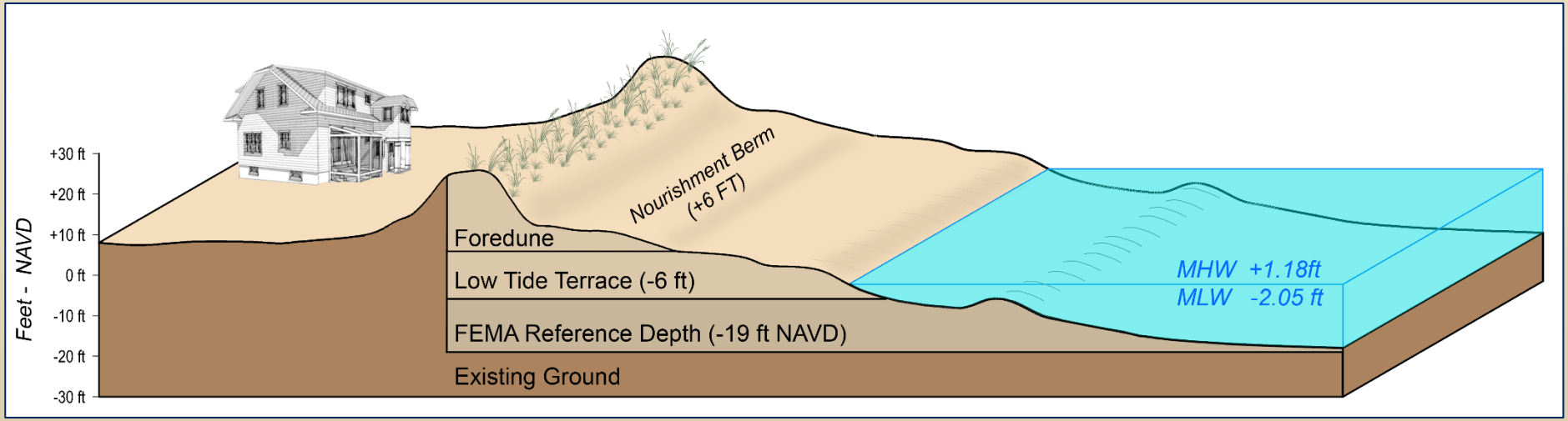
- Required by state and federal permits
- Prerequisite for FEMA's post-storm beach restoration funding

Scope of Work:

- Compaction tests for 3 years (2012-2014)
- Semi-annual condition surveys in Year 1 (2012)
- Annual condition surveys in Years 2-5 (2013-2016)
- Sediment sampling in Years 2 & 4 (2013 & 2015)
- Aerial orthophotos in Year 3 (2014)
- Annual oblique aerial & ground photos (2012-2016)
- Annual monitoring reports (2012-2016)
- Biological studies and reports in Years 1 & 2 (2012-2013)* *(*Conducted by CZR)*

