Coastwide Project Proposals

**All Coastwide Project Proposals have been evaluated by the CWPPRA Workgroups for eligibility according to CWPPRA guidelines. **

CW-01

PPL30 Coastwide Ridges Project

Project Location:
Coastwide

Problem:
There are currently 14 ridge projects listed in the 2017 State Master Plan (SMP). Because ridges are fairly limited in their actual footprint, they do not provide large Wetland Value Assessment (WVA) benefit estimates. By themselves, ridge projects are usually relatively inexpensive and may be considered too limited for full CWPPRA projects by themselves. Because benefits are usually limited, a marsh creation component is typically added to ridge proposals in order to increase the WVA benefits and the associated cost effectiveness. While these added marsh creation polygons are typically considered consistent with the SMP, they do significantly increase the overall costs to the project and to CWPPRA.

Goals:
The goal of the project is to provide a mechanism to address the ridge projects identified in the State Master Plan as a comprehensive coastwide project as compared to numerous smaller, separate proposals. The project would provide a systematic mechanism for prioritizing and implementing ridge proposals in a more streamlined, cost effective manner.

Proposed Solution:
Work with the state and federal agencies to develop a proposal to prioritize and implement multiple ridge projects to address some or all the ridge proposals shown in the SMP. The proposal can be scaled to any size and can be re-authorized and/or rescoped later based on the success of the project. While the overall cost could be high, the money would only be needed in smaller increments like the coastwide nutria control or plantings projects. The features would be similarly simple and inexpensive.

The total for the 14 projects listed in the state master equals \$141M, but this proposal can be scaled to any sized deemed most effective/appropriate. The money would only be needed in relatively small increments throughout the coastwide project's life (Average \$7/year for ALL ridges in the SMP) and/or it could be reauthorized in 20 years to pick up any remaining projects. Recommend a smaller subset to initiate and test the project feasibility which can be scaled up or down depending on its success at approximately \$2M/year.

Project Benefits:
To be determined

Project Costs:
Estimated Cost plus contingency: \$30-\$40M

Preparer of Fact Sheet:
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Coastwide
Ridge Restoration/Creation

Coastal Wetlands Planning, Protection
and Restoration Act

Problems

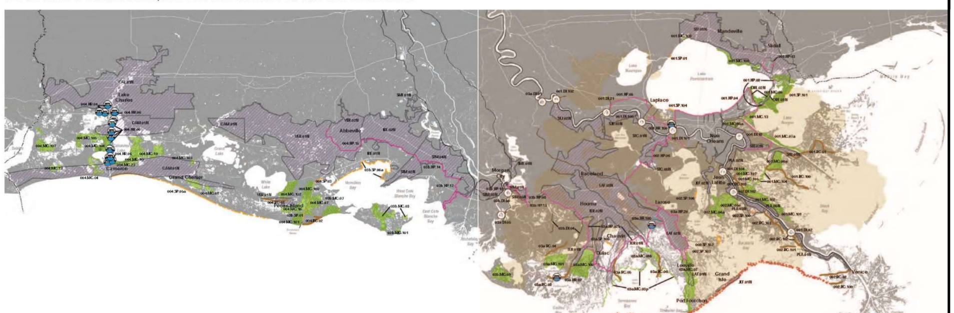
- Ridge projects are relatively inexpensive, but produce few WVA benefits by themselves
- Marsh Creation features are typically added to Ridge projects to increase benefits estimates which increase cost of the project and the cost to CWPPRA
- These smaller, inexpensive projects are hard to get implemented under CWPPRA by themselves

2017 Master Plan Solution

- 14 Ridge Projects listed

2017 COASTAL MASTER PLAN

A $50 BILLION INVESTMENT DESIGNED TO BUILD AND MAINTAIN LAND, REDUCE FLOOD RISK TO COMMUNITIES, AND PROVIDE HABITATS TO SUPPORT ECOSYSTEMS

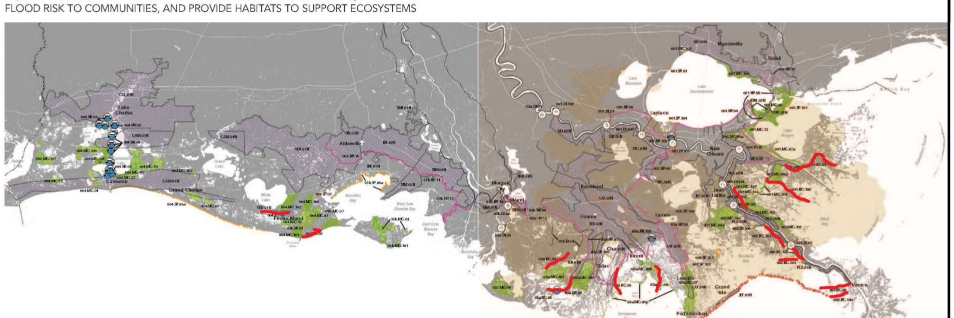


2017 Master Plan Solution

- 14 Ridge Projects listed

2017 COASTAL MASTER PLAN

A $50 BILLION INVESTMENT DESIGNED TO BUILD AND MAINTAIN LAND, REDUCE FLOOD RISK TO COMMUNITIES, AND PROVIDE HABITATS TO SUPPORT ECOSYSTEMS



2017 Master Plan Solution

South West		
004.RC.02 Cheniere au Tigre Ridge Restoration:	Years 31-50	$8,500,000
004.RC.03 Pecan Island Ridge Restoration:	Years 31-50	$6,800,000
Central		
03a.RC.04 Mauvais Bois Ridge Restoration:	Years 1-10	$9,900,000
03a.RC.06 Bayou Pointe Aux Chenes Ridge Restor.:	Years 1-10	$10,600,000
03a.RC.02 Bayou Dularge Ridge Restoration:	Years 11-30	$9,600,000
03a.RC.05 Bayou Terrebonne Ridge Restoration:	Years 11-30	$8,800,000
South East		
001.RC.100 Bayou Terre aux Boeufs Ridge Restoration:	Years 1-10	$15,200,000
001.RC.103 Carlisle Ridge Restoration:	Years 1-10	$9,300,000
002.RC.101 Adams Bay Ridge Restoration:	Years 1-10	$7,200,000
002.RC.102 Bayou Eau Noire Ridge Restoration:	Years 1-10	$9,800,000
002.RC.103 Grand Bayou Ridge Restoration:	Years 1-10	$10,300,000
001.RC.01 Bayou LaLoutre Ridge Restoration:	Years 11-30	$20,200,000
002.RC.02 Spanish Pass Ridge Restoration:	Years 11-30	$11,600,000
002.RC.100 Red Pass Ridge Restoration:	Years 11-30	$3,500,000
	Total	$141,300,000

