10. Cumulative Impacts

The Council on Environmental Quality regulations define “cumulative impact” as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (Council on Environmental Quality 1987).

For the purpose of determining the cumulative impact, the study area was defined as the City of Rehoboth and the surrounding waters that may be impacted by the discharge of effluent, roughly the area shown in Figure 10-1. This area extends far beyond the 1:10,000 dilution contours shown in Section 6.5.8.6 of this report. As discussed in Chapter 4, the preferred alternative, for RBWWTP effluent disposal is an ocean outfall. Past, present, or proposed projects within the study area that may result in cumulative effects when combined with the ocean outfall were investigated. The no action alternative could potentially suffer from cumulative impacts if discharges are added to the Lewes-Rehoboth Canal or Rehoboth Bay, however, the no action alternative is not proposed. The cumulative impacts of land application were not evaluated because, although this alternative was considered in the EIS, the location of land application is unknown, and therefore the cumulative impacts for that alternative could not be determined.

10.1 Actions Affecting Resources of Concern

10.1.1 Past Activities and Projects

10.1.1.1 Beach Replenishment

Beach replenishment has been conducted in Delaware since 1957 and in Rehoboth since 1962 (Western Carolina University 2005). Beach replenishment enhances the beach profile and allows for better stabilization and coast protection while also improving recreational use by increasing the size of the beach, and protecting the shoreline from erosion (Moffatt & Nichol 2007). A summary of beach replenishment in Delaware and Maryland is presented in Table 10-1.

