

Total Nitrogen, Total Phosphorus, Organic Matter and Salinity of Soils
of Coastal Louisiana Marshes

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Abstract

Coastal Louisiana's marshes, holding 40% of U.S. coastal wetlands, are rapidly vanishing into the sea. Restoration projects using various techniques have been implemented to mitigate coastal land loss. This study examines the variability of total nitrogen (N), total phosphorus (P), and organic matter (OM) in relation to soil salinity (SS) in Louisiana's coastal marshes, and evaluates how different restoration techniques affect these soil properties across marshes (fresh, intermediate, brackish, and saline) and hydrological basins (Calcasieu/Sabine, Mermentau, Teche/Vermilion, Atchafalaya delta, Terrebonne, Barataria, Breton Sound, Mississippi River Delta and Pontchartrain).

Fresh marshes exhibited the highest concentrations of N (13.26 ± 0.46 g/kg), P (724.09 ± 18.40 mg/kg), and OM ($34.77 \pm 1.48\%$), with the lowest SS (0.41 ± 0.02 ppt), while saline marshes had the lowest N (4.73 ± 0.25 g/kg), P (529.07 ± 13.34 mg/kg), and OM ($21.34 \pm 0.93\%$), but the highest SS (6.51 ± 0.20 ppt). Among basins, Mermentau had the highest N (13.26 ± 0.70 g/kg), Teche/Vermilion exhibited the highest P (724.86 ± 50.60), Barataria recorded the highest OM (38.23 ± 2.28) and Terrebonne exhibited the highest SS (4.41 ± 0.29).

Among restoration techniques, Outfall Management, Hydrologic Restoration, and Sediment and Nutrient Trapping showed the highest improvements in N, P, and OM, and lowered SS. Hydrologic Restoration significantly reduced SS across fresh, intermediate, and brackish marshes. Standardized analysis confirmed strongest restoration effects in fresh, moderate in intermediate, and weaker in saline marshes. Across basins, Outfall Management improved these soil properties in the Mississippi River Delta most consistently than other techniques. Conversely, Water Diversion and Hydrologic Restoration exhibited reduced N, OM and SS in Teche/Vermilion and the Mississippi River Delta, yet significantly enriched P in

Pontchartrain. Sediment and Nutrient Trapping demonstrated stable to positive effects, particularly enhancing soil properties in Mermentau. These findings underscore the need for marsh and basin specific targeted restoration strategies to effectively sustain and enhance soil properties critical for coastal marsh resilience and restoration success.

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List of Abbreviations

| | |
|----------------|---|
| CWPPRA | Coastal Wetlands Planning, Protection and Restoration Act |
| CPRA | Coastal Protection and Restoration Authority |
| CRMS | Coastwide Reference Monitoring System |
| LDNR | Louisiana Department of Natural Resources |
| USGS | United States Geological Survey |
| ANOVA | Analysis of Variance |
| N | Nitrogen |
| P | Phosphorus |
| ppt | Parts per Thousand (Salinity Measurement) |
| g/kg | Grams per Kilogram |
| mg/kg | Milligrams per Kilogram |
| OM | Organic Matter |
| Eh | Soil Redox Potential |
| CEC | Cation Exchange Capacity |
| DF | Degrees of Freedom |
| R ² | Coefficient of Determination |
| HSD | Honestly Significant Difference |

Chapter 1. Introduction

1.1. Introduction

Coastal marsh soils in Louisiana are vital for maintaining ecological balance, supporting habitats for wildlife and biodiversity, supporting high levels of primary productivity, mitigating greenhouse gas emissions, defending coastal areas from natural disasters and protecting land loss due to sea level rise (Nicholls et al, 2007, Day et al., 2007, Bohannon and Enserink, 2005, Crooks et al., 2011, Suir et al, 2019). Coastal soils have higher carbon sequestration capacity and large carbon storage compared to prairies and grasslands, acting as one of the largest terrestrial carbon sinks (Hansen and Nestlerode, 2013, Markewich et al., 2007, Chmura et al., 2003, Hossler and Bouchard, 2010). By accumulating sediment at a rate equal to or faster than sea level rise, salt marshes may in some cases even be able to sustain the coastline in relation to sea level rise, thus reducing vulnerability to dangers and climate change (Kirwan and Temmerman, 2009, Cahoon et al., 2006). Louisiana's coastal soils are particularly significant, supporting marshes, seagrass meadows, particularly in species like *Spartina alterniflora*, and crucial for regulating the regional nutrient cycle, influencing ecology and climate (Mitsch et al., 2013, Reddy and DeLaune, 2003, Cahoon and Reed, 1995, Hester et al., 2005).

However, Louisiana's wetlands are in a state of rapid degradation, 80% of the nation's coastal land loss occurs in Louisiana. More than 4,800 square kilometers (1.2 million acres), or an area more than 25 times greater than Washington, D.C., have been lost by coastal Louisiana since 1930 (Couvillion et al., 2017). Another study reveals that annually, 65-90 square kilometers of Louisiana's coastal land, an area exceeding the size of Manhattan, vanishes underwater because of subsidence and rising global sea levels (Kennedy and Gill,

2013). The importance of carbon (C), nitrogen (N), and phosphorus (P) of coastal soils in maintaining productivity and elevation of marshes against sea level rise, as well as their biogeochemical cycles have drawn serious attention in recent years (Choi and Wang, 2004, Eyre and McKee, 2002, Baird et al., 2011, Noe and Hupp, 2005, Kennish, 2002).

Over the past 50 years, the Louisiana Department of Wildlife and Fisheries has conducted periodic coastwide vegetation surveys to monitor and manage coastal marshes, most recently in 2021, involving survey by the U.S. Geological Survey and Louisiana State University, and categorized marshes into 4 types: fresh, intermediate, brackish, or saline (Nyman et al., 2022). Due to their capacity to store organic carbon and nutrients (N and P), as well as their ability to accumulate organic matter and deposit mineral sediment, marsh soils are hubs for biogeochemical activity in estuaries and coastal landscapes (Craft et al., 1988, DeLaune et al., 1983, Hatton et al., 1983, Nyman et al., 1990). Tidal marsh soils act as a sink for N and P (Hussein et al., 2002, Wolaver et al., 1983, Gao et al., 2012) since they sequester nutrients through the accumulation of sediment-bound P (Wolaver and Spurrier, 1988, Sundareshwara and Morris, 1999) and the conversion of soluble inorganic N into organic N which is deposited gradually over years (Bowden et al., 1991, Loomis and Craft, 2010, Gribsholt et al., 2005).

Ocean tides regulate soil nutrient cycling and remineralization by controlling sediment exposure and flooding, leading to variations in organic matter and nutrient levels in pore water of marsh soil (Joye et al., 2009). Additionally, because of soil erosion and submergence, marsh systems are particularly vulnerable to sea level rise and respond according to the rates of coastal submergence (Craft et al., 1993, Orson et al., 1985, Roman 2017). The capacity of coastal marshes to adjust to rising sea levels and maintain vertical

land development are greatly impacted by vegetation that contributes to the deposition, soil properties and vertical soil surface expansion. (Friess et al., 2012, Chen et al., 2018, Mudd et al., 2010, Morris and Callaway, 2018).

Organic matter in coastal marsh soils underpins soil structure and fosters microbial processes that contribute to nutrient cycling (Chmura et al., 2003). It also enhances water-holding capacity, enabling marsh soils to retain moisture critical for sustaining plant communities (Bouillon et al., 2011). The accumulation of organic matter in marsh environments leads to carbon storage, mitigating atmospheric carbon dioxide concentrations (Alongi, 2020). This accumulation process is influenced by plant productivity, decomposition rates, and hydrological regimes that together shape the organic matter profile (Reddy & DeLaune, 2008). In Louisiana's coastal regions, organic matter acts as a foundation for ecosystem resilience, particularly as marsh soils adapt to fluctuating water levels and anthropogenic stressors (Mitsch & Gosselink, 2015).

Marsh soil properties, including redox reactions, oxygen diffusion, sediment type, pH, nutrient levels, and waterlogging, directly influence plant growth, which in turn affects soil structure and composition, thus influencing soil productivity (Ibáñez et al., 2012, Pennings and Bertness, 2001, Van der Valk, 2012). The availability of limiting nutrients like phosphorus (P) and nitrogen (N) determines marsh soil productivity (Kiehl et al., 1997, Visser et al., 2006). Previous research demonstrated that nitrogen is the limiting nutrient in salt marsh (Hopkinson and Schubauer, 1984, Morse and Megonigal, 2004, Frost et al., 2009), while other studies indicate phosphorus is the limiting nutrient in fresh marsh (Paludan and Morris, 1999, Sundareshwara and Morris, 1999). Several studies found that N plays a vital role in the growth of *Spartina* and other species, which helps to maintain marsh soil elevation

(Bertness et al., 2008, Deegan et al., 2007, Rozema et al., 2000, Leendertse et al., 1997).

Since phosphorus (P) is one of the elements that regulates the primary production of marsh soil, it also plays a significant role in coastal wetland ecosystems (Pant and Reddy, 2001, Junhong et al., 2017, Reddy and DeLaune, 2003). In certain marshes, phosphorus can be both the major and secondary nutrient limiting *Spartina* growth productivity (Broome et al., 1975, Morris, 2007).

Soil salinity is a key factor in marsh ecosystems, as it directly influences the balance between carbon inputs and outputs in coastal wetlands, regulating the distribution of Soil Organic Carbon (SOC), which in turn shapes vegetation patterns based on plant tolerance to salinity (Chambers et al., 2011). This includes reductions in plant productivity, species richness, and diversity with rising salinity levels, as increased salt concentrations limit nutrient uptake, hinder seed germination, and create stressful growing conditions for many marsh species (McKee and Mendelsohn, 1989, Tuxen et al., 2011, Wieski et al., 2010, Portnoy and Giblin, 1997, Linthurst, 1980), along with variations in the allocation of belowground biomass and changes in species composition which also affect marsh soil properties (Neubauer et al., 2005, Smith 2009). These patterns are consistently aligned with salinity gradients (Ibáñez et al., 2012). Salinity causes osmotic stress, making it difficult for plants to absorb water and essential nutrients because salinity influences nutrient availability, and ion toxicity can disrupt cellular processes (Roseberg et al., 1986, Jackson and Vallaire, 2009, Baldwin and Rees, 2006). It also deteriorates soil structure, impacting water infiltration and root penetration (Roseberg et al., 1986). Soil microbial activity, crucial for nutrient cycling, is suppressed under saline conditions, further diminishing soil fertility (Weston et al., 2011, Ikenaga et al., 2010, Van Ryckegem and Verbeken, 2005). Furthermore, soil salinity in

marsh ecosystems influences the greenhouse gas (CO₂, CH₄) fluxes from soil (Poffenbarger et al., 2011, Krauss and Whitbeck, 2012, Neubauer, 2011).

Due to seawater intrusion, rising sea levels, fast population expansion and unchecked development in coastal locations, coastal wetlands are one of the most vulnerable ecosystems to the effects of climate change and human activity (Kennish, 2002). Loss of coastal wetlands in Louisiana is associated with the loss of coastal marshes due to a reduction of sediment supply from the Mississippi River, altered hydrology because of the construction of levees, roads, and canals, saltwater intrusion, vegetation loss, soil erosion, sea level rise and other interacting factors such as subsidence (Blum and Roberts, 2009, Day et al., 2000, Nyman and DeLaune, 1999). Coastal marsh vegetation is essential for maintaining soil surface elevation and buffering against sea-level rise, and strategically planting species like *Spartina alterniflora* can strengthen marsh resilience, emphasizing the critical role of vegetation management in effective coastal marsh restoration (Baustian et al., 2012). Without adequate soil nutrients supply and tolerant soil salinity levels, it is not possible for marsh vegetation to regrow and protect coastal marshes against land loss and sea level rising (Kotuby-Amacher et al., 2000, Mariotti and Carr, 2014, Wigand et al., 2017).

Coastal wetland restoration in Louisiana incorporates diverse strategies such as hydrologic restoration, sediment and nutrient trapping, freshwater diversions, shoreline protection, marsh management, marsh creation, and outfall management, each aiming to mitigate coastal marsh degradation and land loss (CPRA, 2017). The evaluation and comparison of soil characteristics between restored marsh sites and adjacent natural marshes are imperative for understanding restoration effectiveness. This comparative analysis helps identify whether restoration activities have achieved conditions that resemble natural marsh

functions, particularly regarding critical soil properties such as total nitrogen (N), total phosphorus (P), organic matter (OM), and soil salinity (Craft et al., 2003; Baustian et al., 2012). It is essential to recognize how these restoration practices influence soil nutrient cycles and salinity dynamics, which directly impact marsh vegetation health, soil stability, and carbon sequestration capacity (Mitsch & Gosselink, 2015; DeLaune & White, 2012). By comparing restored and natural marsh soils, this study provides insights into the efficiency of current restoration practices for particular soil properties and guides future adaptive management decisions.

1.2. Previous Studies

Previous studies investigating total nitrogen (N), total phosphorus (P), organic matter (OM), and soil salinity across coastal marsh ecosystems highlight considerable variability influenced by marsh type, hydrological basin, and vertical soil profiles. Studies by Nyman et al. (1990) and Noe and Hupp (2005) observed distinct spatial gradients of nutrients, reporting higher N and OM concentrations in freshwater marshes compared to saline marshes due to greater organic matter accumulation and reduced tidal flushing. Craft et al. (1988) and DeLaune and White (2012) similarly demonstrated that organic matter content in marsh soils significantly decreases from freshwater to saline marshes because higher salinity stress reduces vegetation productivity and increases microbial decomposition rates, thereby diminishing organic accumulation.

Soil phosphorus dynamics have also been extensively documented, indicating strong basin-specific differences related to sediment deposition and geochemical conditions. Phosphorus concentrations typically increase in deltaic environments due to high rates of riverine sediment deposition, whereas non-deltaic basins with lower sediment inputs show

reduced phosphorus retention (Craft & Casey, 2000; Baustian & Turner, 2006). Similarly, numerous studies such as those by Weston et al. (2011) and Neubauer et al. (2005) confirm that salinity exhibits strong spatial patterns linked to tidal inundation, freshwater inflows, and hydrological modifications, shaping marsh plant communities and nutrient availability. Collectively, these investigations underscore the importance of understanding spatial and vertical variability in marsh soil characteristics to better inform coastal management and restoration efforts (Mitsch & Gosselink, 2015; Zhao et al., 2024).

Previous comparative studies of restored and natural marsh soils have shown varied results influenced by restoration types, local hydrological conditions, sediment supply, and nutrient cycling processes (Baustian & Turner, 2006; Craft et al., 2002). Craft et al. (2003) observed that marsh creation projects typically displayed lower organic matter and nutrient contents compared to natural marshes due to less developed vegetation communities and lower sediment organic matter inputs. Similarly, Graham and Mendelssohn (2013) found that hydrologically restored marshes often demonstrated improved soil conditions, including higher organic matter accumulation and nutrient retention, compared to sites where hydrology remained altered. Conversely, excessive freshwater diversions sometimes negatively impact soil nutrient levels by diluting nutrients and altering salinity regimes, thus challenging vegetation establishment and soil productivity (Weston et al., 2011; DeLaune et al., 2013).

Baustian et al. (2012) noted differences in soil phosphorus availability in marshes receiving sediment diversions compared to adjacent natural marshes, with restored marshes often showing increased phosphorus concentrations due to enhanced mineral sediment deposition. Conversely, Wigand et al. (2017) highlighted that marshes restored via shoreline

protection structures had limited differences in soil nutrient profiles compared to natural marshes, primarily influenced by sediment transport and reduced erosive processes rather than direct nutrient addition. Such contrasting outcomes underscore the necessity for detailed comparative analyses that incorporate multiple restoration types, soil parameters, and spatial scales, aiding comprehensive understanding of restoration impacts on soil biogeochemical processes (Baustian & Turner, 2006; Zhao et al., 2024).

While previous research has extensively documented spatial variation in soil nitrogen, phosphorus, organic matter, and salinity across marsh gradients, few studies have explicitly compared these parameters between restored and natural marsh soils while accounting for both restoration technique and ecological context (e.g., marsh type and basin). Most investigations have been confined to either site-specific assessments or evaluations of a single restoration method, such as freshwater diversions or marsh creation, with limited attention to how restoration outcomes vary across salinity zones and hydrological settings (Craft et al., 2002; Baustian & Turner, 2006; Weston et al., 2011). Additionally, although hydrologic restoration and sediment trapping have been recognized for enhancing nutrient retention, their performance has rarely been benchmarked against reference marshes in a multi-basin framework. This study addresses these gaps by systematically comparing total nitrogen, total phosphorus, organic matter, and salinity between restored and natural soils across eight restoration techniques, four marsh types, and nine basins. Such a multi-scalar approach allows for the evaluation of how restoration effects are modulated by local environmental gradients, which has been largely overlooked in existing literature (DeLaune et al., 2013; Graham & Mendelsohn, 2013; Zhao et al., 2024). By integrating restoration

typology with marsh and basin stratification, this thesis offers a comprehensive analysis of restoration effectiveness in replicating natural marsh soil functions.

1.3. Nature and Significance of Study

Revealing the spatial variation and trends of total N, total P, organic matter, and salinity in coastal Louisiana marshes is essential for guiding restoration initiatives and adaptive management in these fragile ecosystems (Reddy & DeLaune, 2008; Pennings et al., 2005). Differences in nutrient availability (N and P) and organic matter content can influence vegetation structure, soil accretion rates, and carbon sequestration potential, all of which are essential for buffering against land loss and supporting diverse ecological communities (Chmura et al., 2003; Craft & Casey, 2000). Assessing differences in soil properties between restored and natural marshes provides critical insights into restoration success and informs strategic coastal management practices (Craft et al., 2003; Zhao et al., 2024).

Comparative analyses between restoration techniques and natural marsh soils aid in identifying best practices that closely mimic or restore natural marsh functions and ecological processes (Graham & Mendelsohn, 2013). This study significantly contributes to the coastal restoration efforts by offering an evaluation framework to determine the relative effectiveness of various restoration approaches for a particular soil property (Craft et al., 2003; Zhao et al., 2024). By capturing large-scale spatial patterns alongside differences in soils of restoration project area and natural marshes, the study addresses a critical gap in wetland science, presenting data needed to calibrate predictive models of marsh evolution and to craft adaptive management policies (Reddy & DeLaune, 2008; Roman, 2017). Such an integrated framework is essential for ensuring that restoration, conservation, and climate adaptation efforts effectively sustain the ecological, economic, and cultural values tied to Louisiana's

coastal wetlands over the coming decades (Mitsch & Gosselink, 2015; Mcleod et al., 2011).

The outcome will guide restoration planning by recommending specific techniques for certain marsh types or basins.

1.4. Objectives & Hypothesis

This study investigates whether total N, total P, and organic matter vary significantly across marsh types and basins in coastal Louisiana due to differences in soil salinity and whether restored marshes have similar total N, total P, organic matter, and salinity of soils compared to natural marshes, as well as the effect of different restoration techniques on these soil properties. The specific objectives are:

1. How do soil total N, total P and organic matter vary across different marshes and basins in relation to soil salinity in the coastal Louisiana?
2. Do restored marshes have similar total N, total P, organic matter, and salinity of soils compared to natural marshes, and how different restoration techniques affect these soil properties?

Total N, total P and organic matter will be higher in soils of marshes and basins with low soil salinity, and will be lower in marshes and basins with higher soil salinity. The difference in total N, total P, organic matter, and soil salinity between restored and natural will not be significant. Restored marshes will have total N, total P, organic matter, and soil salinity close to natural marshes, some restoration techniques will have greater effect on these soil properties than other techniques influenced by soil salinity, marshes and basins.

Chapter 2. Materials and Methods

2.1. Study Area

The coastal region of Louisiana is primarily composed of Histosol wetlands, characterized by diverse ecological conditions ranging from river-influenced fresh and brackish marshes to intermediate and saline marshes, each exhibiting distinct functional characteristics (DeLaune et al., 2013, Chambers et al., 2013). The study area covers marshes and hydrologic basins into which the Coastwide Reference Monitoring System (CRMS) sites were divided are primarily defined by the levee deposits that surround them and the distributary channels of the Mississippi River, which are either active or inactive (Cahoon et al. 1995, Day et al., 2000).

The nine basins are: (1) Calcasieu/Sabine and (2) Mermentau in the Chenier Plain, (3) Teche/Vermilion and (4) Atchafalaya delta (AT) in the marginal deltaic plain, (5) Terrebonne (TE), (6) Barataria (BA), (7) Breton Sound (BS), (8) Mississippi River Delta (MR), and (9) Pontchartrain (PO) in the deltaic plain, in order from west to east (Barras, 2005, Couvillion et al., 2011) (Fig. 1).

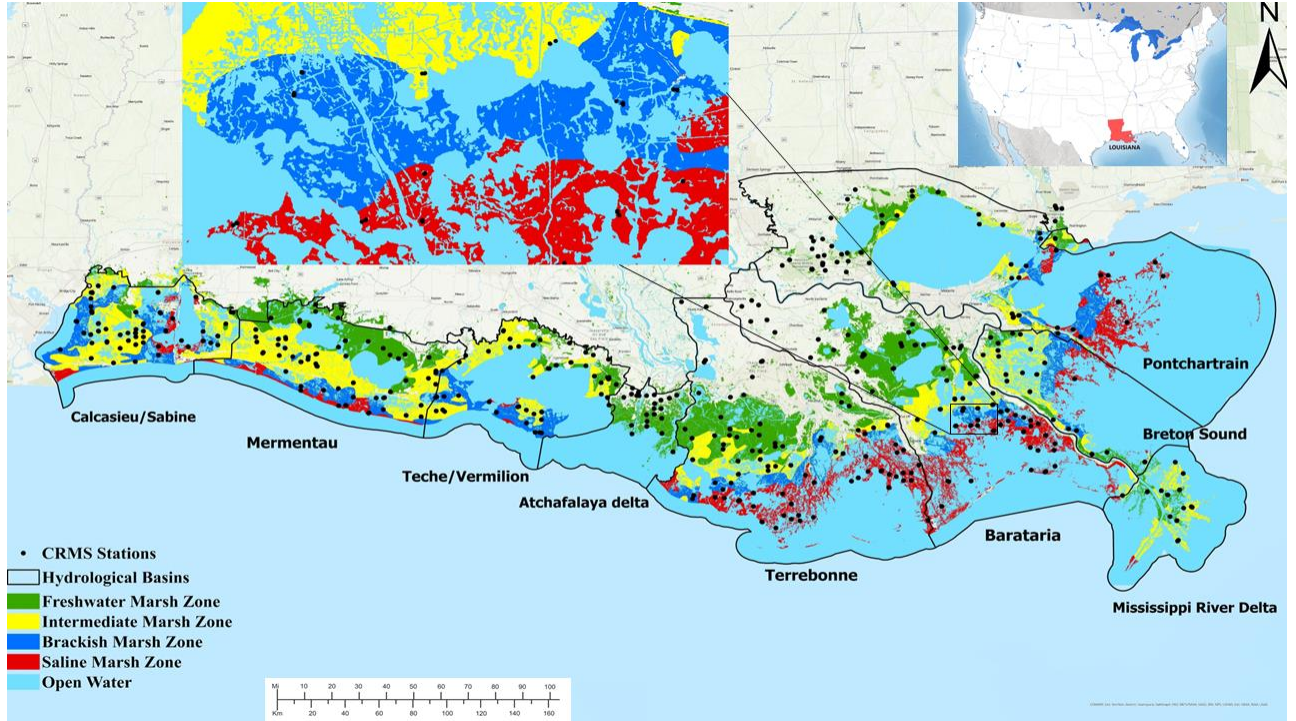


Figure 1: CRMS stations across marshes and basins of the Louisiana coast (CPRA, 2017).