Project Features

- Multiple ridge creation/restoration projects across the coast, sequenced to maximize cost efficiency and restoration priorities
- Multiple projects will be implemented over the 20-year life
- Could be easily scaled up or down depending on success

Project Goals

- Provides a systematic approach for prioritizing and implementing ridge projects across the coast
- Provides a mechanism for implementing these smaller, relatively inexpensive projects in order to maximize cost efficiency and benefits
- Construction plus 25% contingency = $30M - $40M
- Cost would be spread over the 20 year life so the incremental burden to CWPPRA would be small

SOP Consistency

1. Ridges are a proven restoration technique that is routinely applied in LA coastal restoration, and the project will directly provide wetland benefits.
2. The technique can be applied across the coast and is not limited to any marsh type or basin.
3. Ridges are relatively simple features and typically low cost features, and they have limited footprints.
4. The proposal does not divide a traditional large scale project, rather combines numerous small scale projects
5. The project will likely be implemented in smaller increments across the life of the project and can be scaled up or down depending on its success.

CW-02

PPL30 PROJECT NOMINEE FACT SHEET
31 January 2020

Project Name
Coastwide Backfilling

Project Location
Coastwide

Problem
Canals dredged in Louisiana's wetlands dispose of the dredged materials by creating continuous levees, a.k.a. 'spoil banks' of the dredged materials that are aligned perpendicular to the canal. The levee height may be multiple times the tidal range and the deposited spoil material compresses the soil beneath with the effect of inhibiting overland and belowground water flows (Nichols 1957; Swenson and Turner 1987). Upland habitat is created that is colonized by trees and shrubs whose area is equal to the width of the newly created canal on each side (Figure 1).

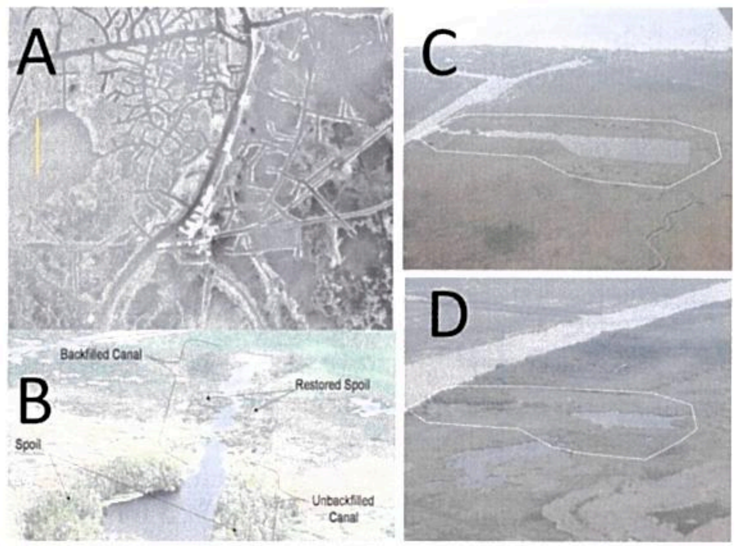


Figure 1. Photographic montage of canals and spoil banks. A. The Leeville, La, oil field with a mosaic of canals, wetlands and open water in 1998. The yellow vertical bar over Catfish Lake is 2 km. B. A canal that is partially backfilled. C. A canal recently backfilled and another in D, that was backfilled much earlier. A white outline of the shape of the spoil bank area is shown. The average width of canals is about 33 m.

The total direct impacts of canals and spoil banks from 1955/56 to 1978 was about 16 percent of the open water gain in coastal Louisiana in the same interval, equal to 7% of the coastal wetlands area in 1978 (Bauman and Turner 1990). The hydrologic restrictions above- and below-ground creates waterlogged soils, which may lead to toxic sulfide accumulations and reduces the accumulation of soil organic matter which dominates vertical accretion rates; the same damming effect causes longer but fewer drying cycles that leads to soil oxidation (Swenson and Turner 1987; Turner 2004, 2009). A site-specific example is on the south side of Jug Lake, west of Houma, LA. There the adjacent wetland went from around 15% open water to 85% open water within 2 years after dredging (Turner and Streever 2002; Chapter 4). Ponds form near to canals, and particularly where two or more spoil banks intersect (Turner and Rao 1990).

Spoil banks are on either side of the canal, and so there are 33,705 km of spoil bank, which equal 4 times the distance from New Orleans to London, England, and more than 3/4ths of the circumference of the Earth. The total length of spoil banks in 2017 was long enough to cross the Louisiana coast east-to-west 79 times with a spoil bank height up to 3-10 times the natural tidal range.

The sum of these effects created a direct relationship between canal density and land loss from the 1930s to 1990 for the deltaic plain (excluding the highly mineral soils found at the tip of river deltas) (Figure 2). The slope of the intercept goes through zero and the slope indicates that there is 4.6 times more land area indirectly lost than directly from the canal.

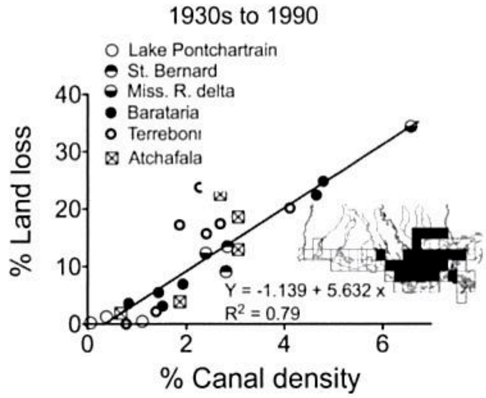


Figure 2. The land loss rate from the 1930s to 1990 and canal density in 15 minute quadrangle maps measured by Britsch and Dunbar (1993). Figure modified from Turner and McClenachan (2018).

Filling in canals with the spoil bank is called 'backfilling' and is intended to restore marsh on the spoil bank and in the marsh. The progress of backfilling restoration success has been followed several times over the last 35 years at 33 locations and with favorable and predictable outcomes, and with virtually no negative consequences (Neill and Turner 1987; Turner et al. 1994; Baustian and Turner 2006). Benefits increase over time, although complete restoration may take longer than twenty years. Backfilling could be quickly implemented coastwide and doing so directly addresses a cause-and-effect driver of coastal wetland loss.

