

# CONSTRUCTION COMPLETION REPORT

## MIRROR LAKE DOVER, DELAWARE

### Prepared For:

Department of Natural Resources &  
Environmental Control  
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March 2014

### Prepared and Submitted By:



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**BrightFields File: 0985.64.52**



## INTERNAL QUALITY CONTROL SHEET

This Construction Completion Report (CCR) has been prepared by BrightFields, Inc. (BrightFields) for the Delaware Department of Natural Resources and Environmental Control (DNREC). This CCR was prepared and reviewed by the following BrightFields personnel:

Prepared By:

A handwritten signature in blue ink, appearing to read "Daniel J. Hartnett II", written over a horizontal line.

Daniel J. Hartnett II  
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Reviewed and Approved By:

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Jeff Vance  
Program Manager

Reviewed and Approved by:

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Marian Young  
Project Director

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# **CONSTRUCTION COMPLETION REPORT**

## **MIRROR LAKE REMEDIATION AND RESTORATION**

### **DOVER, DELAWARE**

#### **1.0 INTRODUCTION**

BrightFields, Inc. (BrightFields) was retained by the Delaware Department of Natural Resources and Environmental Control (DNREC) to plan and manage the remediation and restoration activities at Mirror Lake in Dover, Delaware.

DNREC's goal is to lift the current fish advisory at Mirror Lake. This goal is being accomplished by the placement of a layer of activated carbon, with a product called SediMite™, onto lake bottom sediments to sequester the existing contaminants so they are no longer bio-available to fish and aquatic organisms. After this remediation, new clean sediments will later deposit above the carbon treated layer. Carbon is also being placed into the sediments of the St. Jones River downstream of Mirror Lake approximately to Court Street, which is a distance of approximately 900 feet.

Restoration activities include creating an intertidal wetland on the east side of Mirror Lake, placement of coir logs to stabilize the west bank of the lake, and the installation of two rock vanes to direct the natural stream channel flow around the wetland area.

The success of the remediation will be monitored for several years by DNREC and their partner, Dr. Upal Ghosh, of the University of Maryland - Baltimore County. DNREC plans to lift the fish advisory as soon as analytical data indicate that it is safe to do so.

#### **1.1 Site Description**

The site is comprised of 4.9 acres which includes Mirror Lake and the tidal St Jones River downstream to approximately Court Street. The lake is located near the intersection of East Loockerman Street and Park Drive in Dover, Delaware (Fig. 1).

#### **1.2 Site Background**

Mirror Lake is part of the St. Jones River system and has a large contributing watershed. Until the 1970s, there were little to no federal or state regulations regarding the release of toxic

chemicals. Like many other rivers, the St. Jones River system became contaminated with polychlorinated byphenyls (PCBs) and other industrial chemicals. PCBs were discovered in the Mirror Lake sediments through various core sample studies. Although Federal law now bans the manufacturing and distribution of PCBs, the level of contamination in the sediments are still high enough to impact the fish and wildlife that live in and around the river.

## **2.0 REMEDIAL ACTION GUIDANCE DOCUMENTS**

### **2.1 Remedial Design**

DNREC and Dr. Ghosh conceived of the Mirror Lake remediation and restoration project. DNREC retained Biohabitats, Inc. to prepare a conceptual design plan for the remediation and restoration of Mirror Lake. This was followed by a full construction plan set that was delivered in July, 2013.

BrightFields and Corrado Construction performed a constructability review of the design in December 2012. A meeting was held on January 9, 2013 to present recommendations for several revisions including: forgoing the construction of the wetland bench on the west side of Mirror Lake due to the expected dynamic behavior of soft sediments following placement of the sand overburden; and finding an alternative for the Porta Dam system, which would have significantly increased the duration of the project. Additional discussions following the meeting led to a minor revision of the location of the fill for the east side intertidal wetland bench. As a result of the January meeting and subsequent discussions, Biohabitats made all recommended revisions to the final plan set delivered July 31, 2013.