Part 2 – Project Performance – Methodology

Beach Condition Analysis – *"The Littoral Sand Box"*



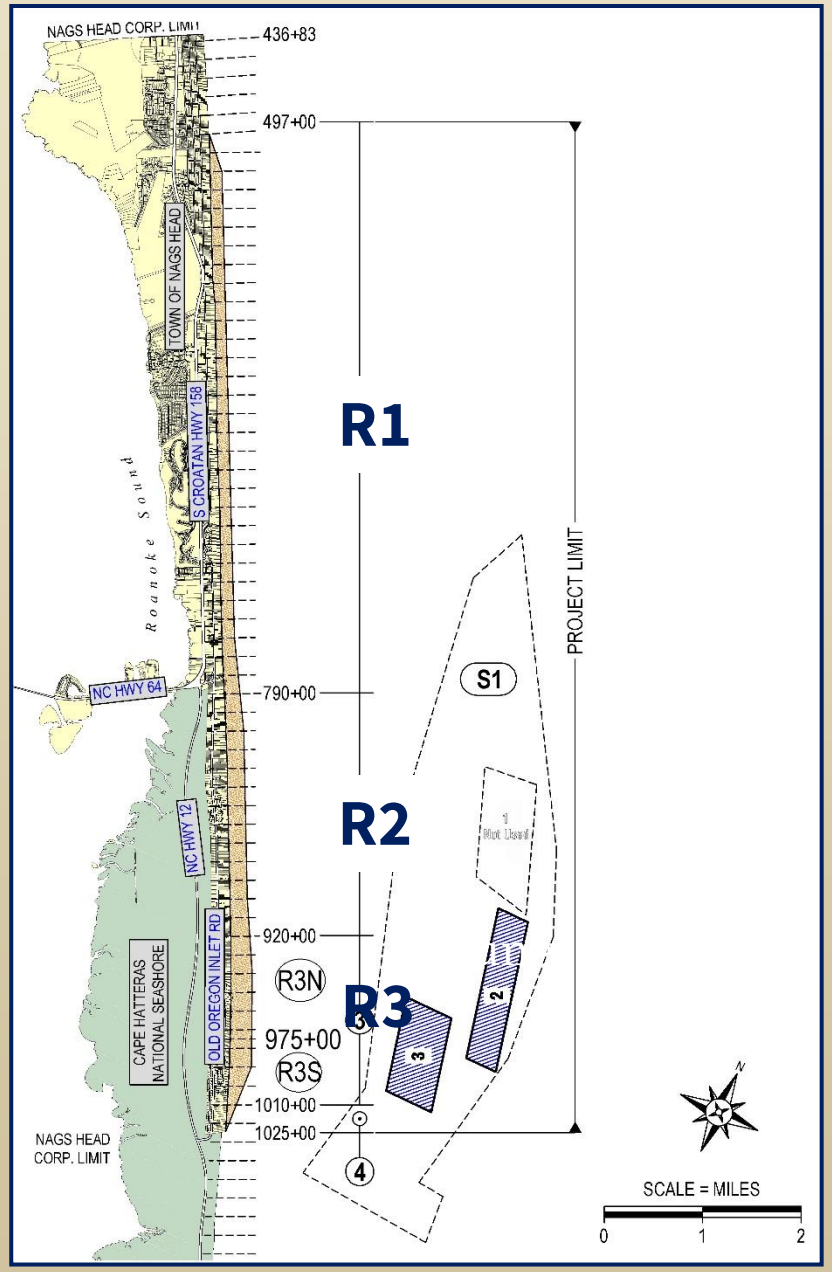
Lens 1 – ***Foredune*** – From the ~crest of dune to +6 ft NAVD*

Lens 2 – ***Beach*** – Between +6 ft and -6 ft NAVD

Lens 3 – ***Underwater*** – Between -6 ft and -19 ft NAVD

**NAVD-North American Vertical Datum of 1988 = ~mean sea level*

Project Reaches and Subreaches



- Reach 1 – MP 11 to 16.8

  497+00 to 790+00
- Reach 2 – MP 16.8 to 19.2

  790+00 to 920+00
- Reach 3 – MP 19.2 to 20.8

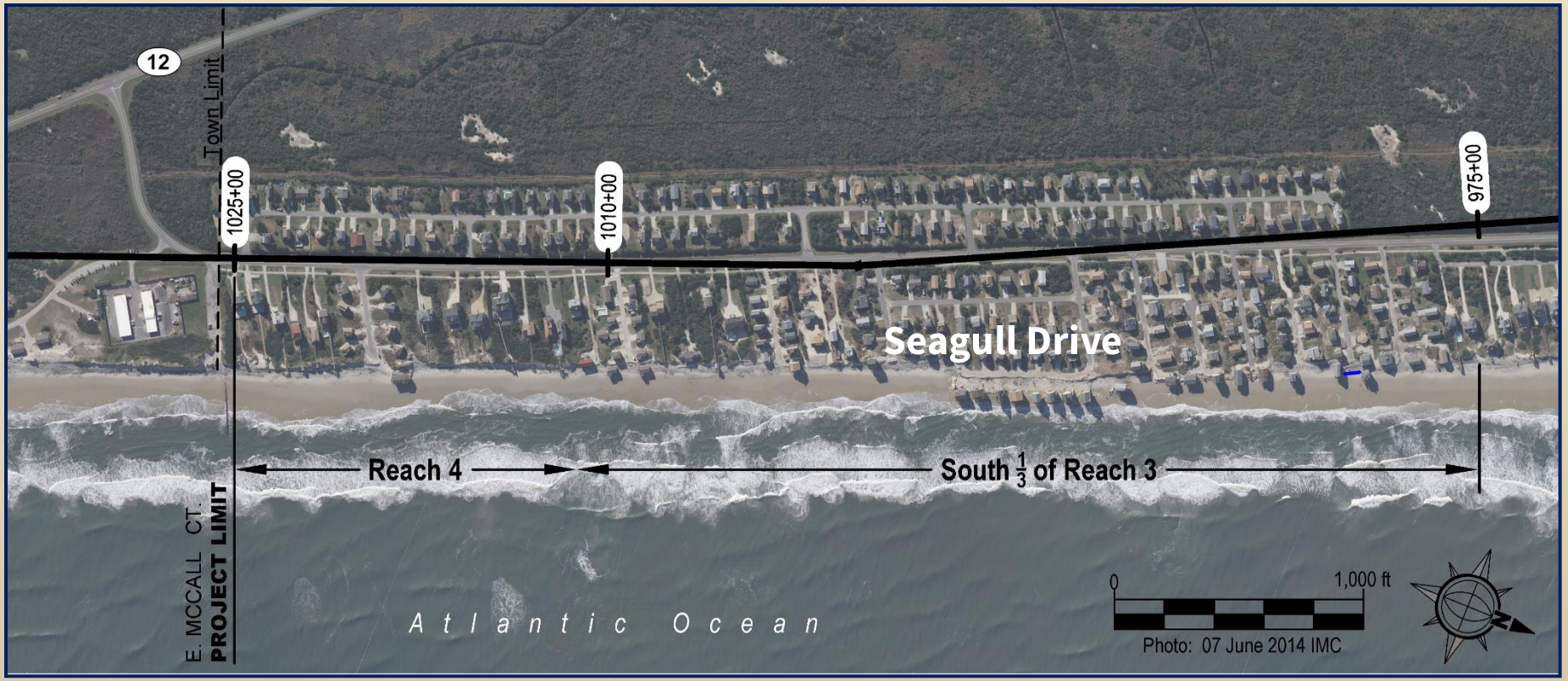
  920+00 to 1010+00
  - R3N – MP 19.2 to 20.2