Figure 10-1 Cumulative Impact Study Area

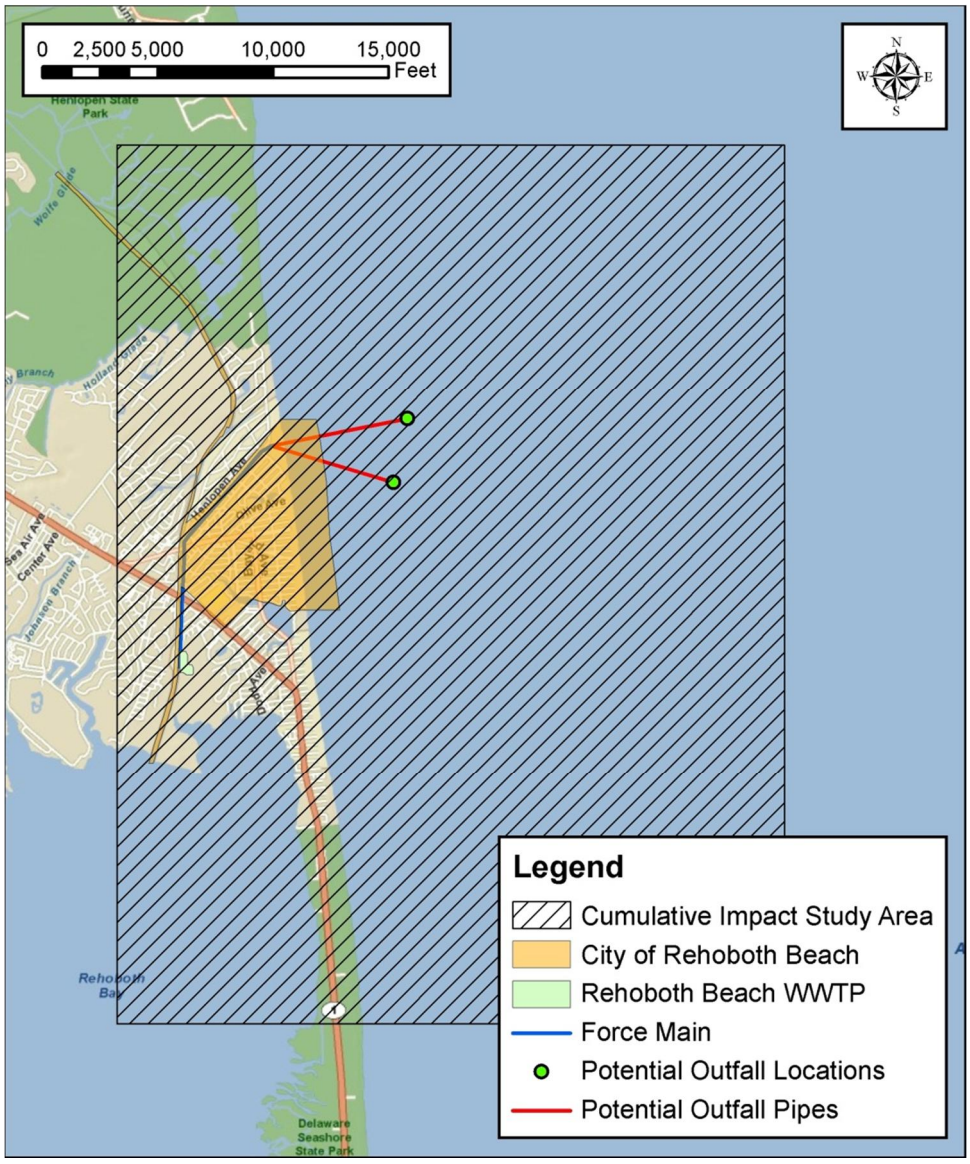


Table 10-1 Beach Replenishment Projects (Western Carolina University 2005)

Beach	Year	Volume (cubic yards)
Beach Plum Island, DE	1994	15,000
Bethany Beach, DE (Beach Cove)	1962	106,780
Bethany Beach, DE	1961	100,000
	1962	69,700
	1989	284,500
	1992	219,735
	1994	184,452
	1998	321,700
Bowers Beach, DE	1998	101,405
Broadkill Beach, DE	1999	36,205
Dewey Beach, DE	**1957**	**512,400**
	1962	**82,000**
	1993	**5,755**
	1994	**14,004**
	1994	**578,874**
	1998	**453,500**
Fenwick Island, DE	1962	67,600
	1988	333,500
	1991	126,800
	1992	37,000
	1992	37,000
	1992	144,900
	1994	68,236
	1998	141,100
Fenwick Island, DE (York Beach)	1962	297,700
Fort Miles, DE	1962	95,400

Beach	Year	Volume (cubic yards)
Indian Beach, DE	1962	148,700
	Information not available	4,800
Kitts Hummock Beach, DE	1996	32,580
Lewes Beach, DE	1998	80,898
North Indian Beach, DE	1994	21,000
North Indian River Inlet, DE	1961	48,000
	1962	290,000
	1963	590,300
	1965	90,000
	1972	774,300
	1974	*Information not available*
	1975	142,500
	1978	535,400
	1982	223,900
	1984	540,000
	1990	175,000
	1991	68,900
	1992	40,000
North Shores, DE	1962	69,400
	1998	188,100
Pickering Beach, DE	2001	27,150
Rehoboth Beach, DE	**1962**	**216,200**
	1998	**274,300**
Rehoboth Beach & Dewey Beach, DE	**2005**	**1,700,000** [1]
Rehoboth Beach, Dewey Beach, Bethany Beach, South Bethany Beach, & Fenwick Island, DE	**2011**	**363,000** [2]
Sea Colony, DE	1998	128,000

