



2023 COASTAL MASTER PLAN

# PROJECT COSTING TOOL DOCUMENTATION

ATTACHMENT F7

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COASTAL PROTECTION AND  
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# COASTAL PROTECTION AND RESTORATION AUTHORITY

This document was developed in support of the 2023 Coastal Master Plan being prepared by the Coastal Protection and Restoration Authority (CPRA). CPRA was established by the Louisiana Legislature in response to Hurricanes Katrina and Rita through Act 8 of the First Extraordinary Session of 2005. Act 8 of the First Extraordinary Session of 2005 expanded the membership, duties, and responsibilities of CPRA and charged the new authority to develop and implement a comprehensive coastal protection plan, consisting of a master plan (revised every six years) and annual plans. CPRA's mandate is to develop, implement, and enforce a comprehensive coastal protection and restoration master plan.

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# EXECUTIVE SUMMARY

As coastal Louisiana faces increasing threats from flooding and sea level rise, there is a great need to advance our scientific understanding of the coast and how coastal Louisiana will need to adapt to future conditions. The Coastal Protection and Restoration Authority (CPRA) is undertaking this challenge through six-year updates of Louisiana's Comprehensive Master Plan for a Sustainable Coast. This document summarizes the process by which CPRA developed candidate projects for consideration in the 2023 Coastal Master Plan.

The 2023 Coastal Master Plan builds on past progress and establishes a clear vision for the future. It refines past plans by improving the methods used to ensure projects are evaluated as efficiently, consistently, and effectively as possible. These improvements include changes to the costing methodology and project structure, as well as the development of the Project Development Geodatabase (PDG), the Project Development Database (PDD), and an automated Project Costing Tool (PCT). This document is intended to serve as the technical documentation as the PCT is developed for the Louisiana 2023 Coastal Master Plan. It will be a living document subject to revision as various portions of the new tools and processes are developed in 2020.

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# LIST OF ABBREVIATIONS

|              |  |
|--------------|--|
| ADCIRC ..... | ADVANCED CIRCULATION                         |
| BS.....      | BANK STABILIZATION                           |
| cfs.....     | CUBIC FEET PER SECOND                        |
| CH .....     | CHANNEL CREATION                             |
| CL .....     | GAP CLOSURES                                 |
| CLARA .....  | COASTAL LOUISIANA RISK ASSESSMENT            |
| CPRA .....   | COASTAL PROTECTION AND RESTORATION AUTHORITY |
| DEM .....    | DIGITAL ELEVATION MODEL                      |
| DI .....     | DIVERSION                                    |
| EADD.....    | EXPECTED ANNUAL DAMAGE IN DOLLARS            |
| EASD.....    | EXPECTED ANNUAL STRUCTURAL DAMAGE            |
| EL .....     | EXISTING LEVEE                               |
| ft .....     | FOOT/FEET                                    |
| GA .....     | PROPOSED GATES                               |
| GIS .....    | GEOGRAPHIC INFORMATION SYSTEM                |
| HR .....     | HYDROLOGIC RESTORATION                       |
| ICM .....    | INTEGRATED COMPARTMENT MODEL                 |
| IP.....      | INTEGRATED PROJECT                           |
| LS .....     | LUMP SUM                                     |
| MC .....     | MARSH CREATION                               |
| MPDAP .....  | MASTER PLAN DATA ACCESS PORTAL               |
| NAVD88 ..... | NORTH AMERICAN VERTICAL DATUM OF 1988        |
| NS.....      | NONSTRUCTURAL RISK REDUCTION                 |
| O&M .....    | OPERATIONS AND MAINTENANCE                   |
| OR .....     | OYSTER BARRIER REEF                          |
| PCS .....    | PROJECT COST SUMMARY                         |
| PCT .....    | PROJECT COSTING TOOL                         |
| PDD.....     | PROJECT DEVELOPMENT DATABASE                 |
| PDF .....    | PROJECT DEVELOPMENT GEODATABASE              |



PL ..... PROPOSED LEVEES  
 PSC..... PITTSBURGH SUPERCOMPUTING CENTER  
 PT ..... PLANNING TOOL  
 PW .....PROPOSED FLOODWALL  
 QAQC ..... QUALITY ASSURANCE QUALITY CONTROL  
 RR..... RIDGE RESTORATION  
 SDE.....SPATIAL DATABASE ENGINE  
 SP .....SHORELINE PROTECTION  
 SR..... STRUCTURAL RISK REDUCTION  
 SQL..... STRUCTURED QUERY LANGUAGE  
 SWAN .....SIMULATING WAVES NEARSHORE  
 XX..... MISCELLANEOUS QUANTITY

# 1.0 INTRODUCTION

As Louisiana faces increasing threats from coastal flooding and sea level rise, there is a great need to advance our scientific understanding of the coast and how coastal Louisiana will need to adapt to future conditions. The Coastal Protection and Restoration Authority (CPRA) is undertaking this challenge through six-year updates of Louisiana's Comprehensive Master Plan for a Sustainable Coast. The 2023 Coastal Master Plan builds on past progress and establishes a clear vision for the future. It refines past plans by improving the methods used to ensure projects are evaluated as efficiently, consistently, and effectively as possible.

As discussed in Appendix F: Project Concepts (Sprague, 2023a), previous master plan iterations required hundreds of Excel spreadsheets, dozens of CSV files, and over forty unique Esri shapefiles to measure, quantify, calculate, and aggregate project information, which in turn required frequent manual data transfers between different modeling teams. Because the 2023 Coastal Master Plan is intended to tackle the analysis of broader, more complicated projects than previous plans, a new system was devised for defining and assembling the building blocks used to describe a project. This new system streamlines this process by replacing the cumbersome spreadsheets and shapefiles with four primary features:

1. A centrally accessible PostgreSQL database, called the Project Development Database (PDD), which houses tables of relevant project attributes, metadata, bid items, costs, and any project-level outputs that may need to be passed between modeling teams. Custom Structured Query Language (SQL) scripts are used to access data directly from the PDD as needed.
2. A python program, called the Project Costing Tool (PCT), which reads inputs from the PDD, calculates quantities and costs of each feature within a project, and stores values back into the PDD. Additional data processing scripts are used in conjunction with the PCT to define project attributes and to streamline quality assurance and control (QAQC) procedures.
3. An Esri geodatabase, called the Project Development Geodatabase (PDG), which contains the geospatial representations of all projects in three feature classes (for points, polygons, and polylines); in future iterations of the master plan, geospatial data is intended to be integrated into the PDD with a Spatial Database Engine (SDE). While the PDG is the source of truth for all geospatial data at the Element Level, a copy of the PDG also exists, referred to as the Mapping PDG, which joins project-level attributes from the PDD to the Elements as represented in the PDG. The Mapping PDG is automatically re-created every time the PDD or PDG is updated.
4. A reporting system (presently using Jaspersoft software) that reads from the PDD to produce project-level Project Cost Summary (PCS) reports.

Ultimately, the PDD and PDG act as a central repository for tabular and basic geospatial data used and generated by the four primary master plan modeling teams: the Advanced CIRCulation (ADCIRC) and Simulating WAVes Nearshore (SWAN) team, the Integrated Compartment Model (ICM) team, the Coastal Louisiana Risk Assessment (CLARA) model team, and the Planning Tool (PT) team. Basic project attributes and vector-based geospatial data are developed and then read by the ADCIRC/SWAN, ICM, and CLARA models. Additional project attributes are produced by these models and stored back into the PDD. The PCT reads attributes and produces costs, which are in turn read by the PT, along with model outputs from the ICM and CLARA, to prioritize projects and store project-level results back to the PDD (Figure 1). This effort is intended to streamline data generation and transfer, while greatly reducing the number of files and overall file size required for project definition within the master plan. The Project Cost Summary (PCS) reports are used to summarize detailed project attributes and costs for CPRA engineers to review as part of the project definition process.

To present the project (via vicinity and project maps) and modeling outputs (i.e., estimated cost and duration, project benefits graphs) in a clear, digestible manner, different fact sheets were created for at four unique geographic scales. [Regional Fact Sheets](#) show compiled data for the five designated coastal regions of Louisiana (e.g., Chenier Plain, Terrebonne, etc.). [Parish Fact Sheets](#) are created for parishes with master plan projects or those impacted by modeling (e.g., Jefferson Parish, Tangipahoa Parish, etc.). [Community Fact Sheets](#) documents model outputs and maps for designated community areas (e.g., Belle Chasse Area, Slidell Area, etc.). Finally, [Project Fact Sheets](#) provide project specific data. All Facts Sheets are found in the Attachments F2 to F5.

Additionally, timeseries data developed by the ICM and CLARA modeling teams are formatted within the PDD for specific API calls by the [Master Plan Data Access Portal](#) (MPDAP), which allows the public to view and download more detailed model outputs than are available in the fact sheets or in the [Master Plan Data Viewer](#).

This document is intended to serve as a framework to define the architectural details of the **PCT** and other python-based processing tools as it stands in July 2023, at the conclusion of the 2023 Coastal Master Plan.

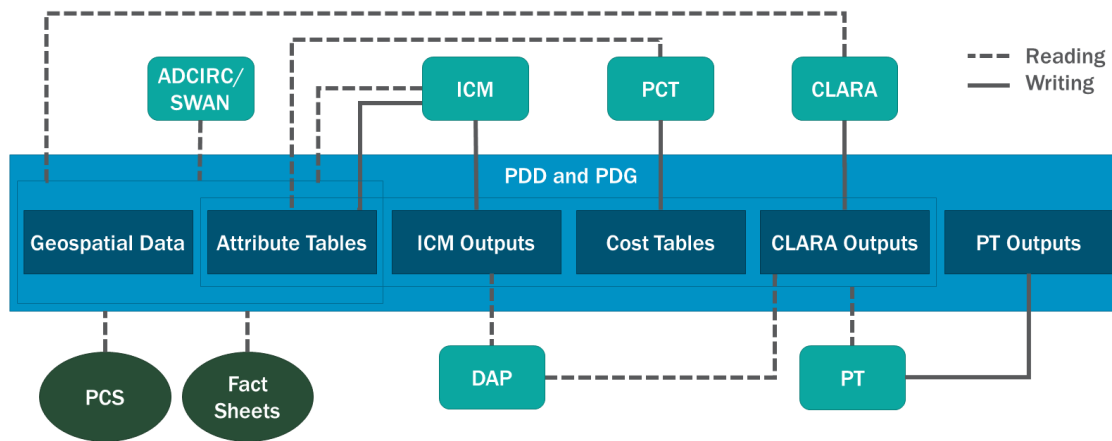


Figure 1. General workflow for data handoffs between modeling teams.