### **2.2 Sediment and Erosion Control Plan**

An Erosion and Sediment Control Plan to guide the remediation and restoration work was prepared by Biohabitats as part of the Remedial and Restoration Plan set. The Erosion and Sediment Control Plan was approved by DNREC's Sediment and Stormwater Program prior to the commencement of land disturbing activities. An Erosion and Sediment Control Preconstruction meeting was held on October 1, 2013 to discuss the Approved Plan.

### **2.3 Health and Safety Plan**

The site-specific Health and Safety Plan (HASP) (BrightFields, 2013) for this project described the potential physical and chemical hazards that could be encountered during remediation and the methods to safely manage these hazards while protecting site workers and the residents living on surrounding properties from potential exposure to impacted sediment during remediation activities. The HASP outlined the requirements for air monitoring during SediMite™ spreading activities and the air monitoring action levels that would require the implementation of engineering controls (such as dust suppression). The HASP also included requirements for safe operation of, and working around, heavy earth-moving equipment, and working safely in and around the water, including boat operation. All volunteers working on boats were required to attend a tailored 1 hour boater safety course, instructed by personnel from Delaware's Division of Fish and Wildlife, prior to commencement of work.

### **3.0 REMEDIAL ACTION ACTIVITIES**

Remediation of the lake sediments was performed by uniformly spreading SediMite™, an activated carbon product, throughout the entirety of the lake and downstream channel by use of a telebelt, induction air horn, Vortex spreaders, and by hand. The SediMite™ application was completed in ten days.

#### **3.1 Site Preparation**

Sediment and Erosion control methods were implemented as outlined in the plans according to the Delaware Erosion and Sediment Control Handbook prior to lake remediation and restoration work. Silt fence and orange construction fence were installed around the perimeter of all areas to be disturbed during construction activities. A stabilized construction entrance (SCE) was installed on the east and west side. Geotextile fabric was placed throughout the construction areas and covered by approximately 1 foot of mulch to provide a base for temporary construction vehicle traffic and operation, while protecting the land surface below. Turbidity curtain was installed around the perimeter of the intertidal wetlands and rock vane work area to keep sediments from traveling up or down stream.

SediMite™ was shipped to Dover and stored at a local industrial facility, courtesy of the owner. As it was transferred to the project site, it was kept in storage containers on the west side of the lake. All other materials were stockpiled on the east side in the designated stockpile areas as outlined in the plans including stone for the rock vanes and sand for the intertidal wetlands.

### **3.2 Remediation**

The remediation of the lake sediments was done by uniformly spreading SediMite™ throughout the lake and the downstream area. SediMite™ was spread from the bank of the lake using a telebelt, and from boats on the lake through the use of an induction air horn, Vortex spreaders, and by hand (Fig. 3).

- The telebelt used a hopper and belt system to evenly distribute the SediMite™ over a large area in uniform rows.
- The induction air horn used compressed air to create a vacuum which could distribute the SediMite™ with an approximate range of 15 feet to 20 feet.
- Vortex spreaders used gravity fed hoppers and a leaf blower to distribute the SediMite™ over an approximate range of 10 feet to 15 feet.
- Spreading the SediMite™ by hand allowed for increased maneuverability in the boats during downstream remediation efforts.

### **3.3 Restoration**

The restoration of the lake and surrounding areas included the pruning of plants along the east and west banks, conversion of the existing sandbar on the east side to an intertidal wetland, the reinforcement of the west bank with coir logs and mulch, and the installation of two rock vanes upstream of the intertidal wetlands.

- The banks along the lake and upstream areas were pruned in order to remove all invasive species and to aid in the remediation and restoration of the lake.
- The existing sandbar was enhanced to create an intertidal wetland on the east bank.
- Rock vanes were constructed upstream of the wetlands to assist in directing the natural flow of the thalweg.

The wetlands are being planted in 5 separate zones. Zone 1 was successfully planted and matted in early November 2013 to ensure the structural integrity of the toe of the intertidal wetland along the channel. Zones 2, 3, 4, and 5 were not needed for structural support and will be

planted in Spring 2014 once the weather is suitable for good growth (Fig. 2). The west bank was reinforced by placing two stacked 16 inch diameter coir logs along the bank and placing mulch in the voids between the coir logs and the bank. In total, about 400 linear feet of shoreline were stabilized through coir log placement. All of the restoration methods help to reduce erosion and enhance the natural beauty of Mirror Lake.