The restoration success for backfilled canals has been almost entirely based on an analysis of the 33 canals that were backfilled by 1984 (Neil and Turner 1987). These canals were not backfilled in a systematic way or chosen for attributes that might be more likely to succeed than others. They were opportunities arising in the permitting office just before the program was stopped. Some are within an impoundment that has a larger influence on wetland hydrology than the smaller backfilled canal; others are in an area that was eroding before backfilling, and others are stubby canals without plugs, or canals used for navigation. They were, in other words, a 'hit-or' miss' opportunity to do something rather than nothing (Houck 2015). But, we did learn that about half of the canal will be restored in 20 years and that putting a plug in the canal greatly improves restoration (Figure 3).

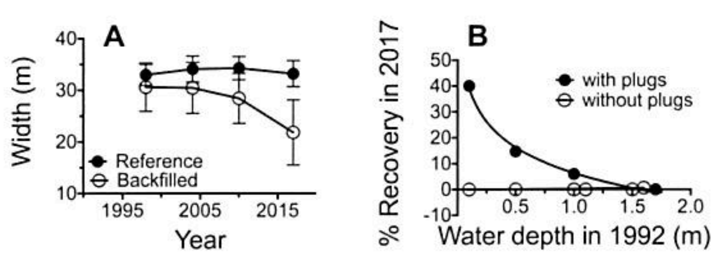


Figure 3. Changes in the width of backfilled and reference canals that were >200 m long in 1992. A: Widths in 1998, 2004, 2010 and 2017. B: Restoration from 1998 for backfilled canals versus the depth of the water in 1992 that were had plugs visible in the imagery. The means ± 1 SE is shown.

Backfilling addresses the consequences to wetlands caused when canals are built and continues to do. Backfilling restores marsh, prevents future wetland loss, and is highly cost effective… but is slow to develop. The backfilling benefits increase over time, although complete restoration may take longer than twenty years. Improving the completeness of spoil removal, coupled with appropriate site selection and plugs, will speed up the restoration process and enhance the success of future backfilling projects. Backfilling can be quickly implemented coastwide and directly addresses the main cause-and-effect driver of coastal wetland loss.

Goals

Restore the hydrology in coastal marshes by placing plugs in abandoned canals, and removing spoil banks to restore overland flow and some belowground flows. The project will almost immediately begin to grow vegetation on the spoil bank if not surrounded by other canals, and gradually fill in the canal. These factors will increase duck habitat behind the plug, increase fisheries access to the nursery habitat of the marshes, increase the functionality of coastal marsh habitats, and improve soil water quality.

Proposed Solution

Backfill 2% of the 27,483 potential canals on land available (Figure 4). The vast majority of coastal wetland is privately owned, with the remainder in various public agencies including School Boards, non-Governmental Agencies, State and Federal Lands. Canals could be backfilled within a program that was positively promulgated by government. A bundling of many backfilled sites within one effort would have economies of scale that doing one at a time do not. A systematic monitoring program would advance restoration knowledge and future attempts. The price of backfilling (without sediment additions) was \$3,751 acre^{-1} in 2005, and \$4,949 acre^{-1} in 2018 when adjusted for inflation. The rough approximation of filling in all abandoned canals is, therefore, about \$335 million dollars. This proposal suggest that a program be started for 2% of that amount = \$7 million dollars. That would create approximately 1286 acres assuming that there was a 10% increase in costs for inflation, monitoring, community engagement and administrative overhead. Savings would occur if backfilling was done within a cluster of canals, rather than individually, one-by-one. Additional benefits accrue, but are unquantified, because the land loss per canal area increases with each year (Turner 2009). Reducing the canal area would diminish future losses away from the canal and allow for indirect restoration (Turner 2009).

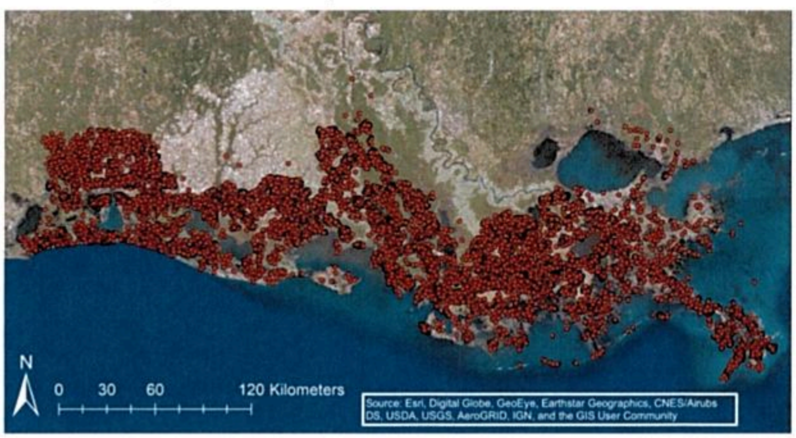


Figure 4. The distribution of oil and gas well permits issued between 1900 and 2017 that were defined as 'plugged' or 'abandoned' in 2017 and on land in the 14 parishes. These are all potential backfilled sites. From Turner and McClenachan (2018).

Preliminary Project Benefits

1) *What is the total acreage benefited both directly and indirectly?*
   The project is expected to yield benefits to approximately 1,286 acres of marsh with a lower land loss rate around the canal cut in half.

2) *How many acres of wetlands will be protected/created over the project life?*
The indirect effects of canals are 4.6 times larger than the canal area. Filling in the canal, therefore, may protect and conserve approximately 5900 additional acres after 20 years when restoration also occurs as an indirect consequence.

3) *What is the anticipated loss rate reduction throughout the area of direct benefits over the project life (<25%, 25-49%, 50-74% and >75%)?*
A loss rate reduction of 75% is expected depending on project features and surrounding hydrologic constraints.

4) *Do any project features maintain or restore structural components of the coastal ecosystem such as barrier islands, natural or artificial levee ridges, beach and lake rims, cheniers, etc?*
No, except when canals on barrier islands are filled in.

5) *What is the net impact of the project on critical and non-critical infrastructure?*
Marshes are sustained that support fisheries and wildfowl habitat, and provides some storm surge protection.