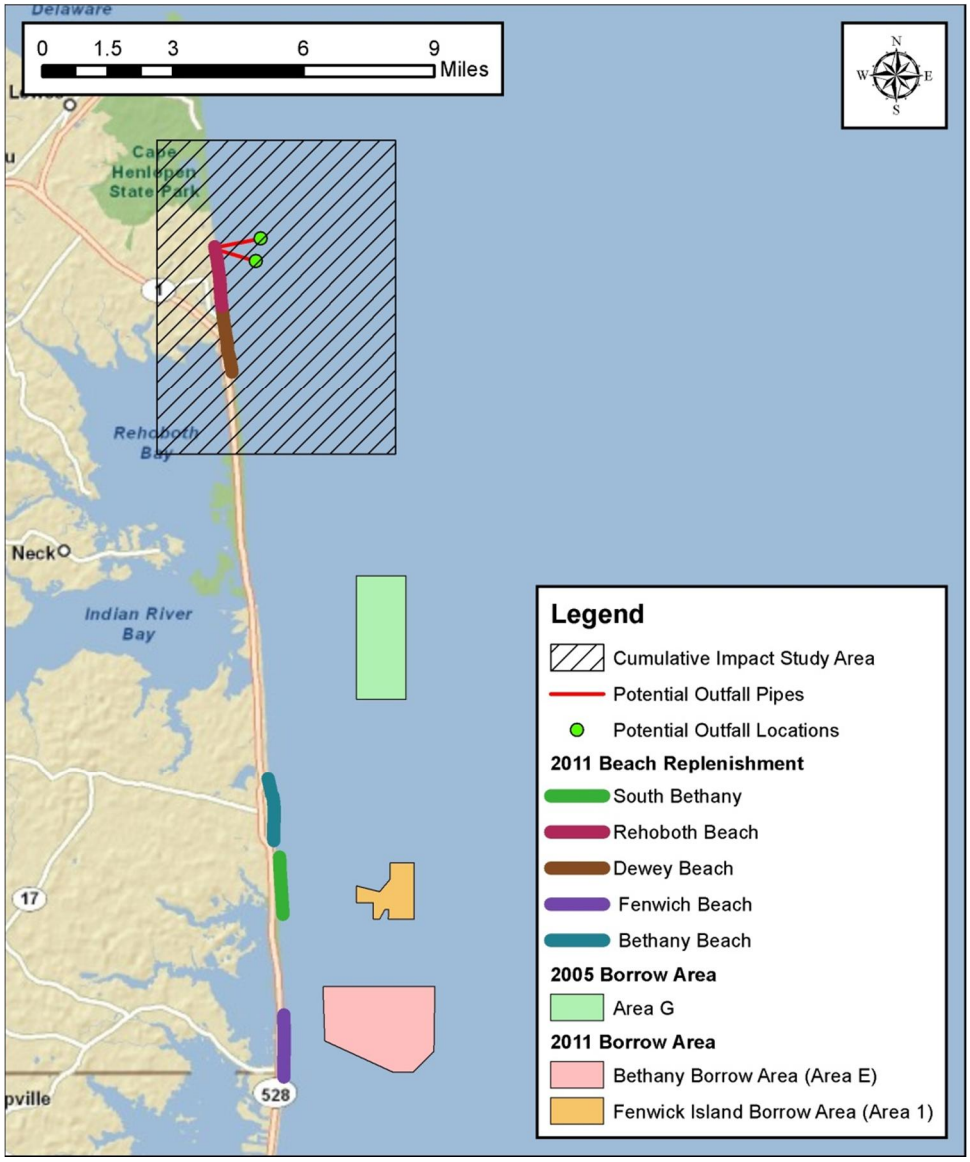
Beach	Year	Volume (cubic yards)
South Bethany, DE	1989	231,600
	1992	192,749
	1994	98,419
	1998	168,900
South Bethany, DE (York Beaches)	1962	65,000
South Bowers, DE	1998	10,300
Assateague Island, MD	2003	2,000,000
Ocean City, MD	1963	1,050,000
	1988	2,700,000
	1991	3,800,000
	1992	1,221,388
	1993	223,515
	2002	700,000
	2005	700,000 [3]

Notes:

1. Approximate. Source: (Rehoboth Beach-Dewey Beach Chamber of Commerce 2005)
2. Source: (Dredging Today 2012)
3. Approximate. Source: (URS Group, Inc. 2010)