### **3.4 Stabilization**

At the completion of the remediation and restoration efforts silt fence, mulch, and stabilized construction entrances were removed upon the consent of DNREC. The disturbed areas on the east and west sides of the lake were seeded and stabilized. Stabilization was done with the use of biodegradable straw matting, compost logs, and straw waddles. Certified Construction Review (CCR) reports were started during December 2013 and will continue until 70% germination can be documented throughout the site.

### **3.5 Operations and Maintenance**

Maintenance of the project area will begin in April 2014, for a period of 3 years. Red Tail Restoration & Land Management, LLC was retained to provide professional services to improve and maintain the ecological health of the natural areas buffering Mirror Lake in Dover, Delaware in support of the Mirror Lake restoration project. Targeted services of the agreement include:

- Selectively removing invasive plants in the cleared areas to support a native plant buffer to Mirror Lake.
- Removing invasive plants from existing forested buffer areas as time permits.
- Working with volunteers to plant native plants in the Spring of 2014.
- Supporting general conservation efforts relating to the Mirror Lake restoration project as mutually agreed upon by the Land Manager and Brightfields, Inc.
- Providing a photograph record taken from the same location/vantage in the Spring, Summer, and Fall in each of the 3 years of the agreement.
- Working with the City of Dover to educate staff on invasive plant management.

This maintenance agreement will be reassessed at the end of each year for a period of 3 years.

#### **4.0 COMMUNITY RELATIONS**

Community relations were an important element in the successful implementation of the Mirror Lake remediation and restoration project. DNREC's public outreach process included:

- Providing notification to state legislators and representatives of Kent County
- Press releases describing the project goals, approach and schedule
- Providing notification to the local residents and businesses through civic associations
- Holding public meetings to explain the project and to respond to questions
- Door-to-door interactions with surrounding residents
- Posting multimedia website and social media presentations describing the project
- Site signage explaining the remediation and the project partners
- Taking elected officials on a walk to show them the project
- Press conference on November 7, 2013 with Governor Jack Markell

Before the project began, DNREC Project Managers went door-to-door in the local neighborhood on three separate occasions to increase public awareness about the project, including when the work would begin and how long it would last.

A public meeting was held in August 2012 for all Dover residents and anyone who was interested in the project.

A website as well as “YouTube” videos were created online to help explain and visually identify different aspects of the project for the public. The “YouTube” videos can be found using the following weblinks:

- <http://www.youtube.com/watch?v=gplVE07eUq4>
- <http://www.youtube.com/watch?v=l88oE6aTHK8>

Governor Jack Markell, EPA Region 3 Administrator Sean Garvin, DNREC Secretary Collin O'Mara, City of Dover Mayor Carlton Carey, DNREC Directors, and representatives from the Philadelphia Army Corps of Engineers, Kent County government and other stakeholders visited the project site on November 7, 2013 to learn about the remediation process and participate in a press event. That event was covered by several local and regional news outlets, including TV, radio, and newspapers.

## **5.0 SUMMARY OF LABOR AND MATERIALS**

As of December 2013 all activities associated with the remediation and restoration of Mirror Lake were completed, with the exception of the wetland plantings in zones 2, 3, 4, and 5.

### **5.1 Labor Summary**

Throughout the remediation and restoration of Mirror Lake, many groups and individuals volunteered their time to assist with the project.

Site preparation was performed during the first month of work in October 2013. BrightFields performed 186 hours of onsite labor and oversight, including coordinating trucking and material deliveries and unloading and securing SediMite™ deliveries, as well as 66 hours of offsite preparation including meetings and office work. In addition, BrightFields contributed 167 volunteer hours for the installation of the Erosion and Sediment controls.

The Sussex Conservation District (SCD) and Meadville Land Service, Inc. (Meadville) were hired to assist with the site preparation, including the installation of the mulch road and lay down areas (SCD) and the installation of the rock vanes and coir logs (Meadville).