## 1.1 PROJECT ORGANIZATION

As detailed in Appendix F: Project Concepts, there are eight distinct project types evaluated in the master plan, split into two primary categories: Risk Reduction and Restoration. Risk Reduction projects can either be Structural (designated as SR) or Nonstructural (NS), while Restoration projects may fall under one of six categories: Diversions (DI), Hydrologic Restoration (HR), Landbridge (LB), Marsh Creation (MC), Ridge Restoration (RR), and Integrated Projects (IP). Each project is composed of one or many Elements, and multiple projects may reference the same Element. There are thirteen unique Element Types used to define Restoration and Structural Risk Reduction projects: Proposed Levees (PL), Improvements to Existing Levees (EL), Proposed Floodwalls (PW), Proposed Gates (GA), Channel Creation (CH), Marsh Creation (MC), Gap Closures (CL), Ridge Restoration (RR), Shoreline Protection (SP), Bank Stabilization (BS), Oyster Reef (OR), Miscellaneous Quantity (XX), and Lump Sum (LS). Nonstructural Risk Reduction projects are defined by the CLARA model based on counts of properties that may be floodproofed, elevated, or acquired, and do not follow the same project-Element relationships defined elsewhere in the PDD.

Each Element has a subgrouping of Components that comprise some feature of that Element. For example, Shoreline Protection rubble mound Elements include geotextile base, riprap, navigational aid, and settlement plate Components. Lists of Components utilized in costing each Element Type are described in detail in Section 2.0.

## 1.2 REPOSITORY INFORMATION

Python codes related to the PCT and any other master plan processing tools have been developed

using Python version 3.7.9 and stored on a private Arcadis GitHub account. The final public version of the PCT is stored in the MP\_PCT repository on the master plan GitHub site ([https://github.com/CPRA-MP/MP\\_PCT](https://github.com/CPRA-MP/MP_PCT)). GitHub is a website often used in software development that offers version control and cloud storage for code repositories, allowing for collaborative development among multiple users. The MP\_PCT repository is composed of four primary directories, listed below.

1. **Donna:** Contains all codes required to run the PCT
2. **ChannelTool:** Contains tools developed to determine paths and average depths for access and flotation channels
3. **DredgeMob:** Contains tools developed to determine sediment pipeline lengths between Elements and borrow areas
4. **DataProcessing:** Contains general data processing scripts, such as those used to verify accuracy of updates the PDD or PCT or to create operation regime graphics
5. **Jasper:** Contains JasperSoft JastperReport XML (JRXML) files used for generating PCS reports for each candidate project based on data from the PDD
6. **SQL:** Contains SQL scripts used to create views and materialized views in the PDD schemas or to get data needed to build PCS reports from PDD data. See Attachment F6: Project Development Database Documentation (Sprague, 2023b) and [Supplemental Material F6.1: Project Development Database \(PDD\) Data Model Excel Workbook](#) for detailed description of views and materialized views.

## 2.0 PCT

This section describes the architecture of the PCT, including the requirements, file structure, hard-coded constants, and specific calculations and Component Codes that the PCT references in estimating Component quantities and costs for each Element. The PCT is currently deployed on the Pittsburgh Supercomputing Center (PSC) system in the /opt/repositories/pct directory on the vm007.bridges2.psc.edu virtual machine and can be triggered manually or via a call in the web based PDD/PCT user interface.

### 2.1 REQUIREMENTS AND STRUCTURE

A list of Python packages required to run the PCT outside of the standard python library is shown in Table 1.

Table 1. Required Python packages for PCT

| LIBRARY    | VERSION | DESCRIPTION   |
|------------|---------|---|
| PANDAS     | 1.1.1   | OPEN SOURCE DATA ANALYSIS AND MANIPULATION TOOL; USED TO MANIPULATE DATA FROM THE PDD IN A TABLE-LIKE FORMAT        |
| SQLALCHEMY | 1.3.21  | SQL TOOLKIT AND OBJECT RELATIONAL MAPPER; USED IN CONJUNCTION WITH PSYCOPG TO ACCESS DATA IN THE PDD                |
| PSYCOPG2   | 2.8.4   | THE MOST POPULAR POSTGRESQL DATABASE ADAPTER FOR PYTHON; USED IN CONJUNCTION WITH PSYCOPG TO ACCESS DATA IN THE PDD |
| NUMPY      | 1.19.1  | FUNDAMENTAL PACKAGE FOR SCIENTIFIC COMPUTING WITH PYTHON; USED FOR VARIOUS GEOMETRIC AND ALGEBRAIC CALCULATIONS.    |

The PCT comprises several individual Python files, including six files referencing constant lookup values, four function libraries, and one file for executing the model (

Table 2).

Table 2. PCT file names

| CATEGORY                  | FILE (.PY)    | DESCRIPTION   |
|---------------------------|---------------|---|
| CONSTANT<br>LOOKUP VALUES | ATTRIBUTENAME | LIST OF ALL ATTRIBUTES FIELD NAMES STRINGS POPULATED BY THE PCT   |
|                           | COMPONENTCODE | LIST OF ALL COMPONENT CODE STRINGS USED BY THE PCT  |
|                           | CONSTANTS     | LIST OF ALL CONSTANTS USED BY THE PCT   |
|                           | COSTTYPES     | LIST OF ALL COST TYPES (E.G., CONTINGENCY, MOBILIZATION, ETC.) USED BY THE PCT  |
|                           | FIELDNAMES    | LIST OF ALL FIELD NAMES OF TABLES IN THE PDD USED BY THE PCT  |
|                           | TABLENAMES    | LIST OF ALL TABLE NAMES IN THE PDD USED BY THE PCT  |
| FUNCTION<br>LIBRARIES     | COSTMODULES   | CONTAINS A GROUP OF COSTMODULE CLASSES AND SUBCLASSES USED AS THE TEMPLATES TO CALCULATE COMPONENT QUANTITIES FOR EACH ELEMENT TYPE; UTILIZES FUNCTIONS FROM GEOMETRY AND MP23LIBRARY   |
|                           | GEOMETRY      | CONTAINS ALL GEOMETRY-RELATED FUNCTIONS USED IN THE PCT   |
|                           | MP23LIBRARY   | CONTAINS ALL NON-GEOMETRIC AND NON-SQL FUNCTIONS USED IN THE PCT  |
|                           | SQLFUNCTIONS  | CONTAINS SQL-RELATED FUNCTIONS USED IN THE PCT. SOME QUERIES RELEVANT FOR THE PCT ARE DIRECTLY STORED IN THE PDD AS VIEWS OR MATERIALIZED VIEWS.  |
| MODEL                     | RUNDONNA      | RUNS THE PCT. READS DATA FROM THE PDD USING FUNCTIONS FROM SQLFUNCTIONS, CALLS COSTMODULES TO OBTAIN COMPONENT QUANTITIES, APPLIES FUNCTIONS FROM MP23LIBRARY TO APPLY UNIT COSTS AND COST PERCENTAGES, AND WRITES RESULTS BACK INTO THE PDD USING FUNCTIONS FROM SQLFUNCTIONS. |

## 2.2 CONSTANTS

The PCT uses a library of hard-coded constants (defined in *Constants.py*) to estimate Component quantities and Element attributes (Table 3). Because MC sediment unit costs are dependent on the distance to the borrow source, additional constants (the slope and intercept of the curves defined in Figure 12 of Appendix F: Project Concepts) related specifically to the MC sediment unit costs are also defined in *Constants.py* and are summarized in Table 4.

Table 3. Constants used in the PCT

| PARAMETER                      | VALUE | UNIT | APPLICATION                                    | ELEMENT TYPE   |
|--------------------------------|-------|------|--|----------------|
| DRAFT REQUIREMENT              | 8     | FT   | DEPTH OF ACCESS CHANNEL AND FLOTATION CHANNELS | BS, RR, OR, SP |
| FLOTATION CHANNEL BOTTOM WIDTH | 80    | FT   | BOTTOM WIDTH OF FLOTATION CHANNELS             | BS, RR, OR, SP |



| PARAMETER                   | VALUE | UNIT | APPLICATION   | ELEMENT TYPE       |
|-----------------------------|-------|------|---|--------------------|
| ACCESS CHANNEL BOTTOM WIDTH | 60    | FT   | BOTTOM WIDTH OF ACCESS CHANNELS   | BS, RR, OR, SP     |
| DEFAULT CHANNEL SLOPE       | 3     | H:V  | SIDE SLOPE USED IN CHANNEL JERRY VOLUMES  | BS, CH, RR, OR, SP |
| PIPELINE CROSSING WIDTH     | 100   | FT   | OPENING WIDTH ALLOWED AT PIPELINE CROSSINGS TO CALCULATE EFFECTIVE LENGTH   | OR, SP             |
| FISH DIP LENGTH             | 50    | FT   | LENGTH OF A FISH DIP WITHIN A CHANNEL. USED TO CALCULATE TOTAL FISH DIP LENGTH AND EFFECTIVE LENGTH                       | OR, SP             |
| FISH DIP SPACING            | 1,000 | FT   | SPACE BETWEEN FISH DIPS ALONG A CHANNEL. USED TO CALCULATE TOTAL FISH DIP LENGTH AND EFFECTIVE LENGTH                     | OR, SP             |
| FISH DIP HEIGHT             | 1.5   | FT   | HEIGHT OF FISH DIP USED TO CALCULATE THE FISH DIP ROCK VOLUME   | SP                 |
| SETTLEMENT PERCENTAGE       | 20    | %    | PERCENTAGE SETTLEMENT EXPECTED, USED TO CALCULATED ADJUSTED CREST ELEVATION   | SP                 |
| SETTLEMENT PLATE SPACING    | 1,000 | FT   | SPACING OF SETTLEMENT PLATES; 1 PLATE PER 1000 FT (LINEAR) OR 1 PLATE PER 50 ACRES (AREA) TO ESTIMATE CONSTRUCTION COSTS  | MC, SP             |
|                             | 50    | ACRE |   |                    |
| NAVIGATIONAL AID SPACING    | 1,000 | FT   | NAVIGATIONAL AIDS SPACED 1 PER 1,000 FT TO ESTIMATE CONSTRUCTION COSTS  | OR, SP             |
| GEOTEXTILE PANEL LENGTH     | 100   | FT   | WIDTH OF A GEOTEXTILE PANEL. USED TO CALCULATE GEOTEXTILE AREA FOR CONSTRUCTION COSTS                                     | CH, OR, SP         |
| GEOTEXTILE PANEL OVERLAP    | 5     | FT   | LENGTH OF OVERLAP BETWEEN GEOTEXTILE PANELS. USED TO CALCULATE GEOTEXTILE AREA FOR CONSTRUCTION COSTS.                    | CH, OR, SP         |
| GEOTEXTILE PANEL OVERHANG   | 5     | FT   | LENGTH OF GEOTEXTILE OVERHANG AT EACH END OF GEOTEXTILE LENGTH. USED TO CALCULATE GEOTEXTILE AREA FOR CONSTRUCTION COSTS. | CH, OR, SP         |
| GEOTEXTILE OVERAGE          | 1.05  | FT   | ADDITIONAL GEOTEXTILE AREA TO BE INCLUDED IN GEOTEXTILE AREA FOR CONSTRUCTION COSTS                                       | CH, OR, SP         |