The Louisiana coastline exhibits a complex geomorphology primarily shaped by the depositional processes of the Mississippi River over the past 7,000 years, resulting in the formation of extensive deltaic and chenier plains (Roberts, 1997; Coleman et al., 1998). The Deltaic Plain, extending from Vermilion Bay eastward to the Pearl River, is characterized by a series of delta lobes formed through the river's distributary networks, with lobes representing phases of deltaic growth and abandonment (Rabalais et al., 1991; Day et al., 2000). The formation of these delta lobes involves the river capturing a distributary that provides a shorter route to the Gulf of Mexico, leading to rapid sediment deposition and delta lobe progradation (Roberts, 1997; Coleman et al., 1998). Over time, as these lobes are abandoned due to channel switching, processes such as subsidence, sediment compaction, and coastal erosion transform them into the landscapes observed today (Baumann et al.,

1984; Meade & Moody, 2010). In contrast, the Chenier Plain, located west of Vermilion Bay to the Texas border, was formed by historic patterns of sedimentation and erosion from the Mississippi River and its distributaries, along with influences from the Gulf of Mexico (Gould & McFarlan, 1959). This region is characterized by a series of sandy ridges (cheniers) and mudflats, resulting from the interplay between sediment deposition and marine processes (Kolker et al., 2011; Henry & Twilley, 2013).

Coastal Louisiana marsh soils develop through a complex interplay of fluvial, marine, and organic inputs that accumulate within the deltaic landscape shaped by the Mississippi River (Blum & Roberts, 2009; Nyman et al., 1990). Historically, periodic overbank flooding and splay formation facilitated the distribution of fresh mineral sediments across marsh surfaces, continually renewing the substrate upon which marsh soils develop (Roberts, 1997). These fluvial sediments serve as a key parent material for marsh soils, providing both physical structure and nutrient-rich particles that support diverse plant communities (Cahoon et al., 2006). Over time, these sediments intermix with the river-borne silts and clays, resulting in variability in soil texture and soil salinity across Louisiana's coastal wetlands (DeLaune & White, 2012). Slow decomposition rates of wetlands promote the formation of organic horizons, enhancing soil fertility and contributing to vertical marsh accretion (Craft, 2001; Mudd et al., 2010). Finally, subsidence influences how parent materials accumulate and are redistributed, as land sinks under both natural and anthropogenic forces (Blum & Roberts, 2009).

Louisiana's coastal climate is classified as humid subtropical, characterized by hot, humid summers and mild winters (Conner & Day, 1987; Keim et al., 2011). The region experiences abundant rainfall throughout the year, with a slight peak during the summer

months (Karl & Knight, 1998; Keim et al., 2007). The average annual temperature ranges from 12°C to 18°C, contributing to an extended growing season of 200 to 340 frost-free days annually (Liu & Fearn, 2000; Barras, 2005). Annual precipitation ranges from 1,250 to 1,500 mm, with the highest rainfall occurring in late spring and summer due to frequent thunderstorms and tropical systems (Barry, 2009). The region is highly susceptible to extreme weather events, including hurricanes, which play a critical role in sediment redistribution and marsh stability (Turner et al., 2006). The high frequency of tropical storms leads to episodic salinity intrusion events that alter soil chemistry and vegetation patterns (Barras, 2007). Figure 2 shows monthly averages of temperature and precipitation of Louisiana (Weather and Climate, 2024).

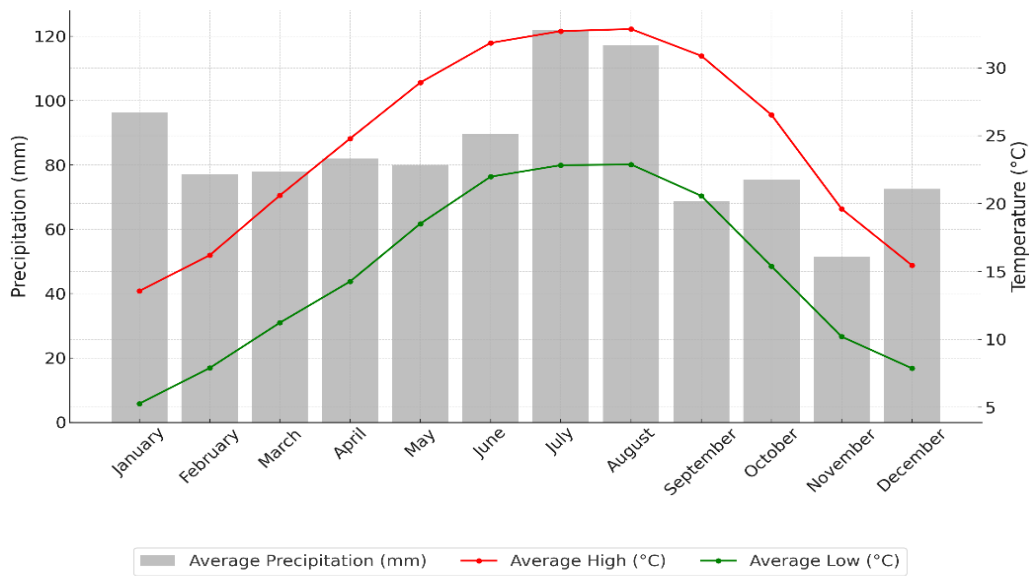


Figure 2: Temperature and Precipitation of Louisiana: Monthly Averages (Weather and Climate, 2024)

Louisiana’s coastal marsh soils exhibit strong spatial heterogeneity, influenced by salinity gradients, hydrology, and vegetation dynamics (Nyman et al., 2006). In the Deltaic Plain, soils are predominantly alluvial, rich in nutrients, and support extensive wetland

vegetation (Day et al., 2000; Rabalais et al., 1991). These alluvial soils are a direct result of sediment deposition from the Mississippi River, contributing to the region's fertility (Chabreck, 1972; Nuttle et al., 1997). In the Chenier Plain, soils are a mix of sandy and clayey deposits. The cheniers themselves are composed of sandy ridges, while the interspersed mudflats consist of finer sediments (Visser et al., 1998; Henry & Twilley, 2013). This combination creates a unique soil composition that supports a variety of vegetation types, from coastal prairie grasses on the ridges to marsh vegetation in the lower-lying areas (DeLaune & White, 2011; Allison et al., 2012).

Coastal Louisiana marshes are categorized into four primary types based on salinity levels and hydrological influence (Nyman et al., 2022). Freshwater marshes are characterized by salinity levels typically below 0.5 parts per thousand (ppt). These marshes support a diverse array of plant species, including *Panicum hemitomon* (maidencane), *Sagittaria lancifolia* (bulltongue), and *Pontederia cordata* (pickerelweed) (Visser et al., 1998). Intermediate marshes exhibit salinity levels ranging from 0.5 to 5 ppt. Serving as transitional zones between freshwater and brackish marshes, they support plant species such as *Sagittaria lancifolia* (bulltongue), *Echinochloa walteri* (Walter's millet), and *Vigna luteola* (deer pea) (Visser et al., 1998). These marshes are particularly sensitive to changes in salinity and hydrology, which can lead to shifts in vegetation composition and overall marsh health (Chabreck, 1972).

Brackish marshes have salinity levels ranging from 5 to 18 ppt. Vegetation is less diverse due to higher salinity, with dominant species including *Spartina patens* (saltmeadow cordgrass) and *Juncus roemerianus* (black needlerush) (Visser et al., 1998). The soils in brackish marshes are typically mineral-rich with lower organic content (Day et al., 2007).

Saline marshes, also known as salt marshes, exhibit salinity levels exceeding 15 ppt (McKee & Mendelssohn, 1989). Vegetation is highly specialized, with dominant species such as *Spartina alterniflora* (smooth cordgrass) and *Salicornia europaea* (glasswort) (Visser et al., 1998). Soils in saline marshes are predominantly mineral based with the least organic matter, and the high salinity impacts microbial decomposition rates which reduces nutrient availability in the soil (McKee & Mendelssohn, 1989). Figure 1 shows four types of marshes covering coastal Louisiana. Table 1 shows characteristics of marshes.

Table 1: Definition of four types of marshes

| Marsh Type | Definition |
|-------------------|---|
| Freshwater Marsh | Freshwater marshes are non-tidal wetlands characterized by shallow, standing or slow-moving water and dominated by herbaceous plants such as sedges and grasses (Mitsch & Gosselink, 2000; Burton & Uzarski, 2009). These marshes support high biodiversity and provide critical ecosystem services such as nutrient cycling and water purification (Li et al., 2022; Bayley et al., 1985). |
| Salt Marsh | Salt marshes are tidally inundated wetlands dominated by halophytic grasses, occurring in coastal zones and estuarine margins (Adam, 1993; Sarika & Zikos, 2021). These systems play a major role in sediment stabilization, carbon sequestration, and habitat provision for migratory and estuarine species (Shepard et al., 2011; Chmura et al., 2003). |
| Brackish Marsh | Brackish marshes occur where freshwater and saltwater mix, producing intermediate salinity levels that sustain a unique assemblage of flora and fauna (Massachusetts Division of Fisheries and Wildlife, 2015; Więski et al., 2010). They are vital in estuarine environments for supporting nursery habitats and mediating nutrient fluxes (Pennings & Callaway, 1992; Bertness & Pennings, 2002). |

| | |
|--------------------|---|
| Intermediate Marsh | Intermediate marshes are transition zones between fresh and brackish marshes, influenced by moderate salinity and hydrological variability (Visser et al., 2000; Holm & Sasser, 2001). These marshes exhibit diverse vegetation and respond sensitively to sea-level rise and salinity intrusion (Sasser et al., 1995; Gosselink et al., 1998). |
|--------------------|---|

Louisiana’s coastal area is divided into nine hydrological basins (Fig. 1), defined primarily by natural levees and distributary channels of the Mississippi River, are crucial in regulating water flow, sediment distribution, and salinity gradients (Roberts, 1997; Blum & Roberts, 2009). The geomorphic evolution of these basins has been largely influenced by delta switching events, where active delta lobes receive sediment input, while older, abandoned lobes undergo subsidence and erosion (Day et al., 2000). Human interventions, particularly levee construction, canal dredging, and hydrocarbon extraction, have further shaped these basins by altering hydrological connectivity, reducing sediment availability, and accelerating wetland loss (Turner, 1997; Morton et al., 2005; Couvillion et al., 2017).

The Calcasieu/Sabine basin in western Louisiana receives freshwater from the Calcasieu and Sabine Rivers, underlain by fine-textured alluvial soils with moderate organic matter, transitioning from freshwater to saline marshes (Twilley et al., 2016; Barras, 2007). Eastward, the Mermentau basin, dominated by the Mermentau River and bayous, supports freshwater and intermediate marshes due to organic-rich soils, although levees and water structures have disrupted freshwater flows, increasing salinity and degradation (Day et al., 2007; Reddy & DeLaune, 2003; Cahoon et al., 1995; Visser et al., 2013). The Teche/Vermilion basin, once an active delta of the Mississippi River, now faces sediment scarcity, subsidence, and salinity intrusion from sea-level rise and storm surges, leading to

marsh conversion and degradation (Roberts, 1997; Mitsch et al., 2013; Bai et al., 2017; Day et al., 2000; Turner, 1997).

The Atchafalaya basin stands out as a site of net land gain due to active sediment deposition by the Atchafalaya River, sustaining productive freshwater marshes and swamps (Twilley et al., 2016; DeLaune et al., 1983; Blum & Roberts, 2009). In contrast, the Terrebonne basin suffers from sediment deprivation and high subsidence, with organic-rich soils vulnerable to compaction and widespread conversion of marshes to open water (Couvillion et al., 2017; Nyman et al., 2006; Morton et al., 2005). The Barataria basin, enclosed by the Mississippi River Delta and Terrebonne, is dominated by organic soils and brackish to saline marshes, but has experienced rapid wetland loss due to levee-induced sediment starvation and oil activities (Twilley et al., 2016; Barras, 2007; Visser & Sasser, 2019; Couvillion et al., 2017). Though more stable, the Breton Sound basin continues to face land loss from rising seas and storm impacts despite limited sediment inputs (Blum & Roberts, 2009; Turner, 1997). The Mississippi River Delta Basin, which includes the active Birdfoot Delta, is characterized by fertile, mineral-rich soils and widespread freshwater marshes, though it experiences frequent salinity fluctuations due to dynamic hydrological conditions (Roberts, 1997; Day et al., 2000). The Pontchartrain Basin, Louisiana's easternmost coastal basin, contains diverse wetlands underlain by soils ranging from organic to mineral-rich, shaped by varying sediment inputs and hydrologic influence (Barras, 2007).

2.2. Data Sources

The study utilized data collected from the CRMS (Coastwide Reference Monitoring System) stations across different hydrological basins and marshes in coastal Louisiana from sites of restored and natural marshes (Fig. 1). The purpose of the CRMS is to track the

outcomes of restoration efforts across a range of geographical scales, from the impact of individual projects to the overall coastal landscape. A defined sampling schedule and consistent data gathering methods are used to monitor 390 locations. There have been two coastwide soil core data collection efforts so far; one during site construction where each site was sampled as it was established (2006 to 2008) and a second coastwide effort from 2018 to 2021 (CPRA, 2024). Only the sites with the four soil properties data located in the four types of marshes across restored and natural marsh areas have been selected for the purpose of this research (Table 2).

Table 2: Summary Table of the dataset and sources.

| Soil Properties | Source | Sites | Sampling Timeline |
|------------------------|---------------|--------------|--------------------------|
| Total N (g/kg) | CRMS | 154 | 8/10/2016 – 9/9/2021 |
| Total P (mg/kg) | CRMS | 154 | 8/10/2016 – 9/9/2021 |
| Soil Salinity (ppt) | CRMS | 154 | 3/23/2006 – 4/2/2015 |
| Organic Matter (%) | CRMS | 154 | 3/23/2006 – 9/9/2021 |

Soil core samples were collected by CPRA across the CRMS stations, which were identified by unique site ID with individual latitude and longitude. The sampling covered four marsh types and was conducted across all the nine basins to analyze soil properties. At every CRMS location, three replicate plots (2m x 2 m) were used to collect soil sample cores and a 10m buffer is maintained around the CRMS sample collection area. Sections of cores were made in 4-cm intervals from 0 cm to 24 cm. The CRMS construction and monitoring were conducted, and all the samples were tested by Coastal Estuary Services, LLC (LDNR, 2005, CPRA, 2017). Only those sites with stations located in the four types of marshes and

have N, P, OM and soil salinity data, have been selected for the purpose of this research (Table 1).

Coastal restoration efforts in Louisiana utilize a variety of techniques to combat marsh degradation and promote ecosystem resilience, many of which are implemented through the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) (CPRA, 2017). Key strategies include hydrologic restoration, freshwater diversion, sediment and nutrient trapping, shoreline protection, marsh creation, and outfall management. Hydrologic restoration reconnects marshes to natural water flows, improving wetland hydrodynamics and reducing salinity stress (Day et al., 2007; DeLaune & White, 2012). Freshwater diversions reduce soil salinity and enhance nutrient delivery, though they may dilute nutrient concentrations depending on flow rates (Weston et al., 2011; DeLaune et al., 2013). Sediment and nutrient trapping structures help to build elevation and retain nutrients within the marsh platform (Craft et al., 2003). Shoreline protection techniques mitigate wave erosion and edge retreat but often show limited influence on internal soil nutrient status (Wigand et al., 2017). Marsh creation using dredged material effectively restores elevation and substrate but initially exhibits lower organic matter and nutrient content compared to natural marshes (Craft et al., 2002; Baustian & Turner, 2006). Outfall management enhances water dispersion from river diversions, improving nutrient retention and vegetation structure (Cahoon et al., 1995; Mitsch & Gosselink, 2015). A systematic evaluation of these techniques is critical for understanding their relative impacts on nitrogen, phosphorus, organic matter, and soil salinity, thereby informing adaptive restoration and coastal sustainability strategies. Only completed restoration projects containing CRMS site IDs within their boundaries were selected for this study. Table 3 shows all the completed projects with their name, site IDs and

restoration techniques. All the stations or sites located outside the area of restoration project are categorized as natural marsh area (Figure 3). Table 4 shows all the restoration techniques and their definitions.

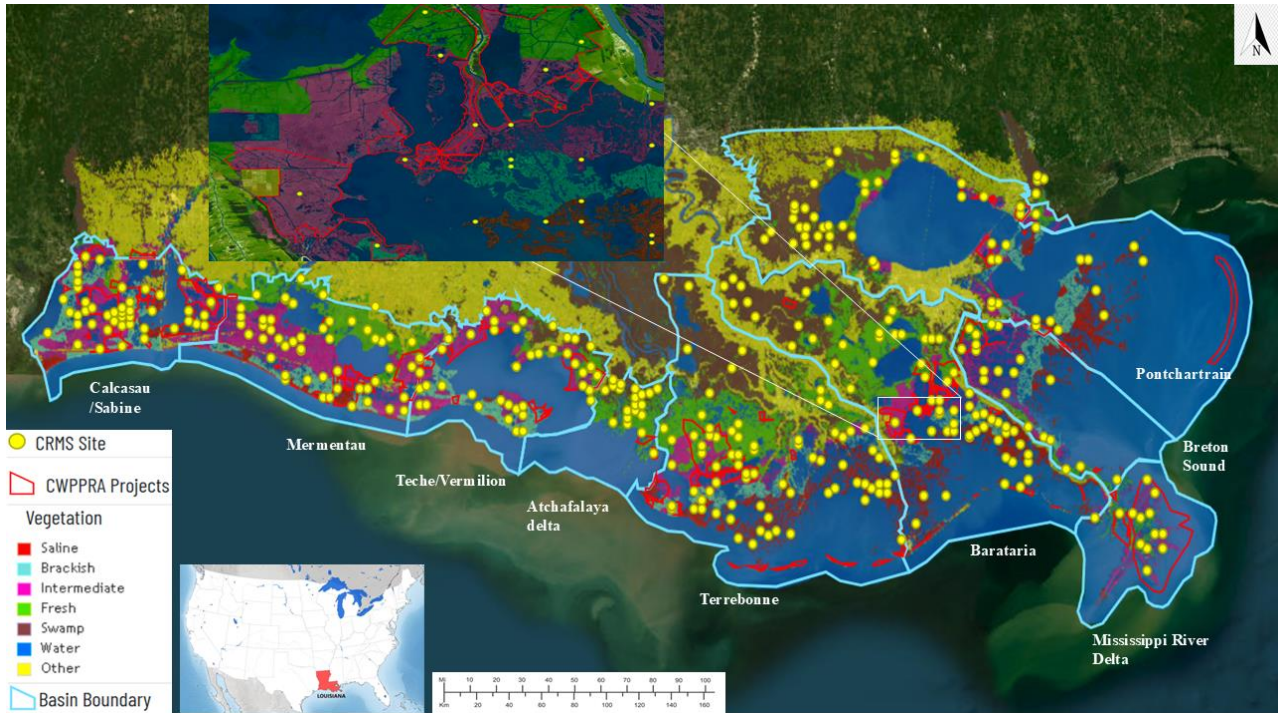


Figure 3: CWPPRA restoration projects and stations across marshes and basins (CPRA, 2017)

Table 3: CWPPRA restoration projects with site IDs and restoration techniques.

| No | Restoration Project Name | Site ID | Restoration Techniques |
|----|---|---|------------------------|
| 1 | GIWW - Perry Ridge West Bank Stabilization | CRMS0697 | Shoreline Protection |
| 2 | East Sabine Lake Hydrologic Restoration | CRMS0660 | Hydrologic Restoration |
| 3 | Sabine National Wildlife Refuge Erosion Protection | CRMS0693, CRMS0694 | Shoreline Protection |
| 4 | Holly Beach Sand Management | CRMS0680 | Shoreline Protection |
| 5 | Replace Sabine Refuge Water Control Structures at Headquarters Canal, West Cove Canal, and Hog Island Gully | CRMS0651, CRMS6301, CRMS0635, CRMS0641, CRMS0639, CRMS2334, CRMS1205, CRMS0638, | Marsh Management |

| | | | |
|----|--|--|-----------------------------------|
| | | CRMS0642, CRMS0677, CRMS0647, CRMS1858 | |
| 6 | Cameron-Creole Maintenance | CRMS0650, CRMS1743, CRMS2418, CRMS1738, CRMS0645, CRMS0648, CRMS0644 | Hydrologic Restoration |
| 7 | Humble Canal Hydrologic Restoration | CRMS0624, CRMS2493 | Hydrologic Restoration |
| 8 | Freshwater Introduction South of Highway 82 | CRMS0609, CRMS0599, CRMS0610, CRMS600 | Hydrologic Restoration |
| 9 | Pecan Island Terracing | CRMS1965, CRMS0623 | Sediment and Nutrient Trapping |
| 10 | Freshwater Bayou Wetland Protection | CRMS0616, CRMS0618, CRMS0619, CRMS0571, CRMS0580 | Hydrologic Restoration |
| 11 | Oaks/Avery Canal Hydrologic Restoration, Increment 1 | CRMS0532 | Hydrologic Restoration |
| 12 | Boston Canal/Vermilion Bay Bank Protection | CRMS1650 | Shoreline Protection |
| 13 | Cote Blanche Hydrologic Restoration | CRMS0488, CRMS0545, CRMS0551, CRMS0544, CRMS0490, CRMS0496, CRMS0517 | Hydrologic Restoration |
| 14 | Atchafalaya Sediment Delivery | CRMS6304 | Hydrologic Restoration |
| 15 | Penchant Basin Natural Resources Plan, Increment 1 | CRMS0290, CRMS0329, CRMS2881, CRMS0327, CRMS0371, CRMS4045, CRMS0354, CRMS0398, CRMS0294, CRMS0296 | Hydrologic Restoration |
| 16 | South Lake Decade Freshwater Introduction | CRMS0394, CRMS0395, CRMS396 | Freshwater Diversion |
| 17 | Bayou Labranche Wetland Creation | CRMS6299 | Marsh Creation |
| 18 | GIWW (Gulf Intracoastal Waterway) to Clovelly Hydrologic Restoration | CRMS0190 | Hydrologic Restoration |
| 19 | Little Lake Shoreline Protection/ Dedicated Dredging Near Round Lake | CRMS6303 | Marsh Creation |
| 20 | Barataria Basin Landbridge Shoreline Protection, Phase 3 | CRMS4218 | Shoreline Protection |
| 21 | Barataria Basin Landbridge Shoreline Protection, Phases 1 and 2 | CRMS0261 | Shoreline Protection |

| | | | |
|----|--|--|--------------------------------|
| 22 | Jonathan Davis Wetland Restoration | CRMS3985, CRMS4245 | Hydrologic Restoration |
| 23 | Naomi Outfall Management | CRMS0287, CRMS4103 | Outfall Management |
| 24 | Barataria Bay Waterway West Side Shoreline Protection | CRMS0248 | Shoreline Protection |
| 25 | Caernarvon Diversion Outfall Management | CRMS0114, CRMS0115, CRMS0117, CRMS0125, CRMS0128 | Outfall Management |
| 26 | Hopedale Hydrologic Restoration | CRMS3800 | Hydrologic Restoration |
| 27 | Lake Borgne Shoreline Protection | CRMS4548 | Shoreline Protection |
| 28 | Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 1 | CRMS4107 | Hydrologic Restoration |
| 29 | Bayou Chevee Shoreline Protection | CRMS3626 | Shoreline Protection |
| 30 | Goose Point/Point Platte Marsh Creation | CRMS0006 | Marsh Creation |
| 31 | Bayou Bonfouca Marsh Creation | CRMS3667 | Marsh Creation |
| 32 | Fritchie Marsh Restoration | CRMS4406, CRMS4407 | Hydrologic Restoration |
| 33 | Delta Management at Fort St. Philip | CRMS0139 | Sediment and Nutrient Trapping |
| 34 | Delta Wide Crevasses | CRMS0161, CRMS2627, CRMS2634, CRMS4448, CRMS0156, CRMS0162, CRMS0157, CRMS0153, CRMS0154, CRMS0159 | Water Diversion |

Table 4: Restoration Techniques and Definitions for Coastal Wetlands of Louisiana (CPRA, 2017, CPRA, 2024)

| Restoration Techniques | Definition |
|-------------------------------|---|
| Freshwater Diversion | Freshwater diversions are engineered openings in levees that redirect river water into adjacent marshes to reduce salinity, deliver sediment, and restore delta-building processes. These are vital for counteracting saltwater intrusion and land loss, especially where natural flooding regimes have been disrupted. |
| Hydrologic Restoration | This technique modifies or removes human-made hydrological barriers (e.g., levees, canals) and installs water control structures to restore natural |

| | |
|--------------------------------|---|
| | flow patterns, improve freshwater delivery, and reduce saltwater intrusion into interior marshes. |
| Marsh Creation | Marsh creation involves placing dredged sediment into open water or deteriorated wetlands to build a substrate that supports colonization by emergent vegetation. This technique mimics natural sediment accretion processes and is among the most widely used restoration strategies in coastal Louisiana. |
| Marsh Management | Marsh management uses levees, weirs, and other hydrologic control structures to manipulate water levels and salinity in order to optimize conditions for marsh vegetation, particularly in brackish and intermediate marshes. |
| Outfall Management | Outfall management ensures that diverted water, sediment, and nutrients from river diversions are evenly distributed across the marsh surface, often using vegetation thinning or small channels to improve water retention and delivery to target areas. |
| Sediment and Nutrient Trapping | This method enhances natural deposition by installing features like terraces, sills, or vegetative plantings to slow water movement, allowing sediments and nutrients to settle, promoting vertical marsh growth and nutrient cycling. |
| Shoreline Protection | Shoreline protection includes constructing breakwaters, rock revetments, or vegetated buffers to reduce wave energy and prevent erosion along marsh edges, thus preserving wetland area and function. |
| Water Diversion | Broadly like freshwater diversion, water diversion refers to any managed redirection of surface water, including stormwater or treated effluent, to nourish wetlands and simulate natural hydrological regimes. |

2.3. Data Analysis

Data obtained from the Coastwide Reference Monitoring System (CRMS) were first compiled, sorted, and pre-processed using Microsoft Excel to ensure accuracy and organize variables by site ids, marsh categories, basins and restoration status. Descriptive statistics, including means, and standard errors, were calculated to provide summary profiles for each soil property. Geographic analysis was performed using ArcGIS Pro (v3.3) to visualize site distribution and spatial relationships across basins and marsh types, enabling the mapping of CRMS stations and restoration project locations. For statistical analysis, One-Way ANOVA

was employed to test for significant differences in soil parameters across basins and marsh types, while Tukey's Honestly Significant Difference (HSD) test was used for post-hoc comparisons to identify which groups exhibited statistically significant variations. In addition, Independent Samples T-tests were conducted to compare soil properties between natural marshes and restoration project sites to assess restoration effectiveness. Standardized Z-score heatmap analysis was conducted to compare effectiveness of restoration techniques for a particular soil property. All statistical analyses were conducted using a combination of RStudio (v2024.09.0+375) and Python (Jupyter Notebook environment with Matplotlib and Pandas libraries), which facilitated hypothesis testing and graphical visualization. All the CRMS stations with the soil data were sorted, selected and categorized into two groups, basins and marshes, according to their locations, using ArcGIS Pro.