    920+00 to 975+00
  - R3S – MP 20.2 to 20.8

    975+00 to 1010+00
- Reach 4 – MP 20.8 to 21

  1010+00 to 1025+00

Subreaches in Reach 3



Part 2 – Project Performance

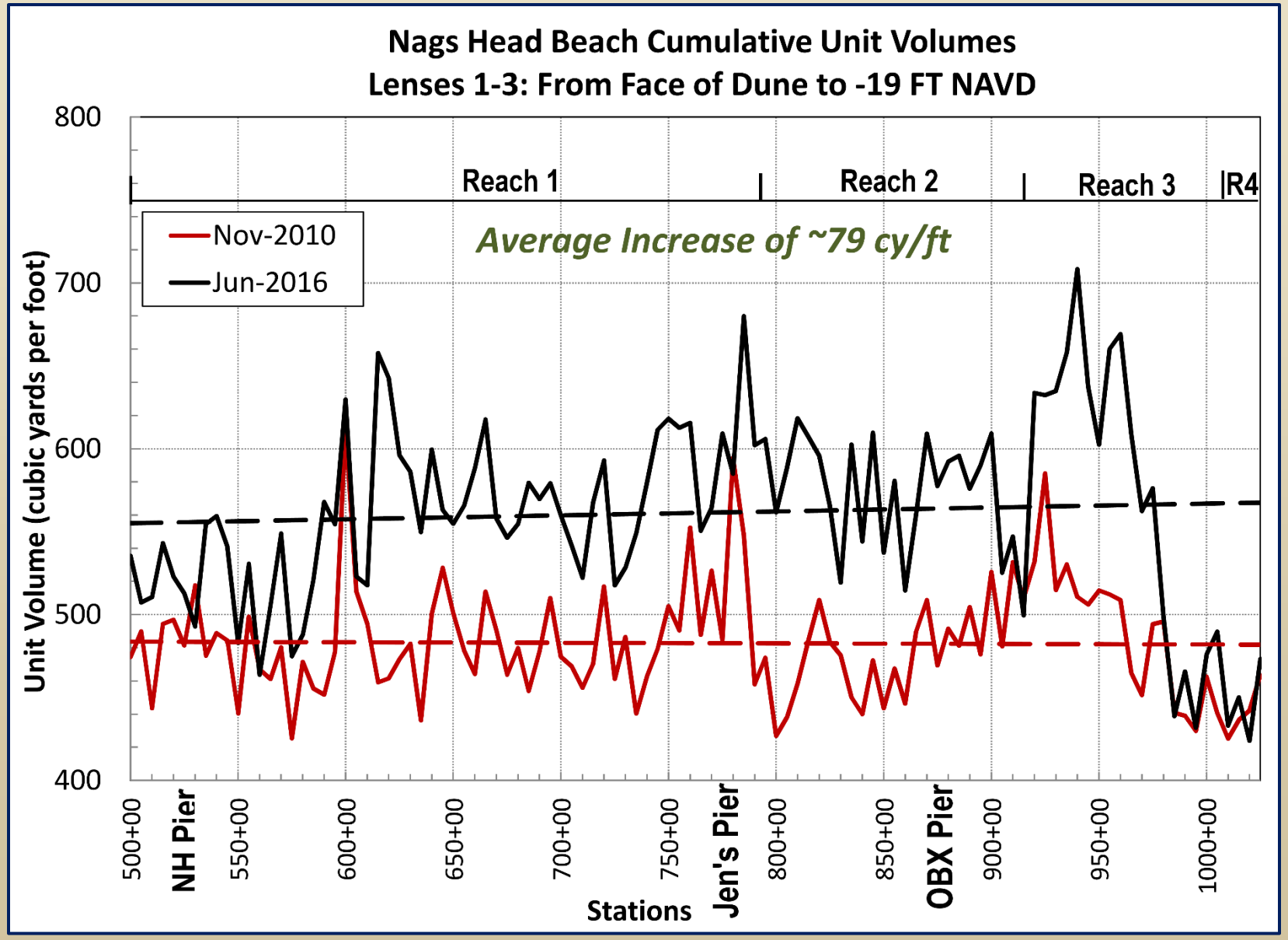
Results include:

- Sand volumes by station along Nags Head
- Volumes by reach and subreach
- Dune growth along Nags Head
- Beach width by 1-mile averages

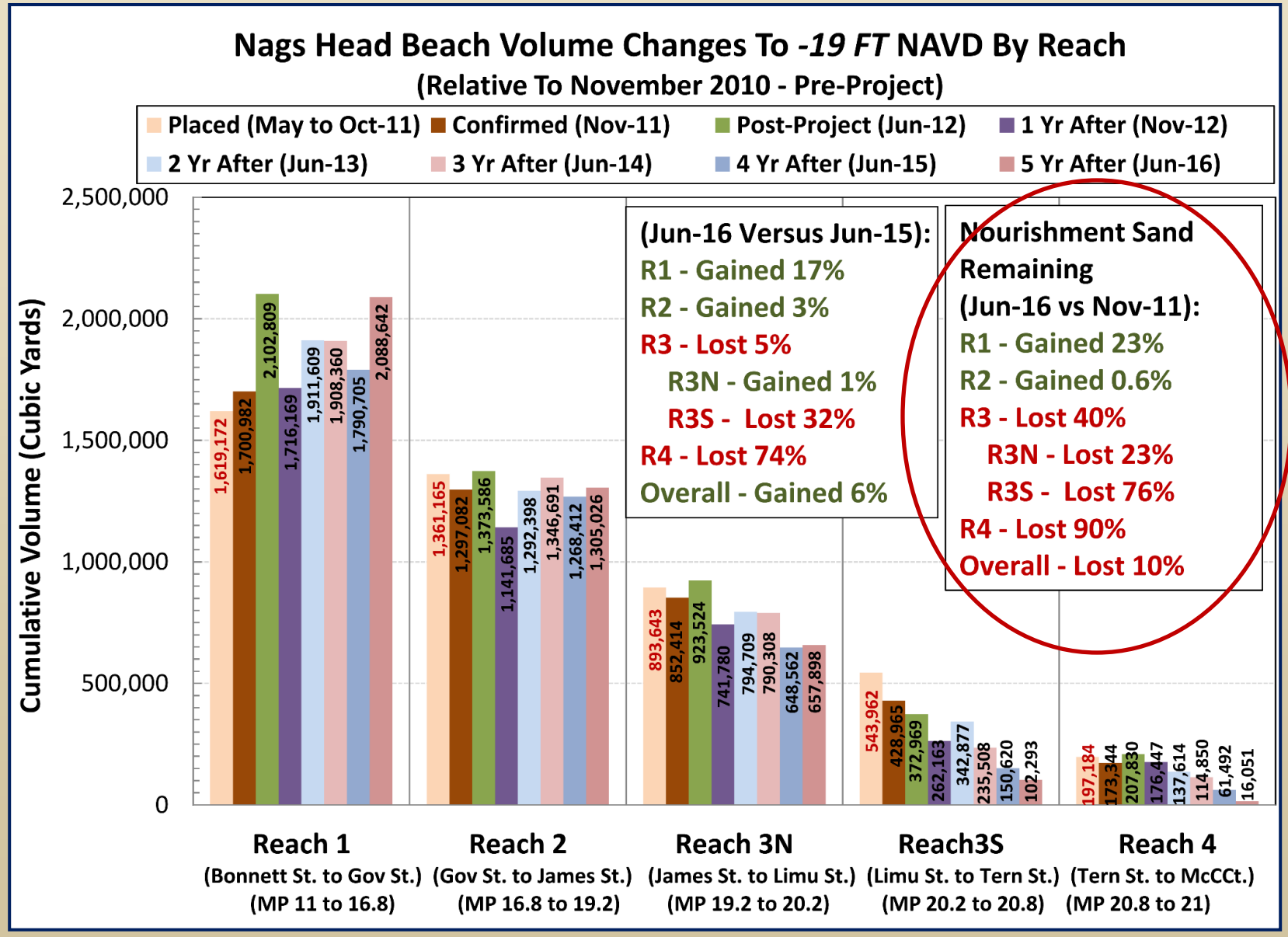
Results compared to:

- Pre-nourishment condition (2016 vs. 2010)
- Previous years (eg - 2016 vs. 2015)
- Historical analysis

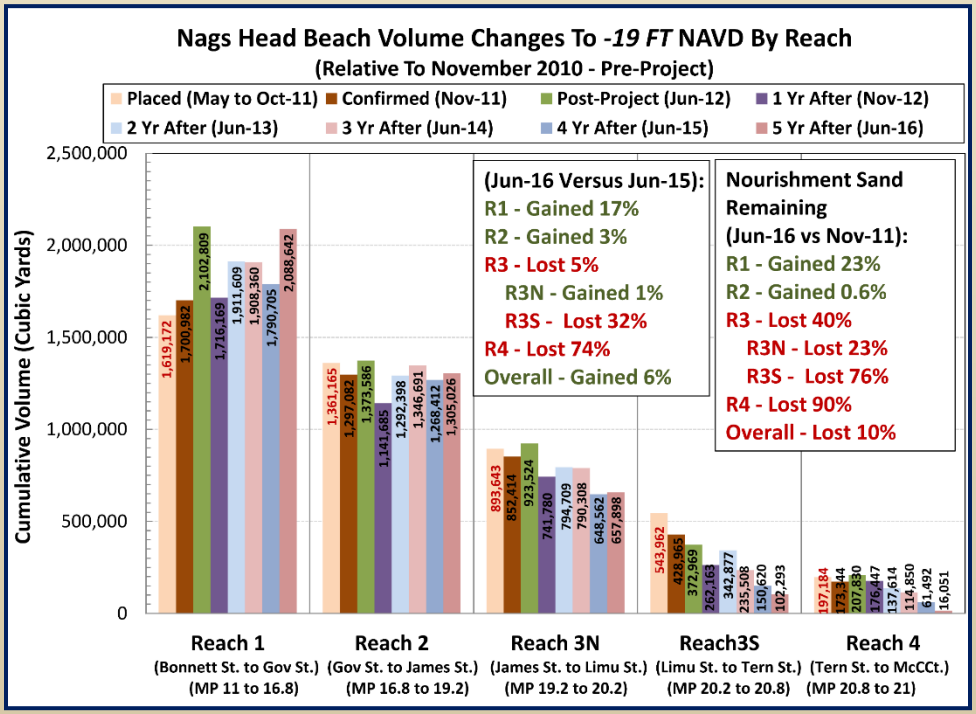
Results –Sand Volumes by Station along Nags Head



Results – Total Volume by Reach and Subreach



Volume Loss along South Nags Head (June 2016 vs. Project Completion in Nov 2011)



- Reach 1 – Gained
  ~390,000 cy (2.8 cy/ft/yr)
- Reach 2 – Stable
- Reach 3N – Lost
  ~200,000 cy (8 cy/ft/yr)
- Reach 3S – Lost
  ~320,000 cy (20 cy/ft/yr)
- Reach 4 – Lost
  ~160,000 cy (23 cy/ft/yr)

Reaches 3&4 lost ***~680,000 cy*** in 5 years

Results Compared to Historical Analysis

- First data set in 1994 – Lack of historical data
- Estimated annual erosion rate by the USACE*: ***900,000 cy/yr***
- Adopted annual erosion rate by CSE**: ***275,000 cy/yr***
- Actual annual erosion rates since project completion have **varied**

Max erosion rate: ~500,000 cy/yr (2012 to 2013)