| PARAMETER                  | VALUE   | UNIT  | APPLICATION   | ELEMENT TYPE |
|----------------------------|---------|-------|---|--------------|
| RIPRAP LIFT 1 PERCENTAGE   | 50      | %     | ADDITIONAL PERCENTAGE RIPRAP VOLUME ADDED DURING FIRST LIFT TO MAINTAIN DESIGN ELEVATION  | SP           |
| RIPRAP LIFT 2 PERCENTAGE   | 25      | %     | ADDITIONAL PERCENTAGE RIPRAP VOLUME ADDED DURING SECOND LIFT TO MAINTAIN DESIGN ELEVATION   | SP           |
| RIPRAP LIFT 3 PERCENTAGE   | 10      | %     | ADDITIONAL PERCENTAGE RIPRAP VOLUME ADDED DURING THIRD LIFT TO MAINTAIN DESIGN ELEVATION  | SP           |
| SEDIMENT LIFT PERCENTAGE   | 20      | %     | ADDITIONAL PERCENTAGE OF SEDIMENT NEEDED TO MAINTAIN DESIGN ELEVATION   | BS           |
| CUT-TO-FILL RATIO          | 1.5     | N/A   | FACTOR APPLIED TO ESTIMATED VOLUME OF SEDIMENT TO ACCOUNT FOR INITIAL SETTLEMENT AND LOSS DURING MOBILIZATION   | BS           |
| MINIMUM PLANTING ELEVATION | 1.5     | FT    | ELEVATIONS BELOW MINIMUM PLANTING ELEVATION DO NOT RECEIVE PLANTINGS  | RR           |
| PLANTING PERCENTAGE        | 60      | %     | PERCENTAGE OF SURFACE AREA THAT HAS PLANTINGS.  | RR, MC       |
| RR LIFT NUMBER             | 3       | COUNT | NUMBER OF LIFTS EXPECTED AS PART OF O&M CALCULATIONS FOR CONSTRUCTION TYPE AND PLANTINGS  | RR           |
| TOE DEPTH BELOW GROUND     | 1       | FT    | DEPTH OF ARMORING REQUIRED BENEATH THE STREAM CHANNEL BOTTOM  | BS           |
| RIPRAP TONS PER CUBIC YARD | 1.55    | TONS  | CONVERSION TO CALCULATE UNIT WEIGHT, USED IN RIPRAP FACTOR  | SP, CH       |
| ROCK OVERAGE PERCENTAGE    | 10      | %     | ADDITIONAL ROCK USED TO CALCULATE RIPRAP FACTOR   | OR, SP       |
| RIPRAP FACTOR              | 0.06315 | N/A   | CALCULATION OF: RIPRAP TONS PER CUBIC YARD / 27 CUBIC FEET PER CUBIC YARD * (ROCK OVERAGE PERCENTAGE + 1). USED TO CALCULATE COMPONENT RIPRAP VOLUME (LARGE AND SMALL). | SP, CH       |
| OVERBUILD PERCENTAGE       | 25      | %     | OVERBUILD HEIGHT FOR PROPOSED LEVEES TO DETERMINE CONSTRUCTION CREST ELEVATION  | PL, RR       |
| STRUCTURAL SUPERIORITY     | 1       | FT    | ADDITIONAL HEIGHT ADDED TO CREST ELEVATION FOR STRUCTURAL SUPERIORITY TO DETERMINE DESIGN ELEVATION   | PW           |

| PARAMETER              | VALUE  | UNIT  | APPLICATION   | ELEMENT TYPE |
|------------------------|--------|-------|---|--------------|
| CLEAR AND GRUB DEPTH   | 0.5    | FT    | DEPTH ACROSS THE LEVEE FOOTPRINT THAT WILL BE CLEARED AND GRUBBED   | PL, EL       |
| CLOSURE OPENING WIDTH  | 40     | FT    | WIDTH OF A CLOSURE OPENING  | CL           |
| CLOSURE OPENING HEIGHT | 8      | FT    | HEIGHT OF A CLOSURE OPENING   | CL           |
| SP LIFT NUMBER         | 3      | COUNT | NUMBER OF LIFTS REQUIRED FOR ACCESS CHANNEL AND FLOTATION CHANNELS O&M  | SP           |
| DREDGE QUANTITY        | 1      | COUNT | NUMBER OF 30" CUTTERHEAD DREDGES USED IN THE DREDGE MOBILIZATION MODULE   | MC, RR       |
| BUGGY EXCAVATOR COUNT  | 16     | COUNT | NUMBER OF BUGGY EXCAVATORS USED PER CELL WITHIN EACH MC ELEMENT; USED IN THE DREDGE MOBILIZATION MODULE                 | MC, RR       |
| DREDGE PUMP DISTANCE   | 25,000 | FT    | MAXIMUM DREDGING DISTANCE BEFORE A BOOSTER IS REQUIRED; USED IN THE DREDGE MOBILIZATION MODULE                          | MC, RR       |
| BOOSTER SPACING        | 15,000 | FT    | SPACING BETWEEN BOOSTERS TO ESTIMATE THE BOOSTER COUNT FOR DREDGE MOB ESTIMATES; USED IN THE DREDGE MOBILIZATION MODULE | MC, RR       |
| PONTOON LINE DISTANCE  | 3,000  | FT    | PONTOON LINE DISTANCE PER MARSH CREATION CELL; USED IN THE DREDGE MOBILIZATION MODULE                                   | MC, RR       |
| EXTRA PIPE FACTOR      | 10     | %     | ADDITIONAL PIPE FACTORED INTO SHORELINE PIPE MOBILIZATION; USED IN THE DREDGE MOBILIZATION MODULE                       | MC, RR       |
| MARSH BUGGY EXCAVATOR  | 16     | COUNT | COUNT OF MARSH BUGGY EXCAVATORS PER MARSH CREATION CELL; USED IN THE DREDGE MOBILIZATION MODULE                         | MC, RR       |

Table 4. MC sediment unit cost parameters

| SEDIMENT TYPE           | SLOPE  | INTERCEPT |
|-------------------------|--------|-----------|
| OFFSHORE SAND           | 0.2926 | 9.2278    |
| RIVER SAND              | 0.6288 | 3.8689    |
| INTERIOR MIXED SEDIMENT | 0.4241 | 1.4279    |
| OFFSHORE MIXED SEDIMENT | 0.2415 | 5.6747    |
| OFFSHORE SAND HOPPER    | 0.3078 | 11.488    |

## 2.3 COMPONENT TEMPLATES

The following sections describe the component lists and calculation assumptions used in the *CostModules* classes (found in *CostModules.py*) to determine component quantities for each Element of a given Element Type. Appendix F: Project Concepts provides additional element- and project-level assumptions, along with detailed information about how component quantities are converted to costs. The Attachment F6: Project Development Database Documentation (Sprague, 2022b) details the structure of the attribute tables in the PDD used as inputs to the PCT and referenced throughout this document.

## PROPOSED LEVEES (PL) AND IMPROVEMENTS TO EXISTING LEVEES (EL)

Table 5 summarizes the specific component calculations used to derive construction and O&M costs for PL and EL elements.

**Table 5. Component calculations summary for EL and PL Elements**

| COMPONENT                            | COMPONENT CODE  | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS   |
|--------------------------------------|---|--------------------|--|
| LEVEE EMBANKMENT AND COMPACTION      | FROM INPUTTED LEVEECODE (LEVLOW, LEVMED, LEVHIGH, LEVXHIGH) | CONSTRUCTION       | VOLUME OF A PRISM DEFINED BY INPUT SLOPES, BASE ELEVATION, BERM TOP AND BOTTOM ELEVATIONS, CREST WIDTH, AND LENGTH PARAMETERS. AN ADDITIONAL 25% OVERBUILD IS ADDED TO THE HEIGHT OF THE LEVEE.<br><br>THE VOLUME OF ANY EXISTING LEVEE IS CALCULATED SIMILARLY AND SUBTRACTED OUT OF THE VOLUME OF THE PROPOSED LEVEE, IF APPLICABLE. |
| CLEARING AND GRUBBING                | CLG   | CONSTRUCTION       | VOLUME OF A RECTANGULAR PRISM COVERING THE PROPOSED LEVEE FOOTPRINT WITH A 0.5-FT GRUBBING DEPTH.<br><br>IN THE CASE OF AN EXISTING LEVEE, THE CLEARING AND GRUBBING VOLUME IS BASED ON THE SURFACE AREA OF THE EXISTING LEVEE, PLUS ANY ADDITIONAL AREA IN THE PROPOSED LEVEE FOOTPRINT OUTSIDE OF THE EXISTING LEVEE FOOTPRINT.      |
| LEVEE COVERING                       | FROM INPUTTED COVERINGCODE (PLNTT, HPTRM)                   | CONSTRUCTION       | SURFACE AREA OF THE LEVEE FEATURE.   |
| TURF OVER INSPECTION AREA            | PLNTT   | CONSTRUCTION       | RECTANGULAR AREA DEFINED BY THE INPUTTED INSPECTION CORRIDOR WIDTHS AND THE LENGTH OF THE LEVEE  |
| STORMWATER POLLUTION PREVENTION PLAN | SWPPP   | CONSTRUCTION       | TWICE THE LENGTH OF THE PROPOSED LEVEE TO ACCOUNT FOR A SILT FENCE PLACED ON EITHER SIDE OF THE LEVEE  |
| ACCESS ROAD: CRUSHED STONE           | CRS   | CONSTRUCTION       | RECTANGULAR AREA DEFINED BY THE INPUTTED ACCESS ROAD WIDTH AND THE LENGTH OF THE LEVEE   |

| COMPONENT                        | COMPONENT CODE | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS   |
|----------------------------------|----------------|--------------------|--|
| ACCESS ROAD:<br>WOVEN GEOTEXTILE | GTW            | CONSTRUCTION       | RECTANGULAR AREA DEFINED BY THE INPUTTED ACCESS ROAD WIDTH AND THE LENGTH OF THE LEVEE.<br>WOVEN GEOTEXTILE (IN THE FORM OF MULTIPLE 100-FT PANELS) IS ASSUMED TO BE PLACED UNDER THE CRUSHED STONE, WITH 5 FT OF OVERLAP ALONG EACH PANEL AND 5 FT OVER OVERHANG ALONG EACH END OF THE ACCESS ROAD, WITH AN ADDITIONAL 5% OF PANEL AREA TO ACCOUNT FOR OVERAGE. |
| LEVEE<br>MAINTENANCE             | OMLA           | O&M                | RECTANGULAR AREA DEFINED BY THE TOTAL LEVEE FOOTPRINT WIDTH (INCLUDING INSPECTION CORRIDOR) AND THE LENGTH OF THE LEVEE  |

## PROPOSED FLOODWALLS (PW)

Table 6 summarizes the specific component calculations used to derive construction and O&M costs for PW elements.