6) *To what extent does the project provide a synergistic effect with other approved and/or constructed restoration projects?*
Potential for synergies exist with a large number of restoration projects across the state.

Considerations
Pipelines, roads, and land ownership are considerations in project design.

Preliminary Costs
The fully funded cost range is $5M - $10M.

Preparer(s) of Fact Sheet:
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References
Baumann, R.H. and Turner, R.E. 1990. Direct impacts of outer continental shelf activities on wetland loss in the central Gulf of Mexico. Environmental Geology and Water Science **15**: 189-198.
Baustian, J.J. and Turner, R.E. 2006. Restoration success of backfilling canals in coastal Louisiana marshes. Restoration Ecology 14: 634-644.
Baustian, J., Turner, R.E., Walters, N.F., and D. Muth, D. 2009. Restoration of dredged canals in wetlands: A comparison of methods. Wetlands Ecology and Management 17: 445-453.
Britsch, L.D. and Dunbar, J.B. 1993. Land loss rates: Louisiana coastal plain. Journal of Coastal Research 9: 324-338.
Houck, O.A. 2015. The reckoning: Oil and gas development in the Louisiana coastal zone. Tulane Environmental Law Journal 28: 185-296.

Neill, C., and Turner, R.E. 1987. Backfilling canals to mitigate wetland dredging in Louisiana coastal marshes. Environmental Management 11: 823-836.
Nichols, L.G. 1959. Rockefeller Refuge Levee Study. La. Wildl. Fish. Comm. Refuge Div. Tech. Rep. 17 pp.
Swenson, E.M. and Turner, R.E. 1987. Spoil banks: Effects on a coastal marsh water-level regime. Estuarine, Coastal and Shelf Science 24: 599-609.
Turner, R.E. 2004. Coastal wetland subsidence arising from local hydrologic manipulations. Estuaries 27: 265-272.
Turner, R.E. 2009. Doubt and the values of an ignorance-based world view for wetland restoration: Coastal Louisiana. Estuaries and Coasts 32: 1054-1068. DOI 10.1007/s12237-009-9214-4.
Turner, R.E. G. McClenachan 2018. Reversing wetland death from 35,000 cuts: opportunities to restore Louisiana's dredged canals. Plos One 13(12): e0207717. https://doi.org/10.1371/journal.pone.0207717
Turner, R.E. and Rao, Y.S. 1990. Relationships between wetland fragmentation and recent hydrologic changes in a deltaic coast. Estuaries 13: 272-281.
Turner, R.E., Lee, J.M. and Neill, C. 1994. Backfilling canals to restore wetlands: empirical results in coastal Louisiana. Wetlands Ecology and Management 3: 63-78.
Turner, R.E. and Streever, B. 2002. Approaches to Coastal Wetland Restoration: Northern Gulf of Mexico. SPB Academic Publishing, The Hague, The Netherlands.

~~CW-03~~ ****Workgroups determined project ineligible to compete according to CWPPRA guidelines****

PPL30 PROJECT FACT SHEET
February 2020

Project Name
Sediment Banking

Master Plan Strategy
This project supports all Master Plan marsh creation projects by strategically managing sediment, providing easier access and reducing project costs.

Project Location
Coastwide

Problem
Sediment costs and availability may eliminate otherwise viable restoration projects from consideration or implementation. Projects located in high land loss areas may not be considered for restoration or unable to effectively compete for restoration funding due to the lack of nearby suitable sediment. Therefore, despite the critical need, restoration efforts in these areas are limited. Materials dredged by third parties or from routine channel maintenance are often "disposed of" offshore. Borrow sources are regularly designated for multiple projects with use on a first come, first served basis.

Proposed Solution
Sediment Banking is a coastwide, strategic approach to identify and develop locations to efficiently accumulate dredged sediments so these materials can be used in coastal restoration projects. It provides a means for optimizing sediment management by establishing pre-designated locations to accumulate sediment. Materials are pre-positioned in strategic locations to facilitate restoration in a cost efficient and sustainable manner. Implementation includes setting forth criteria (e.g. general locations, volume, placement conditions, and testing requirements) and establishing several strategically placed material storage locations during the 20-year project life. By decoupling dredging events and project construction, large and small dredging projects can contribute sediment to managed sites on an ongoing basis to eliminate project timing issues that often present a major barrier to beneficial use.

Project Benefits
Direct benefits (acres of marsh) result from the quantity of banked materials as well as in the future restored marsh. Many restoration projects currently not viable due to lack of suitable borrow may become more competitive for funding and subsequent construction by using materials accumulated in the pre-established sediment sites. This approach facilitates and encourages beneficial use of all dredged sediment resources.

Project Costs
The estimated cost including 25% contingency is \$20M - \$25M.

Preparer(s) of Fact Sheet:
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"We cannot solve our problems with the same thinking we used when we created them."

a quote attributed to Albert Einstein

EPA Proposed Coastwide Project:
Sediment Banking

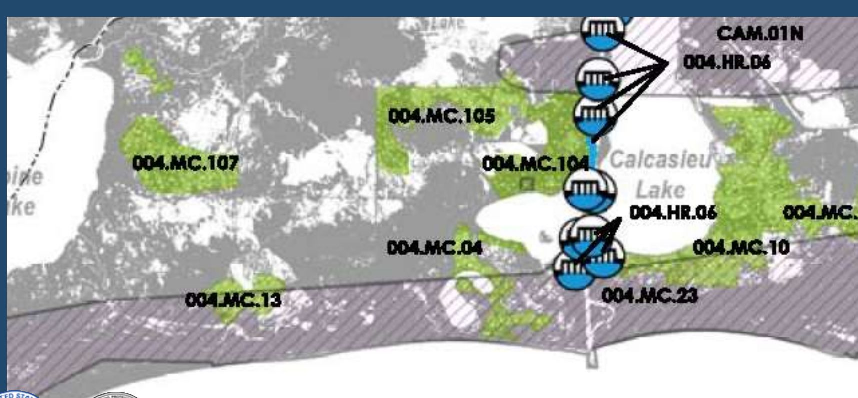
February 2020

Current Situation

- Sediment starved environment
- Restoration projects lack nearby borrow
- Numerous projects using same borrow areas
- Lack of suitable sources – quality/quantity
- Dollars spent searching for sediment
- Dredged materials often placed offshore

2017 Master Plan Solution

This project supports all Master Plan projects using sediment.



Coastwide Process - Where & How?