There were 61 volunteers from DNREC offices, BrightFields, Americorps, Sussex County Correctional Boot Camp (SCC), and the Inter Faith Mission. Throughout the one month remediation and restoration process a total of 551 hours were donated from DNREC volunteers, and 770 hours were donated from the Americorps, SCC Boot Camp, and Inter Faith Mission volunteers, see . The volunteers assisted with the clearing of brush along the lake banks, loading and spreading of the SediMite™ from boats on the lake, daily site clean up throughout the project area, and the planting for all Zone 1 plants in the intertidal wetlands.

### **5.2 Materials Summary**

The following quantities of materials were used during the project:

- A total of 158,381 pounds (~79 tons) of SediMite™ was used to cover the sediments in the lake and downstream channel.
- The intertidal wetland was created over an area of approximately 20,000 square feet using over 1,325 tons of sand.

- The two rock vanes were installed using 120 tons of large stone and riprap.
- The construction entrances and mulch access roads were constructed using over 80 tons of 3-inch stone and 560 cubic yards of mulch.
- 800 linear feet of 16-inch diameter coir logs were placed along the west bank.
- Over 3,000 plants were planted and 7 rolls of coir matting were placed in Zone 1 of the wetland habitat.
- During the last two weeks of work BrightFields placed 250 pounds of grass seed, 37,800 square feet of erosion control matting, and 550 linear feet of 8-inch compost logs.

Upon completion of the construction portion of this project, all materials that could be re-used were donated to public organizations that provided support in some capacity to the project.

- 200 linear feet of 16-inch diameter coir log was given to-DNREC's Drainage Section.
- 500 linear feet of turbidity curtain was given to-DNREC's Shoreline and Waterway Section.
- 400 linear feet of silt fence was given to-City of Dover's Public Works Department.
- 80 tons of stone from the construction entrances was given to-City of Dover's Water Department.
- 560 cubic yards of mulch from the access roads was given to-City of Dover's Parks Department.

## **6.0 CONSTRUCTION SUMMARY**

The Mirror Lake Remediation and Restoration Project took many months of planning and preparation to ensure proper techniques were employed and to ensure that a timely schedule was kept (Table 1). Prior to the in-lake work, there was one month of onsite preparation, including: the installation of over 500 feet of silt fencing, over 1,000 feet of orange construction fencing, and 600 feet of turbidity curtain surrounding the existing sandbar. The mulch access roads and construction entrances were built, and the SediMite™ was stockpiled in storage containers.

As of December 2013 all of the remediation work and almost all of the restoration work was completed except for the planting of the wetland habitat zones 2, 3, 4, and 5.

The onsite work consisted of multiple coordination efforts on both the east and west banks of the lake. Throughout the remediation work, volunteers were given daily briefings on health and safety issues as well as direction to work together on land and in boats to spread the SediMite™ and keep work areas clean. Volunteers typically worked 5-8 hour days (depending upon tides), Monday through Friday, to ensure that the remediation work was completed on schedule.

SediMite™ was spread using the telebelt, induction air horn, Vortex spreaders, and by hand. The telebelt was on site for 5 full 8 hour days, including two days of down time due to a broken cable on the extension arm. It was the most efficient method of application and was able to broadcast approximately 40 tons of SediMite™ during the 3 operational days on the east and west sides. The telebelt was also used to place all of the sand used for the intertidal wetland restoration. The induction air horns were used on land and in the boats to evenly spread the SediMite™ along the banks of the lake as well as in the areas which were not accessible with the telebelt (e.g. under overhanging trees). Transect lines and 20 foot by 20 foot grids were used to mark application areas. Induction air horns were able to apply approximately 3-4 tons of SediMite™ in an 8 hour work day. SediMite™ was applied to downstream areas using Vortex spreaders, induction air horns, and by hand spreading. Hand spreading was an efficient method of application but required more boat maneuvering to uniformly spread the SediMite™ over the entire area. The Vortex spreaders were less efficient than other methods used and were cumbersome to use while on a boat. However, hand spreading and Vortex spreaders were able to spread 4-5 tons of SediMite™ in an 8 hour work day (see Figure 2).