**Table 6. Component calculations summary for PW Elements**

| COMPONENT                  | COMPONENT CODE | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS   |
|----------------------------|----------------|--------------------|--|
| CONCRETE                   | CC             | CONSTRUCTION       | VOLUME OF TWO RECTANGULAR PRISMS (FOR THE BASE AND FOR THE STEM) DEFINED BY INPUT ELEVATIONS, LENGTH, THICKNESS, AND BASE PARAMETERS |
| FOUNDATION PILES (H-PILES) | FPHP           | CONSTRUCTION       | LINEAR FEET OF PILES DEFINED BY INPUT PILE LENGTH, PILE SPACING, AND PILE ROWS   |
| SHEETPILE CUTOFF WALL      | SPCW           | CONSTRUCTION       | RECTANGULAR AREA DEFINED BY LENGTH OF PW ELEMENT AND INPUTTED SHEETPILE LENGTH   |
| THREE-BULB WATER STOP      | WS             | CONSTRUCTION       | LENGTH OF PW ELEMENT   |
| EXCAVATION                 | EXC            | CONSTRUCTION       | RECTANGULAR PRISM OF WALL BASE DEFINED BY INPUT LENGTH, BASE WIDTH, AND BASE THICKNESS   |

| COMPONENT                            | COMPONENT CODE | COMPONENT CATEGORY | QUALITY CALCULATION ASSUMPTIONS   |
|--------------------------------------|----------------|--------------------|---|
| CLEARING AND GRUBBING                | CLG            | CONSTRUCTION       | VOLUME OF THE PROPOSED WALL FOOTPRINT (INCLUDING INSPECTION AREA) WITH A 0.5-FT GRUBBING DEPTH  |
| STORMWATER POLLUTION PREVENTION PLAN | SWPPP          | CONSTRUCTION       | COST CALCULATED AS TWICE THE LENGTH OF THE PROPOSED WALL  |
| ACCESS ROAD: CRUSHED STONE           | CRS            | CONSTRUCTION       | RECTANGULAR AREA DEFINED BY THE INPUTTED ACCESS ROAD WIDTH AND THE LENGTH OF THE WALL   |
| ACCESS ROAD: WOVEN GEOTEXTILE        | GTW            | CONSTRUCTION       | RECTANGULAR AREA DEFINED BY THE INPUTTED ACCESS ROAD WIDTH AND THE LENGTH OF THE WALL.<br><br>WOVEN GEOTEXTILE (IN THE FORM OF MULTIPLE 100-FT PANELS) IS ASSUMED TO BE PLACED UNDER THE CRUSHED STONE, WITH 5 FT OF OVERLAP ALONG EACH PANEL AND 5 FT OVER OVERHANG ALONG EACH END OF THE ACCESS ROAD, WITH AN ADDITIONAL 5% OF PANEL AREA TO ACCOUNT FOR OVERAGE. |
| INSPECTION                           | OMIN           | O&M                | LENGTH OF PW ELEMENT  |
| FLOODWALL MAINTENANCE                | OMFM           | O&M                | LENGTH OF PW ELEMENT  |

## PROPOSED GATES (GA)

Table 7 summarizes the specific component calculations used to derive construction and O&M costs for GA elements.

**Table 7. Component calculations summary for GA Elements**

| COMPONENT        | COMPONENT CODE  | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS |
|------------------|---|--------------------|----------------------------------|
| GATE             | FROM INPUTTED GATECODE, SEE GATE TABLE FOR FULL LIST OF OPTIONS | CONSTRUCTION       | INPUTTED NUMBER OF GATES         |
| GATE MAINTENANCE | OMMG  | O&M                | INPUTTED NUMBER OF GATES         |

## CHANNEL CREATION (CH)

Table 8 summarizes the specific component calculations used to derive construction costs for CH elements.

**Table 8. Component calculation summary for CH Elements**

| COMPONENT             | COMPONENT CODE   | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS   |
|-----------------------|--|--------------------|--|
| CHANNEL               | FROM INPUTTED CHANNELCODE (CHCVD, CHCVE, CHID, CHIE, CHOD, CHOE) | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM DEFINED BY INPUT SLOPE, ELEVATION, CREST WIDTH, AND LENGTH PARAMETERS. CHANNEL TYPE (EXCAVATION OR DREDGING) IS SPECIFIED BY THE LAST LETTER OF THE COMPONENT CODE (E OR D, RESPECTIVELY). IF AN EXISTING CHANNEL IS PRESENT IN THE INPUT TABLE, THE EXCAVATION AND DREDGING ARE MODIFIED TO INCORPORATE THE DIFFERENCE IN GEOMETRY. |
| SCOUR PROTECTION      | FROM INPUTTED SCOURPROTECTION CODE (ACB, RPSM)                   | CONSTRUCTION       | SURFACE AREA OF THE TRAPEZOIDAL PRISM CHANNEL. IF THE SCOUR PROTECTION IS RIPRAP, THE VOLUME OF RIPRAP IS CALCULATED BASED ON THE INPUT RIPRAP THICKNESS.  |
| GEOTEXTILE            | FROM INPUTTED GEOTEXTILECODE (GTW, GTNW)                         | CONSTRUCTION       | RECTANGULAR AREA COVERING THE BOTTOM WIDTH OF THE CHANNEL.<br><br>WOVEN GEOTEXTILE (IN THE FORM OF MULTIPLE 100-FT PANELS) IS ASSUMED TO BE PLACED ALONG THE CHANNEL BOTTOM, WITH 5 FT OF OVERLAP ALONG EACH PANEL AND 5 FT OVER OVERHANG ALONG EACH END OF THE CHANNEL, WITH AN ADDITIONAL 5% OF PANEL AREA TO ACCOUNT FOR OVERAGE.                               |
| CLEARING AND GRUBBING | CLG  | CONSTRUCTION       | VOLUME EQUAL TO THE CHANNEL FOOTPRINT MULTIPLIED BY A STANDARD CLEARING AND GRUBBING DEPTH OF 0.5 FT, IF THE INPUT CHANNELCODE SPECIFIES EXCAVATION  |

## MARSH CREATION (MC) AND BORROW OPTIONS



Table 9 summarizes the specific component calculations used to derive construction and mobilization costs for MC elements.

Table 9. Component calculation summary for MC Elements

| COMPONENT                             | COMPONENT CODE  | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS  |
|---------------------------------------|---|--------------------|---|
| SETTLEMENT PLATES                     | STPL  | CONSTRUCTION       | ONE PER 50 ACRES OF INPUTTED MARSHAREA  |
| VEGETATIVE PLANTING                   | FROM INPUTTED MARSHVEGETATIONCODE (PLNTB, PLNTF, PLNTS)   | CONSTRUCTION       | 60% OF THE INPUTTED MARSHAREA   |
| MARSH CREATION                        | SEDIMENTCODE IN BORROWSOURCESEDIMENTTYPE TABLE, LINKED FROM INPUTTED BORROWSOURCE (OSS, RS, MIXF) | CONSTRUCTION       | INPUTTED MARSHVOLUME  |
| CONTAINMENT DIKE                      | CND   | CONSTRUCTION       | INPUTTED DIKELENGTH   |
| SUBLINE AND PONTOON PIPE MOBILIZATION | SLPPM   | MOBILIZATION       | INPUTTED DREDGESUBLINEPRELAY PLUS AN ADDITIONAL 3,000 FT PER CELL WITHIN THE ELEMENT  |
| SUBLINE PIPE PRELAY                   | SLPPL   | MOBILIZATION       | INPUTTED DREDGESUBLINEPRELAY  |
| SUBLINE PIPE PICKUP                   | SLPPU   | MOBILIZATION       |   |
| SHORELINE PIPE MOBILIZATION           | SHPM  | MOBILIZATION       | INPUTTED DREDGESHORELINEPRELAY PLUS AN ADDITIONAL 10% OF THE OVERALL SUMMED FILL-TO-BORROW DISTANCE FOR ALL CELLS                           |
| SHORELINE PIPE PRELAY                 | SHPPL   | MOBILIZATION       |   |
| SHORELINE PIPE PICKUP                 | SHPPU   | MOBILIZATION       | INPUTTED DREDGESHORELINEPICKUP  |
| 30-INCH DREDGE                        | DR30  | MOBILIZATION       | ALWAYS EQUAL TO ONE   |
| BOOSTER PUMP                          | BP  | MOBILIZATION       | ONE PER 15,000 FT OVER 25,000 FT OF THE AVERAGE FILL-TO-BORROW DISTANCE FOR ALL CELLS, MULTIPLIED BY THE NUMBER OF CELLS WITHIN THE ELEMENT |

| COMPONENT       | COMPONENT CODE | COMPONENT<br>CATEGORY | QUANTITY CALCULATION ASSUMPTIONS |
|-----------------|----------------|-----------------------|----------------------------------|
| MARSH EXCAVATOR | MRBE           | MOBILIZATION          | SIXTEEN PER CELL                 |

## GAP CLOSURES (CL)

Table 10 summarizes the specific component calculations used to derive construction costs for CL elements.

Table 10. Component calculation summary for CL Elements

| COMPONENT      | COMPONENT CODE | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS   |
|----------------|----------------|--------------------|--|
| SHEETPILE WALL | MCL            | CONSTRUCTION       | AREA EQUAL TO THREE TIMES THE DEPTH AT THE CLOSURE (CRESTELEVATION - BASEELEVATION) MULTIPLIED BY THE INPUTTED LENGTH, MINUS A 40-FT BY 8-FT RECTANGULAR AREA IF CLOSUREOPEN IS TRUE.<br><br>SHEET PILES ARE ASSUMED TO FOLLOW A GENERAL RULE OF 1/3 OF THEIR TOTAL LENGTH STICKING UP IN A CANTILEVER FASHION (EITHER IN WATER OR AIR) AND 2/3 OF THEIR TOTAL LENGTH BURIED, AS MEASURED FROM THE CHANNEL INVERT. |

## RIDGE RESTORATION (RR)

Table 11 summarizes the specific component calculations used to derive construction costs for RR elements. If an RR Element has an inputted Ridge Component code of OMIXF or RS, a dredge mobilization costs are itemized as is done for MC Elements; otherwise, the standard mobilization percentage is applied.