- Decouple dredging/project construction
- Identify potential material sources
  - Port expansions
  - Routine channel maintenance activities
  - Third party dredging
  - USACE maintenance dredging
- Strategically locate and establish sediment banks
  - Low energy locations
  - Refill previous borrow areas
  - Develop pre-established containment areas
- Match sites to restoration project needs

Coastwide Concept/Management

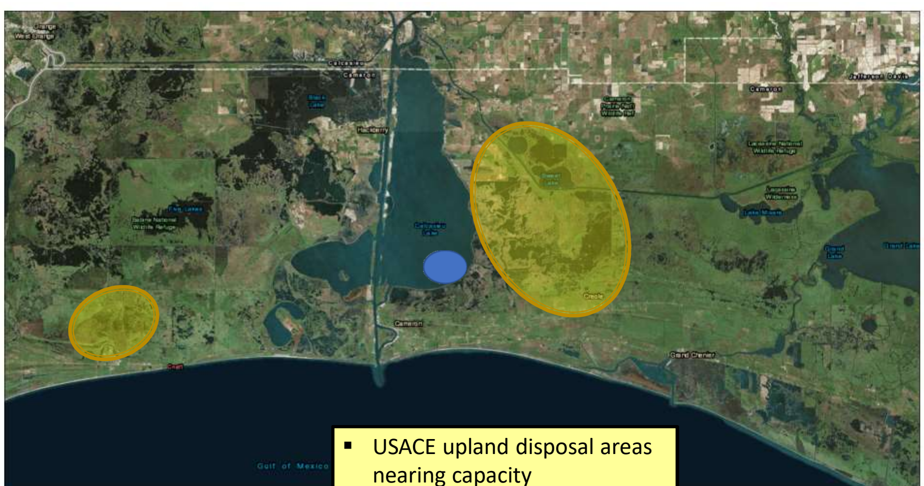
- Sites would be “managed”
- Materials tested as needed
- Sites monitored for quality/quantity as needed
- Locations established or decommissioned as needed

Direct Benefits
Example: Marsh Creation Using USACE Dredged Materials

- USACE dredges 77 MCY annually
  - 42% used beneficially
- 15-20 MCY USACE available annually could yield **2,000 acres restored annually**
- **40,000 acres over a 20 year project life**

Additional sources of materials = more acres

Example 1: USACE Maintenance Dredging - Calcasieu



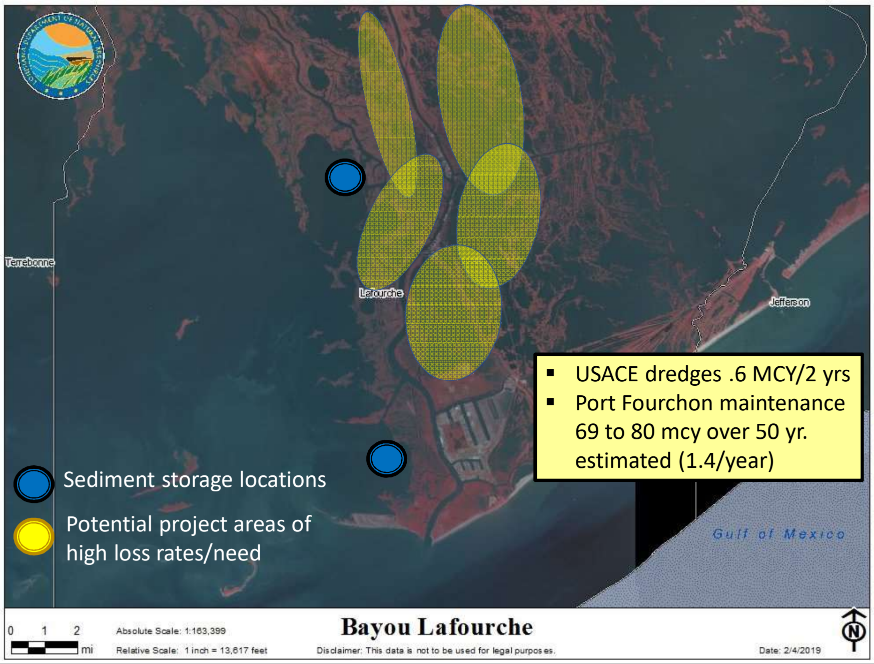
November 7, 2018

- Sediment storage location
- Potential project areas of high loss rates/need

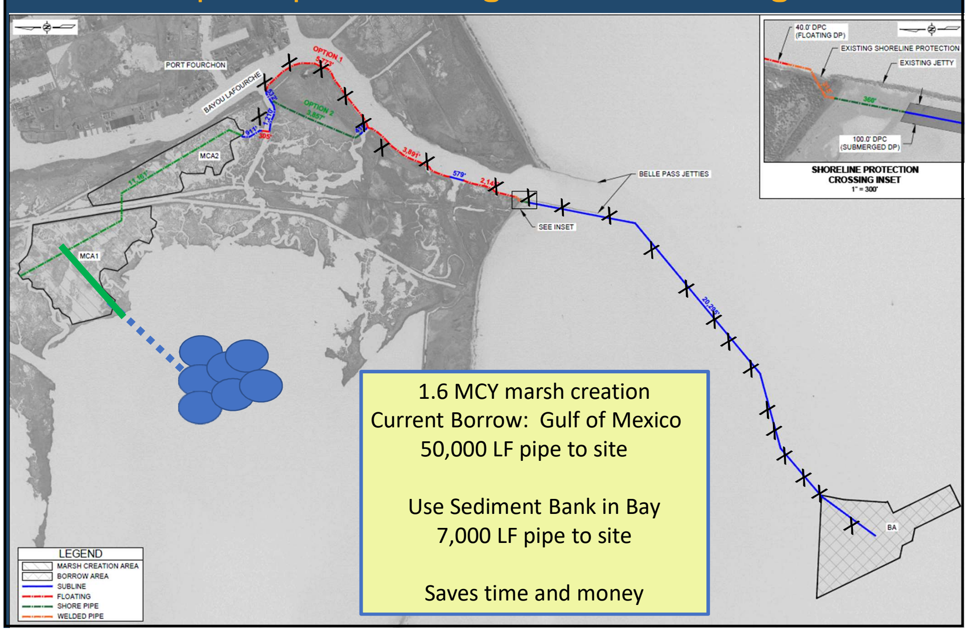
- USACE upland disposal areas nearing capacity
- 2019 estimate = 4 MCY/2 yrs
- Establish sediment storage location(s) in Calcasieu Lake for restoration projects