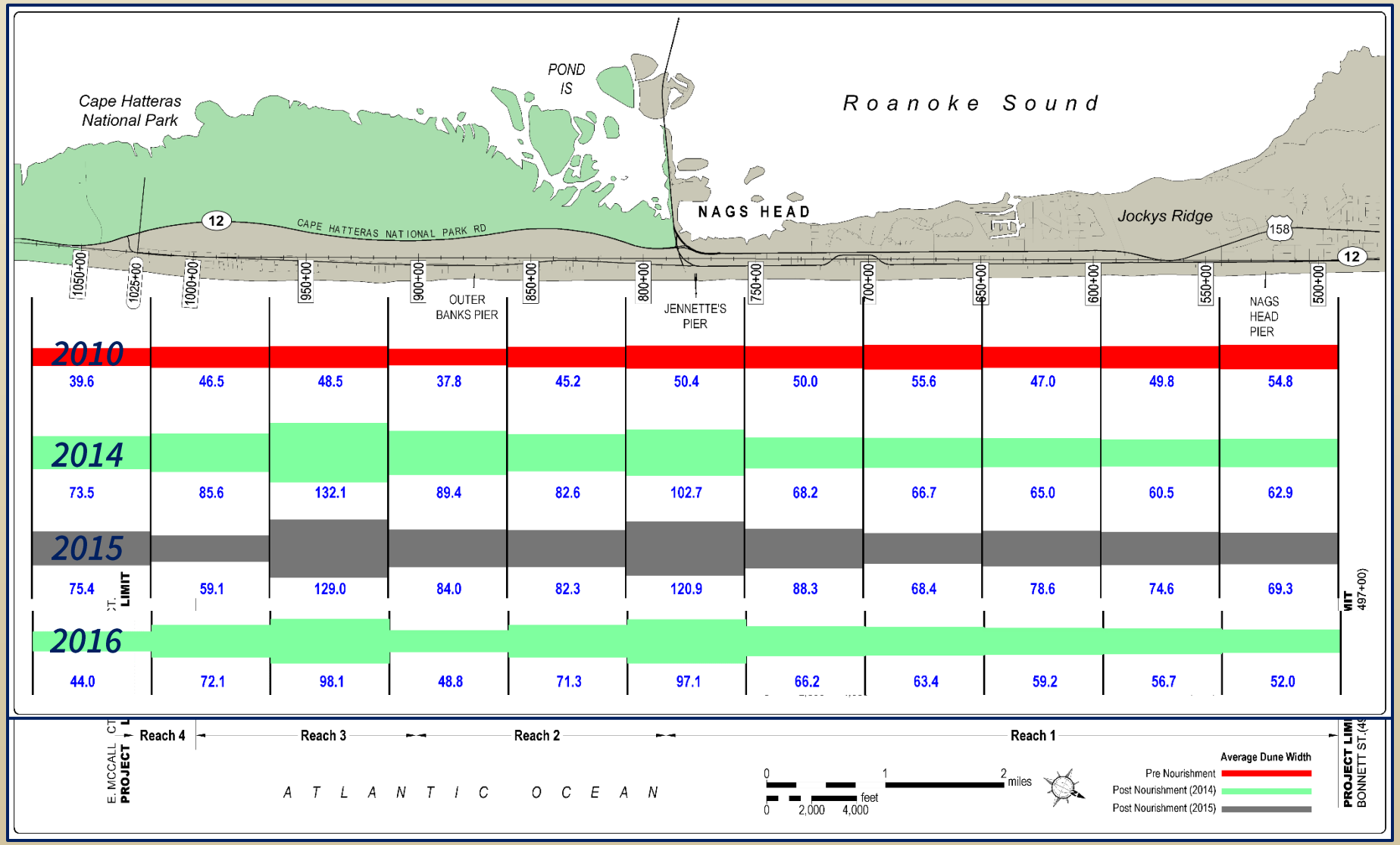
Max accretion rate: ~250,000 cy/yr (2015 to 2016)