Table 11. Component calculation summary for RR Elements

| COMPONENT           | COMPONENT CODE   | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS  |
|---------------------|--|--------------------|---|
| RIDGE               | FROM INPUTTED CONSTRUCTIONCODE (RCBK, RCMB, OMIXF, RS) | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM DEFINED BY INPUT SLOPE, BASE ELEVATION, CREST ELEVATION, CREST WIDTH, AND LENGTH PARAMETERS, AND A BORROW-FILL RATIO OF 1.5. AN ADDITIONAL 25% OVERBUILD IS ADDED TO THE HEIGHT OF THE RIDGE. |
| VEGETATIVE PLANTING | PLNTS  | CONSTRUCTION       | 60% OF THE SURFACE AREA FROM ELEVATION FROM +1.5 FT NAVD88 UP TO THE CREST ELEVATION  |

| COMPONENT                             | COMPONENT CODE | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS  |
|---------------------------------------|----------------|--------------------|---|
| HARDWOOD PLANTING                     | PLNTH          | CONSTRUCTION       | SURFACE AREA OF CREST, DEFINED BY CREST WIDTH AND RIDGE LENGTH  |
| ACCESS CHANNEL                        | CHA            | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM WITH INPUTTED LENGTH AND ELEVATION, AN 8-FT DEPTH, 3H:1V SIDE SLOPES, AND A BOTTOM WIDTH OF 60 FT |
| SUBLINE AND PONTOON PIPE MOBILIZATION | SLPPM          | MOBILIZATION       | INPUTTED DREDGESUBLINEPRELAY PLUS AN ADDITIONAL 3,000 FT PER ELEMENT, AS APPLICABLE   |
| SUBLINE PIPE PRELAY                   | SLPPL          | MOBILIZATION       | INPUTTED DREDGESUBLINEPRELAY, WHEN APPLICABLE   |
| SUBLINE PIPE PICKUP                   | SLPPU          | MOBILIZATION       |   |
| SHORELINE PIPE MOBILIZATION           | SHPM           | MOBILIZATION       | INPUTTED DREDGESHORELINEPRELAY PLUS AN ADDITIONAL 10% OF THE OVERALL FILL-TO-BORROW DISTANCE, WHEN APPLICABLE                   |
| SHORELINE PIPE PRELAY                 | SHPPL          | MOBILIZATION       |   |
| SHORELINE PIPE PICKUP                 | SHPPU          | MOBILIZATION       | INPUTTED DREDGESHORELINEPICKUP, WHEN APPLICABLE   |
| 30-INCH DREDGE                        | DR30           | MOBILIZATION       | ALWAYS EQUAL TO ONE, WHEN APPLICABLE  |
| BOOSTER PUMP                          | BP             | MOBILIZATION       | ONE PER 15,000 FT OVER 25,000 FT OF THE AVERAGE FILL-TO-BORROW DISTANCE, WHEN APPLICABLE  |
| MARSH EXCAVATOR                       | MRBE           | MOBILIZATION       | SIXTEEN PER ELEMENT   |

## SHORELINE PROECTION (SP)

Table 12 summarizes the specific component calculations used to derive construction and O&M costs for SP elements.

Table 12. Component calculation summary for SP Elements

| COMPONENT                 | COMPONENT CODE                        | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS   |
|---------------------------|---------------------------------------|--------------------|--|
| SHORELINE PROTECTION      | FROM INPUTTED RIPRAPCODE (RPSM, RPLG) | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM DEFINED BY INPUT SLOPE, BASE ELEVATION, CREST ELEVATION, CREST WIDTH, AND EFFECTIVE LENGTH PARAMETERS, A ROCK TONS-TO-CUBIC YARD RATIO OF 1.55 AND A 10% ROCK SPILLAGE VALUE (I.E., 10% OF ROCK VOLUME ASSUMED TO SPILL INTO ADJACENT AREAS). THE HEIGHT OF THE ROCK FEATURE WAS INCREASED BY 20% TO ACCOUNT FOR SETTLEMENT.<br>FISH-DIPS WERE ASSUMED TO BE SPACED EVERY 1,000 FT, AND THE VOLUME OF A RECTANGULAR PRISM OF 50 FT IN LENGTH, 1.5-FT HEIGHT, AND THE WIDTH OF THE SHORELINE PROTECTION FEATURE WAS ADDED TO THE TOTAL VOLUME.<br>NO ROCK WAS PLACED OVER PIPELINE CROSSINGS. |
| SETTLEMENT PLATES         | STPL                                  | CONSTRUCTION       | ONE PER 1,000 LINEAR FT  |
| NAVIGATIONAL AIDS (SMALL) | NAVS                                  | CONSTRUCTION       | ONE PER 1,000 LINEAR FT  |
| WOVEN GEOTEXTILE          | GTW                                   | CONSTRUCTION       | RECTANGULAR AREA COVERING THE FOOTPRINT OF THE ROCK FEATURE. WOVEN GEOTEXTILE (IN THE FORM OF MULTIPLE 100-FT PANELS) IS ASSUMED TO BE PLACED ALONG THE FEATURE, WITH 5 FT OF OVERLAP ALONG EACH PANEL AND 5 FT OVER OVERHANG ALONG EACH END OF THE CHANNEL, WITH AN ADDITIONAL 5% OF PANEL AREA TO ACCOUNT FOR OVERAGE.   |
| ACCESS CHANNEL            | CHA                                   | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM WITH INPUTTED LENGTH AND ELEVATION, AN 8-FT DEPTH, 3H:1V SIDE SLOPES, AND A BOTTOM WIDTH OF 60 FT  |
| FLOTATION CHANNEL         | CHF                                   | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM WITH INPUTTED LENGTH AND ELEVATION, AN 8-FT DEPTH, 3H:1V SIDE SLOPES, AND A BOTTOM WIDTH OF 80 FT  |
| ELEMENT LIFT              | FROM INPUTTED RIPRAPCODE (RPSM, RPLG) | O&M                | A TOTAL OF 85% (50% FOR LIFT 1, 25% FOR LIFT 2, 10% FOR LIFT 3) OF THE VOLUME OF THE SHORELINE PROTECTION FEATURE  |
| ACCESS CHANNEL            | CHA                                   | O&M                | THREE TIMES THE QUANTITY FOR ACCESS CHANNELS   |

| COMPONENT         | COMPONENT CODE | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS                |
|-------------------|----------------|--------------------|---|
| FLOTATION CHANNEL | CHF            | O&M                | THREE TIMES THE QUANTITY FOR FLOTATION CHANNELS |

## BANK STABILIZATION (BS)

Table 13 summarizes the specific component calculations used to derive construction and O&M costs for BS elements.

Table 13. Component calculation summary for BS Elements

| COMPONENT          | COMPONENT CODE                    | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS  |
|--------------------|-----------------------------------|--------------------|---|
| BANK STABILIZATION | BS                                | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM DEFINED BY INPUT SLOPE, BASE ELEVATION, CREST ELEVATION, CREST WIDTH, AND LENGTH PARAMETERS, AND A BORROW-FILL RATIO OF 1.5 |
| ARMORING           | FROM INPUT ARMORTYPE (HPTRM, ACB) | CONSTRUCTION       | SURFACE AREA OF THE TRAPEZOIDAL PRISM PLUS AREA 1 FT BELOW THE BOTTOM OF THE FEATURE ON THE FLOOD SIDE SLOPE  |
| ACCESS CHANNEL     | CHA                               | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM WITH INPUTTED LENGTH AND ELEVATION, AN 8-FT DEPTH, 3H:1V SIDE SLOPES, AND A BOTTOM WIDTH OF 60 FT                           |
| BANK STABILIZATION | BS                                | O&M                | 20% OF THE VOLUME OF THE RIDGE TO COUNTERACT SETTLEMENT, ASSUMING ONE RIDGE LIFT  |
| ARMORING           | FROM INPUT ARMORTYPE (HPTRM, ACB) | O&M                | EQUAL TO THE INITIAL ARMORING AREA, ASSUMING ONE RIDGE LIFT   |
| ACCESS CHANNEL     | CHA                               | O&M                | THREE TIMES THE QUANTITY FOR ACCESS CHANNELS  |

## OYSTER BARRIER REEF (OR)

Table 14 summarizes the specific component calculations used to derive construction costs for OR elements.

Table 14. Component calculation summary for OR Elements

| COMPONENT                  | COMPONENT CODE | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS   |
|----------------------------|----------------|--------------------|--|
| OYSTER REEF                | OR             | CONSTRUCTION       | EFFECTIVELENGTH  |
| NAVIGATIONAL AIDS (MEDIUM) | NAVM           | CONSTRUCTION       | ONE PER 1,000 LINEAR FT  |
| GEOTEXTILE                 | GTW            | CONSTRUCTION       | RECTANGULAR AREA COVERING THE FOOTPRINT OF THE OYSTER REEF FEATURE.<br><br>WOVEN GEOTEXTILE (IN THE FORM OF MULTIPLE 100-FT PANELS) IS ASSUMED TO BE PLACED ALONG THE FEATURE, WITH 5 FT OF OVERLAP ALONG EACH PANEL AND 5 FT OVER OVERHANG ALONG EACH END OF THE CHANNEL, WITH AN ADDITIONAL 5% OF PANEL AREA TO ACCOUNT FOR OVERAGE. |
| ACCESS CHANNEL             | CHA            | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM WITH INPUTTED LENGTH AND ELEVATION, AN 8-FT DEPTH, 3H:1V SIDE SLOPES, AND A BOTTOM WIDTH OF 60 FT  |
| FLOTATION CHANNEL          | CHF            | CONSTRUCTION       | VOLUME OF A TRAPEZOIDAL PRISM WITH INPUTTED LENGTH AND ELEVATION, AN 8-FT DEPTH, 3H:1V SIDE SLOPES, AND A BOTTOM WIDTH OF 80 FT  |

#### MISCELLANEOUS (XX AND LS)

Table 15 summarizes the specific component calculations used to derive construction and O&M costs for XX and LS Elements.

Table 15. Component calculation summary for XX and LS Elements

| ELEMENT TYPE | COMPONENT               | COMPONENT CODE              | COMPONENT CATEGORY | QUANTITY CALCULATION ASSUMPTIONS                  |
|--------------|-------------------------|-----------------------------|--------------------|---|
| XX           | MISCELLANEOUS COMPONENT | FROM INPUTTED COMPONENTCODE | CONSTRUCTION       | QUANTITY (DIRECT INPUT)                           |
| LS           | MISCELLANEOUS COMPONENT | LS                          | CONSTRUCTION       | QUANTITY (DIRECT INPUT)                           |
| XX           | PUMP STATION REPAIR     | OMPS, OMPS                  | O&M                | IF INPUT IS PUMP STATION, QUANTITY (DIRECT INPUT) |

## 3.0 CHANNEL TOOLS

This section summarizes the arcpy tools developed to determine paths and average depths for access and flotation channels required for BS, RR, OR, and SP Elements for the 2023 Coastal Master Plan. These tools utilize the statewide 15-meter topobathymetric digital elevation model (DEM) to determine paths of minimal dredging from each Element to navigable water (access channel) and paths parallel to each Element used for barges to place material along the linear feature (flotation channel).