1:288,895

Example 2: Bayou Lafourche Sediment Sources



TE-134 West Fourchon Marsh Creation Example Impact of Using Sediment Banking



Summary - Sediment Banking

- Strategic and comprehensive coastwide approach to sediment management
- Provides reliable sources of sediment
- Saves construction costs
- De-couples dredging/project construction
- Enables restoration projects in areas previously not feasible due to lack of nearby sediment sources

Construction cost + 25% contingency is $20M - $25M

Demonstration Project Proposals

****All Demonstration Project Proposals have been evaluated by the CWPPRA Workgroups for eligibility according to CWPPRA guidelines. ****

~~Demo-01~~ **Workgroups determined project ineligible to compete according to CWPPRA Guidelines****

PPL30 DEMONSTRATION PROJECT NOMINEE FACT SHEET
FEBRUARY 4, 2020

Project Name:
Accuracy and Precision of Drone Based LiDAR (Topographic and Bathymetric)

Project Location:
Applicable Statewide

Problem:
Typical Real Time Kinematic (RTK) and bathymetric surveys are expensive, labor intensive, and time consuming. Both types have their own accuracy and precision tolerances. RTK surveys also require some type of vessel to traverse across the marsh which can sometimes cause damage. Drone and LiDAR technology is evolving at an alarming scale and may be a remedy to many of the above problems, but confidence in this technology varies across potential users due to many factors.

Goals:
The goal of this demonstration project is to determine uniform specifications on how various types of drone-based LiDAR surveys should be performed and to quantify the accuracy and precision of various methods when compared to conventional RTK and bathymetric methods. Accuracy and precision will be broken down by:

- Infrared (Topographic) – bare earth and 2-4 different vegetative scenarios determined based on parameters such as density and height.
- Green (bathymetric) – 2-5 scenarios based on parameters such as depth of water, turbidity, density of SAVs, and salinity.
- Each of the above may further be broken down into 1-3 manufacturer's equipment as well as post-processing software and techniques.

Proposed Solution:

- Contract with an Architect/Engineering (A/E) firm to:
  - Review existing industry standards (such as 3DEP for LiDAR) and provide recommendations on how to adapt drone-based LiDAR for use in coastal marsh and open water surveys.
  - Research and review applicable existing studies that may assist in this project.
  - Make recommendations on which equipment and flight parameters/settings should be fixed and which should be variable to best achieve the goals described above.
- Develop a panel of 3-5 people from CWPPRA Task Force agency personnel to review the above recommendations and determine the final specifications and specific locations to conduct the surveys.
- A/E firm:
  - Conduct surveys using the drone-based specifications as well as conventional RTK and/or bathymetric specifications at all locations.
  - Compare the data and develop accuracy and precision variability under each of the scenarios and provide their technical expert opinion as to on the results were obtained.
  - Develop a cost and time savings comparison of the different methods.

Project Benefits:
The primary benefit expected from this project is to quantify the accuracy and precision of various types of drone-based LiDAR so that agencies can determine if the technology meets their needs and determine which specifications would best meet their needs. Coastal restoration projects could potentially save time, money, and prevent damage to existing marsh during initial design surveys, , progress surveys during construction, as-built surveys, monitoring surveys, and determining damage after major storms.

Project Costs:
$1,000,000 fully funded will be used as a placeholder to solicit for and research new products, seek potential location(s), construction, and 1 year of monitoring. Cost includes contingencies.

NOTE: Using existing restoration project(s) with already funded RTK and bathymetric surveys for comparison could be a dramatic cost savings.

Preparer(s) of Fact Sheet:
Brandon Samson, USDA-NRCS, (318) 473-7793, brandon.samson@usda.gov

Accuracy and Precision of Drone Based LiDAR (Topographic and Bathymetric)

Problem

- Typical RTK/Bathy Surveys
  - Expensive
  - labor intensive
  - time consuming.
  - require some type of vessel to traverse across the marsh and cause damage.
- Drone/LiDAR Surveys
  - Reduced cost
  - Reduced labor
  - Reduced time
  - BUT....confidence in this technology varies across the board due to many factors.

Goals

- Develop uniform specifications for various types of drone-based LiDAR surveys
- Quantify the accuracy and precision of when compared to conventional RTK and bathymetric methods
- Quantify actual cost and time savings

Proposed Solution

- Accuracy and precision will be broken down by:
  - Infrared (Topographic) – bare earth and 2-4 different vegetative scenarios determined based parameters such as density and height
  - Green (bathymetric) – 2-5 scenarios based on parameters such as depth of water, turbidity, density of SAVs, and salinity
  - Each of the above may further be broken down into 1-3 manufacturers equipment as well as post processing software and techniques

Benefits/Cost

- Establish potential use, cost savings, and time savings on:
  - initial design surveys
  - verifying damage after major storms
  - progress surveys during construction
  - as-built surveys
  - monitoring surveys
- Approximately $1million

Demo - 02

CWPPRA PPL 30 Nomination Sign-Up Sheet

Complete a sign-up sheet for each project you nominate. Please print neatly!

Name of Project: MARINE GARDENS - Dolosse Armor

Is this a demonstration project? Yes No

If not, please provide the below information.

Region: *(Circle one)*	1	2	3	4	**Coastwide**
Basin: *(Circle one)*	Pontchartrain	Barataria	Terrebonne	Calcasieu-Sabine	
		Breton Sound	Atchafalaya	Mermentau	
			Teche-Vermilion		

Did you provide a factsheet? Yes No ON DISK

Contact Information:

Name: Michael Boatright

Phone Number: 504 430 8900

Email: ~~MEBoa~~ michael@marine-GARDENS.com

PPL30 DEMONSTRATION PROJECT NOMINEE FACT SHEET
February 6, 2020

Demonstration Project Name: Marine Gardens/Dolosse Hard Armor

Potential Demonstration Project Location(s): Louisiana Gulf Coast/use in existing projects

Problem: Shoreline protection is needed in areas to protect marsh and delicate soils from marine traffic near channels and other areas that are primarily organic soils. Losing this marsh is very costly. Traditionally, the use of limestone rock jetties has been used to protect these delicate areas. Heavy dense solid limestone is not well suited for this purpose in areas with mostly organic soils. Jetties continuously sink in several areas due to soft soils and dense stones that have little surface displacement. These areas are difficult to maintain and have high maintence costs. Solutions to stabilize the base using light weight aggregates and bag systems have been tried; however, we still use limestone rock that does not interlock and is very dense per cu. ft. of displacement. Solutions are still needed to slow or stop jetties from sinking. Secondarily, supply chain of limestone rock is not mined locally having high transportation cost and it can be in short supply in an emergency breach, leaving areas and even towns exposed.