In the past decade, two replenishment projects have deposited sand on Dewey Beach and Rehoboth Beach. In 2005, sand was pumped from borrow Area G, approximately 2.6 miles (4.2 km) east of the Indian River Inlet, to 2.5 miles (4.0 kms) of beach extending from the northern end of Rehoboth Beach to the southern end of Dewey Beach (Rehoboth Beach-Dewey Beach Chamber of Commerce 2005). Multiple beaches along the Delaware coast were replenished in 2011, including Bethany Beach, Rehoboth Beach, Dewey Beach, and Fenwick Island. Sand for Rehoboth Beach and Dewey Beach was taken from the Fenwick Island Borrow Area (Area 1); however, additional beach replenishment utilized sand in the Bethany Borrow Area (Area E). The locations of borrow areas used in 2005 and 2011 are presented in Figure 10-2. The closest borrow area used is over 7.5 miles away from the proposed RBWWTP outfall site, far outside of the study area.

Figure 10-2 2005 and 2011 Beach Replenishment Projects (USACE 2004) (USACE 2010)

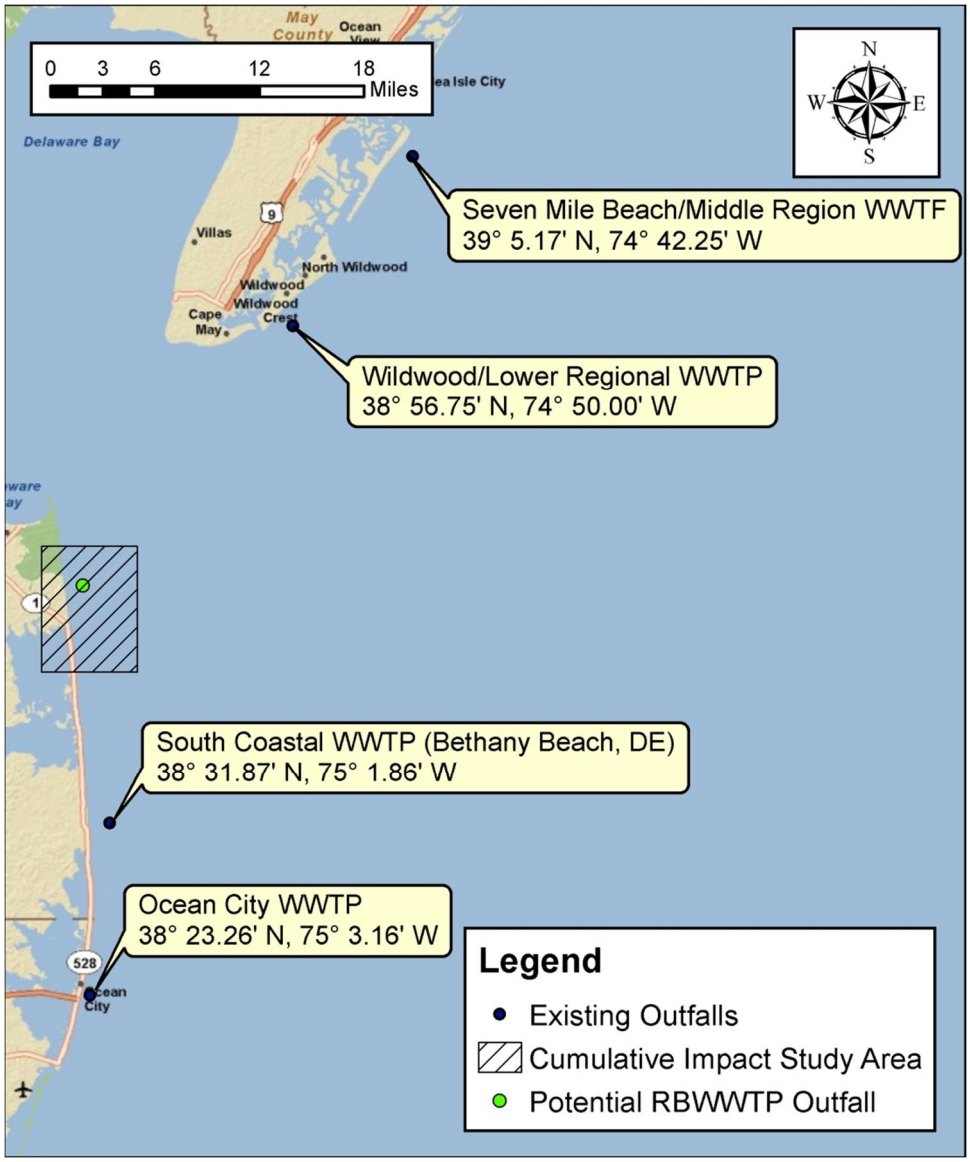


10.1.1.2 Treated Effluent Discharge