Average change erosion at ***100,000 cy/yr***

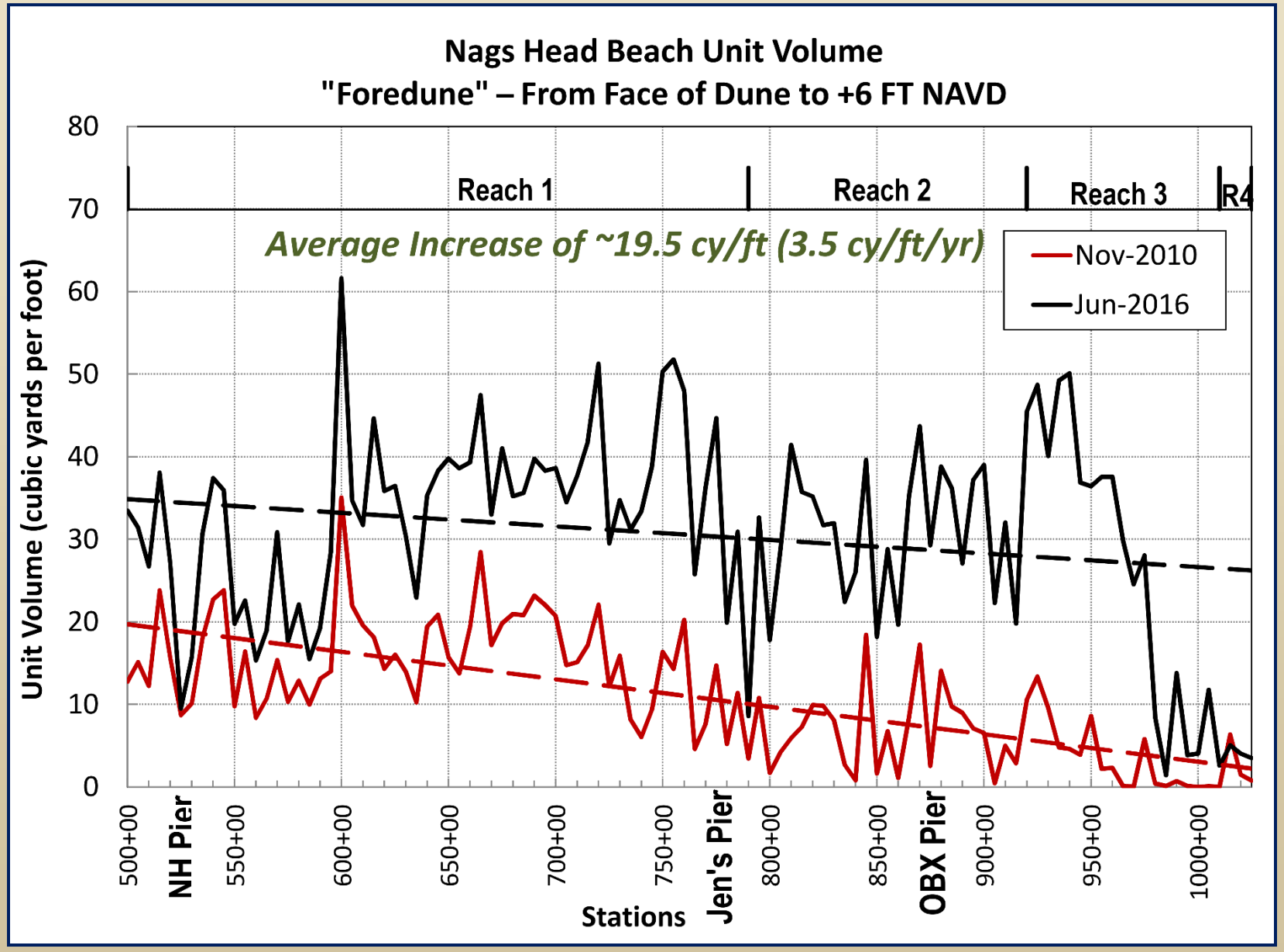
**USACE 2000. Final feasibility report and environmental impact statement: Dare County beaches.*