Access channels are drawn between each Element and navigable waters. The navigable waters polygon was manually created using the DEM, federal navigable waters, and manually identified shipping channels. These channels were identified by either continuing channels only partially resolved by the DEM, or through knowledge of shipping pathways. Manually identified channels were all assumed to be 600 ft wide. Discontinuous pockets of deep water were not included in the navigable waters feature class, but access and flotation channels may use these areas with no associated dredging costs. Draft requirements for calculating access and flotation channels are set to -8 ft NAVD88 with a water surface elevation of 0 ft NAVD88 and do not consider regional variations in water surface elevations.

Figure 2 shows the results of the Channel Tools, where the Element-parallel flotation channels (blue) are connected to navigable waters (grey) by access channels (red) where necessary. The northern Element does not require an access channel because it intersects navigable waters.

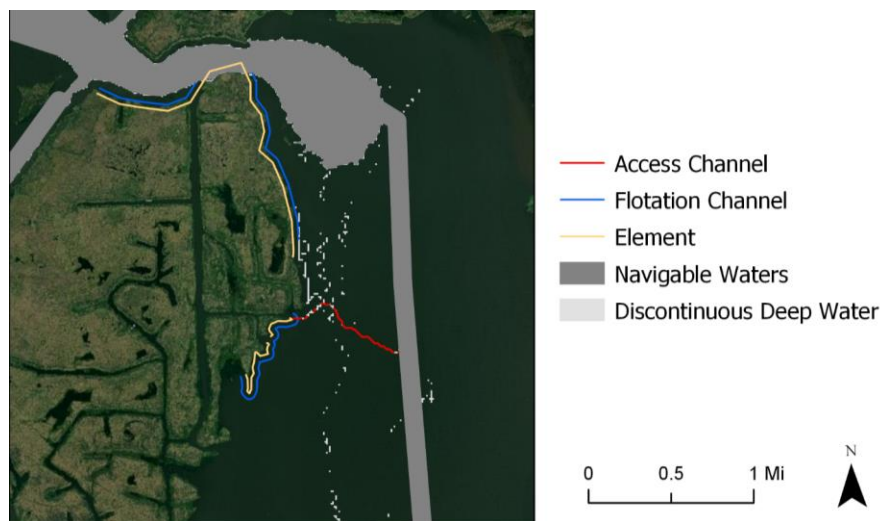


Figure 2. Example access and flotation channels.

Flotation and Access Channel tools are written using the arcpy library associated with ArcGIS Pro version 2.7.0 and require an Advanced ArcGIS license with the Spatial Analyst toolbox. These tools are



run locally through a python console or directly in ArcGIS Pro but are not available on the PSC virtual machine due to Esri licensing limitations.

The *ChannelTool* directory in the MP\_PCT repository contains six python files required to produce access and flotation channel features. The *Inputs.py* file defines file paths to the required Lines feature class from the PDG, the statewide DEM, the navigable waters polygon feature class, along with other constants used in the tool, such as the 8-ft draft requirement. The *Functions.py* is used to define common functions that are referenced by the remaining four scripts that are used in serial to create the AccessChannel and FlotationChannel feature classes, which define the alignment and average existing elevation of each path for each Element. These four scripts are run in the following order, and are each described in detail later in this section:

1. **Preprocessing.py** Processes the DEM at the state level to determine a path of least dredging between navigable waters and any other location; only needs to run if the DEM or navigable waters input are updated.
2. **FlotationPath.py** Generates flotation paths along SP and OR Elements.
3. **AccessPath.py** Generates access paths to BS and RR Elements and SP and OR flotation paths.
4. **ExportData.py** Determines access and flotation channels by removing areas with discontinuous deep water, and extracts lengths and average depths.

## PREPROCESSING

The *Preprocessing.py* script creates rasters to determine the path of least dredging between navigable waters and any other location in the DEM below 0 ft NAVD88. This script needs to be run once before producing access and flotation channels, but only needs to be re-run if the DEM or the navigable waters feature class are updated. Outputs of *Preprocessing.py* include the following three rasters and one polygon feature class, used as inputs in the *AccessPath.py* and *ExportData.py* scripts:

- **path\_raster:** A raster indicating areas that access paths can be drawn (between 0 and -8 ft NAVD88)
- **cost\_raster:** A raster indicating the dredging depth associated areas in the *PathRast* output.
- **backlink\_raster:** A raster indicating the direction of travel for the path of least dredging to navigable water for any area along the coast.
- **deep\_poly:** Polygon feature class of all areas below -8 ft NAVD88.

## FLOTATION PATH

The *FlotationPath.py* script creates flotation channel paths parallel to each SP and OR Element. Flotation paths are offset 55 ft from the Element centerline and are drawn even in navigable waters

where dredging is not required (these sections are later removed in *ExtractAttributes.py*). The tool draws the flotation channel on the side of the Element adjacent to open water, which is always on the right side of Elements in the 2023 Coastal Master Plan. Outputs of *FlotationPath.py* include the following feature class, used in *ExtractAttributes.py*:

- **flotation\_paths:** A line feature class representing preliminary flotation path alignments.

## ACCESS PATH

The *AccessChannel.py* script uses the rasters created in *Preprocessing.py* to create access paths based on the path of least dredging between each Element and navigable water. Like in *FlotationPath.py*, access paths may be drawn in areas where dredging is not required, but these sections are later removed in *ExtractAttributes.py*. The tool bases paths on both distance and required dredging. Due to local bathymetry, the chosen path may not be the shortest distance path. The tool creates an access path for each Element in a project, but there may be some instances in which connecting to an adjacent Element's flotation channel produces a shorter channel, which would not be captured by the *AccessChannel.py* tool. Outputs of *AccessPath.py* include the following feature class, used in *ExtractAttributes.py*:

- **access\_paths:** A line feature class representing preliminary access path alignments.

## EXPORT DATA

The *ExportData.py* script uses the *flotation\_paths* and *access\_paths* feature classes produced in the previous two scripts, along with the *deep\_poly* feature class produced in the *Preprocessing.py* script to remove pieces of flotation and access paths located in deep water (areas below -8 ft NAVD88) and determine final channel length and average existing elevation for each access and flotation channel. In some instances, the entire path drawn by the *FlotationChannel.py* or *AccessChannel.py* may be in deep water, and thus deleted by *ExtractAttributes.py*. The final outputs of the Channel Tool are produced via *ExtractAttributes.py*, and include:

- **flotation\_channel:** A line feature class representing final flotation path alignments, with Element number, length, and average existing elevation (feet NAVD88) attributes.
- **access\_channel:** A line feature class representing final access path alignments, with Element number, length, and average existing elevation (feet NAVD88) attributes.

## 4.0 DREDGE MOBILIZATION TOOL

This section summarizes the arcpy tool developed to determine sediment mobilization paths between Elements and borrow areas for all MC Elements and some RR Elements considered in the 2023 Coastal Master Plan. This tool utilizes the master plan's statewide land/water initial conditions raster, along with user-specified allowed paths (paths that a dredge pipeline can traverse that are too small to be resolved in land/water raster) to determine the shortest path between each applicable borrow source and groups of MC cells within each project. Once the path reaches each group, it fans out to reach each cell within that group, and then is directed to the farthest edge of that cell. The same land/water raster is used to determine over-land and over-water path distances for use in dredge mobilization cost calculations. The tool calculates attributes for subline prelay, shoreline prelay, and shoreline pickup distances, that are in turn stored in the PDD.

Dredge mobilization pathways are based on groupings (called GIS groups) of MC cells within each Element. A GIS group may represent the same aggregation of cells as an Element, or an Element may be broken into multiple GIS groups if some cells within an element are closer to a different borrow source than the rest of the cells. Dredge mobilization pathways between borrow sources and GIS groups (known as GIS group paths) are drawn for each appropriate borrow source based on defined regions (Figure 3). GIS group paths are drawn to the GIS group from each interior or river borrow source within its region, as well as from the nearest offshore borrow source.

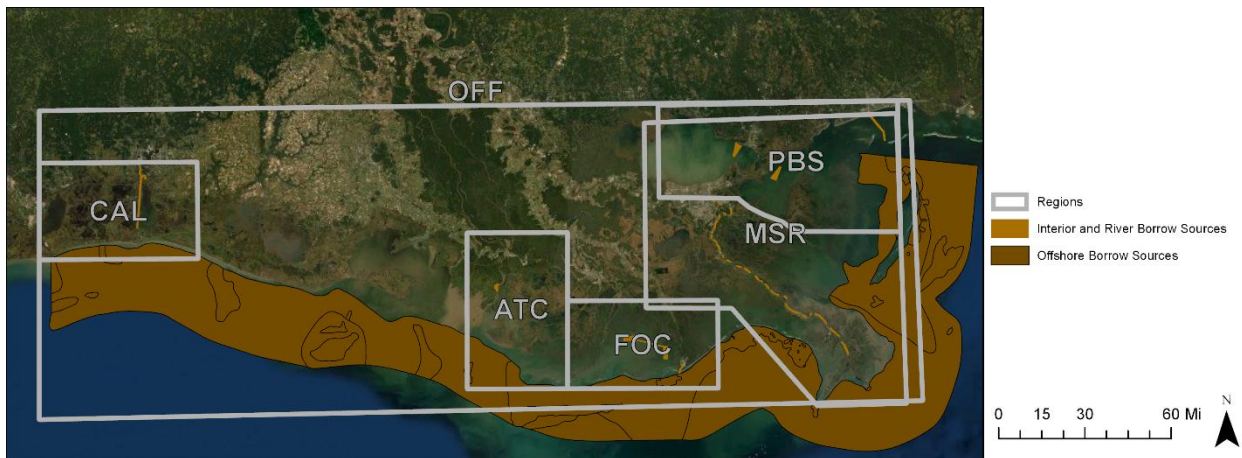


Figure 3. Defined borrow regions.

An example output of the dredge mobilization tool is shown in Figure 4. GIS group paths (red) connect borrow sources (grey) to the closest edge of each marsh creation GIS group (tan). To-cell paths (blue) connect the end of the GIS group path to the closest edge of each cell, and in-cell paths (black) connect to the farthest edge of each cell.