Chapter 3. Results & Discussion

3.1 Total N, Total P, Organic Matter and Soil Salinity

Total nitrogen (N), total phosphorus (P), organic matter (OM), and soil salinity in Louisiana’s coastal marshes show significant variation across four marsh types and nine hydrological basins. The results of the one-way ANOVA (Table 5) confirm statistically significant differences in these soil properties. Results from Table 6 and Table 7 show the mean total N, total P, organic matter and soil salinity from sites across basins and marshes with the standard error.

Table 5: Summary of One-Way ANOVA for total N, total P, organic matter and soil salinity across basins and marshes.

| Source | Total N | | | Total P | | | Soil Salinity | | | OM | | |
|--------------|---------|------------|--------------|---------|------------|--------------|---------------|-------------|--------------|--------|------------|------------|
| | D F | F Value | P Value | D F | F Value | P Value | D F | F Value | P Value | D F | F Value | P Value |
| Basin | 8 | 26.14 | 7.59 E-38 | 8 | 15.05 | 2.58 E-21 | 8 | 294.1 0 | 2.32 E-16 | 8 | 7.89 | 0.000 1 |
| Marsh | 3 | 77.83 | 1.77 E-46 | 3 | 37.61 | 2.28 E-23 | 3 | 3402. 74 | 2.64 E-16 | 3 | 5.43 | 0.005 |

Table 6: Summary of mean total N, total P, organic matter and soil salinity of marshes with standard error.

| Marsh Type | Sites | Total N (g/kg) | Total P (mg/kg) | OM (%) | Soil Salinity (ppt) |
|--------------|-------|----------------|-----------------|--------------|---------------------|
| Brackish | 22 | 7.88 ± 0.53 | 548.72 ± 17.20 | 27.71 ± 1.83 | 3.86 ± 0.19 |
| Fresh | 46 | 13.26 ± 0.46 | 724.09 ± 18.40 | 34.77 ± 1.48 | 0.41 ± 0.02 |
| Intermediate | 52 | 10.03 ± 0.34 | 628.57 ± 22.20 | 33.43 ± 1.12 | 2.09 ± 0.12 |
| Saline | 34 | 4.73 ± 0.25 | 529.07 ± 13.34 | 21.34 ± 0.93 | 6.51 ± 0.20 |

Table 7: Summary of mean total N, total P, organic matter and soil salinity of basins with standard error.

| Hydrological Basins | Sites | Total N (g/kg) | Total P (mg/kg) | OM (%) | Soil Salinity (ppt) |
|----------------------------|--------------|-----------------------|------------------------|---------------|----------------------------|
| Atchafalaya | 13 | 6.22 ± 0.40 | 681.67 ± 21.48 | 21.90 ± 1.26 | 0.39 ± 0.01 |
| Barataria | 23 | 10.76 ± 0.71 | 530.55 ± 46.29 | 38.23 ± 2.28 | 0.90 ± 0.27 |
| Breton Sound | 12 | 7.03 ± 0.40 | 605.79 ± 22.09 | 22.71 ± 1.30 | 1.87 ± 0.10 |
| Calcasieu-Sabine | 19 | 7.22 ± 0.48 | 520.72 ± 13.03 | 37.45 ± 1.92 | 4.07 ± 0.19 |
| Mermentau | 20 | 13.26 ± 0.70 | 539.35 ± 20.06 | 37.43 ± 2.01 | 2.31 ± 0.30 |
| Mississippi River Delta | 11 | 2.17 ± 0.19 | 718.85 ± 24.72 | 8.01 ± 0.56 | 0.56 ± 0.05 |
| Pontchartrain | 13 | 10.74 ± 0.69 | 548.13 ± 35.00 | 35.34 ± 2.02 | 1.05 ± 0.16 |
| Teche/Vermilion | 21 | 7.62 ± 0.46 | 724.86 ± 50.60 | 26.54 ± 1.46 | 1.58 ± 0.09 |
| Terrebonne | 22 | 7.24 ± 0.74 | 527.08 ± 23.72 | 29.76 ± 2.08 | 4.41 ± 0.29 |

3.1.1. Variation Across Marshes

Among the four marsh types (Figure 4), fresh marshes contained the highest mean total N concentration (2.84 g/kg), while saline marshes exhibited the lowest (1.25 g/kg). This is consistent with findings by Noe and Hupp (2005), who reported that freshwater marshes tend to have higher N retention due to limited tidal flushing and stronger organic matter accumulation. The lower nitrogen levels in saline marshes likely result from frequent tidal flushing and lower organic matter accumulation due to high salinity stress on plant productivity (Neubauer, 2011).

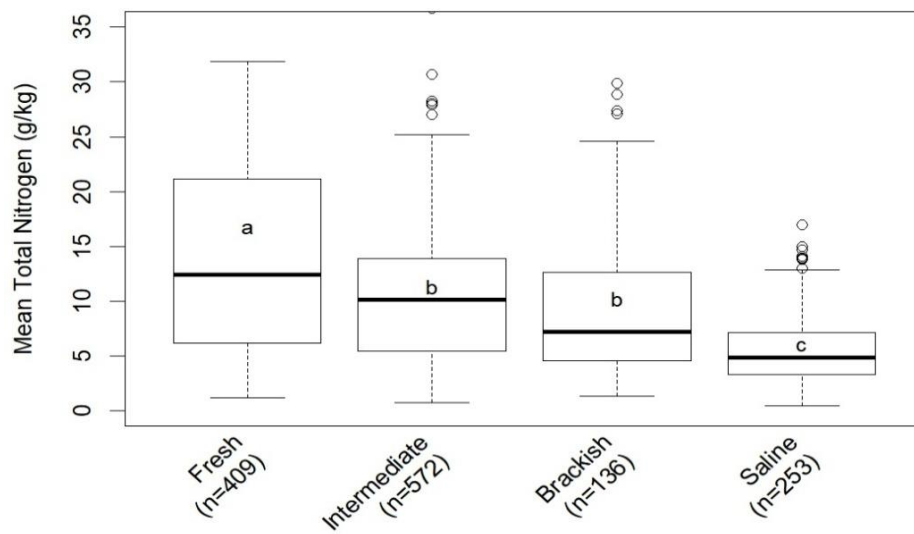


Figure 4: Boxplots of total N with Tukey groupings across marshes.

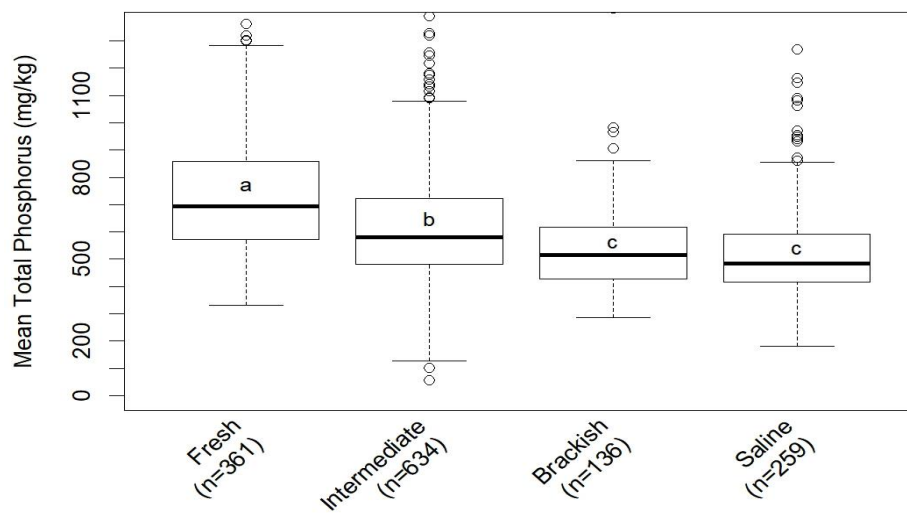


Figure 5: Boxplots of total P with Tukey groupings across marsh.

Fresh marshes exhibited the highest total P concentrations (530 mg/kg), while saline marshes had the lowest (280 mg/kg) in Figure 5. This pattern is expected, as phosphorus availability in marsh soils is often influenced by organic matter accumulation and redox conditions. In freshwater marshes, phosphorus is more likely to bind with organic compounds, whereas in saline environments, P availability is often limited due to precipitation with calcium and iron oxides (Paludan & Morris, 1999; Sundareshwar & Morris, 1999).

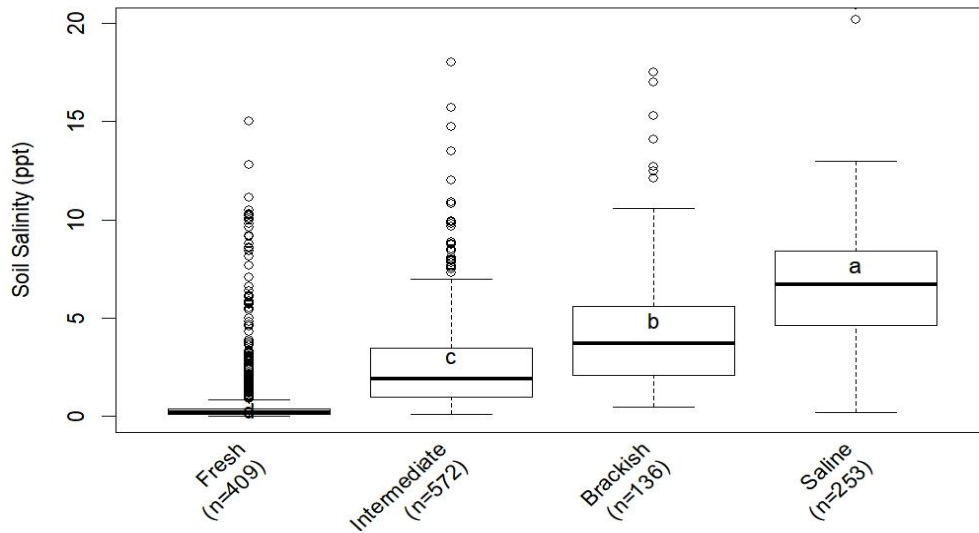


Figure 6: Boxplots of soil salinity with Tukey groupings across marshes.

Saline marshes exhibited the highest salinity levels (17.3 ppt), while fresh marshes had the lowest (0.8 ppt) (Fig. 6). Intermediate and brackish have soil salinity level more than fresh marshes. This follows well-documented salinity gradients in Louisiana’s coastal wetlands, where freshwater marshes are more protected from tidal influence, whereas saline marshes experience direct exposure to marine water (Mitsch & Gosselink, 2015; Reddy & DeLaune, 2008).

From figure 7, analyzing marsh types for organic matter revealed a clear gradient, with freshwater marshes containing the highest mean organic matter content (36%), followed by intermediate marshes (33%), brackish marshes (28%), and finally saline marshes (21%) with the lowest OM levels. This trend supports the hypothesis that marsh type significantly influences organic matter accumulation, driven by varying vegetation types, salinity levels, microbial decomposition rates, and tidal flushing frequencies (Neubauer et al., 2005; Chambers et al., 2011). Freshwater marshes, benefiting from low salinity stress, dense vegetation growth, and slower decomposition rates under anaerobic conditions, are conducive to high OM accumulation (Visser et al., 1998; Craft & Casey, 2000). In contrast, saline marshes experience increased tidal flushing, higher decomposition rates, and lower vegetation productivity, resulting in reduced organic matter content (Poffenbarger et al., 2011; Neubauer, 2011).

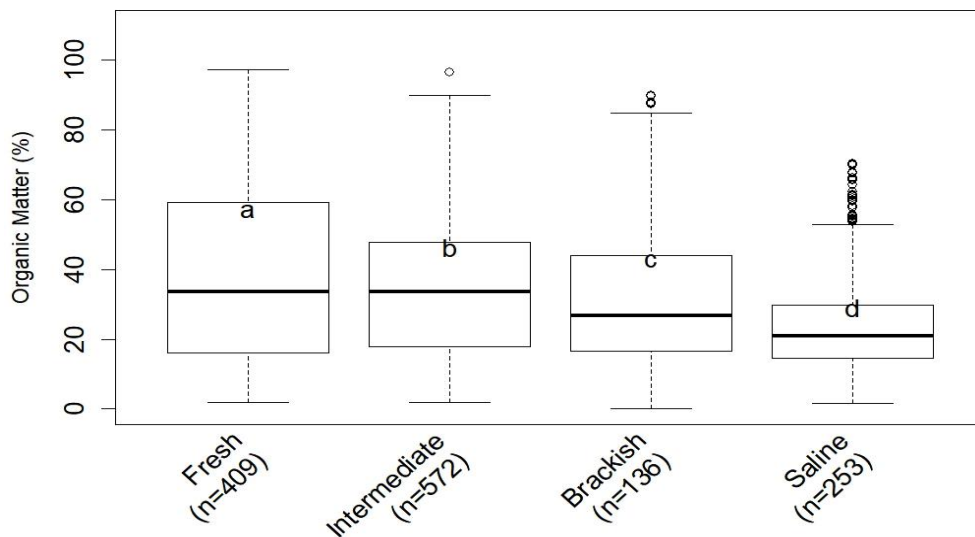


Figure 7: Boxplots of OM with Tukey groupings across marshes.

3.1.2. Variation Across Basins

Figure 8 illustrates the significant variation of total N across the nine hydrological basins and four marshes with assigned Tukey letters of significance. The highest mean total nitrogen concentrations were observed in the Calcasieu/Sabine Basin (3.01 g/kg) and Mermentau Basin (2.87 g/kg), while the Mississippi River Delta Basin exhibited the lowest concentrations (1.25 g/kg). This pattern can be attributed to higher organic matter accumulation in the western basins due to lower tidal exchange, reduced oxidation rates, and higher freshwater inflows (Bai et al., 2017; Mitsch & Gosselink, 2015). Similar trends were reported in previous studies, where nitrogen accumulation was positively correlated with organic-rich sediments in freshwater marshes (Reddy & DeLaune, 2008).

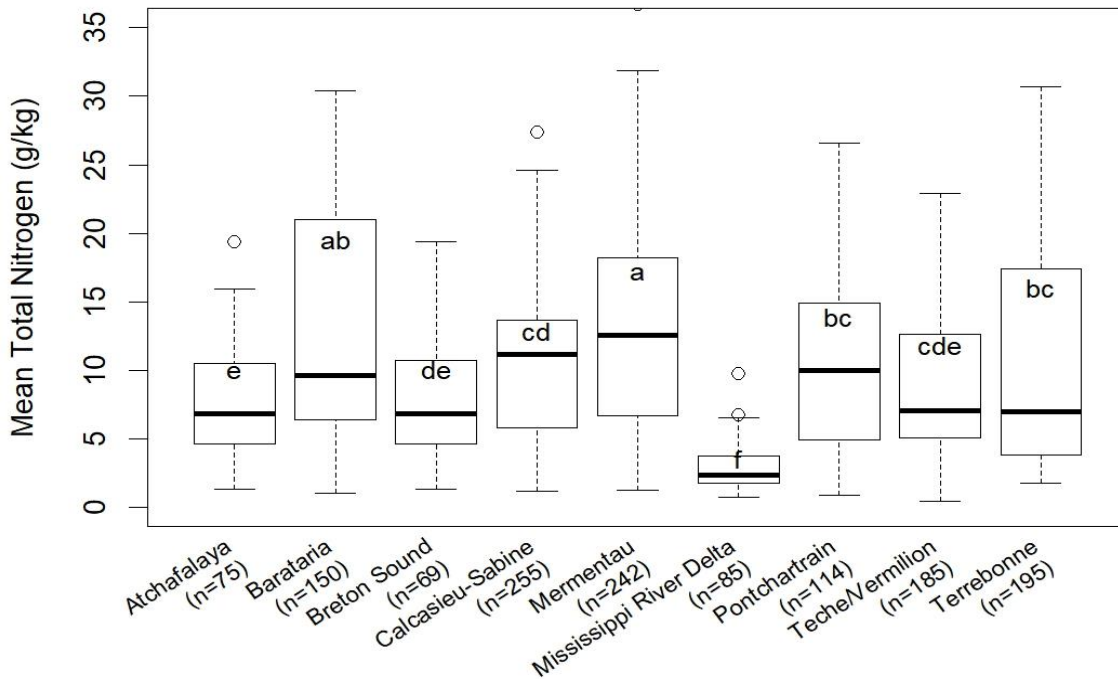


Figure 8: Boxplots of total N with Tukey groupings across basins.

The spatial distribution of total phosphorus (Figure 9) reveals that the Mississippi River Delta Basin (540 mg/kg) and Teche/Vermilion Basin (530 mg/kg) contained the highest phosphorus concentrations, while the Calcasieu/Sabine Basin had the lowest (280 mg/kg). This pattern is largely driven by differences in sediment deposition and hydrodynamic conditions across basins. The high phosphorus levels in the Mississippi River Delta Basin are consistent with previous studies indicating that deltaic systems act as major phosphorus sinks due to high rates of sediment deposition from riverine inputs (Noe & Hupp, 2005; Craft & Casey, 2000).

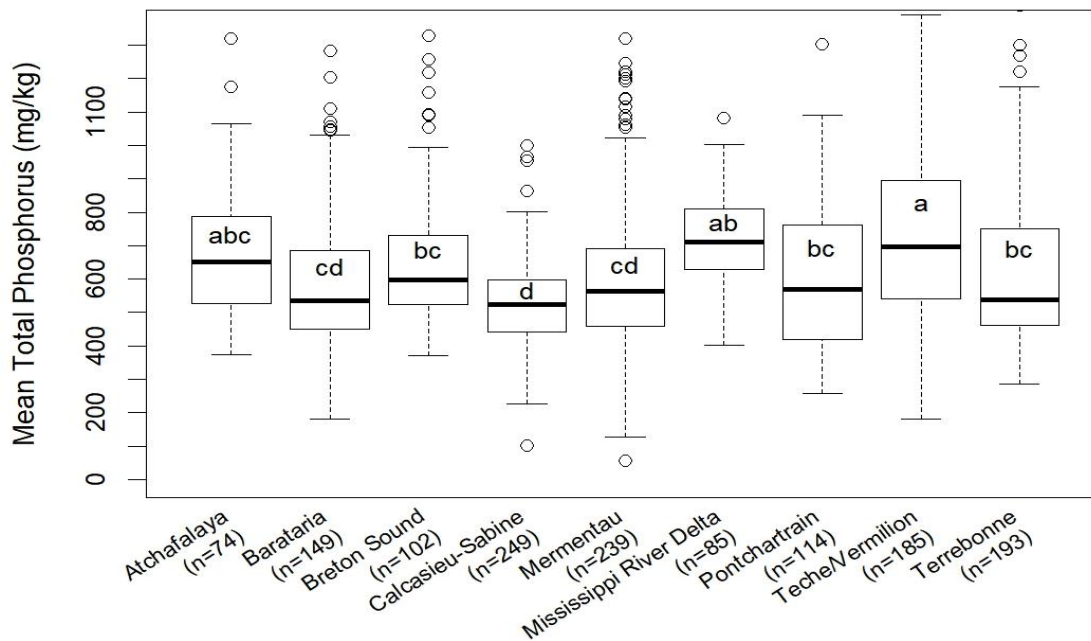


Figure 9: Boxplots of total P with Tukey groupings across basins.

The distribution of soil salinity across basins (Figure 10) confirms significant spatial heterogeneity. The highest soil salinity was recorded in the Terrebonne Basin (16.5 ppt) and Calcasieu/Sabine Basin (15.8 ppt), while the lowest salinity levels were found in the

Atchafalaya Delta (2.1 ppt) and Mississippi River Delta (1.9 ppt). These findings align with previous studies indicating that the Atchafalaya and Mississippi River Delta basins experience substantial freshwater input, leading to lower soil salinity (Turner, 1997; Couvillion et al., 2017). In contrast, the Terrebonne Basin, which is highly vulnerable to saltwater intrusion, has experienced increased salinity levels due to land loss and hydrological modifications (Kennedy & Gill, 2013).

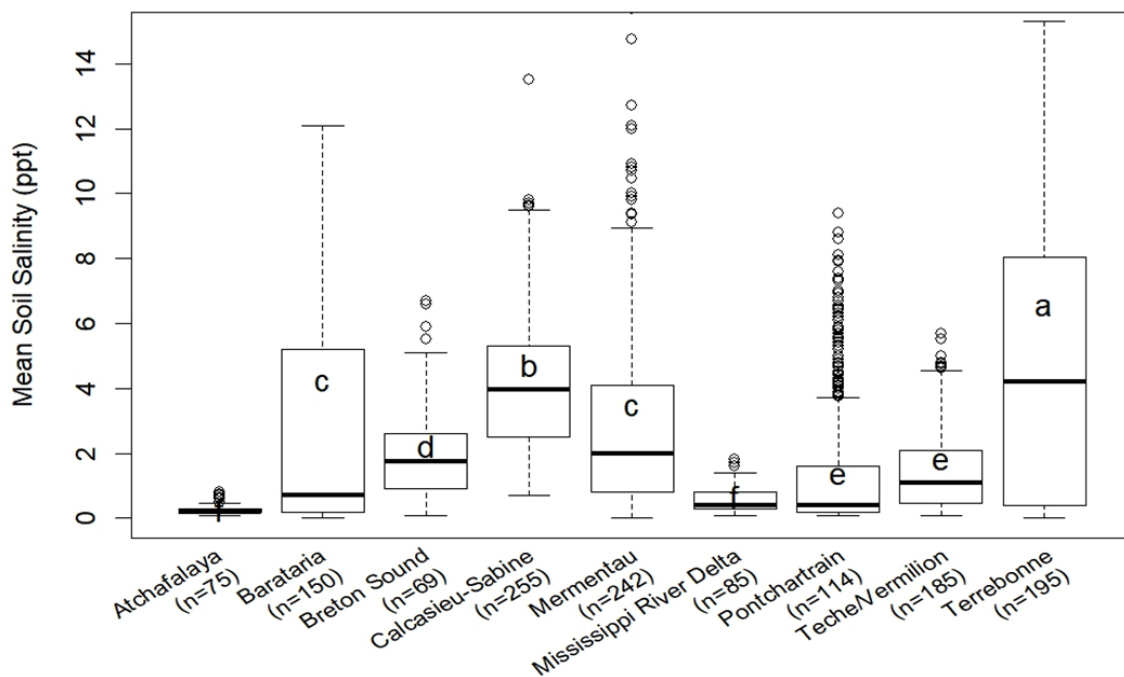


Figure 10: Boxplots of soil salinity with Tukey groupings across basins.