The stabilization of work areas around the lake, including the removal of all silt fence and orange construction fencing was completed prior to any stabilization with approval from DNREC officials. Approximately 37,800 square feet of biodegradable straw matting and 250 pounds of grass seed were placed on all disturbed areas throughout the site over 9 days. There will be continual site reviews until 70% stabilization is reached throughout the site.

The remaining restoration will be completed in Spring 2014, under the direction of DNREC, including planting zones 2, 3, 4, and 5. There will also be continued monitoring of the lake habitat and water conditions to determine the lasting effects of this project and the possible future applications of SediMite™ to other impacted streambed ecosystems in the State.

## 7.0 REFERENCES

Ghosh, U.; Greene, R., 2012, In-situ Treatment of Mirror Lake Sediments to Reduce Uptake of Pollutants in the Food Chain, May 2012

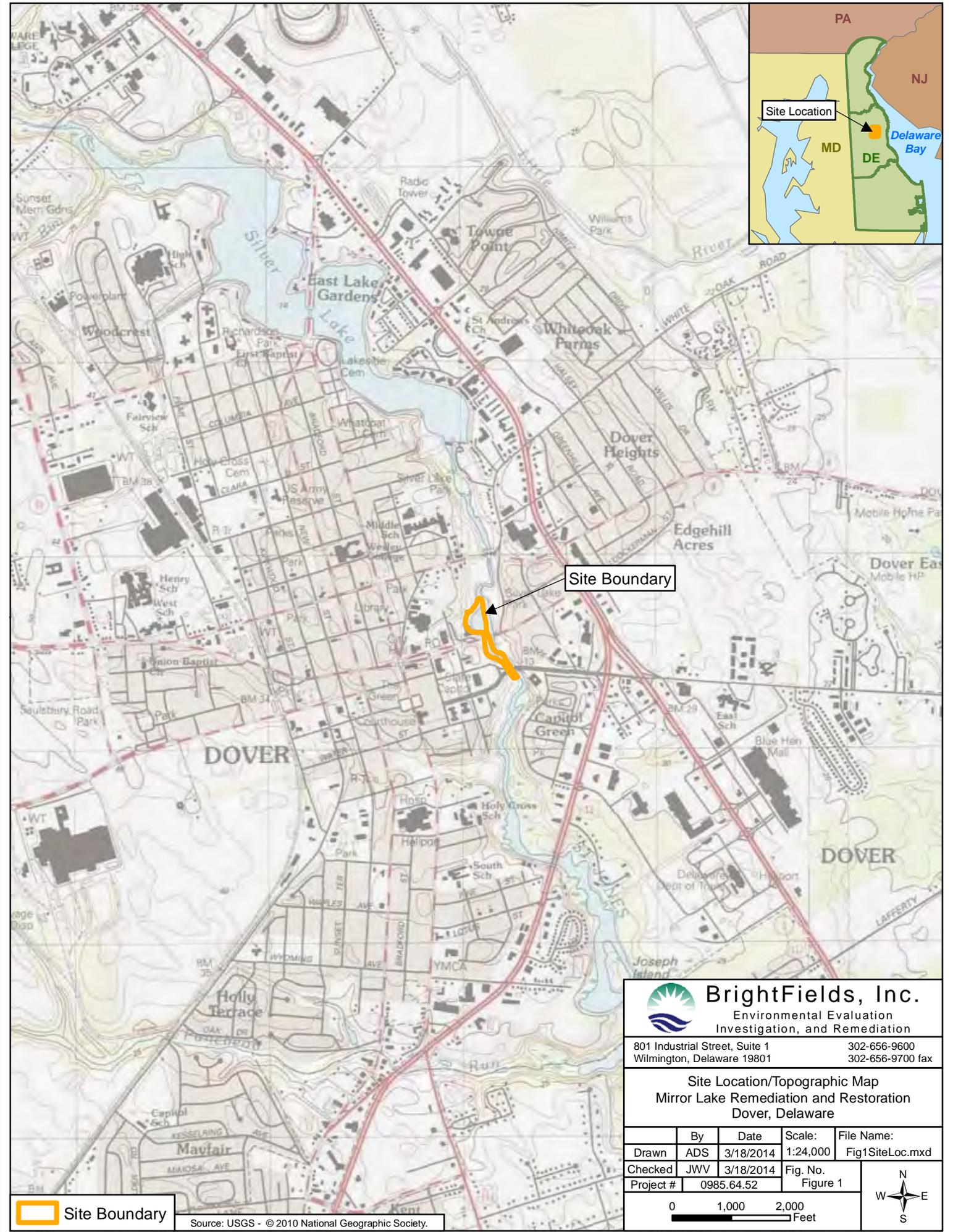
Biohabitats, 2013, Mirror Lake Remediation and Restoration Construction Plans, July 2013.