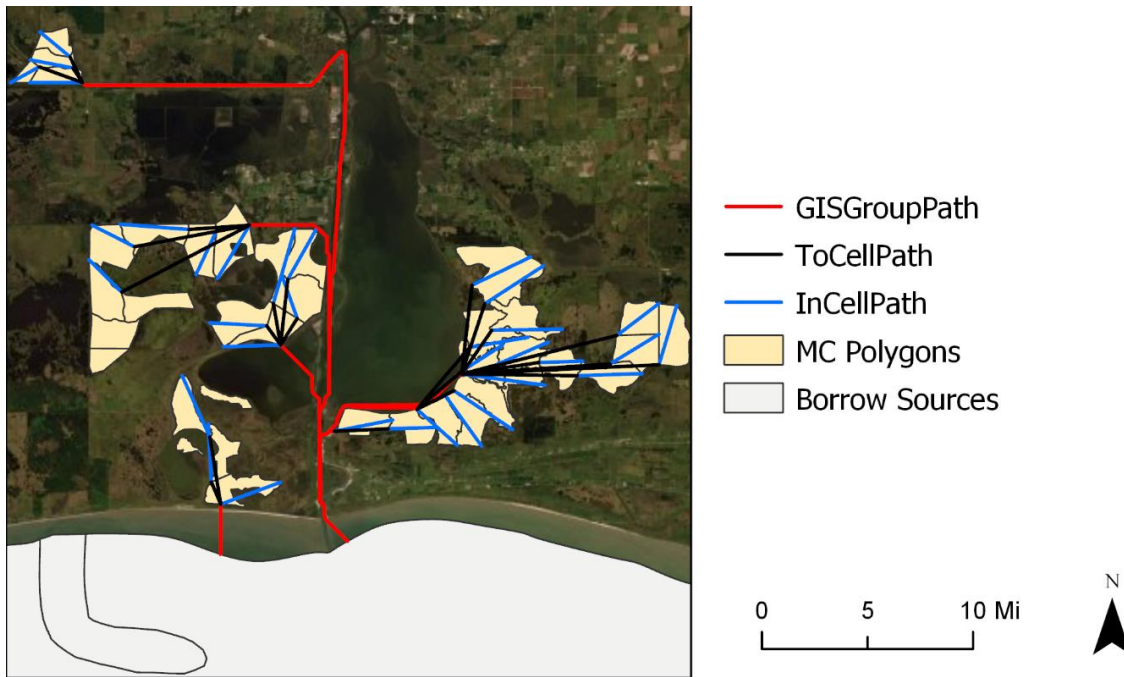


Figure 4. Dredge Mobilization Tool Outputs.

The Dredge Mobilization tool is written using the arcpy library associated with ArcGIS Pro version 2.7.0 and requires an Advanced ArcGIS license with the Spatial Analyst toolbox, along with the additional packages outlined in Table 16. These tools are run locally through a python console or directly in ArcGIS Pro, but are not available on the PSC virtual machine due to Esri licensing limitations.

Table 16. Required Python packages for the Dredge Mobilization Tool

| LIBRARY | VERSION                                   | DESCRIPTION  |
|---------|---|--|
| ARCPY   | CORRESPONDING TO ARCGIS PRO VERSION 2.7.0 | ESRI'S PROPRIETARY LIBRARY FOR GEOPROCESSING FUNCTIONS   |
| ARCGIS  | 1.8.3                                     | USED TO IMPORT GEOSPATIAL DATA AS PANDAS OBJECTS   |
| PANDAS  | 1.1.1                                     | OPEN-SOURCE DATA ANALYSIS AND MANIPULATION TOOL; USED TO MANIPULATE DATA IN A TABLE-LIKE FORMAT                  |
| NUMPY   | 1.19.1                                    | FUNDAMENTAL PACKAGE FOR SCIENTIFIC COMPUTING WITH PYTHON; USED FOR VARIOUS GEOMETRIC AND ALGEBRAIC CALCULATIONS. |

The *DredgeMob* directory in the MP\_PCT repository contains seven python files required to produce dredge mobilization pathways. The *Inputs.py* file defines input file paths and any constants used in the tool. Inputs include the Polygons\_cells feature class from the PDG, the statewide land/water raster,

the borrow source and borrow regions polygon feature classes, and the allowed paths line feature class. The *Functions.py* file is used to define common functions that are referenced by the remaining five scripts. These scripts are used in serial to create the *ElementPath* output feature class, which defines the alignment and relevant attributes of each dredge mobilization path. These five scripts are run in the following order, and are each described in detail later in this section:

1. **Preprocessing.py:** Processes the land/water raster at the state level to determine the shortest path to each borrow source for any given location within a borrow region.
2. **GISGroupPath.py:** Generates the shortest distance path either over water or along allowed paths from each GIS group to each applicable borrow source.
3. **CellPath.py:** Generates in-cell and to-cell paths for each cell, based on each GIS group path.
4. **CalculateAttributes.py:** Calculates dredge mobilization attributes (subline prelay, shoreline prelay, shoreline pickup) based on lengths of paths over land and water.
5. **ExportData.py:** Formats outputs for the PDD and PDG.

## PREPROCESSING

The *Preprocessing.py* script creates rasters to determine the shortest path over water or along manually specified allowed paths between borrow sources and any given location within a borrow region. This tool produces output rasters for each borrow source clipped to their applicable region. This script needs to be run once before producing dredge mobilization pathways, but only needs to be re-run if the land/water raster, borrow source feature class, or allowed paths feature class are updated. Outputs of *Preprocessing.py* include the following three rasters and one polygon feature class, used as inputs in the *GISGroupPath.py* and *CalculateAttributes.py* scripts:

- **Distance Rasters (distanceraster\_\*):** A set of rasters indicating the distance (along the corresponding *PathRasters*) to the target borrow area, generated for each borrow source.
- **Backlink Rasters (backlink\_\*):** A set of rasters indicating the direction to travel to reach the target borrow area, generated for each borrow source.
- **Water Polygon (water\_poly):** A polygon feature class of water extents used to calculate overland distance.

## GIS GROUP PATH

The *GISGroupPath.py* script determines the shortest paths between each GIS group and each borrow source using the outputted *Distance Rasters*, and *Backlink Rasters* from the *Preprocessing.py* script. Paths are generated to each GIS Group from every available borrow source within a region; for example, if a region has 3 borrow sources, projects in that region will be assigned a path to each of the three sources, as well as to the nearest offshore source. GIS group paths do not cross any land that is not allowed via the *AllowedPaths* feature class. To account for discrepancies between the

extents of the MC cells and the land/water interface, GIS groups are buffered, and paths are drawn to the buffered extent and then connected to the original GIS group by a straight line. Outputs of *GISGroupPath.py* include the following feature classes, used in subsequent steps of the Dredge Mobilization tool:

- **GISGroupPath:** A line feature class representing preliminary GIS group path alignments.

## CELL PATH

The *CellPath.py* script creates the paths that fan out to reach each cell within a GIS group (called the to-cell paths) and paths that are directed to the farthest edge of each cell (called the in-cell paths). Unlike GIS group paths, to-cell paths and in-cell paths can travel anywhere and are simply a straight line between points. The MC cell at the fanout point (i.e., the cell that the GIS Group Path intersects) does not require a to-cell path. Outputs of *CellPath.py* include the following feature classes, used in subsequent steps of the Dredge Mobilization tool:

- **ToCellPath:** A line feature class representing the paths from the end of GIS group path to each corresponding MC cell.
- **InCellPath:** A line feature class representing the paths from the end of the to-cell path to the farthest edge of each corresponding MC cell.

## CALCULATE ATTRIBUTES

The *CalculateAttributes.py* script compares the outputs from *GISGroupPath.py* and *CellPath.py* to the *water\_poly* feature class produced in the *Preprocessing.py* script to determine the length of each path that lies either over land or over water. In-cell paths are always classified as over-land pipe, even if they overlap the *water\_poly* feature class. No new output feature classes or rasters are created with this tool, but new attributes are added to the *ToCellPath* and *InCellPath* feature classes and used in subsequent calculations in the *ExportAttributes.py* script.

## EXPORT DATA

The *ExportData.py* script combines the *GISGroupPath*, *ToCellPath*, and *InCellPath* feature classes into a single *ElementPath* feature class and determines the subline prelay, shoreline prelay, and shoreline pickup attributes at the Element level. The subline prelay length is equal to sum of the lengths of the GIS group and to-cell paths that traverse over water. The shoreline prelay length is equal to sum of the lengths of the GIS group, to-cell, and in-cell paths that traverse over land, while the shoreline pickup length is equal to the sum of just the over-land GIS group and to-cell paths. These attributes are ultimately stored in the *BorrowOptions* table in the pct schema of the PDD.

Additionally, this script determines the preferred borrow source for each Element, defined as the

borrow source which provides sediment to the MC Element at the lowest overall cost. The preferred borrow source is ultimately stored as an attribute in the *Attributes\_MC* table in the pct schema of the PDD. Outputs of *ExportData.py* include the following:

- **ElementPath:** A line feature class representing the combined GIS group and cell paths from a borrow source to all cells within an MC Element.
- **Attributes\_MC.csv:** A csv file mirroring the structure of the *Attributes\_MC* table, used to import dredge mobilization attributes into the PDD.
- **BorrowOptions.csv:** A csv file mirroring the structure of the *BorrowOptions* table, used to import dredge mobilization attributes into the PDD.



## 5.0 DATA PROCESSING TOOLS

The *DataProcessing* directory in the MP\_PCT repository contains four python files used for general Quality Assurance and Quality Control (QAQC) of the PDD, PCT, PDG and PCS reports, including *ComparePGAndExcel.py*, *MirrorPostGres.py*, *TransferPGtoGDB.py*, and *CompareJasperPDFs.py*. Additionally, the *AreaFactSheet\_RiskGraph\_by\_Year.py*, *OperationRegime\_Graphics.py* and *ProjectFactSheet\_RiskGraph\_by\_Year.py* are used to produce plots for use in PCS reports and fact sheets.

A list of Python packages required to run the Data Processing tools is shown in Table 17. These tools are typically run locally through a python console. All tools except *TransferPGtoGDB.py* are available to run on the PSC virtual machine.

Table 17. Python packages used in data processing

| LIBRARY      | VERSION                                   | DESCRIPTION   |
|--------------|---|---|
| ARCPY        | CORRESPONDING TO ARCGIS PRO VERSION 2.7.0 | ESRI'S PROPRIETARY LIBRARY FOR GEOPROCESSING FUNCTIONS; USED IN GIS TOOLS                                     |
| ARCGIS       | 1.8.3                                     | USED TO IMPORT GEOSPATIAL DATA AS PANDAS DATAFRAME OBJECTS  |
| MATPLOTLIB   | 3.3.1                                     | USED TO CREATE OPERATION REGIME GRAPHICS FOR PROJECT SUMMARY REPORTS  |
| PDFMINER.SIX | 20201018                                  | COMMUNITY-MAINTAINED TOOL FOR MINING PDFS, USED TO EXTRACT TEXT FROM PROJECT COST SUMMARY REPORTS             |
| XLRD         | 1.2.0                                     | USED TO READ AND FORMAT INFORMATION FROM MICROSOFT EXCEL FILES  |
| OPENPYXL     | 3.0.5                                     | USED IN CONJUNCTION WITH PANDAS AND XLRD TO READ, FORMAT, AND WRITE INFORMATION TO/FROM MICROSOFT EXCEL FILES |

QAQC procedures are utilized to conform to a specified standard or requirement after changes are made to the PCT. A Python script, *ComparePGAndExcel.py*, is used to automate the process of comparing tabular data in an archived Excel workbook version of the PDD to the live version of the PDD. This script outputs an Excel workbook that highlights any differences between values in the archived Excel tables and values in the current PDD tables, including attribute tables, background tables, metadata, and outputted cost tables produced by the PCT. For numerical values, a percent difference is also calculated between the old and new values to provide contextual information on the changed values.