Across hydrological basins, organic matter content exhibited substantial variation (Fig. 11). The Calcasieu-Sabine showed the highest mean organic matter content (39%), followed closely by the Mermentau Basin (37%). Moderate OM levels were observed in the Barataria Basin (36%), Pontchartrain (32%), and Terrebonne (23%) Basins. Notably, significantly lower OM levels were found in the Atchafalaya (21%) and Breton Sound (19%)

Basins, while the Mississippi River Delta Basin exhibited the lowest organic matter content (9%) overall. This spatial distribution pattern is likely attributed to differences in hydrological regimes, sediment deposition, vegetation productivity, and tidal influences unique to each basin (DeLaune & White, 2012; Twilley et al., 2016).

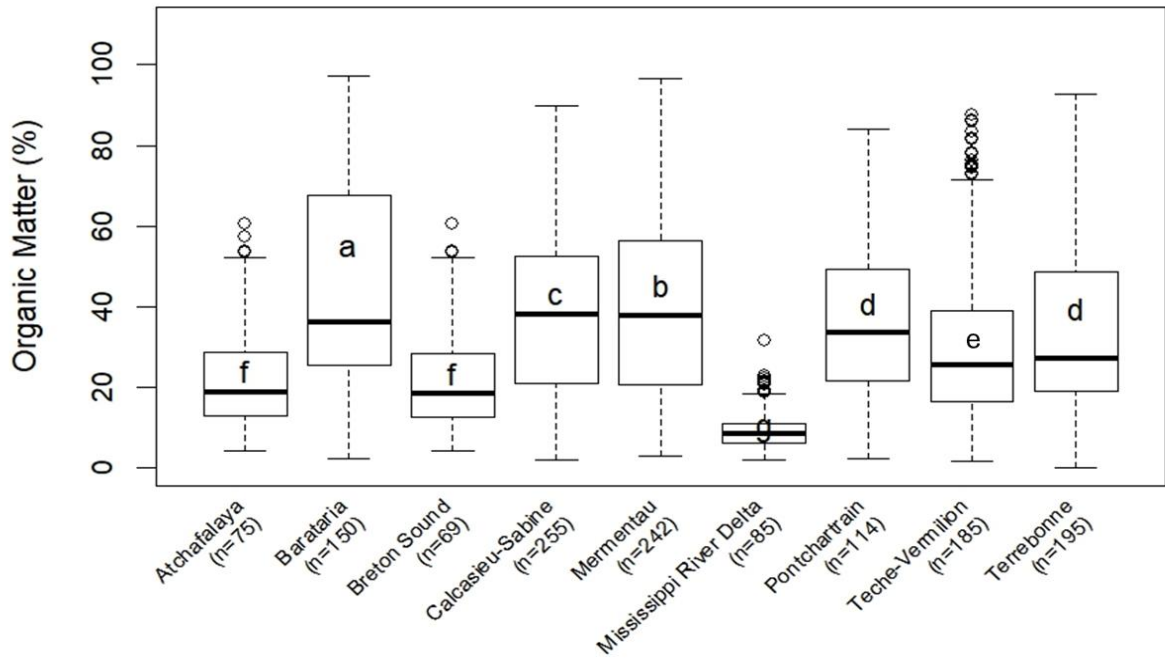


Figure 11: Boxplots of OM with Tukey groupings across basins.

3.2. Difference Between Restored and Natural Marsh Soils Across Techniques

The analysis of soil properties across restoration projects with different techniques compared to natural marshes provides insights into how restoration techniques influence total nitrogen, total phosphorus, organic matter, and soil salinity. Table 8 shows summary of the mean total N, total P, organic matter and salinity of soils from all the sites of restoration projects and natural marshes with standard deviation and independent T-test results, revealed significant P value except for soil salinity.

Table 8: Summary of mean total N, total P, OM and salinity of soils from restoration sites and natural marshes with standard error and T-test

| Soil Type | Sites | Total Nitrogen (g/kg) | Total Phosphorus (mg/kg) | Organic Matter (%) | Soil Salinity (ppt) |
|------------------------------|-------|-----------------------|--------------------------|--------------------|---------------------|
| Natural Marsh Soil | 114 | 9.954 ± 0.27 | 649.402 ± 14.03 | 35.915 ± 0.84 | 2.545 ± 0.10 |
| Restoration Project Soil | 39 | 10.115 ± 0.38 | 619.523 ± 14.02 | 34.514 ± 1.36 | 2.720 ± 0.18 |
| P-Value (Independent T-test) | - | 7.26E-08 | 9.73E-49 | 3.60E-13 | 0.624 |

Figure 12 presents the mean total N concentrations (g/kg) across different restoration techniques. Natural marshes exhibited a mean total N concentration of 9.95 g/kg, which served as the reference for comparison. Natural marshes are always assigned to the Tukey significance letter “A” for comparing with restored marshes across techniques. Any restoration technique having “B” means it is significantly lower or higher than the natural marshes at $p < 0.05$ significance. Among the restoration techniques, Outfall Management exhibits the highest total nitrogen concentration at 17.41 g/kg, surpassing natural marshes. Other restoration methods, such as Hydrologic Restoration (11.91 g/kg) and Sediment and Nutrient Trapping (11.32 g/kg), also display elevated total nitrogen. In contrast, Water Diversion sites have the lowest recorded mean total nitrogen of 3.04 g/kg, significantly lower than natural marshes. Other restoration types, including Freshwater Diversion (10.89 g/kg), Marsh Management (10.85 g/kg), and Marsh Creation (8.58 g/kg), exhibit nitrogen levels similar to or slightly lower than natural marshes.

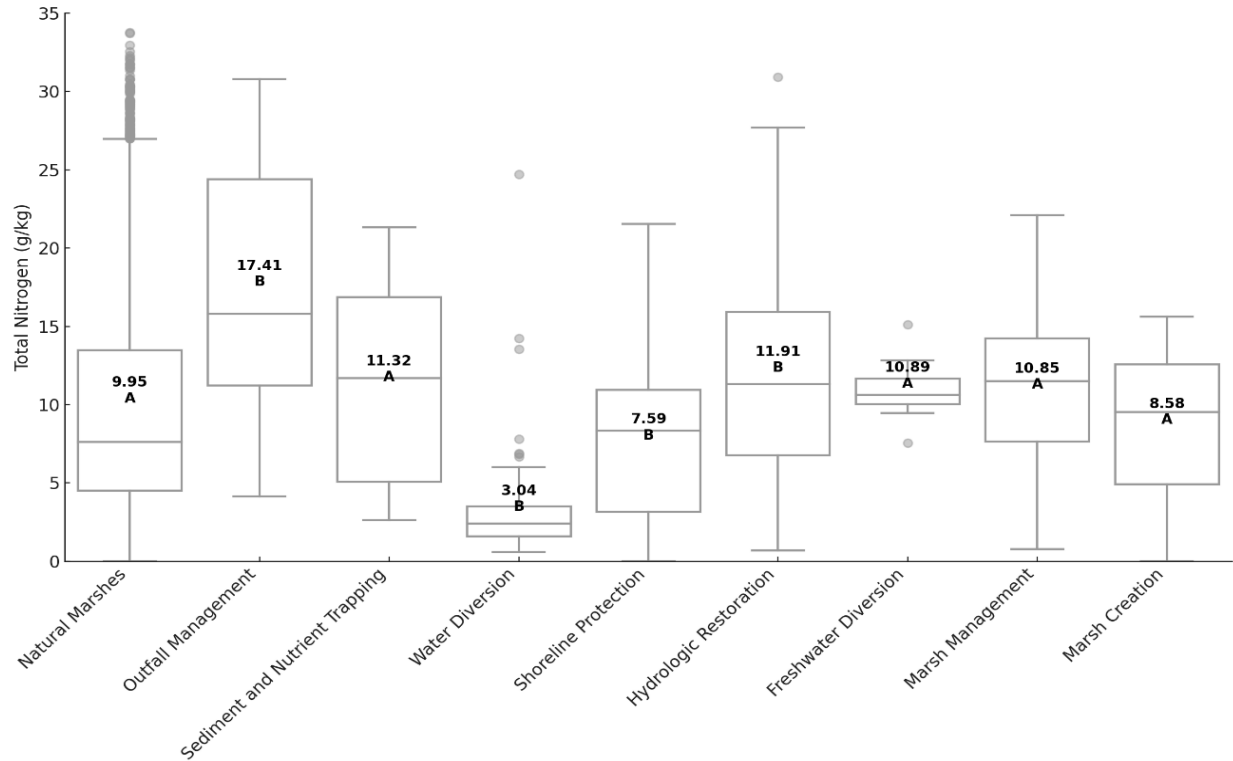


Figure 12: Boxplots of mean total N with Tukey groupings in natural and restored sites across techniques.

Studies have shown that hydrologic modifications facilitating nutrient retention can lead to greater nitrogen accumulation in marsh soils over time (Craft et al., 2002).

Hydrologic restoration projects that reintroduce natural hydrology help maintain nitrogen availability by reducing excessive tidal flushing and promoting sediment trapping (Mitsch & Gosselink, 2015). Conversely, the notably lower total nitrogen in Water Diversion sites aligns with findings by Weston et al. (2011), who reported that excessive freshwater inputs could dilute soil nitrogen concentrations. Freshwater diversions are often designed to reduce salinity and enhance plant productivity, but in some cases, they may lead to nitrogen limitation if nitrogen inputs do not compensate for the dilution effect (DeLaune et al., 2013).

Over time, nitrogen accumulation in restored marshes may increase as plant biomass

contributes to organic nitrogen pools, though this process depends on hydrologic stability and nutrient cycling efficiency (Zhao et al., 2024).

Figure 13 presents mean total phosphorus concentrations (mg/kg) across restoration project sites and natural marshes. Natural marshes contain 649.40 mg/kg of total phosphorus as a reference. Among the restoration types, Outfall Management exhibits the highest mean total phosphorus concentration of 800.99 mg/kg, followed by Water Diversion (732.25 mg/kg) and Sediment and Nutrient Trapping (700.94 mg/kg). In contrast, Freshwater Diversion (553.28 mg/kg), Marsh Management (550.55 mg/kg), and Marsh Creation (521.44 mg/kg) have lower total phosphorus concentrations than natural marshes.

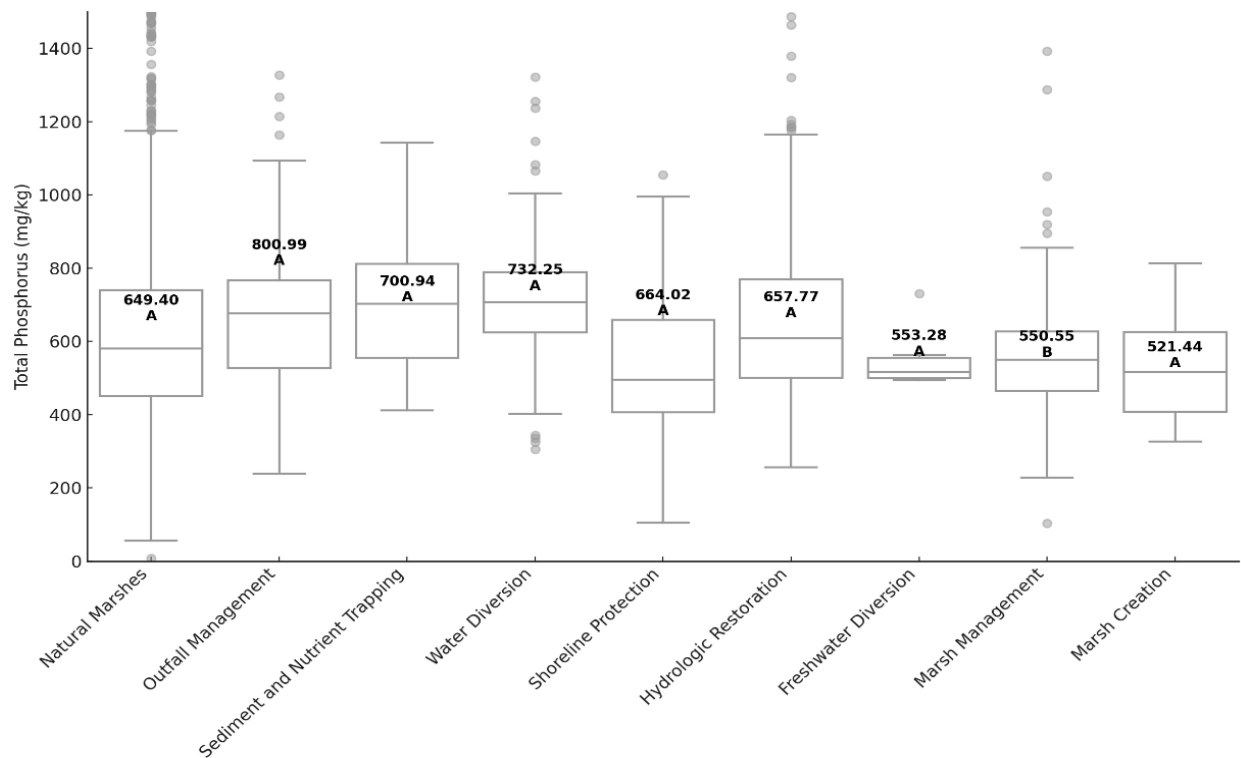


Figure 13: Boxplots of mean total P with Tukey groupings in natural and restored sites across techniques.

Past studies have demonstrated that wetlands receiving external phosphorus inputs, particularly from riverine sources, exhibit enhanced phosphorus retention due to the adsorption of phosphorus onto sediment particles (Noe & Hupp, 2005, Sundareshwar & Morris, 1999). Similarly, hydrologic connectivity plays a crucial role in phosphorus retention, as periodic flooding enhances phosphorus binding within wetland soils (Craft et al., 1988). Lower phosphorus concentrations in Marsh Creation and Marsh Management sites may be attributed to differences in sediment composition and organic phosphorus accumulation rates.

Craft et al. (2002) reported that newly created marshes initially have lower phosphorus content due to the use of mineral-based sediments, which lack organic-bound phosphorus. Over time, phosphorus concentrations may increase in created marshes as organic matter accumulation and microbial processes enhance phosphorus retention (VanZomeren & Piercy, 2020). However, phosphorus bioavailability in wetland soils is influenced by various biogeochemical factors, including pH, redox potential, and iron-phosphorus interactions, which can affect phosphorus release and retention (Kolker et al., 2012).

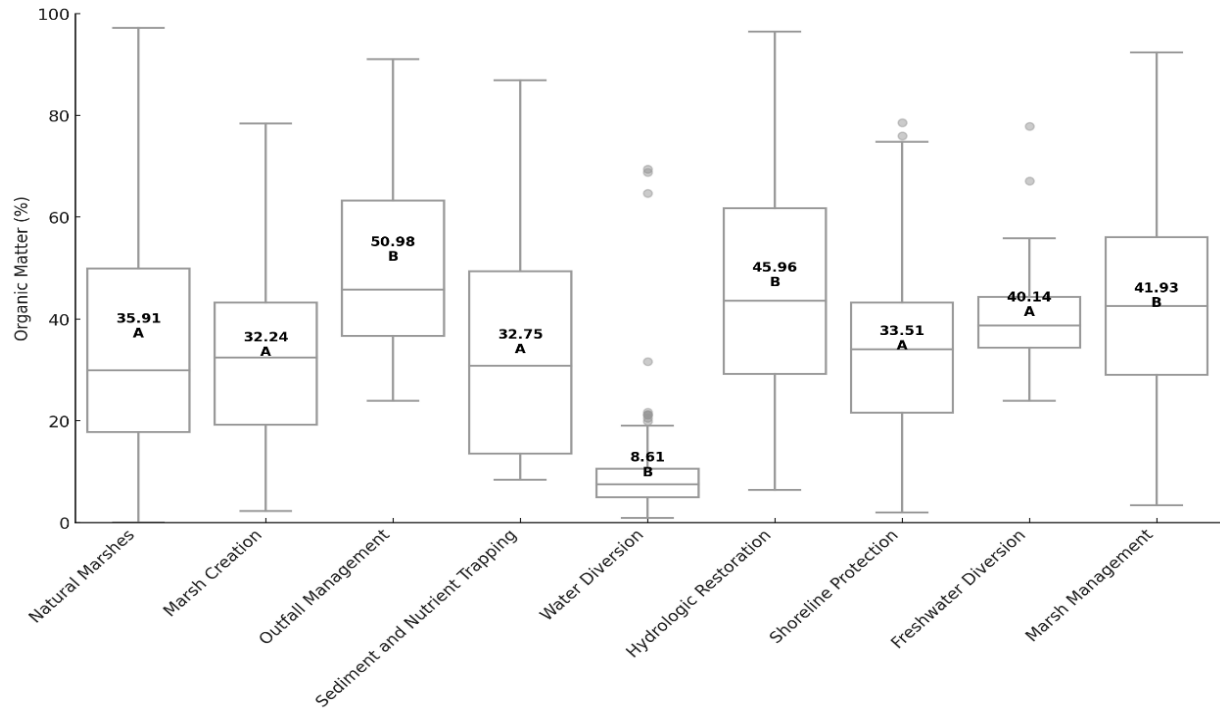


Figure 14: Boxplots of mean OM with Tukey groupings in natural and restored sites across techniques.

Figure 14 shows natural marshes have a mean organic matter content of 35.91%. Among the restoration project sites, Sediment and Nutrient Trapping exhibits the highest organic matter concentration at 50.98%, followed by Hydrologic Restoration at 45.96%. Freshwater Diversion (40.14%) and Shoreline Protection (33.51%) maintain values close to natural marshes. Water Diversion sites have the lowest organic matter content, with a mean value of 8.61%. Marsh Creation (32.24%) and Outfall Management (32.75%) exhibit organic matter levels slightly lower than those of natural marshes. The high organic matter levels in Sediment and Nutrient Trapping and Hydrologic Restoration sites suggest that these sites facilitate greater plant productivity and organic matter retention, aligning with the findings of Chmura et al. (2003), who reported that organic matter accumulation is highest in wetlands with steady sediment inputs.

Mudd et al. (2010) similarly observed that sediment-rich marshes with moderate flooding regimes promote organic carbon storage over time. The low organic matter content in Water Diversion sites is consistent with findings by Weston et al. (2011), who demonstrated that excessive freshwater inputs could lead to reduced plant biomass production and lower organic matter accumulation. Organic matter accumulation is also affected by decomposition rates, with higher salinity conditions generally leading to slower decomposition and greater organic carbon retention (Craft & Casey, 2000). Over time, organic matter levels in restored sites may increase as vegetation establishes and organic inputs from plant detritus accumulate (Kelsall et al., 2023).

The mean soil salinity of natural marshes is 2.54 ppt, which serves as the reference for comparison (Figure 15). Among the restoration project sites, Hydrologic Restoration (2.63 ppt) and Shoreline Protection (1.96 ppt) maintain soil salinity levels close to those of natural marshes. Freshwater Diversion (3.53 ppt) and Marsh Management (3.57 ppt) have slightly higher salinity levels. In contrast, Water Diversion exhibits the lowest mean salinity at 0.48 ppt, indicating excessive freshwater influence. Outfall Management (1.05 ppt) and Marsh Creation (1.56 ppt) also have lower salinity than natural marshes.

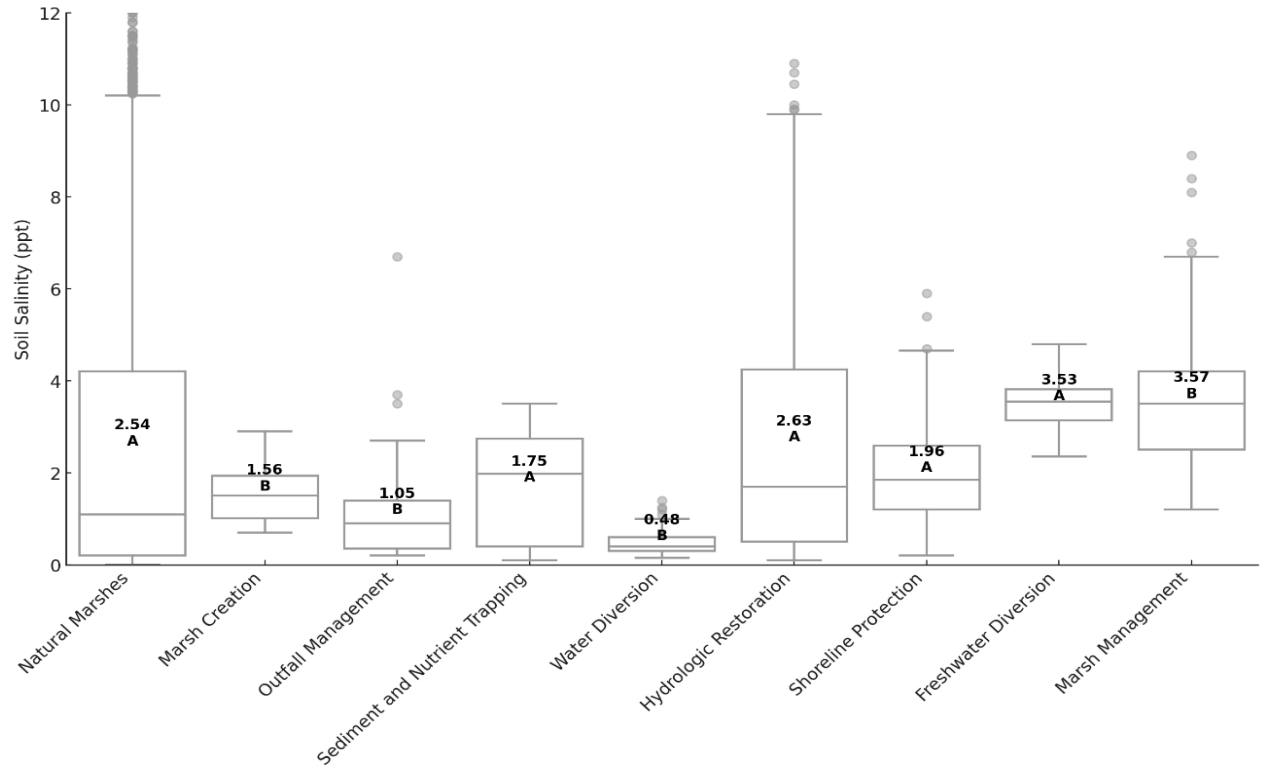


Figure 15: Boxplots of mean soil salinity with Tukey groupings in natural and restored sites across techniques.

The observed trends in Hydrologic Restoration and Freshwater Diversion sites align with findings by DeLaune et al. (2013), who reported that hydrologic restoration projects help maintain natural salinity levels by controlling freshwater inflows and preventing excessive saltwater intrusion. Conversely, the extremely low soil salinity in Water Diversion sites is consistent with Weston et al. (2011), who found that excess freshwater inputs could lead to reduced soil salinity. The slightly higher salinity levels in Shoreline Protection and Marsh Management sites suggest that these areas may experience less tidal flushing, leading to salt accumulation in surface soils (Kolker et al., 2012).

3.2.1. Restoration Techniques by Marshes

The bar plot (Figure 30) displays the variation in mean total nitrogen (g/kg) across eight restoration technique categories, stratified by marsh type. Notably, Outfall Management sites demonstrated the highest nitrogen levels, particularly in Fresh marshes (19.18 g/kg) and Intermediate marshes (15.95 g/kg), underscoring the role of enhanced freshwater discharge in nutrient enrichment (Turner et al., 2006). Sediment and Nutrient Trapping also exhibited elevated nitrogen in Intermediate marshes (14.89 g/kg), likely due to sediment accretion processes enhancing soil nutrient retention (Craft, 2007).