Proposed Solution

The proposed solution is to produce modified lighter weight dolo erosion structures (dolosse plural) using a ferro sialate based marine geopolymer concrete, as a replacement product for limestone rock in areas with soft organic soils. Basic dolosse structures are a proven design that has been used worldwide for coastal protection. Several have been installed across the U.S. A more recent example can be found in Cleveland Ohio, to repair jetty damage from Hurricane Sandy. The dolosse design interlocks in an irregular pattern that deflects and dissipates wave energy vs. blocking it. They do not form a slope when they settle, like blocks, flat surfaced structures, and rocks. Sloping increases wave energy. Dolosse do not dislodge or become displaced from wave energy. They form an interlocking wall with porous spaces that are sediment trappers. This quickly builds up organic matter and debris in crevices forming useful habitat sea birds above the water line and fish and shellfish below the water line. The structures are easier and quicker to install and maintain using a magnetic harness and modern software for accurate placement. They are taller, wider, and lighter than limestone boulders with a greater displacement. Each unit can be identified and are easily monitored for settling. Settling is less due to interlocking design and reduced weight, reducing long term maintenance.

We are proposing a modification to the basic 6.5-ton dolo mold by hollowing the structure with an insert and using a high-strength geopolymer concrete which will reduce the weight of the structure by 30-50% while maintaining the footprint displacement of a heavier dolo. The modifications will reduce the problem of settling and sinking in soft organic soils. Thereby reducing maintenance costs through weight reduction, greater surface displacement and a taller structure, without compromising, durability or stability. The basic design of the dolosse produces an interlocking but slightly flexible wall with porous spaces that acts as a unit.

Goals:

1. Produce 300 dolo pre-caste structures as described.
2. Delivery onsite to contractor, within 100 miles (barge).
3. Provide support personnel for placement and loading equipment.
4. Cost analysis of dolosse production for future pre-cast coastal products.

Describe demonstration project features in as much detail as possible.

Worldwide, a number of coastal erosion projects use dolosse and similar structure designs made from high strength unreinforced Portland concrete as coastal barrier protection. The dolosse is a common, proven design and one of the most well studied and favored of the engineered breakwater structures. It is known for good interlocking and low settling and has been used by US Army Corp of Engineers in other regions of the country. **This is a modified dolosse that specifically targets problems associated with our local soils while maintaining the proven design and shape of the dolo.**

The dolosse design, works by dissipating and deflecting rather than blocking the energy of waves. Their design deflects most wave action energy to the side, making them more difficult to dislodge than objects of a similar weight presenting a flat surface. Though they are placed into position on top of each other by cranes, over time they tend to get further entangled as the waves shift them. Their design ensures that they interlock forming porous spaces between them and create a slightly flexible wall. The individual units are often numbered so that their movements can be tracked. This helps engineers gauge whether they need to add more dolosse to the pile. The dolosse will be manufactured in Louisiana, can be produced in large numbers, stockpiled locally, loaded directly on to a barge, railcar, or truck directly from the plant, reducing transport costs for local programs.

The dolosse will be pre-cast from a ferro sialate based marine geopolymer concrete formula developed in Louisiana, made from local minerals and local soils under controlled conditions in a local facility. This process will create consistent, permanent, hardened, stable structures that would form a solid protection barrier wherever shoreline protection is needed. Geopolymer concrete composite materials are made up of 70-80% local sands and aggregates and 20-30 % waste minerals (slag, silica fume, fly ash, bauxite residue) from local industrial plants and bulk materials companies. The remainder of the mix is composed of binding agents and concrete additives. When properly mixed and cured, they form a new mineral species or stone. It is environmentally friendly, inert, nano-porous, non-leaching, and provides an excellent base for shellfish production (see Appendix). Mix designs can vary in strength and weight and can be reinforced if needed (traditional dolosse are made of unreinforced Portland concrete due to corrosion issues).

These ferro sialate geopolymer concretes have undergone extensive independent testing and certification by an EPA certified lab under the EPA standard and the ASTM E-729 guidelines for aquatic life testing. Multiple replicates of long-term larval safety testing for marine fish, marine shellfish, and fresh water minnows were completed. All replicates passed, there were no differences in the control in any of the tests or the replicates for mortality or growth, in long term or in acute testing. ASTM Mechanical testing was conducted, most geopolymer mix designs meet or exceed ordinary Portland TYPE II concrete reaching strengths as high as 13,800 psi. Leaching and TNORM levels are below EPA limit. A Beneficial Use application is in process for general production approval and for use as a ferro sialate geopolymer concrete. Ferro sialate concretes are in the early commercialization stage as a green alternative cement to Portland concrete.

The molds are modified to reduce dolo weight by using an insert making the structure hollowed in the center with a stronger concrete mix. The open center allows more surface area, further energy dispersion and access for fish and shellfish habitat.

Preliminary Project Benefits:

This demonstration project/product addresses some specific problems of shoreline protection that still needs some better options. A dolo is a complex geometric shape which can be modified to emphasize desired functions. They can be different lengths, shapes, and weights. They interlock in great numbers as protection against the erosive force of waves from a body of water and can made from a variety of mix designs to achieve optimal performance.

They provide these benefits:

1. Reduced sinking and settling.
2. Uses less material with higher compressive strength.
3. Has much greater surface displacement and is interlocked.
4. Special shape deflects and dissipates wave energy.
5. Protects and enhances existing planted shoreline vegetation.
6. Design features traps sediment and reduces wave energy.
7. Dolo designs are commonly attached to large tree logs combined with debris organic matter and dirt to form living structures, natural habitat along rivers and waterways.
8. Protects and enhance aquatic life, promotes shellfish production on structure.
9. Produces fish and shell fish habitat, produces sea bird habitat, mud brown color.
10. May reduce costs to the program.
11. Geopolymer coastal structures are more abrasion resistant and durable.