BrightFields, 2013, Health and Safety Plan, Mirror Lake Remediation, Dover, Delaware, September 2011.

# FIGURES

# **FIGURE 1**

## **Site Location Map**



Site Boundary

DOVER

DOVER



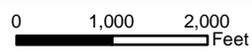
**BrightFields, Inc.**

Environmental Evaluation  
Investigation, and Remediation

801 Industrial Street, Suite 1 302-656-9600  
Wilmington, Delaware 19801 302-656-9700 fax

Site Location/Topographic Map  
Mirror Lake Remediation and Restoration  
Dover, Delaware

	By	Date	Scale:	File Name:
Drawn	ADS	3/18/2014	1:24,000	Fig1SiteLoc.mxd
Checked	JWV	3/18/2014	Fig. No.	
Project #	0985.64.52		Figure 1	

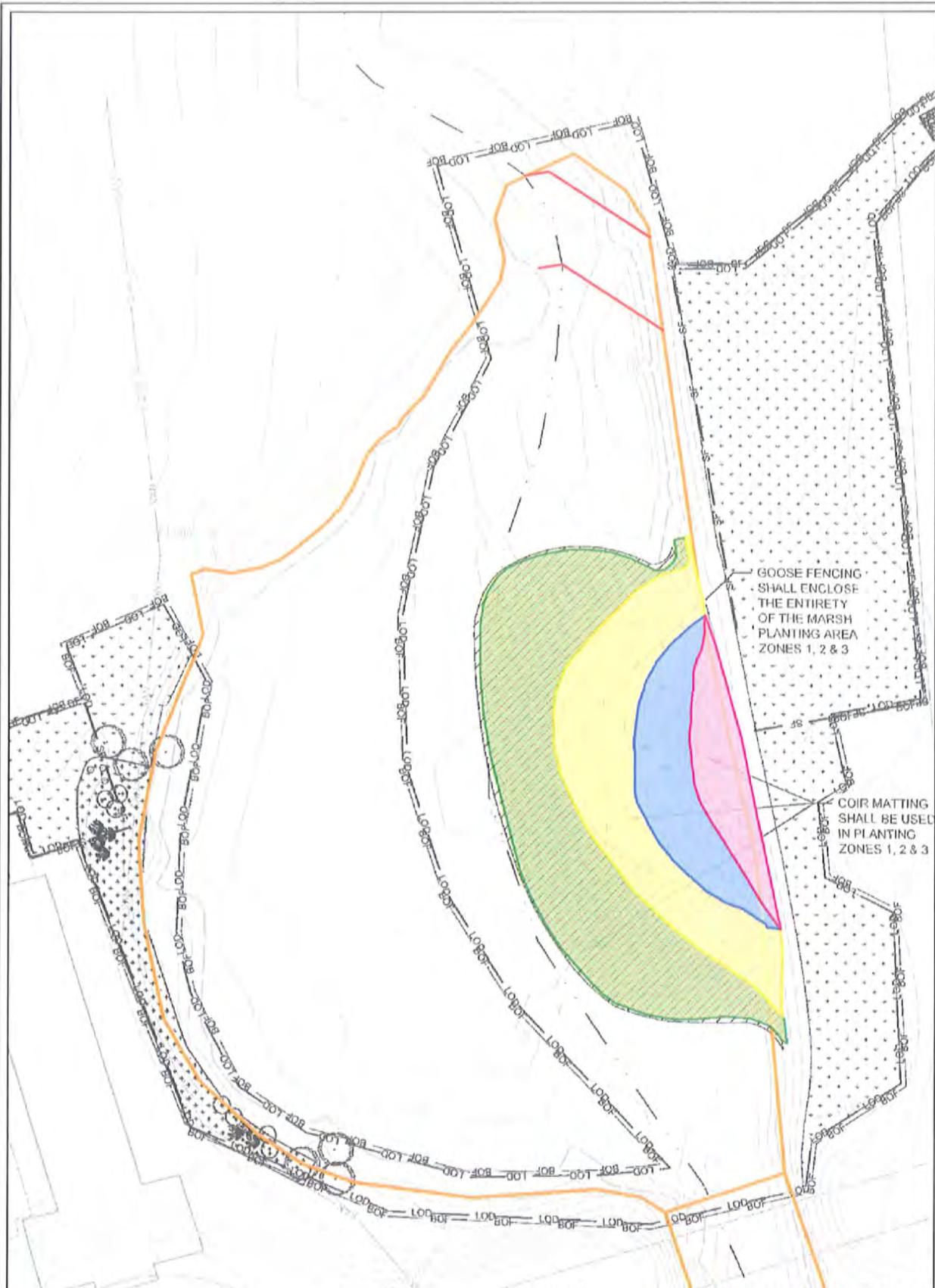


Site Boundary

Source: USGS - © 2010 National Geographic Society.

## **FIGURE 2**

# **Intertidal Wetland As-Built**



- Rock Vane
- Intertidal Wetland Not Installed
- Zone 1 Planning
- Zone 2 Planning
- Zone 3 Planning
- Site Boundary

Source: Georeferenced base map was created by Bishel's Inc.

**BrightFields, Inc.**  
Environmental Evaluation  
Investigation, and Remediation

801 Industrial Street, Suite 1      302-650-0600  
Wilmington, Delaware 19801      302-650-9700 fax

**Intertidal Wetland As-Built**  
**Mirror Lake Remediation and Restoration**  
Dover, Delaware

Drawn	ADS	3/20/2014	Scale:	File Name:
Checked	JWV	3/20/2014	1:800	Fig2AsBuilt.mxd
Project #	0065.04.52		Fig. No.	Figure 2

0      25      50

Feet