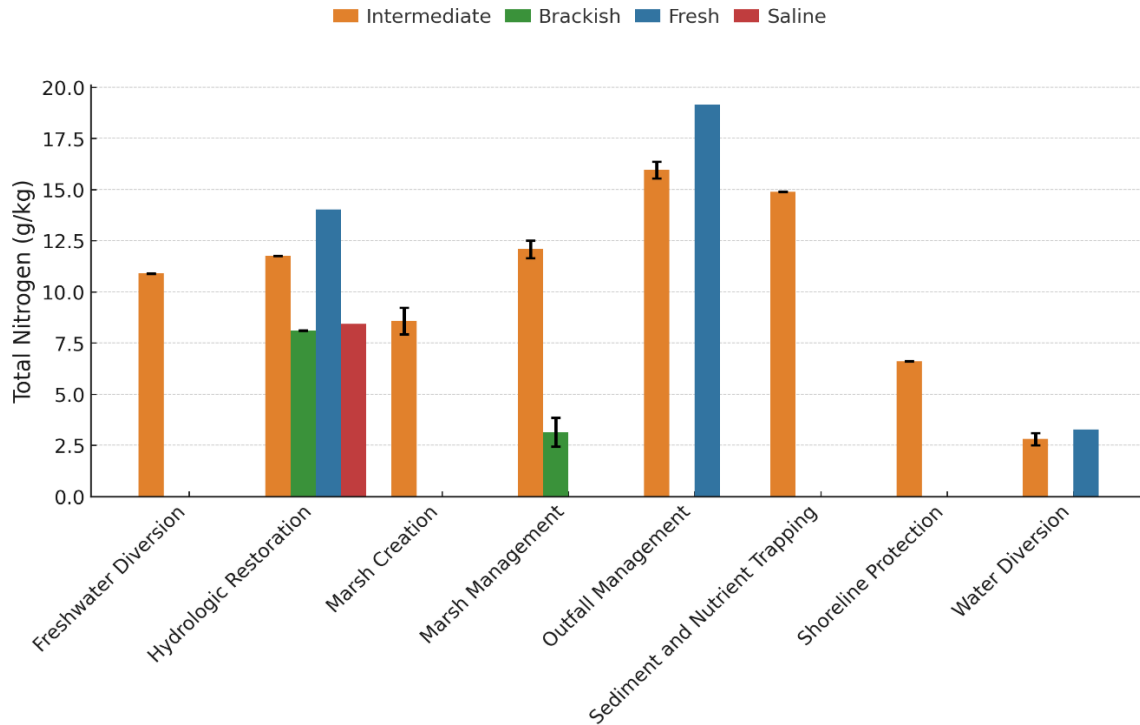


Figure 16: Bar plots of total N by restoration techniques and marshes

Hydrologic Restoration sites showed moderate to high nitrogen levels: Fresh marshes recorded 14.02 g/kg, Intermediate 11.83 g/kg, and Brackish and Saline marshes 8.04 g/kg and 8.39 g/kg, respectively (Fig. 16). Conversely, Water Diversion and Shoreline Protection

showed the lowest nitrogen levels (<3.5 g/kg), indicating limited nutrient accumulation in these interventions. These results emphasize that restoration techniques involving controlled hydrologic inputs are more effective at enhancing nitrogen storage in coastal marsh soils (Mitsch & Gosselink, 2015; Moreno-Mateos et al., 2012).

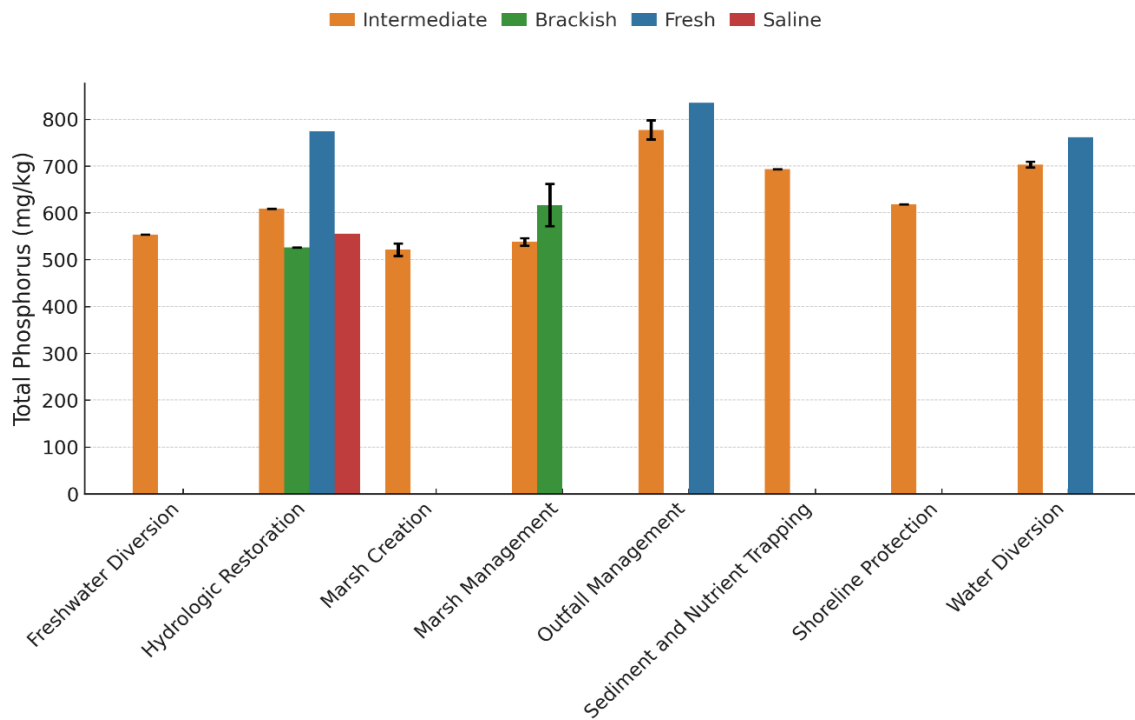


Figure 17: Bar plots of total P by restoration techniques and marshes

Figure 17 shows Outfall Management sites recorded the highest total P, particularly in fresh marshes (838.26 mg/kg) and intermediate marshes (775.87 mg/kg), indicating significant phosphorus accumulation under managed freshwater discharge conditions. These results corroborate studies showing that phosphorus delivery from riverine inputs can enhance soil fertility in deltaic wetlands (Noe et al., 2003; Turner & Rabalais, 2003). Water Diversion sites also exhibited elevated values, 757.49 mg/kg in Fresh and 697.90 mg/kg in intermediate marshes, suggesting that large-scale diversions can sustain phosphorus retention

under appropriate hydrologic conditions (Lane et al., 2002). Moderate phosphorus levels were observed in Hydrologic Restoration areas, ranging from 521.51 mg/kg (Brackish) to 772.88 mg/kg (Fresh), while Marsh Creation and Marsh Management had lower values (~520–620 mg/kg). Shoreline Protection sites showed more variability, with intermediate marshes at 622.73 mg/kg.

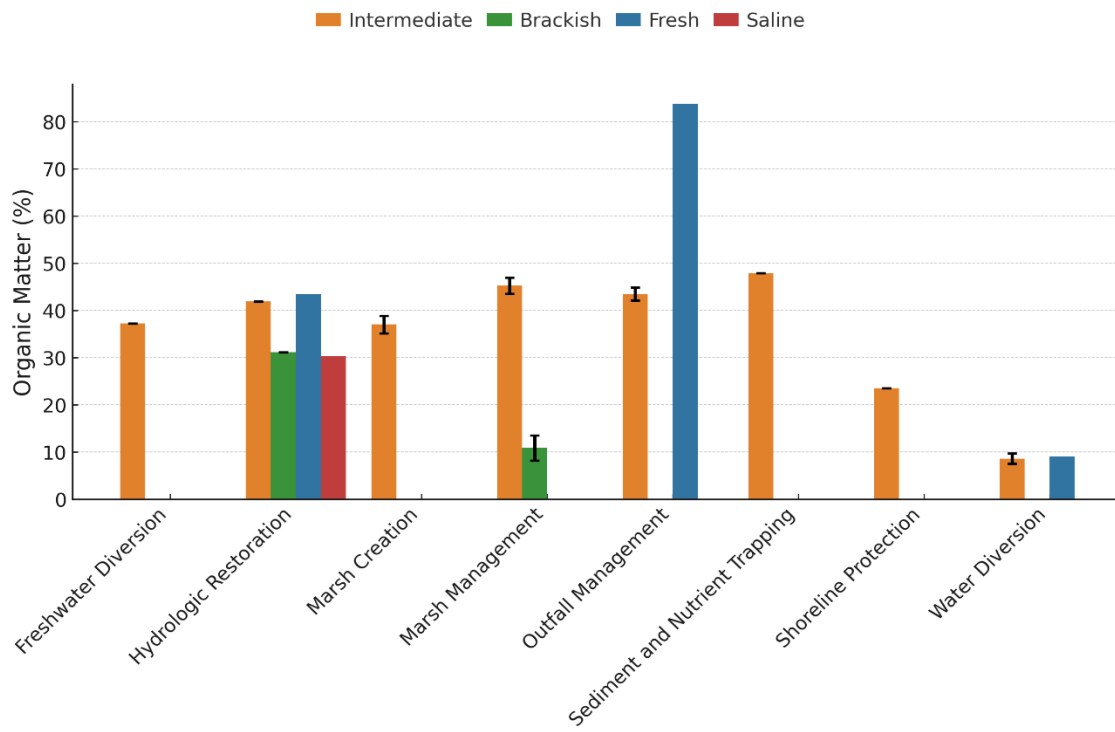


Figure 18: Bar plots of OM by restoration techniques and marshes

Figure 18 represents organic matter (%) across marsh types under various restoration strategies. Outfall Management in Fresh marshes exhibited the highest organic matter content (83.94%), followed by Intermediate marshes under Sediment and Nutrient Trapping (47.88%) and Marsh Management (45.24%). These results support prior findings that freshwater-dominated and sediment-enhanced systems promote peat accumulation and organic matter buildup through high plant productivity and slower decomposition (Craft,

2001; Neubauer, 2013). Hydrologic Restoration showed moderate levels in Intermediate (41.62%) and Fresh marshes (43.34%), but lower values in Brackish (31.52%) and Saline marshes (30.47%), highlighting the influence of salinity in reducing organic matter accumulation via stress on vegetation and microbial activity (Mendelssohn & Morris, 2000). In contrast, Shoreline Protection (23.84%) and Water Diversion (~9%) displayed the lowest levels, reflecting limited organic inputs or enhanced decomposition under fluctuating water regimes. Overall, organic matter trends align with studies emphasizing the role of hydrologic and salinity regimes in regulating carbon storage in coastal soils (Mitsch & Gosselink, 2015; Chmura et al., 2003).

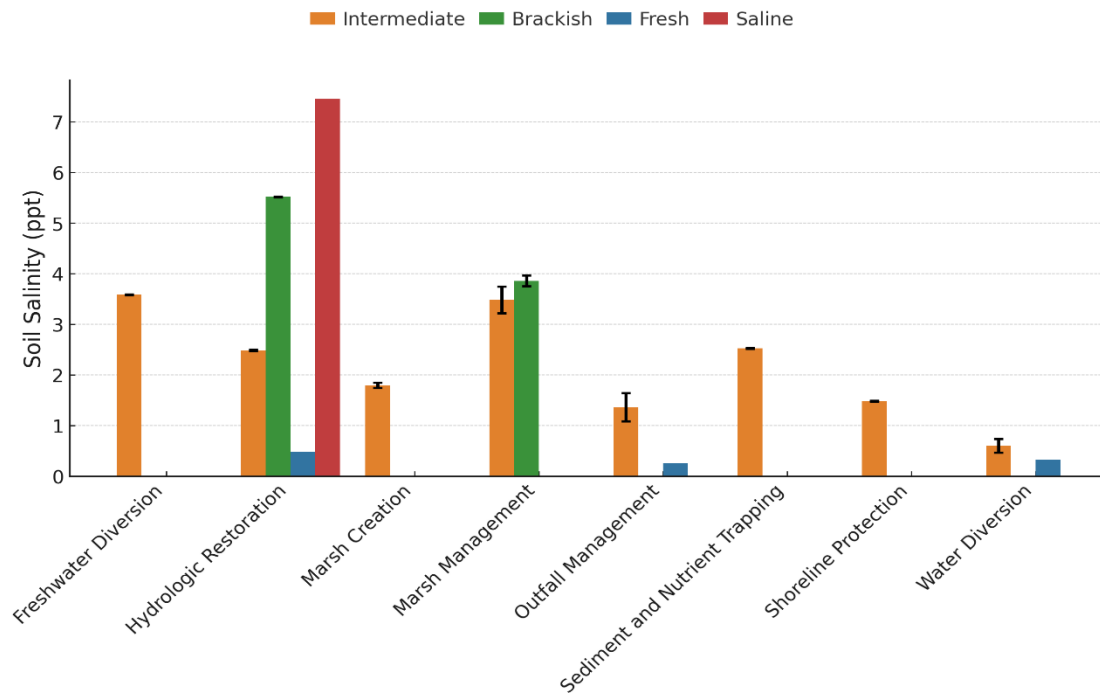


Figure 19: Bar plots of soil salinity by restoration techniques and marshes

The highest salinity was observed under Marsh Creation in saline marshes (7.37 ppt) (Fig. 19) and brackish marshes (5.49 ppt), suggesting that restored marshes in high-salinity

environments retain elevated salt concentrations, potentially influencing plant zonation and microbial activity (Mendelsohn & Morris, 2000). In contrast, fresh marshes maintained low salinity levels across all restoration types, with values such as 0.29 ppt in Hydrologic Restoration, 0.26 ppt in Outfall Management, and 0.31 ppt in Water Diversion. Intermediate marshes generally exhibited moderate salinities ranging from 0.63 ppt (Water Diversion) to 3.55 ppt (Freshwater Diversion). Brackish and intermediate marshes in Marsh Management showed salinities of 3.49 ppt and 3.85 ppt, respectively, indicating potential tidal or groundwater influence. These patterns support existing evidence that restoration outcomes depend on local hydrology and proximity to saltwater intrusion (Herbert et al., 2015). Maintaining optimal salinity is essential for sustaining vegetation productivity and nutrient cycling (Noe et al., 2013; Neubauer, 2013).

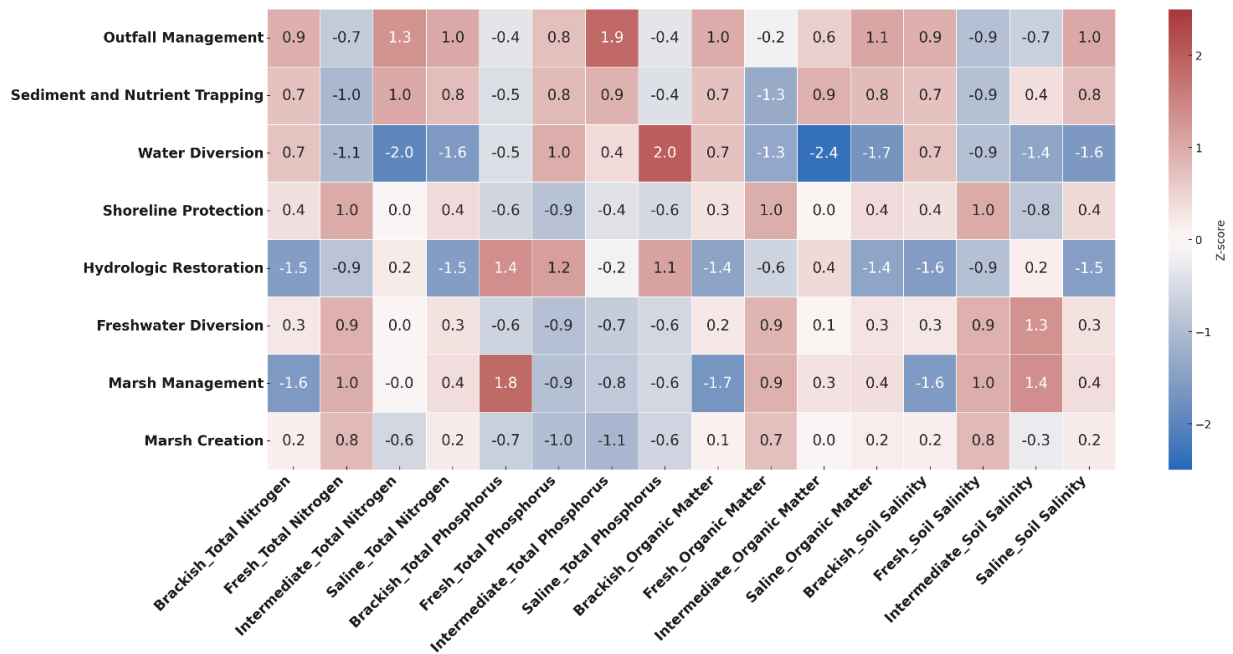


Figure 20: Standardized Z-score Heatmap of soil properties by restoration techniques across basins

The Z-score heatmap (Figure 20) illustrates the standardized deviations of soil parameters (total N, total P, OM and soil salinity) across marshes under different restoration approaches. Notably, Outfall Management in Fresh marshes shows strong positive Z-scores for total nitrogen (+1.3), total phosphorus (+1.9), and organic matter (+1.0), reinforcing previous findings that hydrologic inputs enhance biogeochemical accumulation (Day et al., 2007). Sediment and Nutrient Trapping also exhibited elevated Z-scores for nitrogen and phosphorus in intermediate marshes (+0.9 and +0.8, respectively), indicating the role of sedimentation in nutrient retention (Craft, 2007). In contrast, Water Diversion in fresh marshes had a strongly negative Z-score for total N (-2.0) and organic matter (-2.4), suggesting nutrient dilution or limited productivity due to altered hydrology without accompanying sediment input (Lane et al., 2002). Hydrologic Restoration in brackish and saline marshes displayed positive phosphorus Z-scores (+1.4, +1.2) but negative salinity Z-scores, pointing to successful salinity suppression.

3.2.2. Restoration Techniques by Basins

The bar plots (Figure 21) display the spatial variability of mean total nitrogen (g/kg) across restoration techniques by basin in coastal Louisiana. Outfall Management sites in Barataria (19.29 g/kg) and Breton Sound (15.94 g/kg) exhibit the highest nitrogen concentrations, suggesting strong influence of freshwater inflow and enhanced sediment-nutrient interactions in these basins (Turner et al., 2006). Similarly, Sediment and Nutrient Trapping in Mermentau (14.85 g/kg) and Hydrologic Restoration in Barataria (16.08 g/kg) further reinforce that sediment-rich and hydrologically active basins favor nitrogen accumulation (Craft, 2001). In contrast, Water Diversion in the Mississippi River Delta shows the lowest nitrogen level (3.13 g/kg), indicating potential dilution effects from high-

volume water inputs without proportional organic matter accumulation (Lane et al., 2002).

Shoreline Protection and Marsh Management also show moderate to low nitrogen levels across basins, notably Calcasieu-Sabine (10.74 g/kg) and Pontchartrain (8.69 g/kg), reflecting limited nutrient retention in more static systems.

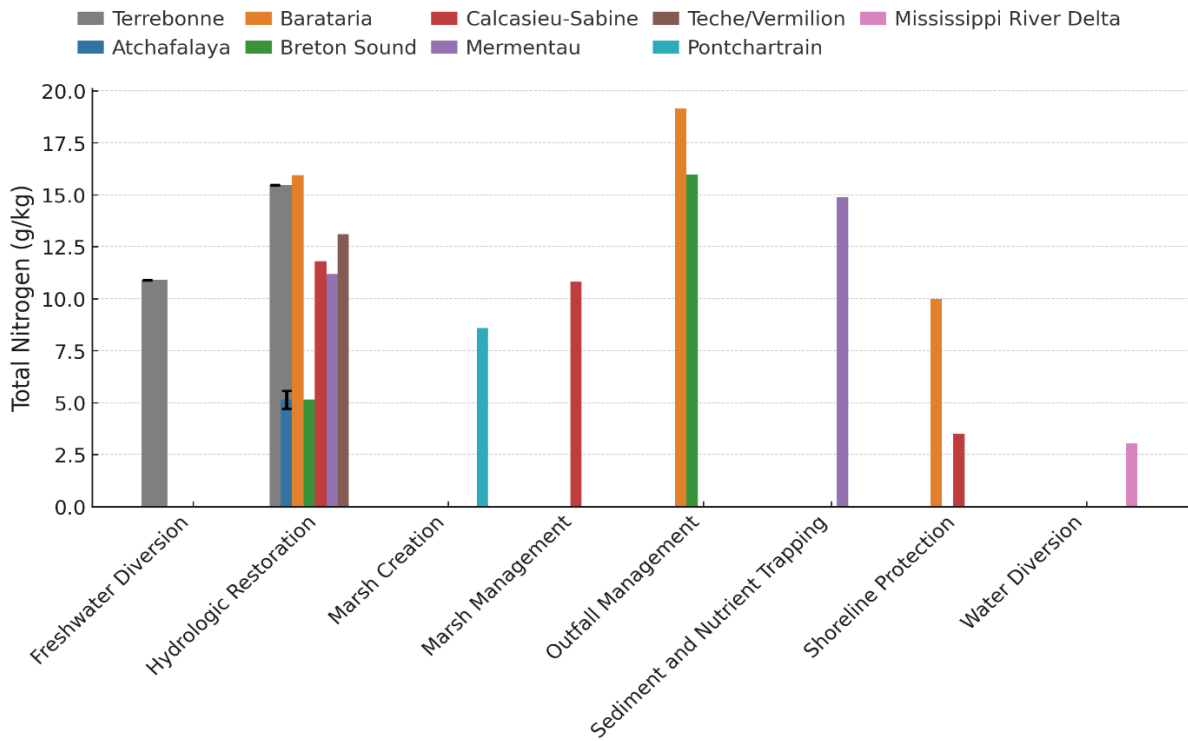


Figure 21: Bar plots of total N by restoration techniques and basins

Figure 22 shows Outfall Management in Barataria (837.10 mg/kg) and Breton Sound (781.43 mg/kg) recorded the highest phosphorus concentrations, emphasizing the strong nutrient retention associated with managed inflows and sediment delivery (Craft, 2007; Day et al., 2007). Similarly, Hydrologic Restoration in Teche/Vermilion (829.76 mg/kg) and Barataria (680.01 mg/kg) also showed elevated phosphorus levels, suggesting effective nutrient accumulation where hydrologic reconnection enhances nutrient deposition (Lane et al., 2002). Sediment and Nutrient Trapping in Mermentau (690.82 mg/kg) and Water

Diversion in the Mississippi River Delta (735.06 mg/kg) further support that sediment-enriched basins retain significant phosphorus pools, consistent with findings that phosphorus binds with mineral particles during sediment accretion (Noe et al., 2003; Reddy & Delaune, 2008). In contrast, Marsh Creation and Shoreline Protection showed moderate levels across basins (e.g., Pontchartrain: 521.74 mg/kg, Calcasieu-Sabine: 485.84 mg/kg), likely due to limited long-term sedimentation or organic accumulation.