No ocean outfalls currently exist off the coast of Rehoboth Beach. Nearby ocean outfalls discharging treated effluent are shown in Figure 10-3. All existing ocean outfalls are far outside the study area. The South

Coastal WWTP ocean outfall, located off the coast of Bethany Beach, is the closest to the proposed RBWWTP outfall at 13 miles (21 km).

Figure 10-3 Existing WWTP outfalls (Clean Ocean Action 2001) (USEPA 1992)

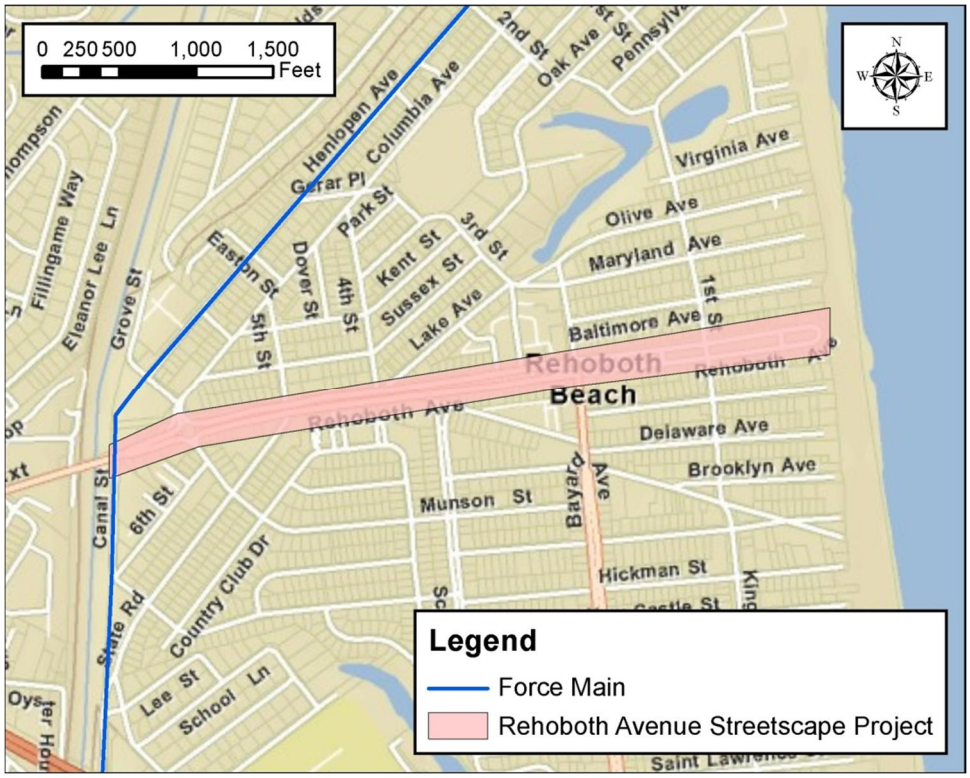


10.1.1.3 Rehoboth Avenue Streetscape Project

Construction of the Rehoboth Avenue Streetscape Project began in October 2002 and concluded in June 2006. During the three phases of the project, various improvements were made to the mile long stretch of Rehoboth Avenue between the Lewes Rehoboth Canal and the boardwalk. Improvements included new and widened sidewalks, landscaping, utility relocation, traffic calming, parking reconfiguration, and

construction of a new pavilion and replica lighthouse (Deleware Department of Transportation 2006). The proposed forcemain will cross Rehoboth Avenue near Canal Street, as shown in Figure 10-4.