Once the data comparison workbook is produced, differences are investigated to ensure that changes were implemented correctly, that all reported differences were expected, and that the numerical value differences are with an acceptable range or percent difference. If errors regarding the changes, or



other errors are found, additional edits are made and the QAQC process is repeated. Once all differences are reconciled, a new archive Excel workbook is created using another Python script, *MirrorPostGres.py*. The archived Excel workbook is used as the new baseline for future comparisons.

Once data is archived, attributes in feature classes within the PDG are synced with the PDD using a script called *TransferPGtoGDB.py*. This script pulls the latest metadata attributes from the PDD, compares the list of Elements in the PDD with those in the PDG, transfers relevant attributes to the feature classes within the PDG, creates the Mapping PDG by joining Element- and Project-level data, and produces an additional QAQC workbook archiving any differences that may exist between the two data sources. Once again, if discrepancies between the PDG and PDD are discovered, the QAQC process is repeated until errors are resolved.

The master plan team has developed a *Software Configuration Management Policy and QAQC Procedure Memo* (available upon request), which contains a more detailed description of the QAQC process for the PCT and other tools developed for the 2023 Coastal Master Plan.

## REPORT PLOTS

The data processing scripts used for report graphics generally follow the same format where data is sourced from the PDD either as a direct download csv or saved in an external Excel, read into a data frame, formatted and plotted as the correct graphic. Two different graphics are created by these data processing scripts:

1. **Operation Region Graphics:** plots for the flow regime for different diversion projects for use in Project Fact Sheets and Project Cost Summary.
2. **Risk Graph by Year:** Community Area and project risk graph plots showing expected annual damages in dollars (EADD) in dollars and expected annual structural damage (EASD) in number of structures by year for use in Area Fact Sheets and Project Fact Sheets.

To create the operation regime graphs, operation regime information is pulled from the PDD, saved in an Excel file (*MP23 Operations Regime Graphics.xlsx*), and translated into data points representing key features of the plot, such as the x- and y-coordinate bounds, axis labels, and rating curve inflection points. Most graphics require a minimum of four inflection points to fully represent the rating curve but will vary depending on the complexity of the system. Once data points and labels are compiled in the Excel file, the *OperationRegime\_Graphics.py* script sets the figure components and pulls data to create one graphic for each diversion. An example operation regime graphic is shown in Figure 5.

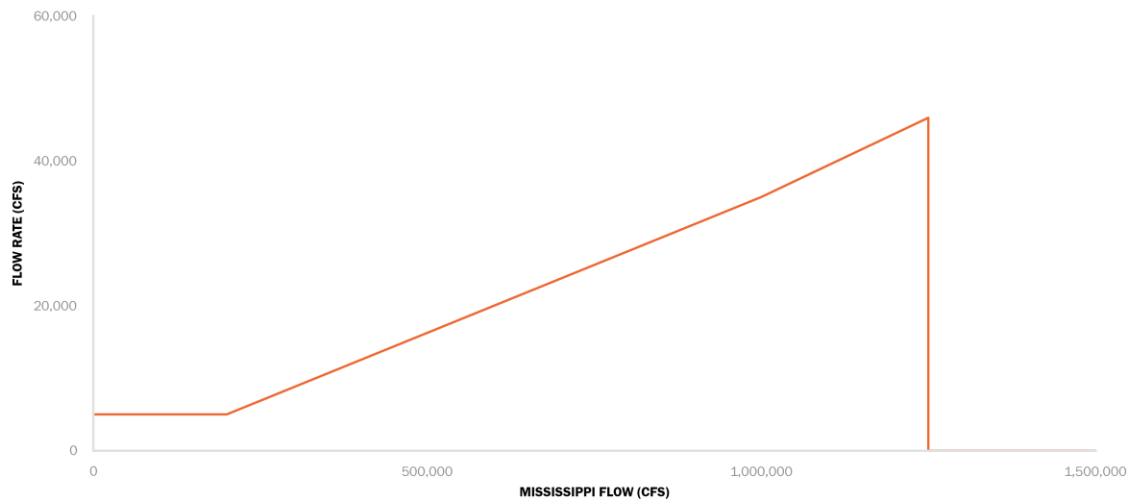


Figure 5. Operation regime graphic example.

The risk graphics are created with data that is formatted first in a materialized view on the PDD (e.g., *mv\_coastwide\_risk\_fwa*) and export to be read by the appropriate version of the script (coastwide, area or project). The EADD and EASD model outputs are formatted to the appropriate order of magnitude (e.g., \$ 200,000,000 becomes \$200 Million). The *AreaFactSheet\_RiskGraph\_by\_Year.py*, *Coastwide\_RiskGraph\_by\_Year.py*, or *ProjectFactSheet\_RiskGraph\_by\_Year.py* sets the figure components (e.g., plot colors, bar vs point data) and creates one graphic per feature (e.g., coast, area or project etc.) An example risk graphic is shown in Figure 6.

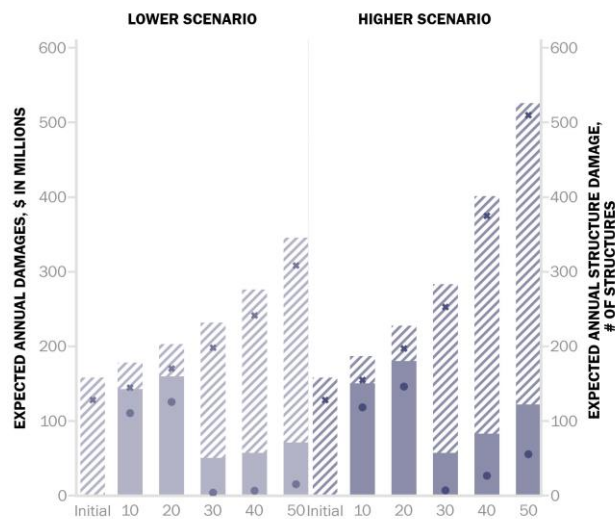


Figure 6. Area Fact Sheet risk graph by year example.

Graphics are saved in a location accessible to the Jaspersoft or InDesign programs, which in turn load each graphic for inclusion in either the PCS reports or fact sheets. Legends and titles for the graphs are added in the respective program.

# 6.0 PROJECT COST SUMMARY REPORTS

Project-level Project Cost Summary (PCS) reports are created for each candidate project considered in the 2023 Coastal Master Plan. The PCS reports summarize high-level costs associated with each Project to be used by Parish engineers, CPRA staff, or other designers as a starting point for further design.

TIBCO JasperSoft® Studio (JasperSoft) is a free software that allows users to create customizable reporting tools that integrate with existing databases. For the 2023 Coastal Master Plan, JasperSoft is used to import attribute and cost data from the PDD to generate the PCS reports based on a single, dynamic report template, described below.

## 6.1 LAYOUT OF PCS REPORTS

Each PCS includes a map of the project area, a brief description of the project's features, a high-level summary of the estimated project-level costs, a breakdown of the quantities and costs for each Component as inputted into the PDD or calculated using the PCT, and a detailed list of all the relevant attributes associated with each Element of the project (Figure 7). The dynamic elements on the report are updated for each project, pulling data from the PDD as well as from locally stored project maps, project type icons, and project type template images.



## 2023 Coastal Master Plan

Project Name  
ProjectID

Project  
type  
icon

Reported attributes and costs are not intended to be accurate to design-level standards, and are subject to change.

|                              |  |                                    |
|------------------------------|--|------------------------------------|
| Map of project area          | <b>Project Costs</b>   |                                    |
|                              | Planning, Engineering, and Design                                      | Rounded<br>project-<br>level costs |
|                              | Construction*  |                                    |
|                              | Construction Management  |                                    |
|                              | Contingency  |                                    |
| Operations and Maintenance** |  |                                    |
|                              | <b>Total</b>   |                                    |
| Brief project description    | *Breakdown of construction costs<br>** Note that O&M is an annual cost |                                    |

### Component Costs

| Component Description | Quantity | Unit | Unit Cost | Cost |
|-----------------------|----------|------|-----------|------|
| Component-level costs |          |      |           |      |

### Project Template

Project type template

### Project Attributes

Attribute tables for each Element type included in the project

Red varies by *project*  
Blue varies by *project type*

Candidate Project Data Summary

Figure 7. Project Cost Summary layout.

## 6.2 PCS REPORT LIMITATIONS

Jaspersoft starts running into limitations when reports have dynamic elements that do not keep the same shape. All the tables in the cost summaries have a variable length depending on the number of Elements included in a project. Tables will grow to fit the number of rows being imported and will shift other report objects downward to accommodate. Issues occur when these tables grow and push other objects to new pages. Formatting decisions start to overlap, and Jaspersoft does not always consistently prioritize formatting decisions in the same way, causing excess blank spaces between tables.

Reported attributes and costs are not intended to be accurate to design-level standards and are subject to change throughout the course of the master plan development. Major assumptions that affect cost are not explicitly defined in the PCS reports. A comprehensive breakdown for both Element- and project-level assumptions can be found in Attachment F6: Project Development Database Documentation (Sprague, 2023b).

## 7.0 REFERENCES

Sprague, H, Nelson, T. Weikmann, A, Norman, D, Gong, D. (2023a). 2023 Coastal Master Plan: 2023 Coastal Master Plan: Attachment F1: Project Definition. Baton Rouge, Louisiana: Coastal Protection and Restoration Authority.

Sprague, H., Nelson, T., Weikmann, A., Gong, D., & Norman, D. (2023b). 2023 Coastal Master Plan: Attachment F6: Project Database Development Documentation. Baton Rouge, Louisiana: Coastal Protection and Restoration Authority.

Supplemental Material F6.1: Project Development Database (PDD) Data Model Excel Workbook.  
[https://coastal.la.gov/wp-content/uploads/2023/08/Supplemental-Material-F6.1\\_PDD-Data-Model-Excel-Workbook.xlsx](https://coastal.la.gov/wp-content/uploads/2023/08/Supplemental-Material-F6.1_PDD-Data-Model-Excel-Workbook.xlsx)