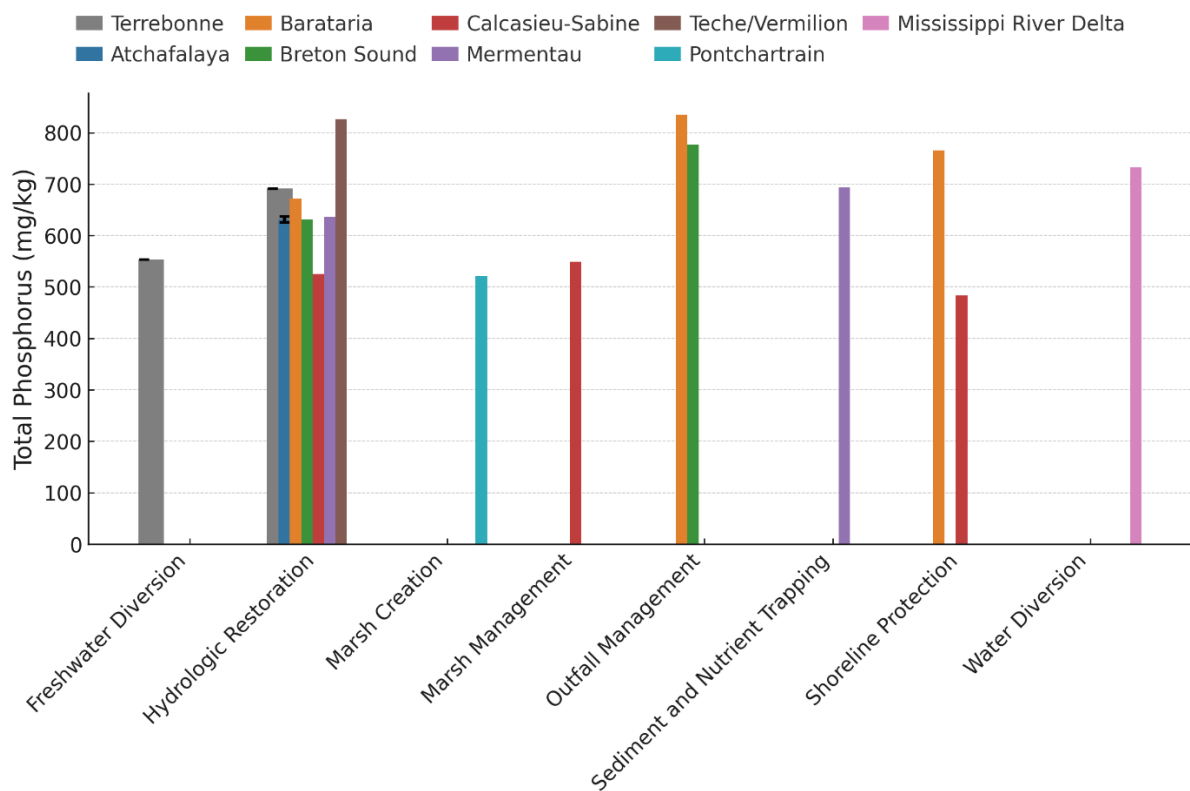


Figure 22: Bar plots of total P by restoration techniques and basins

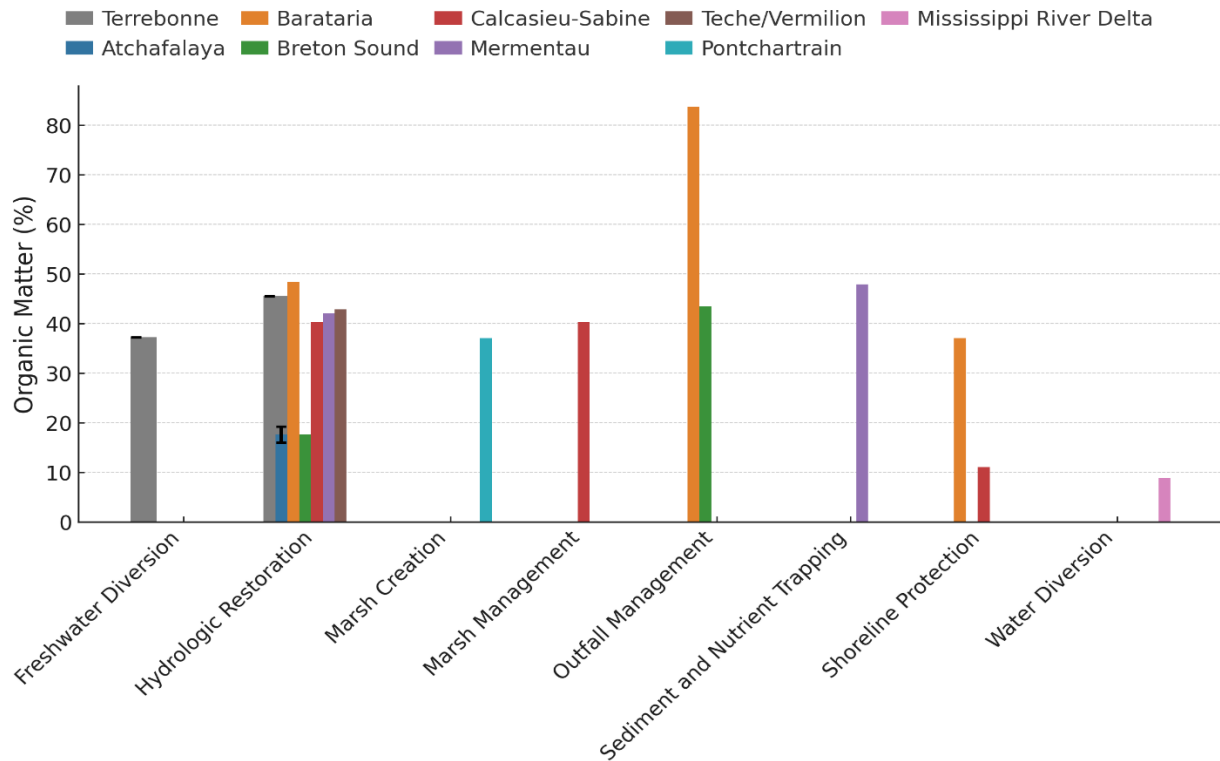


Figure 23: Bar plots of OM by restoration techniques and basins

From figure 23, Outfall Management in Barataria Basin stands out with the highest organic matter content (83.94%), followed by Sediment and Nutrient Trapping in Mermentau (47.91%) and Hydrologic Restoration in Barataria (48.64%). These elevated values reflect effective organic matter accumulation in hydrologically dynamic and sediment-enriched basins, where water management promotes vegetation productivity and inhibits decomposition (Craft, 2001; Neubauer, 2013). Hydrologic Restoration also yielded consistently high values in other basins, including Terrebonne (45.21%) and Teche/Vermilion (42.56%), reinforcing its role in supporting peat formation through freshwater retention and salinity control (Mitsch & Gosselink, 2015). In contrast, Water Diversion in the Mississippi River Delta exhibited the lowest mean organic matter (9.04%), indicating potential organic matter dilution or erosion under high water flux conditions (Lane

et al., 2002). Similarly, Shoreline Protection in Calcasieu-Sabine and Barataria showed lower values (11.46% and 36.78%, respectively), likely due to limited sediment or organic input.

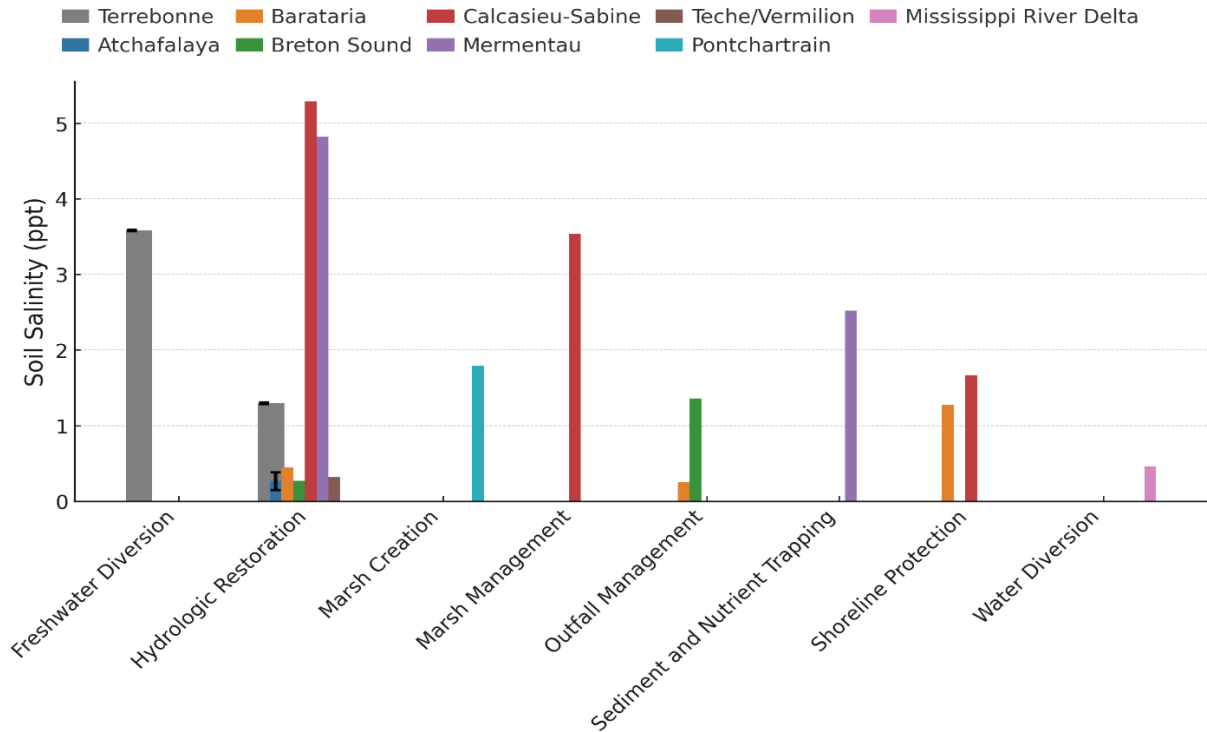


Figure 24: Bar plots of soil salinity by restoration techniques and basins

The highest soil salinity levels were observed (Figure 24) under Hydrologic Restoration in Calcasieu-Sabine (5.34 ppt) and Mermentau (4.83 ppt), indicating salt accumulation in regions with limited freshwater inflow or higher tidal exchange, which can impede freshwater vegetation and microbial processes (Herbert et al., 2015; Mendelsohn & Morris, 2000). Freshwater Diversion in Terrebonne showed a moderately high salinity of 3.57 ppt, reflecting partial salinity intrusion despite diversion efforts, possibly due to insufficient flow volumes or regional geomorphology (Lane et al., 2002). In contrast, Outfall Management, Hydrologic Restoration, Water Diversion, and Marsh Creation in most basins, including Barataria, Breton Sound, Teche/Vermilion, Atchafalaya and Mississippi River

Delta, showed notably low salinity (<1 ppt), reflecting effective salinity suppression and freshwater maintenance, conducive to organic matter accumulation and nutrient retention (Neubauer, 2013). Moderate salinity levels were observed under Shoreline Protection (e.g., Barataria: 1.31 ppt) and Sediment and Nutrient Trapping in Mermentau (2.53 ppt), which may represent transitional or brackish zones.

The Z-score heatmap (Figure 25) presents standardized deviations of soil parameters, total nitrogen (N), total phosphorus (P), organic matter (OM), and soil salinity, across restoration techniques and basins with significant results only: Mississippi River Delta, Pontchartrain, and Teche/Vermilion. Outfall Management consistently shows strong positive Z-scores across all parameters and basins (e.g., N: +0.9, P: +0.9, OM: +1.1 in Mississippi Delta), confirming its efficacy in promoting biogeochemical enrichment (Craft, 2001). Similarly, Sediment and Nutrient Trapping also exhibits moderate positive values across the board (e.g., OM: +0.7, P: +0.6), aligning with findings that sediment accretion enhances nutrient and carbon storage (Noe et al., 2003; Reddy & Delaune, 2008). In contrast, Water Diversion and Hydrologic Restoration show sharp negative Z-scores for nitrogen in Teche/Vermilion (-2.3) and Mississippi Delta (-2.3), indicating nutrient dilution or inadequate nutrient trapping (Lane et al., 2002). However, both techniques exhibit extremely high Z-scores for phosphorus in Pontchartrain (+2.5), suggesting localized P enrichment, potentially from upstream sources or enhanced deposition. Marsh Creation also shows similar phosphorus enrichment in Pontchartrain (+2.4), while OM and salinity remain strongly negative (OM: -2.3, salinity: -2.4), reflecting early successional stages with limited organic buildup (Mitsch & Gosselink, 2015).

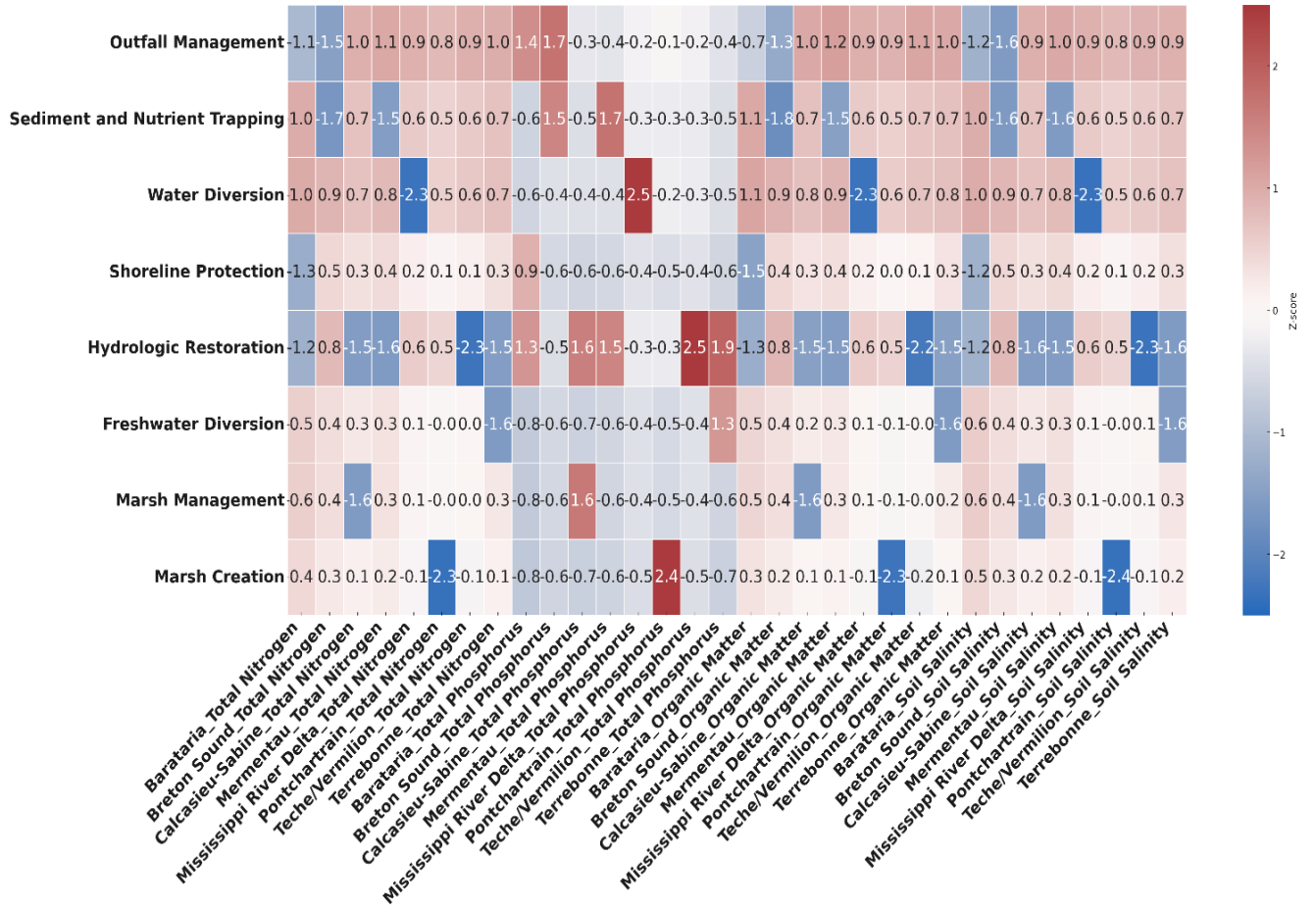


Figure 25: Standardized Z-score Heatmap of soil properties by restoration techniques across basins

Chapter 4. Limitations and Uncertainties of the Study

This study has several limitations that should be considered when interpreting the results. One primary limitation was the uneven spatial distribution of sampling sites across restoration techniques, marsh types, and basins. Some restoration techniques were underrepresented in specific regions, which may have affected the statistical power and generalizability of the findings. Similarly, limited sample availability for certain techniques and marsh categories constrained the ability to assess variability comprehensively.

Another important limitation is the absence of consistent temporal data. While the study aimed to assess spatial and temporal trends, the irregular and short-term nature of soil sampling intervals limited the ability to analyze long-term restoration impacts or seasonal dynamics. Furthermore, the effect of restoration on soil properties depends not only on technique but also on project-specific factors such as design structure, age, implementation quality, and local geo-hydrological conditions including sediment input, tidal exchange, and salinity gradients. These factors were not included in the current analysis but can significantly influence nutrient dynamics, organic matter accumulation, and salinity behavior.

In addition, biotic factors such as vegetation types and root density, which also affect soil biogeochemistry, were not accounted for. Lastly, external environmental drivers such as extreme weather events, climate variability, and human interventions (e.g., land use changes or hydrologic alterations) may have influenced soil conditions but were beyond the scope of this study. Future research should aim to incorporate these multidimensional factors for a more comprehensive evaluation of restoration effectiveness.

Chapter 5. Conclusion

This study examined the significant variations in total N, total P, and organic matter across different marsh types and hydrological basins in coastal Louisiana as influenced by differences in soil salinity. Additionally, the study assessed the comparison in soil characteristics (total N, total P, OM, and soil salinity) between restored and natural marshes and evaluated the impact of various restoration techniques on these soil properties.

Fresh marshes consistently exhibited higher total N, total P, and OM content and lower soil salinity compared to saline marshes, highlighting the influence of reduced salinity and enhanced vegetation productivity on nutrient retention and organic matter accumulation. Conversely, saline marshes demonstrated notably lower nutrient and OM levels with elevated soil salinity, underscoring the detrimental impact of high salinity on soil productivity and nutrient cycling. Brackish marshes were identified most vulnerable with low concentrations of these soil properties after saline marshes. Basins such as Mermentau, Barataria and Calcasieu/Sabine presented notably elevated soil nutrients, OM, and moderate to low soil salinity levels due to limited tidal influence, significant freshwater influx, basin's extensive vegetation and reduced hydrological disturbances, promoting soil stability and nutrient retention. In contrast, the Mississippi River Delta Basin consistently exhibited lower soil nutrients and OM, influenced by frequent hydrological disruptions and sediment characteristics unique to deltaic environments. Additionally, the Atchafalaya Basin exhibited relatively lower soil salinity and moderate nutrient concentrations due to consistent freshwater inflows from the Atchafalaya River, facilitating stable marsh conditions

Among restoration methods, Outfall Management, Hydrologic Restoration, and Sediment and Nutrient Trapping showed the highest improvements in total N, total P, and

OM, and lowered soil salinity, particularly in fresh marshes of Barataria. Sediment and Nutrient Trapping greatly improved these soil properties in intermediate marshes of Mermentau. Hydrologic Restoration was most effective for reducing soil salinity in fresh, intermediate, and brackish marshes for most of the basins except for Calcasieu-Sabine and Mermentau. Although Water Diversion increased total P and lowered soil salinity significantly, it did not increase total N, and OM. Marsh Management primarily enhanced OM and total N but did not increase total P and did not lower soil salinity across basins.

Standardized statistical analysis further highlighted specific outcomes: Outfall Management consistently provided positive soil properties improvement, particularly in the Mississippi River Delta, enhancing soil nutrients and OM significantly. In contrast, Water Diversion and Hydrologic Restoration showed definite variability in their impacts, with low soil nutrients observed in the Teche/Vermilion, yet considerable total P improvement noted in the Pontchartrain. Marsh Creation revealed significant total P enhancement but reduced OM and higher soil salinity, particularly in the Pontchartrain, whereas Freshwater Diversion and Sediment and Nutrient Trapping showed mixed effects depending heavily on local basin conditions. This study emphasizes that the success of restoration efforts is highly dependent on the alignment of specific restoration techniques with local marsh and basin conditions. Future restoration practices should incorporate these findings to optimize outcomes, focusing strategically on techniques proven to enhance critical soil properties essential for marsh sustainability and resilience against coastal degradation. Moreover, these findings confirm that restoration effectiveness for soil properties is dependent on the technique used, salinity gradients, location specific geo-hydrology, and the environmental context in which it is applied.

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Appendix

Appendix: CRMS datasets of Soil Properties

| Site_ID | Sample Date (mm/dd/yyyy) | Sample Depth (cm) | Total N (g/kg) | Total P (mg/kg) | Organic Matter (%) | Soil Salinity (ppt) |
|----------|-----------------------------|-------------------------|-------------------|--------------------|--------------------------|---------------------------|
| CRMS0003 | 6/12/2008 | 0 to 4 | 3.16 | 404.12 | 9.43 | 6.62 |
| CRMS0003 | 6/12/2008 | 12 to 16 | 2.84 | 319.95 | 11.59 | 6.60 |
| CRMS0003 | 6/12/2008 | 16 to 20 | 1.96 | 259.24 | 11.03 | 7.47 |
| CRMS0003 | 6/12/2008 | 20 to 24 | 2.14 | 278.73 | 9.82 | 7.43 |
| CRMS0003 | 6/12/2008 | 4 to 8 | 1.73 | 355.26 | 9.20 | 6.47 |
| CRMS0003 | 6/12/2008 | 8 to 12 | 2.92 | 298.88 | 13.54 | 7.07 |
| CRMS0030 | 5/9/2007 | 0 to 4 | 11.75 | 766.96 | 35.60 | 1.17 |
| CRMS0030 | 5/9/2007 | 12 to 16 | 9.78 | 506.00 | 29.44 | 1.58 |
| CRMS0030 | 5/9/2007 | 16 to 20 | 10.65 | 542.98 | 31.26 | 1.70 |
| CRMS0030 | 5/9/2007 | 20 to 24 | 13.16 | 555.03 | 33.95 | 1.62 |
| CRMS0030 | 5/9/2007 | 4 to 8 | 6.64 | 401.50 | 24.37 | 1.30 |
| CRMS0030 | 5/9/2007 | 8 to 12 | 7.89 | 402.59 | 26.75 | 1.47 |
| CRMS0033 | 5/10/2007 | 0 to 4 | 20.86 | 1449.79 | 64.22 | 1.30 |
| CRMS0033 | 5/10/2007 | 12 to 16 | 21.30 | 885.95 | 58.91 | 1.70 |
| CRMS0033 | 5/10/2007 | 16 to 20 | 24.53 | 876.67 | 62.28 | 1.63 |
| CRMS0033 | 5/10/2007 | 20 to 24 | 24.07 | 804.89 | 61.46 | 1.68 |
| CRMS0033 | 5/10/2007 | 4 to 8 | 16.71 | 718.04 | 53.80 | 1.47 |
| CRMS0033 | 5/10/2007 | 8 to 12 | 16.89 | 738.95 | 51.33 | 1.67 |
| CRMS0108 | 6/12/2008 | 0 to 4 | 9.12 | 599.12 | 32.75 | 4.00 |
| CRMS0108 | 6/12/2008 | 12 to 16 | 4.49 | 380.36 | 26.03 | 3.40 |
| CRMS0108 | 6/12/2008 | 16 to 20 | 8.21 | 387.59 | 32.87 | 3.80 |
| CRMS0108 | 6/12/2008 | 20 to 24 | 9.17 | 393.53 | 35.28 | 4.03 |
| CRMS0108 | 6/12/2008 | 4 to 8 | 6.43 | 426.79 | 23.66 | 3.55 |
| CRMS0108 | 6/12/2008 | 8 to 12 | 4.60 | 385.43 | 22.70 | 3.43 |
| CRMS0115 | 7/20/2009 | 0 to 4 | 22.42 | 1142.85 | 53.50 | 0.63 |
| CRMS0115 | 7/20/2009 | 12 to 16 | 13.32 | 618.87 | 38.11 | 1.57 |
| CRMS0115 | 7/20/2009 | 16 to 20 | 14.02 | 585.41 | 41.92 | 1.70 |
| CRMS0115 | 7/20/2009 | 20 to 24 | 16.47 | 665.85 | 47.28 | 1.83 |
| CRMS0115 | 7/20/2009 | 4 to 8 | 17.09 | 1004.90 | 42.11 | 1.05 |
| CRMS0115 | 7/20/2009 | 8 to 12 | 12.42 | 645.51 | 37.97 | 1.38 |
| CRMS0118 | 5/17/2007 | 0 to 4 | 11.90 | 906.90 | 26.77 | 0.47 |
| CRMS0118 | 5/17/2007 | 12 to 16 | 6.63 | 617.88 | 20.22 | 0.27 |
| CRMS0118 | 5/17/2007 | 16 to 20 | 8.93 | 612.17 | 23.62 | 0.33 |
| CRMS0118 | 5/17/2007 | 20 to 24 | 11.48 | 578.87 | 25.55 | 0.48 |
| CRMS0118 | 5/17/2007 | 4 to 8 | 10.32 | 710.34 | 26.34 | 0.23 |
| CRMS0118 | 5/17/2007 | 8 to 12 | 6.96 | 576.54 | 20.78 | 0.23 |
| CRMS0135 | 6/20/2006 | 0 to 4 | 10.65 | 899.71 | 25.29 | 2.38 |