Figure 10-4 Rehoboth Avenue Streetscape Project



10.1.1.4 Indian River Inlet Bridge

The new 2,600 foot (793 meter) Indian River Inlet Bridge spans the 950 feet Indian River Inlet, located approximately 8 miles (12.9 kilometers) south of the proposed RBWWTP outfall. Construction of the bridge began in 2008, and the bridge opened to traffic on January 20, 2012. Final demolish of the existing bridge will be completed by Spring 2013 (Delaware Department of Transportation 2012).

10.1.2 Present Activities

Present and ongoing activates within the study area include recreational water use and fishing. Neither of these present significant impacts to water quality. Currently, no commercial fishing is done within the study area.

10.1.3 Future Projects

While it is anticipated that additional beach replenishment will be required within the study area in the future, no specific beach replenishment projects are planned at this time.

At one time it was anticipated that NRG Bluewater Wind would construct a wind farm more than 13 miles off the coast of Delaware, extending just south of Cape Henlopen to just south of the Indian River Inlet (NRG Bluewater Wind 2012). However, at this time, a lack of private and public funding has resulted in NRG Bluewater Wind withdrawing from the proposed power purchase agreement, and there are no expectations for construction of any wind farms off the coast of Delaware in the near future (Hurdle 2011). Similarly, there are no plans for offshore oil or gas extraction within the study area.

No major commercial construction is expected within the study area. For the most part, the City of Rehoboth is built-out, and there is no land available for additional development. Construction of the RBWWTP ocean outfall will not increase the treatment capacity of RBWWTP, and thus will not encourage any additional growth or redevelopment of existing structures.

10.1.4 Climate Change

According to the U.S. Climate Change Science Program, "Increasing atmospheric concentrations of greenhouse gases, primarily from human contributions, are *very likely* warming the atmosphere and oceans. The warmer temperatures raise sea level by expanding ocean water, melting glaciers, and possibly increasing the rate at which ice sheets discharge ice and water into the oceans" (2009). The Intergovernmental Panel on Climate Change has projected that global sea levels will likely rise between 7 and 23 inches (19 and 59 centimeters) by the end of the century (2090 to 2099), relative to the base period (1980 to 1999) (U.S. Climate Change Science Program 2009).

10.2 Potential Cumulative Impacts

With the exception of the RBWWTP ocean outfall discussed within this report, no projects have occurred recently or are anticipated to occur in the near future within the project study area. While there are environmental impacts of construction and operation of the RBWWTP ocean outfall, as discussed in Chapters 7 through 9 of this report and summarized in Table 10-2, it is not anticipated that the impacts will accumulate over time with impacts from other projects if proper mitigation techniques are utilized.

Existing beach replenishment borrow areas and other ocean outfalls discharging treated effluent are far outside the study area and the anticipated extent of impacts from the RBWWTP outfall. Onshore, all land disturbed during construction of the forcemain and outfall piping will be returned to the existing cover, and all components will be below grade. Thus, there will be no increase in impervious surface, which could contribute to increased runoff. All marine components of the outfall will be either below grade or on the ocean bottom, therefore rising sea levels will not have a direct impact on the outfall. Future beach replenishment to counteract the impacts of erosion and rising sea levels may be required. The area around the RBWWTP ocean outfall pipe and diffuser will no longer be available for use as a borrow area.