Preliminary Construction Costs:

This project is to meet the stated goals above for a pre-cast of 300 modified dolo units, delivered by barge onsite to contractor of choice within 100 miles of Gramercy Louisiana. Appendix A represents dolosse cast from the actual molds that will be used and the outside physical dimensions of the proposed dolosse. The weight will be lighter, the color will be muddy brown, there will small visible holes in the structure, and it will be made of high strength ferro sialate based marine geopolymer concrete. The physical design is unchanged

The estimated cost including a 25% contingency is $390,000.

Preparer(s) of Fact Sheet:

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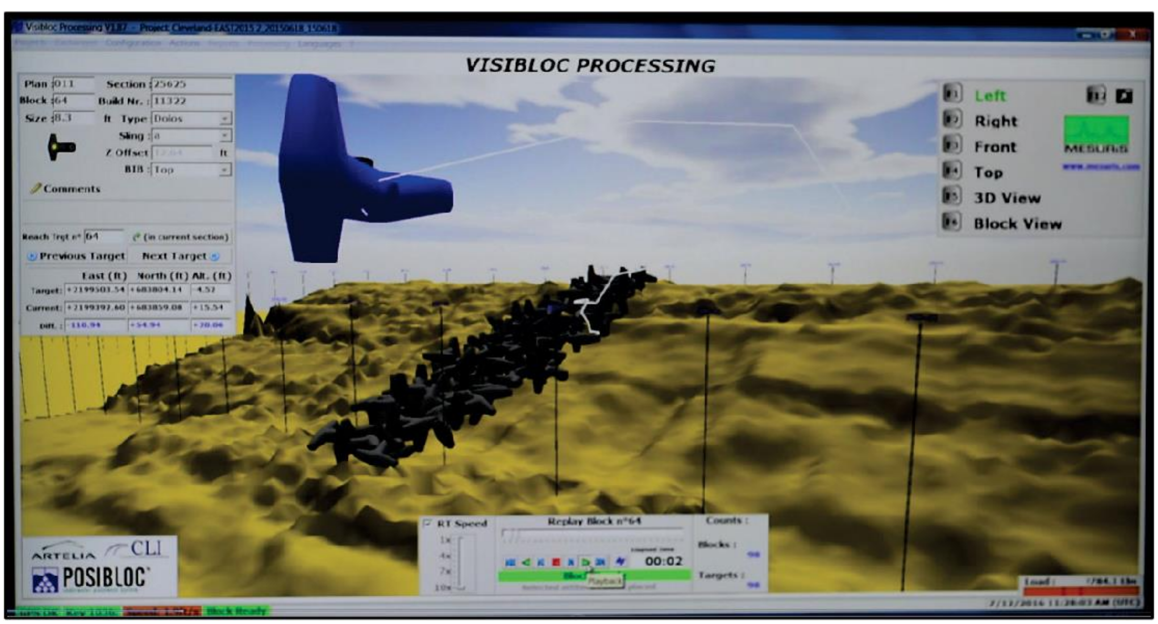
Appendix A

The mold is the standard 6.5ton dolo it is approximately 9 ft end to end and center to center. When interlocked on a flat surface the height is approximately 12 ft. (exact print dimensions currently unavailable)

6.5-ton dolo structures at production yard for size comparison.

Dolosse structure Cleveland, Ohio 6.5-ton units

Software aided controlled placement



Seabirds adapt rapidly to the new habitat

Magnetic harness for precise placement

The barnacle growth on a marine geopolymer rock after 18 months in brackish water on the north shore of Lake Pontchartrain. The reef rock endured extremely heavy silting and very low salinity with 2 spillway openings during the time period. This small surface is also the home of more than dozen small blue crabs a few shrimp and a type of blenny fish.

PPL 30 PROPOSED DEMONSTRATION PROJECT
MARINE GARDENS – DOLOSSE ARMOR SHORELINE PROTECTION
GEOPOLYMER STRUCTURES

Modified Dolo Armor Structures – geopolymer concrete, lightweight interlocking structures for soft soils

Shoreline Protection/Ridge Building/Soft Soils
(dolosse-plural)

PPL 30 PROPOSED DEMONSTRATION PROJECT
MARINE GARDENS-DOLOSSE ARMOR

- Location: Anywhere in Louisiana, can be incorporated into existing projects
- Problem: Shoreline protection in softer soils has traditionally created challenges supporting rock armor near channels and delicate shorelines.
- Goals to demonstrate:
- Modify proven interlocking design using a lighter weight dolosse cast from marine geopolymer ferro sialate concrete to slow sinking and address the problem.
- Prove the advantages of using marine geopolymer concretes in the program.
- Evaluate the financial advantages of large scale pre-caste to the coastal programs.

WHAT IS A DOLO? – ADVANTAGES OF THIS PROJECT?

- Interlocking concrete structures that form coastal shoreline protection
- Reduced sinking greater strength due to interlocking design. They form an interlocked wall.
- Special shape deflects and dissipates wave energy.
- Design features traps sediment and reduces wave energy.
- Protects and enhances existing planted shoreline vegetation
- Dolo designs are commonly attached to large tree logs combined with pylons, debris organic matter and dirt to form living structures and natural habitat along waterways.
- Protects and enhance aquatic life, promotes shellfish production on structure.
- Produces fish and shell fish habitat, produces sea bird habitat.
- Geopolymer coastal structures are more abrasion resistant, durable and chloride resistant
- Uses less material with higher compressive strength.
- Potential for large scale manufacture of Louisiana coastal products.
- Potential savings to the program.

PROPOSED TEST SOLUTION

- Manufacture and deliver onsite 300 dolo shoreline protection structures.
- Modified dolo structures with weight reduction of 30%-50% for 6.5 ton dolo.
- Used in place of heavy limestone boulder in specific problem areas.
- Proof of concept for all stated goals in fact sheet.
- Use the model to test lighter weight dolosse and determine long term financial benefits for coastal programs using pre-cast production of coastal products

TESTING OF MIX DESIGN AND RECAP OF PROJECT

- Mix design passed all EPA aquatic safety tests
- Passed radiological worker safety test. EPA
- Passed heavy metal, toxic leaching test . EPA
- Passed a series of ASTM mechanical tests
- Approval for full production expected 2020
- RECAP
- Project is for the manufacture and delivery onsite by barge for 300 modified dolo structures
- Use of the 6.5 ton basic dolo mold with weight reduction modifications of 30%-50% for the same dimensions.
- Submitting for PPL 30 demonstration or integration into existing projects that may benefit from this product.
- Total Costs to CWPPRA including 25% contingency
- $390,000