| | | | | | | |
|----------|------------|----------|-------|---------|-------|------|
| CRMS0135 | 6/20/2006 | 12 to 16 | 4.39 | 473.53 | 19.25 | 2.80 |
| CRMS0135 | 6/20/2006 | 16 to 20 | 5.68 | 494.20 | 20.98 | 2.82 |
| CRMS0135 | 6/20/2006 | 20 to 24 | 7.58 | 527.20 | 24.14 | 2.83 |
| CRMS0135 | 6/20/2006 | 4 to 8 | 7.22 | 578.67 | 24.29 | 2.55 |
| CRMS0135 | 6/20/2006 | 8 to 12 | 5.11 | 524.40 | 28.83 | 2.85 |
| CRMS0136 | 8/23/2006 | 0 to 4 | 8.42 | 792.24 | 27.29 | 3.93 |
| CRMS0136 | 8/23/2006 | 0 to 4 | 8.42 | 792.24 | 27.29 | 3.93 |
| CRMS0136 | 8/23/2006 | 12 to 16 | 4.91 | 542.43 | 21.90 | 4.25 |
| CRMS0136 | 8/23/2006 | 12 to 16 | 4.91 | 542.43 | 21.90 | 4.25 |
| CRMS0136 | 8/23/2006 | 16 to 20 | 6.93 | 588.80 | 22.46 | 4.30 |
| CRMS0136 | 8/23/2006 | 16 to 20 | 6.93 | 588.80 | 22.46 | 4.30 |
| CRMS0136 | 8/23/2006 | 20 to 24 | 7.11 | 530.51 | 21.45 | 4.00 |
| CRMS0136 | 8/23/2006 | 20 to 24 | 7.11 | 530.51 | 21.45 | 4.00 |
| CRMS0136 | 8/23/2006 | 4 to 8 | 5.33 | 582.24 | 20.63 | 4.18 |
| CRMS0136 | 8/23/2006 | 4 to 8 | 5.33 | 582.24 | 20.63 | 4.18 |
| CRMS0136 | 8/23/2006 | 8 to 12 | 4.18 | 570.70 | 18.28 | 3.82 |
| CRMS0136 | 8/23/2006 | 8 to 12 | 4.18 | 570.70 | 18.28 | 3.82 |
| CRMS0139 | 6/27/2007 | 0 to 4 | 5.18 | 869.41 | 12.79 | 0.28 |
| CRMS0139 | 6/27/2007 | 12 to 16 | 3.92 | 725.67 | 11.09 | 0.30 |
| CRMS0139 | 6/27/2007 | 16 to 20 | 3.05 | 557.70 | 10.29 | 0.40 |
| CRMS0139 | 6/27/2007 | 20 to 24 | 2.90 | 507.84 | 9.97 | 0.43 |
| CRMS0139 | 6/27/2007 | 4 to 8 | 4.54 | 776.73 | 11.77 | 0.17 |
| CRMS0139 | 6/27/2007 | 8 to 12 | 5.44 | 828.30 | 15.43 | 0.22 |
| CRMS0146 | 10/29/2008 | 0 to 4 | 10.33 | 758.59 | 31.42 | 4.77 |
| CRMS0146 | 10/29/2008 | 12 to 16 | 5.26 | 448.80 | 26.25 | 3.37 |
| CRMS0146 | 10/29/2008 | 16 to 20 | 5.83 | 488.34 | 28.81 | 2.50 |
| CRMS0146 | 10/29/2008 | 20 to 24 | 10.20 | 529.98 | 37.18 | 2.00 |
| CRMS0146 | 10/29/2008 | 4 to 8 | 6.57 | 566.94 | 25.78 | 4.18 |
| CRMS0146 | 10/29/2008 | 8 to 12 | 3.86 | 429.55 | 21.51 | 3.83 |
| CRMS0147 | 6/8/2006 | 0 to 4 | 10.40 | 673.58 | 24.31 | 3.73 |
| CRMS0147 | 6/8/2006 | 12 to 16 | 1.20 | 371.29 | 14.49 | 4.00 |
| CRMS0147 | 6/8/2006 | 16 to 20 | 7.65 | 422.01 | 23.39 | 4.17 |
| CRMS0147 | 6/8/2006 | 20 to 24 | 6.72 | 370.47 | 19.90 | 3.90 |
| CRMS0147 | 6/8/2006 | 4 to 8 | 3.35 | 380.71 | 18.72 | 4.30 |
| CRMS0147 | 6/8/2006 | 8 to 12 | 1.65 | 414.91 | 17.03 | 4.12 |
| CRMS0154 | 6/25/2007 | 0 to 4 | 4.28 | 1083.67 | 11.61 | 0.40 |
| CRMS0154 | 6/25/2007 | 12 to 16 | 3.00 | 678.40 | 9.97 | 0.27 |
| CRMS0154 | 6/25/2007 | 16 to 20 | 2.96 | 640.90 | 9.10 | 0.27 |
| CRMS0154 | 6/25/2007 | 20 to 24 | 3.09 | 694.23 | 9.52 | 0.27 |
| CRMS0154 | 6/25/2007 | 4 to 8 | 2.78 | 713.23 | 10.01 | 0.40 |
| CRMS0154 | 6/25/2007 | 8 to 12 | 3.07 | 697.65 | 9.66 | 0.27 |
| CRMS0159 | 6/27/2007 | 0 to 4 | 4.42 | 849.43 | 11.15 | 0.45 |
| CRMS0159 | 6/27/2007 | 12 to 16 | 2.07 | 522.03 | 6.53 | 0.63 |

| | | | | | | |
|----------|-----------|----------|-------|---------|-------|-------|
| CRMS0159 | 6/27/2007 | 16 to 20 | 1.57 | 445.53 | 6.41 | 0.73 |
| CRMS0159 | 6/27/2007 | 20 to 24 | 1.67 | 470.38 | 6.51 | 0.73 |
| CRMS0159 | 6/27/2007 | 4 to 8 | 3.45 | 856.08 | 7.24 | 0.43 |
| CRMS0159 | 6/27/2007 | 8 to 12 | 5.35 | 758.50 | 8.89 | 0.42 |
| CRMS0163 | 6/25/2007 | 0 to 4 | 3.47 | 795.44 | 11.67 | 0.40 |
| CRMS0163 | 6/25/2007 | 12 to 16 | 2.61 | 720.05 | 10.66 | 0.83 |
| CRMS0163 | 6/25/2007 | 16 to 20 | 1.85 | 634.90 | 8.84 | 0.97 |
| CRMS0163 | 6/25/2007 | 20 to 24 | 2.27 | 696.23 | 8.82 | 1.10 |
| CRMS0163 | 6/25/2007 | 4 to 8 | 3.36 | 710.67 | 10.45 | 0.52 |
| CRMS0163 | 6/25/2007 | 8 to 12 | 3.30 | 751.17 | 11.49 | 0.78 |
| CRMS0171 | 5/22/2007 | 0 to 4 | 5.98 | 748.34 | 16.99 | 4.85 |
| CRMS0171 | 5/22/2007 | 12 to 16 | 1.59 | 466.67 | 12.51 | 5.33 |
| CRMS0171 | 5/22/2007 | 16 to 20 | 1.65 | 385.32 | 11.94 | 5.83 |
| CRMS0171 | 5/22/2007 | 20 to 24 | 1.53 | 367.95 | 11.36 | 5.80 |
| CRMS0171 | 5/22/2007 | 4 to 8 | 2.15 | 535.69 | 11.37 | 5.50 |
| CRMS0171 | 5/22/2007 | 8 to 12 | 1.03 | 409.67 | 10.37 | 5.37 |
| CRMS0172 | 5/15/2007 | 0 to 4 | 6.49 | 677.96 | 18.16 | 3.95 |
| CRMS0172 | 5/15/2007 | 12 to 16 | 3.33 | 482.08 | 16.86 | 4.73 |
| CRMS0172 | 5/15/2007 | 16 to 20 | 3.81 | 351.12 | 18.61 | 5.17 |
| CRMS0172 | 5/15/2007 | 20 to 24 | 4.17 | 505.78 | 19.41 | 5.57 |
| CRMS0172 | 5/15/2007 | 4 to 8 | 3.93 | 377.81 | 18.67 | 3.85 |
| CRMS0172 | 5/15/2007 | 8 to 12 | 2.96 | 473.70 | 15.82 | 4.48 |
| CRMS0173 | 6/8/2006 | 0 to 4 | 9.91 | 655.71 | 27.87 | 7.62 |
| CRMS0173 | 6/8/2006 | 12 to 16 | 7.34 | 571.54 | 37.75 | 7.90 |
| CRMS0173 | 6/8/2006 | 16 to 20 | 10.76 | 557.97 | 42.63 | 7.67 |
| CRMS0173 | 6/8/2006 | 20 to 24 | 9.56 | 536.98 | 40.15 | 7.63 |
| CRMS0173 | 6/8/2006 | 4 to 8 | 6.89 | 500.68 | 32.47 | 7.98 |
| CRMS0173 | 6/8/2006 | 8 to 12 | 6.19 | 498.84 | 35.50 | 8.53 |
| CRMS0175 | 6/5/2006 | 0 to 4 | 8.31 | 728.33 | 27.97 | 10.12 |
| CRMS0175 | 6/5/2006 | 12 to 16 | 6.43 | 423.19 | 25.79 | 9.33 |
| CRMS0175 | 6/5/2006 | 16 to 20 | 5.95 | 360.08 | 25.82 | 9.62 |
| CRMS0175 | 6/5/2006 | 20 to 24 | 6.77 | 400.25 | 27.71 | 10.08 |
| CRMS0175 | 6/5/2006 | 4 to 8 | 5.19 | 506.98 | 23.60 | 9.32 |
| CRMS0175 | 6/5/2006 | 8 to 12 | 4.38 | 496.42 | 21.36 | 9.62 |
| CRMS0189 | 5/24/2007 | 0 to 4 | 27.60 | 1504.27 | 89.59 | 0.15 |
| CRMS0189 | 5/24/2007 | 12 to 16 | 28.67 | 708.53 | 94.67 | 0.23 |
| CRMS0189 | 5/24/2007 | 16 to 20 | 24.50 | 649.55 | 94.77 | 0.23 |
| CRMS0189 | 5/24/2007 | 20 to 24 | 28.54 | 621.88 | 94.16 | 0.20 |
| CRMS0189 | 5/24/2007 | 4 to 8 | 29.53 | 685.12 | 92.63 | 0.17 |
| CRMS0189 | 5/24/2007 | 8 to 12 | 30.43 | 839.97 | 93.79 | 0.20 |
| CRMS0192 | 3/19/2007 | 0 to 4 | 21.01 | 799.66 | 89.94 | 0.13 |
| CRMS0192 | 3/19/2007 | 12 to 16 | 24.52 | 623.21 | 92.76 | 0.10 |
| CRMS0192 | 3/19/2007 | 16 to 20 | 24.06 | 607.52 | 92.69 | 0.10 |

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|----------|-----------|----------|-------|---------|-------|------|
| CRMS0192 | 3/19/2007 | 20 to 24 | 22.40 | 622.98 | 93.64 | 0.10 |
| CRMS0192 | 3/19/2007 | 4 to 8 | 22.62 | 559.35 | 91.73 | 0.10 |
| CRMS0192 | 3/19/2007 | 8 to 12 | 23.95 | 633.90 | 92.69 | 0.10 |
| CRMS0209 | 6/20/2006 | 0 to 4 | 6.14 | 602.64 | 24.70 | 6.75 |
| CRMS0209 | 6/20/2006 | 12 to 16 | 9.02 | 399.34 | 36.35 | 7.67 |
| CRMS0209 | 6/20/2006 | 16 to 20 | 13.13 | 539.39 | 44.20 | 7.97 |
| CRMS0209 | 6/20/2006 | 20 to 24 | 14.74 | 560.48 | 49.24 | 8.30 |
| CRMS0209 | 6/20/2006 | 4 to 8 | 5.96 | 479.90 | 26.37 | 7.88 |
| CRMS0209 | 6/20/2006 | 8 to 12 | 5.51 | 438.96 | 31.88 | 8.43 |
| CRMS0211 | 11/9/2006 | 0 to 4 | 24.36 | 1045.00 | 89.62 | 0.20 |
| CRMS0211 | 11/9/2006 | 12 to 16 | 21.75 | 729.43 | 93.18 | 0.20 |
| CRMS0211 | 11/9/2006 | 16 to 20 | 23.10 | 591.98 | 93.43 | 0.20 |
| CRMS0211 | 11/9/2006 | 20 to 24 | 22.48 | 654.11 | 94.64 | 0.20 |
| CRMS0211 | 11/9/2006 | 4 to 8 | 24.40 | 770.00 | 90.54 | 0.13 |
| CRMS0211 | 11/9/2006 | 8 to 12 | 19.89 | 771.29 | 91.92 | 0.17 |
| CRMS0224 | 6/7/2006 | 0 to 4 | 7.48 | 480.62 | 27.13 | 7.43 |
| CRMS0224 | 6/7/2006 | 12 to 16 | 5.74 | 387.70 | 30.38 | 7.23 |
| CRMS0224 | 6/7/2006 | 16 to 20 | 7.85 | 443.19 | 35.12 | 7.40 |
| CRMS0224 | 6/7/2006 | 20 to 24 | 8.59 | 441.13 | 37.38 | 6.60 |
| CRMS0224 | 6/7/2006 | 4 to 8 | 5.68 | 443.45 | 21.22 | 6.97 |
| CRMS0224 | 6/7/2006 | 8 to 12 | 5.00 | 387.54 | 27.02 | 7.27 |
| CRMS0225 | 6/21/2006 | 0 to 4 | 9.07 | 493.81 | 38.28 | 6.90 |
| CRMS0225 | 6/21/2006 | 12 to 16 | 11.03 | 453.61 | 40.68 | 5.40 |
| CRMS0225 | 6/21/2006 | 16 to 20 | 12.02 | 446.43 | 43.36 | 5.32 |
| CRMS0225 | 6/21/2006 | 20 to 24 | 10.73 | 357.59 | 37.60 | 4.95 |
| CRMS0225 | 6/21/2006 | 4 to 8 | 8.12 | 350.00 | 37.69 | 6.30 |
| CRMS0225 | 6/21/2006 | 8 to 12 | 8.84 | 376.46 | 38.97 | 5.82 |
| CRMS0237 | 6/7/2006 | 0 to 4 | 8.01 | 541.16 | 27.75 | 7.15 |
| CRMS0237 | 6/7/2006 | 12 to 16 | 6.64 | 401.46 | 28.05 | 6.42 |
| CRMS0237 | 6/7/2006 | 16 to 20 | 7.70 | 180.80 | 28.79 | 6.47 |
| CRMS0237 | 6/7/2006 | 20 to 24 | 7.33 | 345.61 | 28.88 | 6.02 |
| CRMS0237 | 6/7/2006 | 4 to 8 | 4.47 | 441.21 | 24.33 | 6.73 |
| CRMS0237 | 6/7/2006 | 8 to 12 | 5.63 | 371.25 | 28.10 | 6.48 |
| CRMS0253 | 6/13/2006 | 0 to 4 | 8.55 | 672.87 | 29.67 | 4.63 |
| CRMS0253 | 6/13/2006 | 12 to 16 | 5.91 | 397.95 | 27.79 | 5.02 |
| CRMS0253 | 6/13/2006 | 16 to 20 | 7.26 | 457.29 | 29.54 | 4.23 |
| CRMS0253 | 6/13/2006 | 20 to 24 | 6.54 | 427.13 | 26.49 | 4.25 |
| CRMS0253 | 6/13/2006 | 4 to 8 | 6.95 | 437.63 | 30.78 | 5.25 |
| CRMS0253 | 6/13/2006 | 8 to 12 | 6.29 | 398.07 | 26.73 | 5.10 |
| CRMS0261 | 5/14/2007 | 0 to 4 | 18.10 | 1055.25 | 44.40 | 1.50 |
| CRMS0261 | 5/14/2007 | 12 to 16 | 9.53 | 493.35 | 30.79 | 2.13 |
| CRMS0261 | 5/14/2007 | 16 to 20 | 11.28 | 390.88 | 32.38 | 2.17 |
| CRMS0261 | 5/14/2007 | 4 to 8 | 12.80 | 519.76 | 38.76 | 1.93 |

| | | | | | | |
|----------|-----------|----------|-------|---------|-------|-------|
| CRMS0261 | 5/14/2007 | 8 to 12 | 10.55 | 450.16 | 35.64 | 2.03 |
| CRMS0273 | 6/14/2006 | 0 to 4 | 23.36 | 1468.00 | 84.09 | 0.75 |
| CRMS0273 | 6/14/2006 | 12 to 16 | 26.07 | 681.75 | 90.78 | 0.50 |
| CRMS0273 | 6/14/2006 | 16 to 20 | 21.77 | 685.51 | 87.73 | 0.45 |
| CRMS0273 | 6/14/2006 | 20 to 24 | 27.43 | 512.36 | 92.26 | 0.50 |
| CRMS0273 | 6/14/2006 | 4 to 8 | 24.98 | 844.85 | 85.67 | 0.65 |
| CRMS0273 | 6/14/2006 | 8 to 12 | 21.69 | 739.77 | 84.01 | 0.50 |
| CRMS0287 | 6/17/2008 | 0 to 4 | 26.79 | 911.43 | 83.12 | 0.23 |
| CRMS0287 | 6/17/2008 | 12 to 16 | 26.97 | 637.68 | 83.21 | 0.27 |
| CRMS0287 | 6/17/2008 | 16 to 20 | 27.49 | 601.29 | 85.33 | 0.28 |
| CRMS0287 | 6/17/2008 | 20 to 24 | 25.42 | 639.19 | 78.63 | 0.30 |
| CRMS0287 | 6/17/2008 | 4 to 8 | 24.12 | 680.66 | 86.58 | 0.20 |
| CRMS0287 | 6/17/2008 | 8 to 12 | 26.66 | 684.88 | 85.54 | 0.23 |
| CRMS0292 | 5/12/2006 | 0 to 4 | 3.03 | 664.37 | 16.50 | 9.02 |
| CRMS0292 | 5/12/2006 | 0 to 4 | 3.03 | 664.37 | 16.50 | 9.02 |
| CRMS0292 | 5/12/2006 | 12 to 16 | 3.34 | 484.00 | 16.57 | 9.77 |
| CRMS0292 | 5/12/2006 | 12 to 16 | 3.34 | 484.00 | 16.57 | 9.77 |
| CRMS0292 | 5/12/2006 | 16 to 20 | 3.80 | 505.70 | 20.19 | 10.63 |
| CRMS0292 | 5/12/2006 | 16 to 20 | 3.80 | 505.70 | 20.19 | 10.63 |
| CRMS0292 | 5/12/2006 | 20 to 24 | 3.72 | 374.51 | 19.72 | 10.80 |
| CRMS0292 | 5/12/2006 | 20 to 24 | 3.72 | 374.51 | 19.72 | 10.80 |
| CRMS0292 | 5/12/2006 | 4 to 8 | 2.84 | 673.54 | 15.82 | 8.68 |
| CRMS0292 | 5/12/2006 | 4 to 8 | 2.84 | 673.54 | 15.82 | 8.68 |
| CRMS0292 | 5/12/2006 | 8 to 12 | 3.31 | 640.46 | 16.08 | 8.85 |
| CRMS0292 | 5/12/2006 | 8 to 12 | 3.31 | 640.46 | 16.08 | 8.85 |
| CRMS0301 | 1/17/2008 | 0 to 4 | 24.34 | 1633.82 | 53.91 | 0.17 |
| CRMS0301 | 1/17/2008 | 12 to 16 | 21.72 | 751.67 | 41.57 | 0.17 |
| CRMS0301 | 1/17/2008 | 16 to 20 | 19.62 | 725.17 | 36.86 | 0.17 |
| CRMS0301 | 1/17/2008 | 20 to 24 | 16.98 | 614.71 | 34.03 | 0.17 |
| CRMS0301 | 1/17/2008 | 4 to 8 | 24.08 | 1033.92 | 45.90 | 0.17 |
| CRMS0301 | 1/17/2008 | 8 to 12 | 25.02 | 882.29 | 46.32 | 0.20 |
| CRMS0305 | 12/6/2006 | 0 to 4 | 7.54 | 858.50 | 26.13 | 1.07 |
| CRMS0305 | 12/6/2006 | 0 to 4 | 7.54 | 858.50 | 26.13 | 1.07 |
| CRMS0305 | 12/6/2006 | 12 to 16 | 6.14 | 377.95 | 20.59 | 1.43 |
| CRMS0305 | 12/6/2006 | 12 to 16 | 6.14 | 377.95 | 20.59 | 1.43 |
| CRMS0305 | 12/6/2006 | 16 to 20 | 6.59 | 397.51 | 21.48 | 1.43 |
| CRMS0305 | 12/6/2006 | 16 to 20 | 6.59 | 397.51 | 21.48 | 1.43 |
| CRMS0305 | 12/6/2006 | 20 to 24 | 6.06 | 415.64 | 20.96 | 1.35 |
| CRMS0305 | 12/6/2006 | 20 to 24 | 6.06 | 415.64 | 20.96 | 1.35 |
| CRMS0305 | 12/6/2006 | 4 to 8 | 7.57 | 545.68 | 24.73 | 1.27 |
| CRMS0305 | 12/6/2006 | 4 to 8 | 7.57 | 545.68 | 24.73 | 1.27 |
| CRMS0305 | 12/6/2006 | 8 to 12 | 7.44 | 471.88 | 23.96 | 1.50 |
| CRMS0305 | 12/6/2006 | 8 to 12 | 7.44 | 471.88 | 23.96 | 1.50 |