Table 10-2 Summary of Environmental Consequences of Ocean Outfall Alternative

	Potential Short Term / Temporary Impacts	Potential Long Term Impacts
Physical Environment		
Air Quality/Odor	Emissions of construction vehicles and equipment. *Expected to be minor.*	None.
Soils/Groundwater	Disruption of soils from construction. *Expected to be minor.*	None.
Surface Water Quality/Quantity	Increased erosion and sedimentation during construction. *Mitigate with silt fencing and other erosion control methods* Potential increased turbidity. *Expected to be localized and minimal.* Potential for frac-out. *Best management practices will be implemented.*	Contaminants in wastewater enter the ocean. *Effluent treated to a high level. Model predicts rapid dilution to background levels.*
Floodplains	Disruption of 100 yr floodplain along alignment and at HDD staging area. *Expected to be minor.*	None.
Prime Agricultural Land	None	Potential for growth and disturbance if treatment capacity increased. *RBWWTP capacity will not increase.*
Biological Environment		
Terrestrial Biota/Habitat	None. *Forcemain predominately follows existing utilities and roadways and will be directionally drilled under sensitive areas.*	None.
Wetlands Biota/Habitat	None.	None.
Benthic Biota	Disruption of communities due to dredging. *Benthic resettling and recolonization are expected to occur rapidly. Benthic biota sampling would be done before and after construction.*	Disturbance from effluent. *Effluent treated to a high level and rapidly diluted. Studies show biota diversity remains high and communities are not characterized as degraded due to effluent discharge.*

	Potential Short Term / Temporary Impacts	Potential Long Term Impacts
Phytoplankton	Increased turbidity due to dredging, decreasing sunlight. *Potential mortality due to construction not expected to be greater than natural rates.*	None. *Effluent rapidly dispersed.*
Submerged Aquatic Vegetation	None.	None.
Fish	Physical injury to fish or disruption of food resources due to dredging. *Fish are highly mobile and migratory. Construction activity will only disturb a small fraction of the total EFH area.*	Disturbance from effluent. *Effluent treated to a high level and rapidly diluted. Fish are highly mobile and migratory, thus any exposure to contaminant transient and minimal.*
Marine Mammals	Disruption of communities due to dredging, including sound produced by construction equipment. *Construction during winter months will mitigate impact to dolphins. Seal habitats will be avoided by utilizing HDD. Construction equipment will be selected to minimize sound intensity and duration.*	Disturbance from effluent. *Effluent treated to a high level and rapidly diluted. Mammals are highly mobile and migratory, thus any exposure to contaminant is transient and minimal. Outfall not located in area of high mammal diversity.*
Sea Turtles	Physical injury due to dredging. Dredging methods will low impact to sea turtles (cl*amshell or CSD) will be used. Construction to during winter months will minimize impact.*	Disturbance from effluent. *Effluent treated to a high level and rapidly diluted. Sea turtles are highly mobile and migratory, thus any exposure to contaminant is transient and minimal.*
Human Environment		
Growth and Development	Disruption due to construction. *Expected to be minor.*	Potential for growth and development if treatment capacity increased. *RBWWTP capacity will not increase.*
Community Facilities	Disruption due to construction. *Expected to be minor.*	None. *Public utility service will not be interrupted.*

	Potential Short Term / Temporary Impacts	Potential Long Term Impacts
Economics	Disruption due to construction. *Expected to be minor. Impact to tourism and retail minimized by construction during winter months.*	Reduced tourism due to negative public perception. *No noticeable difference in tourism to nearby beaches before and after construction of an ocean outfall.*
Public Health	Effects inherent to all construction activity. *Expected to be minor.*	Public exposure to contaminants within effluent. *Effluent reduced to contaminate standards/limits within zone of initial dilution*
Noise	Noise from construction. *Expected to be minor. Noise of dredging far offshore and masked by surf background noise.*	None.
Historic/Archeologic	Impact to historical sites along alignment. *Mitigated by utilizing HDD techniques near know sites.* Impact to submerged cultural resources. *Magnetometer and side-scan sonar survey performed, and no conflict with cultural resources expected.*	None.
Aesthetics/Recreation	Disruption of beaches along forcemain alignment, at staging area, and offshore due to construction. *Impact minimized by winter construction. Trenching ships and barges far enough offshore to not have direct impact on beach visits.*	Contamination of ocean. *Effluent treated to a high level and rapidly diluted. Outfall over a mile from shore, where swimming and fishing is not likely.*