## **FIGURE 3**

# **SediMite™ Distribution Map**



# **TABLE 1**

## **Material and Associated Labor**

**TABLE 1**  
**Materials and Associated Labor**

<b>Site Preparation</b>			
<b>Task</b>	<b>Material</b>	<b>Hours</b>	<b>Estimated Costs</b>
Project Coordination	managing deliveries, site preparation	430	~
Install of E & S controls.	500 ft. silt fence, 1,000 ft. orange fencing	167	\$ 15,531.00
Install of turbidity curtain.	600 ft. of turbidity curtain	30	~
Install of mulch access road.	560 cubic yards of mulch	153	~
Install of rock vanes.	120 tons of stone	72	~
Install of coir logs along bank.	500 ft. of double layered 16 in. by 20 ft. coir logs	35	~
<b>Remediation</b>			
<b>Task</b>	<b>Material</b>	<b>Hours</b>	<b>Estimated Costs</b>
Load buckets of SediMite™	200, 5 gallon buckets loaded as needed	560	~
Spreading of SediMite™			~
by telebelt	80,000 pounds	140	\$ 7,812.00
by induction air horn	55,000 pounds	401	\$ 45,125.00
by Vortex spreader and hand	23,000 pounds	154	\$ 16,273.00
Spreading of sand by telebelt	1,325 tons of sand	37.5	\$ 2,092.00
<b>Restoration</b>			
<b>Task</b>	<b>Material</b>	<b>Hours</b>	<b>Estimated Costs</b>
Zone 1 planting.	3,000 wetland plants	104	\$ 9,672.00
Placement of coir matting.	7 rolls of matting.	4	\$ 372.00
Removal of mulch.	560 cubic yards of mulch	154	\$ 14,372.00
Seeding and grading.	250 pounds of seed.	40	~
Placement of straw matting.	37,800 square feet of straw matting	65	~