*** CSE 2005 & 2011. Preliminary and final design reports for beach nourishment at Nags Head.*

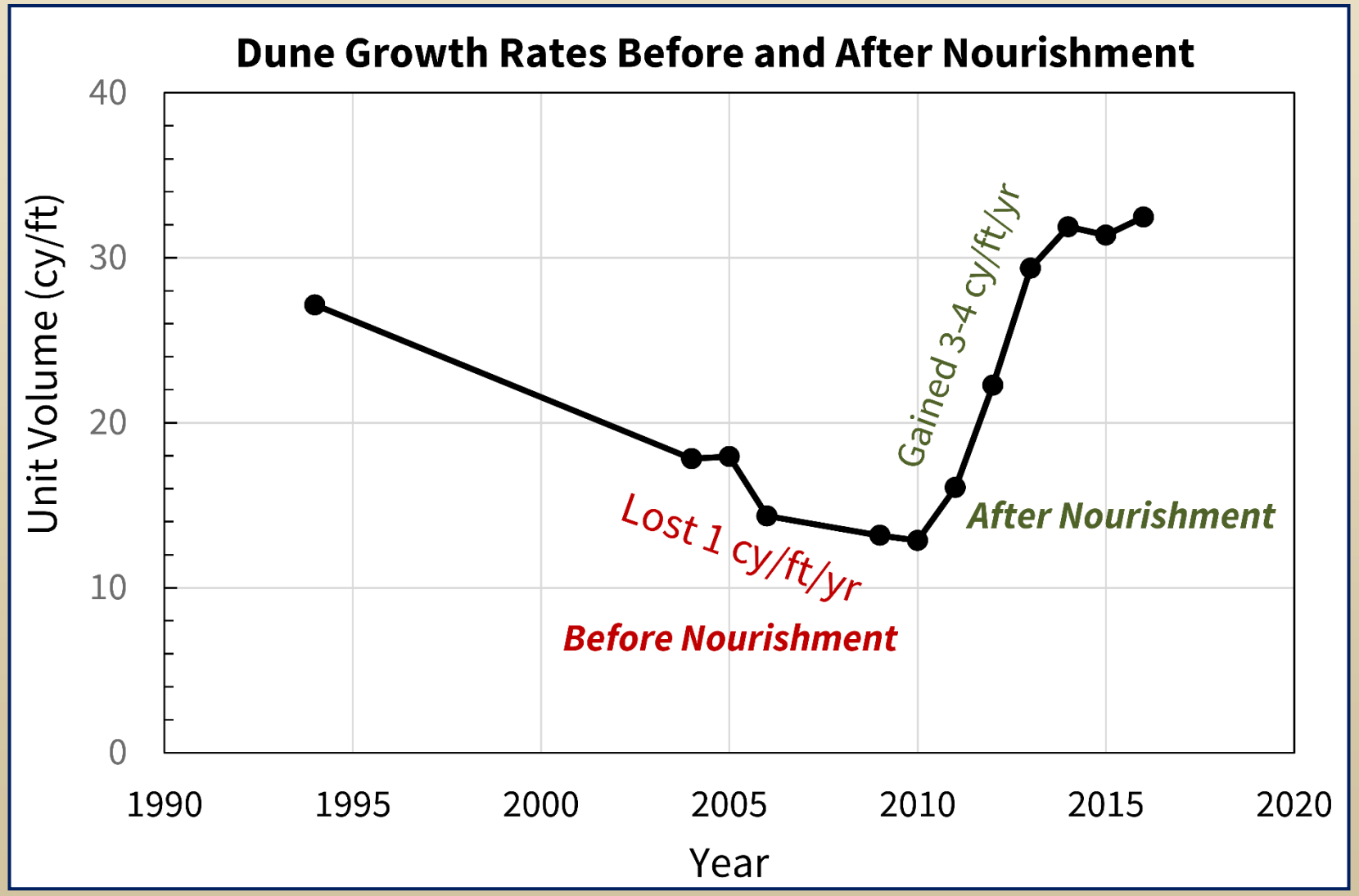
Results – Beach Width by 1-Mile Average



Results – Dune Growth along Nags Head



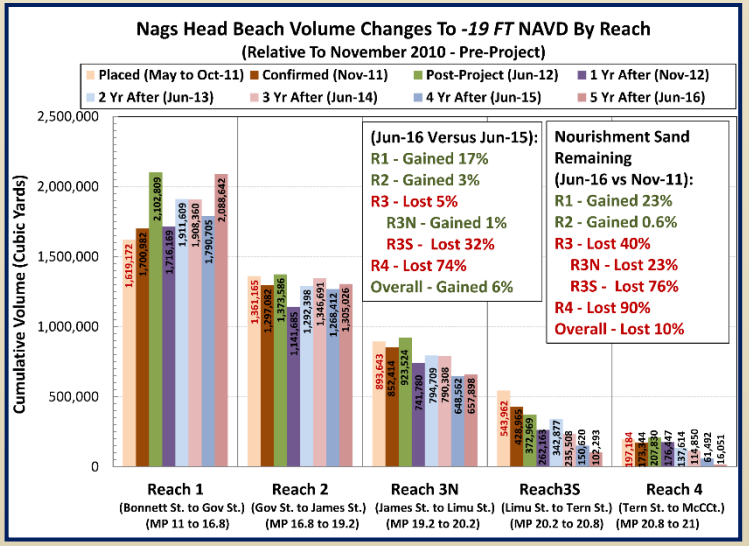
Results – Dune Behavior Before/After Nourishment



Nags Head Post-Nourishment Dune Growth

5 Year Summary – 2011 to 2016

- Overall lost 10% of nourishment sand
- North ~5.8 miles gained ~390,000 cy
- Middle to south ~2.4 miles were stable
- South ~1.8 miles lost~680,000 cy



Nourishment CAN:

- Provide wide beach
- Provide the source to natural dune growth
- Reduce damage under storms

Nourishment CANNOT:

- Stop chronic erosion
- Reduce high erosion rate in south Nags Head
- Control aeolian sand movement and sand destination

Moving Forward:

- Adequately address south Nags Head erosion issue
- Integrate dune management plan into the renourishment design