The table shows the materials, the total man hours, and the estimated costs associated with each task throughout the three phases of the project: site preparation, remediation, and restoration. The estimated costs represent the costs of labor (on a 2013 prevailing wage basis) had it not been volunteered. **If the tasks had not been performed by volunteers the estimated labor costs would have been in the range of \$111,249.**

# APPENDICES

# **APPENDIX A**

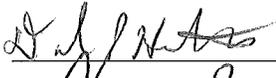
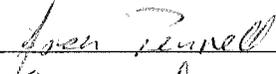
## **Volunteer Sign-Up Sheet**

## SITE HEALTH AND SAFETY PLAN REVIEW RECORD

Site Name: **Mirror Lake Remediation**

By my signature, I acknowledge that I have read and understand this Site Health and Safety Plan (Safety Plan) and was presented a health and safety briefing for the Site. I have been briefed on the nature, level, and degree of exposure anticipated as a result of participation in this project. I agree to follow and conform to the requirements of this Safety Plan.

I understand that DNREC not liable or responsible for any activities performed that are not in accordance with this Safety Plan, or the directions given by the Health & Safety Contractor (BrightFields). If I have any questions regarding health and safety issues, I will bring them to the attention of the Site Safety and Health Officer.

Name	Signature	Affiliation	Date
Dan Hurnett		BrightFields	10-17-13
Doug SAPP		Conservation DIST	10-17-13
JOHN STEVENS		BRIGHTFIELDS	10-17-13
Jeff Vance		BrightFields	10-18-13
Nate Koontz		MLS	10-28-13
Richard K. Cook		MLS	10-28-13
Richard Capeland		MLS	10-28-13
CLIFF HERBERT JR.		MLS	10-28-13
Jason Pennell		Boot Camp	11/4/13
Andrew Morrison		Boot Camp	11/4/13
Brandon Hoover		Boot camp	11/4/13
Jake Fu		Boo Camp	11/4/13
Richie Magee		Boot Camp	11/4/13
Keith Taylor		Boo Camp	11/4/13
Meganne Radway		NCCC	11/4/13
Alicia Spack		NCCC	11/4/13
Ben Quimby		NCCC	11/4/13
Jositt Bracken		NCCC	11/4/13
Anthony Reyna		"	"

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Name	Signature	Affiliation	Date
Erik VanCleve		NCCC	11-4-13
Jocelyn Pratt		NCCC	11-4-13
Bryan Lundholm		NCCC	11-4-13
Octavia Veloz		NCCC	11/4/13
Lorray Jones		DNREC-SIRS	11/5/13
Ellen Dicker		DNREC-SW	11/5/13
Todd Keyes		DNREC-SIR	11/5/13
Larry Penatto		DNREC-WAS	11/05/13
Greg DeCowsky		DNREC-SIRS	11/5/13
Whitcol Hammond		SBC	11/5/13
Colby Hopkins		BOOT CAMP	11-5-13
Jose Rose		Boot-camp	11-5-13
Andrew Kaufman		Boot Camp	11-5-13
Kevin Hood		BK	11/5/13
Derrell Gibbs		Boot Camp	11/5/13
Crystal Nagyski		DNREC	11/7/13
Traci Evans		DNREC	11/7/13
Mark Biddle		DNREC	11/7/13







# **APPENDIX B**

## **Site Photographs**

## Site Photos Mirror Lake Remediation Dover, Delaware

### East Side of Mirror Lake



East bank of Mirror Lake prior to remediation.



Erosion and Sediment Controls in Place.



Mulch road installation.



Turbidity Curtain installation.



Cross Vane Installation.



Induction air horn spreading along bank.



Telebelt spreading sand and SediMite™.



Sand bar partially completed.



Seeding and erosion control matting.



Completed restoration.

## West Side of Mirror Lake



West side of Mirror Lake prior to remediation. Erosion and sediment controls in place.



Mulch road installation.



Clearing along bank.



Coir log installation.



Induction air horn spreading along bank.



Induction air horn spreading from boat.



Telebelt spreading SediMite™ from west side.



Removing mulch and grading site.



Mulch placed along bank behind coir logs.



Seeding and erosion control matting.



Completed restoration.