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|----------|-----------|----------|-------|---------|-------|------|
| CRMS0309 | 6/7/2006 | 0 to 4 | 3.49 | 658.55 | 17.83 | 8.85 |
| CRMS0309 | 6/7/2006 | 12 to 16 | 2.47 | 471.95 | 15.26 | 6.97 |
| CRMS0309 | 6/7/2006 | 16 to 20 | 2.21 | 285.01 | 14.35 | 6.67 |
| CRMS0309 | 6/7/2006 | 20 to 24 | 2.11 | 445.87 | 15.51 | 6.13 |
| CRMS0309 | 6/7/2006 | 4 to 8 | 3.08 | 597.60 | 18.50 | 7.05 |
| CRMS0309 | 6/7/2006 | 8 to 12 | 2.47 | 519.37 | 17.76 | 7.62 |
| CRMS0312 | 5/2/2006 | 0 to 4 | 23.86 | 1419.00 | 77.79 | 2.98 |
| CRMS0312 | 5/2/2006 | 0 to 4 | 23.86 | 1419.00 | 77.79 | 2.98 |
| CRMS0312 | 5/2/2006 | 12 to 16 | 27.01 | 825.00 | 82.11 | 2.82 |
| CRMS0312 | 5/2/2006 | 12 to 16 | 27.01 | 825.00 | 82.11 | 2.82 |
| CRMS0312 | 5/2/2006 | 16 to 20 | 30.67 | 809.36 | 85.29 | 2.70 |
| CRMS0312 | 5/2/2006 | 16 to 20 | 30.67 | 809.36 | 85.29 | 2.70 |
| CRMS0312 | 5/2/2006 | 20 to 24 | 27.94 | 622.22 | 86.84 | 2.67 |
| CRMS0312 | 5/2/2006 | 20 to 24 | 27.94 | 622.22 | 86.84 | 2.67 |
| CRMS0312 | 5/2/2006 | 4 to 8 | 25.21 | 970.30 | 78.18 | 2.90 |
| CRMS0312 | 5/2/2006 | 4 to 8 | 25.21 | 970.30 | 78.18 | 2.90 |
| CRMS0312 | 5/2/2006 | 8 to 12 | 25.12 | 690.13 | 80.43 | 2.67 |
| CRMS0312 | 5/2/2006 | 8 to 12 | 25.12 | 690.13 | 80.43 | 2.67 |
| CRMS0315 | 6/13/2006 | 0 to 4 | 13.80 | 1148.20 | 41.62 | 5.43 |
| CRMS0315 | 6/13/2006 | 12 to 16 | 13.90 | 1267.55 | 37.68 | 6.47 |
| CRMS0315 | 6/13/2006 | 16 to 20 | 14.69 | 1887.58 | 38.80 | 6.37 |
| CRMS0315 | 6/13/2006 | 20 to 24 | 15.01 | 750.79 | 39.35 | 6.35 |
| CRMS0315 | 6/13/2006 | 4 to 8 | 13.01 | 1165.22 | 38.59 | 6.62 |
| CRMS0315 | 6/13/2006 | 8 to 12 | 14.12 | 1089.24 | 40.21 | 6.48 |
| CRMS0319 | 6/14/2007 | 0 to 4 | 5.58 | 590.74 | 23.96 | 6.80 |
| CRMS0319 | 6/14/2007 | 12 to 16 | 3.40 | 465.90 | 20.30 | 7.10 |
| CRMS0319 | 6/14/2007 | 16 to 20 | 4.82 | 472.45 | 24.53 | 6.67 |
| CRMS0319 | 6/14/2007 | 20 to 24 | 6.06 | 462.39 | 27.88 | 7.00 |
| CRMS0319 | 6/14/2007 | 4 to 8 | 3.69 | 467.98 | 22.38 | 6.57 |
| CRMS0319 | 6/14/2007 | 8 to 12 | 2.62 | 490.11 | 19.88 | 7.00 |
| CRMS0326 | 4/28/2006 | 0 to 4 | 4.75 | 444.57 | 23.15 | 7.70 |
| CRMS0326 | 4/28/2006 | 12 to 16 | 2.13 | 405.56 | 15.35 | 6.45 |
| CRMS0326 | 4/28/2006 | 16 to 20 | 3.54 | 365.38 | 20.02 | 6.38 |
| CRMS0326 | 4/28/2006 | 20 to 24 | 2.27 | 425.81 | 26.08 | 8.20 |
| CRMS0326 | 4/28/2006 | 4 to 8 | 3.17 | 397.91 | 19.29 | 7.52 |
| CRMS0326 | 4/28/2006 | 8 to 12 | 2.38 | 398.15 | 15.86 | 7.22 |
| CRMS0327 | 5/8/2007 | 0 to 4 | 20.26 | 796.34 | 63.64 | 0.13 |
| CRMS0327 | 5/8/2007 | 12 to 16 | 20.70 | 592.66 | 54.81 | 0.38 |
| CRMS0327 | 5/8/2007 | 16 to 20 | 20.95 | 591.15 | 53.42 | 0.42 |
| CRMS0327 | 5/8/2007 | 20 to 24 | 23.46 | 771.34 | 51.41 | 0.48 |
| CRMS0327 | 5/8/2007 | 4 to 8 | 20.80 | 765.62 | 58.33 | 0.20 |
| CRMS0327 | 5/8/2007 | 8 to 12 | 19.55 | 641.64 | 58.01 | 0.30 |
| CRMS0331 | 6/28/2006 | 0 to 4 | 29.59 | 1676.00 | 74.34 | 0.50 |

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|----------|-----------|----------|-------|---------|-------|-------|
| CRMS0331 | 6/28/2006 | 12 to 16 | 23.69 | 586.53 | 70.35 | 0.50 |
| CRMS0331 | 6/28/2006 | 16 to 20 | 22.98 | 621.82 | 66.54 | 0.47 |
| CRMS0331 | 6/28/2006 | 20 to 24 | 27.63 | 731.38 | 66.10 | 0.48 |
| CRMS0331 | 6/28/2006 | 4 to 8 | 28.71 | 1221.00 | 70.43 | 0.32 |
| CRMS0331 | 6/28/2006 | 8 to 12 | 28.36 | 887.75 | 75.30 | 0.37 |
| CRMS0335 | 6/25/2007 | 0 to 4 | 4.33 | 471.17 | 20.76 | 7.67 |
| CRMS0335 | 6/25/2007 | 12 to 16 | 1.77 | 458.08 | 13.92 | 7.48 |
| CRMS0335 | 6/25/2007 | 16 to 20 | 1.89 | 404.88 | 13.69 | 7.63 |
| CRMS0335 | 6/25/2007 | 20 to 24 | 2.90 | 338.94 | 15.23 | 7.90 |
| CRMS0335 | 6/25/2007 | 4 to 8 | 2.94 | 416.53 | 16.78 | 7.22 |
| CRMS0335 | 6/25/2007 | 8 to 12 | 2.90 | 493.91 | 17.69 | 7.03 |
| CRMS0337 | 5/11/2006 | 0 to 4 | 5.28 | 607.80 | 19.08 | 8.00 |
| CRMS0337 | 5/11/2006 | 12 to 16 | 2.27 | 417.03 | 15.40 | 8.85 |
| CRMS0337 | 5/11/2006 | 16 to 20 | 2.87 | 464.52 | 17.09 | 9.17 |
| CRMS0337 | 5/11/2006 | 20 to 24 | 3.31 | 423.69 | 17.53 | 8.93 |
| CRMS0337 | 5/11/2006 | 4 to 8 | 3.36 | 394.34 | 16.86 | 8.40 |
| CRMS0337 | 5/11/2006 | 8 to 12 | 3.03 | 493.85 | 16.62 | 8.93 |
| CRMS0338 | 6/6/2006 | 0 to 4 | 5.82 | 472.20 | 24.01 | 10.27 |
| CRMS0338 | 6/6/2006 | 12 to 16 | 3.84 | 469.55 | 22.73 | 9.93 |
| CRMS0338 | 6/6/2006 | 16 to 20 | 3.77 | 466.67 | 23.13 | 10.07 |
| CRMS0338 | 6/6/2006 | 20 to 24 | 6.13 | 510.60 | 27.45 | 10.00 |
| CRMS0338 | 6/6/2006 | 4 to 8 | 5.04 | 543.89 | 24.55 | 9.97 |
| CRMS0338 | 6/6/2006 | 8 to 12 | 4.17 | 434.65 | 22.21 | 10.02 |
| CRMS0341 | 5/17/2007 | 0 to 4 | 6.11 | 601.01 | 19.10 | 7.02 |
| CRMS0341 | 5/17/2007 | 12 to 16 | 4.20 | 458.31 | 16.45 | 7.17 |
| CRMS0341 | 5/17/2007 | 16 to 20 | 2.41 | 462.88 | 13.28 | 6.85 |
| CRMS0341 | 5/17/2007 | 20 to 24 | 3.17 | 428.22 | 14.64 | 6.68 |
| CRMS0341 | 5/17/2007 | 4 to 8 | 5.39 | 489.77 | 20.22 | 7.17 |
| CRMS0341 | 5/17/2007 | 8 to 12 | 5.06 | 485.69 | 19.50 | 7.17 |
| CRMS0345 | 11/8/2006 | 0 to 4 | 3.55 | 637.83 | 14.14 | 7.63 |
| CRMS0345 | 11/8/2006 | 12 to 16 | 3.33 | 586.95 | 15.26 | 8.80 |
| CRMS0345 | 11/8/2006 | 16 to 20 | 3.42 | 461.88 | 16.08 | 9.17 |
| CRMS0345 | 11/8/2006 | 20 to 24 | 3.38 | 446.29 | 14.71 | 8.70 |
| CRMS0345 | 11/8/2006 | 4 to 8 | 3.26 | 623.33 | 14.70 | 8.88 |
| CRMS0345 | 11/8/2006 | 8 to 12 | 3.33 | 587.77 | 14.91 | 8.38 |
| CRMS0354 | 4/27/2006 | 0 to 4 | 10.31 | 841.52 | 34.50 | 3.68 |
| CRMS0354 | 4/27/2006 | 12 to 16 | 7.80 | 488.89 | 31.78 | 4.50 |
| CRMS0354 | 4/27/2006 | 16 to 20 | 7.69 | 464.01 | 30.86 | 4.23 |
| CRMS0354 | 4/27/2006 | 20 to 24 | 7.08 | 375.18 | 35.82 | 4.38 |
| CRMS0354 | 4/27/2006 | 4 to 8 | 9.00 | 538.62 | 36.11 | 4.47 |
| CRMS0354 | 4/27/2006 | 8 to 12 | 8.00 | 530.03 | 34.18 | 4.47 |
| CRMS0355 | 5/3/2006 | 0 to 4 | 5.27 | 570.58 | 21.20 | 8.80 |
| CRMS0355 | 5/3/2006 | 12 to 16 | 8.80 | 526.16 | 28.79 | 9.15 |

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|----------|-----------|----------|-------|---------|-------|------|
| CRMS0355 | 5/3/2006 | 16 to 20 | 7.11 | 588.52 | 26.63 | 8.77 |
| CRMS0355 | 5/3/2006 | 20 to 24 | 6.52 | 512.05 | 23.52 | 8.40 |
| CRMS0355 | 5/3/2006 | 4 to 8 | 6.15 | 575.74 | 23.90 | 9.15 |
| CRMS0355 | 5/3/2006 | 8 to 12 | 8.85 | 533.59 | 28.49 | 9.05 |
| CRMS0367 | 6/28/2006 | 0 to 4 | 25.25 | 1607.56 | 67.30 | 0.33 |
| CRMS0367 | 6/28/2006 | 12 to 16 | 22.79 | 1075.84 | 55.36 | 0.20 |
| CRMS0367 | 6/28/2006 | 16 to 20 | 23.28 | 882.85 | 54.11 | 0.20 |
| CRMS0367 | 6/28/2006 | 20 to 24 | 23.22 | 696.18 | 44.29 | 0.25 |
| CRMS0367 | 6/28/2006 | 4 to 8 | 25.28 | 1456.71 | 67.21 | 0.23 |
| CRMS0367 | 6/28/2006 | 8 to 12 | 25.30 | 1174.04 | 65.15 | 0.27 |
| CRMS0369 | 5/31/2007 | 0 to 4 | 7.27 | 727.59 | 27.28 | 4.03 |
| CRMS0369 | 5/31/2007 | 12 to 16 | 5.78 | 527.58 | 22.86 | 3.58 |
| CRMS0369 | 5/31/2007 | 16 to 20 | 5.44 | 526.60 | 22.82 | 3.67 |
| CRMS0369 | 5/31/2007 | 20 to 24 | 5.75 | 530.25 | 25.83 | 3.83 |
| CRMS0369 | 5/31/2007 | 4 to 8 | 6.42 | 660.00 | 25.41 | 3.73 |
| CRMS0369 | 5/31/2007 | 8 to 12 | 4.90 | 527.82 | 22.37 | 3.48 |
| CRMS0377 | 6/6/2007 | 0 to 4 | 3.76 | 436.27 | 18.56 | 6.27 |
| CRMS0377 | 6/6/2007 | 12 to 16 | 3.29 | 397.52 | 16.23 | 6.82 |
| CRMS0377 | 6/6/2007 | 16 to 20 | 3.30 | 380.36 | 14.64 | 6.18 |
| CRMS0377 | 6/6/2007 | 20 to 24 | 2.62 | 446.67 | 13.46 | 6.67 |
| CRMS0377 | 6/6/2007 | 4 to 8 | 3.01 | 365.50 | 17.05 | 6.40 |
| CRMS0377 | 6/6/2007 | 8 to 12 | 3.00 | 393.34 | 14.41 | 6.40 |
| CRMS0382 | 6/7/2006 | 0 to 4 | 25.07 | 1470.49 | 77.29 | 4.03 |
| CRMS0382 | 6/7/2006 | 12 to 16 | 23.72 | 975.33 | 75.51 | 3.33 |
| CRMS0382 | 6/7/2006 | 16 to 20 | 22.92 | 781.86 | 75.73 | 3.30 |
| CRMS0382 | 6/7/2006 | 20 to 24 | 25.12 | 773.55 | 75.01 | 2.85 |
| CRMS0382 | 6/7/2006 | 4 to 8 | 24.39 | 1301.17 | 79.09 | 3.12 |
| CRMS0382 | 6/7/2006 | 8 to 12 | 22.70 | 1433.61 | 79.14 | 3.12 |
| CRMS0395 | 3/23/2006 | 0 to 4 | 13.44 | 730.84 | 43.12 | 4.52 |
| CRMS0395 | 3/23/2006 | 12 to 16 | 10.08 | 497.97 | 30.70 | 3.10 |
| CRMS0395 | 3/23/2006 | 16 to 20 | 10.69 | 493.73 | 36.82 | 3.18 |
| CRMS0395 | 3/23/2006 | 20 to 24 | 10.41 | 503.49 | 42.19 | 3.18 |
| CRMS0395 | 3/23/2006 | 4 to 8 | 11.22 | 530.19 | 37.06 | 3.93 |
| CRMS0395 | 3/23/2006 | 8 to 12 | 9.52 | 563.44 | 33.63 | 3.57 |
| CRMS0398 | 6/27/2008 | 0 to 4 | 14.55 | 823.25 | 39.35 | 0.40 |
| CRMS0398 | 6/27/2008 | 12 to 16 | 6.61 | 480.66 | 25.71 | 0.83 |
| CRMS0398 | 6/27/2008 | 16 to 20 | 6.56 | 477.26 | 24.33 | 0.97 |
| CRMS0398 | 6/27/2008 | 20 to 24 | 6.96 | 509.13 | 26.55 | 1.10 |
| CRMS0398 | 6/27/2008 | 4 to 8 | 10.59 | 817.90 | 33.13 | 0.47 |
| CRMS0398 | 6/27/2008 | 8 to 12 | 8.84 | 674.56 | 30.25 | 0.60 |
| CRMS0399 | 6/2/2008 | 0 to 4 | 6.07 | 566.47 | 24.94 | 1.25 |
| CRMS0399 | 6/2/2008 | 12 to 16 | 4.56 | 446.13 | 20.00 | 2.45 |
| CRMS0399 | 6/2/2008 | 16 to 20 | 4.82 | 448.68 | 22.93 | 2.67 |

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|----------|------------|----------|-------|---------|-------|------|
| CRMS0399 | 6/2/2008 | 20 to 24 | 4.63 | 350.53 | 25.78 | 2.77 |
| CRMS0399 | 6/2/2008 | 4 to 8 | 5.55 | 485.08 | 27.47 | 1.45 |
| CRMS0399 | 6/2/2008 | 8 to 12 | 5.37 | 449.70 | 23.83 | 2.13 |
| CRMS0434 | 4/18/2006 | 0 to 4 | 6.51 | 601.79 | 27.50 | 4.53 |
| CRMS0434 | 4/18/2006 | 12 to 16 | 5.31 | 523.30 | 21.31 | 4.92 |
| CRMS0434 | 4/18/2006 | 16 to 20 | 4.57 | 544.79 | 19.78 | 5.05 |
| CRMS0434 | 4/18/2006 | 20 to 24 | 3.83 | 461.23 | 18.03 | 4.73 |
| CRMS0434 | 4/18/2006 | 4 to 8 | 6.03 | 548.35 | 26.69 | 5.35 |
| CRMS0434 | 4/18/2006 | 8 to 12 | 5.83 | 537.32 | 23.01 | 5.17 |
| CRMS0461 | 3/15/2007 | 0 to 4 | 6.60 | 570.87 | 17.03 | 0.17 |
| CRMS0461 | 3/15/2007 | 12 to 16 | 6.63 | 485.83 | 17.08 | 0.13 |
| CRMS0461 | 3/15/2007 | 16 to 20 | 5.47 | 421.87 | 14.22 | 0.13 |
| CRMS0461 | 3/15/2007 | 20 to 24 | 4.66 | 461.13 | 12.53 | 0.13 |
| CRMS0461 | 3/15/2007 | 4 to 8 | 5.38 | 528.35 | 14.60 | 0.13 |
| CRMS0461 | 3/15/2007 | 8 to 12 | 7.52 | 569.27 | 19.01 | 0.17 |
| CRMS0463 | 12/13/2006 | 0 to 4 | 7.56 | 935.37 | 21.44 | 0.20 |
| CRMS0463 | 12/13/2006 | 12 to 16 | 5.28 | 779.58 | 18.67 | 0.20 |
| CRMS0463 | 12/13/2006 | 16 to 20 | 4.52 | 747.10 | 17.53 | 0.27 |
| CRMS0463 | 12/13/2006 | 20 to 24 | 4.84 | 504.79 | 16.33 | 0.28 |
| CRMS0463 | 12/13/2006 | 4 to 8 | 6.80 | 797.78 | 18.14 | 0.18 |
| CRMS0463 | 12/13/2006 | 8 to 12 | 6.14 | 713.71 | 21.21 | 0.20 |
| CRMS0464 | 4/30/2008 | 0 to 4 | 13.73 | 1175.74 | 30.61 | 0.10 |
| CRMS0464 | 4/30/2008 | 0 to 4 | 13.73 | 1175.74 | 30.61 | 0.10 |
| CRMS0464 | 4/30/2008 | 12 to 16 | 5.29 | 492.37 | 16.00 | 0.15 |
| CRMS0464 | 4/30/2008 | 12 to 16 | 5.29 | 492.37 | 16.00 | 0.15 |
| CRMS0464 | 4/30/2008 | 16 to 20 | 3.71 | 473.21 | 15.92 | 0.20 |
| CRMS0464 | 4/30/2008 | 16 to 20 | 3.71 | 473.21 | 15.92 | 0.20 |
| CRMS0464 | 4/30/2008 | 20 to 24 | 4.62 | 440.00 | 12.58 | 0.20 |
| CRMS0464 | 4/30/2008 | 20 to 24 | 4.62 | 440.00 | 12.58 | 0.20 |
| CRMS0464 | 4/30/2008 | 4 to 8 | 10.55 | 1048.49 | 23.74 | 0.10 |
| CRMS0464 | 4/30/2008 | 4 to 8 | 10.55 | 1048.49 | 23.74 | 0.10 |
| CRMS0464 | 4/30/2008 | 8 to 12 | 6.89 | 842.88 | 17.47 | 0.10 |
| CRMS0464 | 4/30/2008 | 8 to 12 | 6.89 | 842.88 | 17.47 | 0.10 |
| CRMS0465 | 11/28/2006 | 0 to 4 | 9.59 | 1045.87 | 18.51 | 0.23 |
| CRMS0465 | 11/28/2006 | 0 to 4 | 9.59 | 1045.87 | 18.51 | 0.23 |
| CRMS0465 | 11/28/2006 | 12 to 16 | 1.75 | 520.59 | 8.02 | 0.17 |
| CRMS0465 | 11/28/2006 | 12 to 16 | 1.75 | 520.59 | 8.02 | 0.17 |
| CRMS0465 | 11/28/2006 | 16 to 20 | 2.14 | 786.15 | 11.41 | 0.27 |
| CRMS0465 | 11/28/2006 | 16 to 20 | 2.14 | 786.15 | 11.41 | 0.27 |
| CRMS0465 | 11/28/2006 | 20 to 24 | 1.39 | 443.55 | 9.47 | 0.23 |
| CRMS0465 | 11/28/2006 | 20 to 24 | 1.39 | 443.55 | 9.47 | 0.23 |
| CRMS0465 | 11/28/2006 | 4 to 8 | 6.91 | 572.32 | 15.77 | 0.27 |
| CRMS0465 | 11/28/2006 | 4 to 8 | 6.91 | 572.32 | 15.77 | 0.27 |

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|----------|------------|----------|-------|--------|-------|------|
| CRMS0465 | 11/28/2006 | 8 to 12 | 4.63 | 657.47 | 11.73 | 0.17 |
| CRMS0465 | 11/28/2006 | 8 to 12 | 4.63 | 657.47 | 11.73 | 0.17 |
| CRMS0479 | 5/20/2007 | 0 to 4 | 1.59 | 690.61 | 8.56 | 0.17 |
| CRMS0479 | 5/20/2007 | 0 to 4 | 1.59 | 690.61 | 8.56 | 0.17 |
| CRMS0479 | 5/20/2007 | 12 to 16 | 2.33 | 618.97 | 8.32 | 0.10 |
| CRMS0479 | 5/20/2007 | 12 to 16 | 2.33 | 618.97 | 8.32 | 0.10 |
| CRMS0479 | 5/20/2007 | 16 to 20 | 2.28 | 797.33 | 7.68 | 0.10 |
| CRMS0479 | 5/20/2007 | 16 to 20 | 2.28 | 797.33 | 7.68 | 0.10 |
| CRMS0479 | 5/20/2007 | 20 to 24 | 3.06 | 780.70 | 9.11 | 0.10 |
| CRMS0479 | 5/20/2007 | 20 to 24 | 3.06 | 780.70 | 9.11 | 0.10 |
| CRMS0479 | 5/20/2007 | 4 to 8 | 1.35 | 674.71 | 7.54 | 0.10 |
| CRMS0479 | 5/20/2007 | 4 to 8 | 1.35 | 674.71 | 7.54 | 0.10 |
| CRMS0479 | 5/20/2007 | 8 to 12 | 1.54 | 907.58 | 8.31 | 0.10 |
| CRMS0479 | 5/20/2007 | 8 to 12 | 1.54 | 907.58 | 8.31 | 0.10 |
| CRMS0482 | 6/7/2007 | 0 to 4 | 11.06 | 373.10 | 38.73 | 0.27 |
| CRMS0482 | 6/7/2007 | 12 to 16 | 10.45 | 635.26 | 31.79 | 0.23 |
| CRMS0482 | 6/7/2007 | 16 to 20 | 12.41 | 601.39 | 31.22 | 0.27 |
| CRMS0482 | 6/7/2007 | 20 to 24 | 12.42 | 883.29 | 31.63 | 0.40 |
| CRMS0482 | 6/7/2007 | 4 to 8 | 9.32 | 944.03 | 36.41 | 0.17 |
| CRMS0482 | 6/7/2007 | 8 to 12 | 10.16 | 716.82 | 35.40 | 0.18 |
| CRMS0488 | 11/7/2006 | 0 to 4 | 19.00 | 939.40 | 60.75 | 0.23 |
| CRMS0488 | 11/7/2006 | 12 to 16 | 18.80 | 819.05 | 61.67 | 0.27 |
| CRMS0488 | 11/7/2006 | 16 to 20 | 21.15 | 807.00 | 63.67 | 0.30 |
| CRMS0488 | 11/7/2006 | 20 to 24 | 18.40 | 717.50 | 55.37 | 0.33 |
| CRMS0488 | 11/7/2006 | 4 to 8 | 16.83 | 775.40 | 57.67 | 0.20 |
| CRMS0488 | 11/7/2006 | 8 to 12 | 21.13 | 886.87 | 63.99 | 0.23 |
| CRMS0493 | 11/5/2007 | 0 to 4 | 9.76 | 878.10 | 30.76 | 0.68 |
| CRMS0493 | 11/5/2007 | 12 to 16 | 6.89 | 533.53 | 28.06 | 0.37 |
| CRMS0493 | 11/5/2007 | 16 to 20 | 5.21 | 466.89 | 25.91 | 0.43 |
| CRMS0493 | 11/5/2007 | 20 to 24 | 5.22 | 418.63 | 23.04 | 0.33 |
| CRMS0493 | 11/5/2007 | 4 to 8 | 11.32 | 898.34 | 29.24 | 0.50 |
| CRMS0493 | 11/5/2007 | 8 to 12 | 11.53 | 704.28 | 28.87 | 0.43 |
| CRMS0496 | 2/4/2008 | 0 to 4 | 6.83 | 774.77 | 26.73 | 0.32 |
| CRMS0496 | 2/4/2008 | 12 to 16 | 4.14 | 602.46 | 18.28 | 0.52 |
| CRMS0496 | 2/4/2008 | 16 to 20 | 3.70 | 625.98 | 15.72 | 0.47 |
| CRMS0496 | 2/4/2008 | 20 to 24 | 6.59 | 666.07 | 24.73 | 0.52 |
| CRMS0496 | 2/4/2008 | 4 to 8 | 5.91 | 614.48 | 18.80 | 0.33 |
| CRMS0496 | 2/4/2008 | 8 to 12 | 5.81 | 601.80 | 22.67 | 0.43 |
| CRMS0498 | 4/17/2007 | 0 to 4 | 9.21 | 543.62 | 28.31 | 2.87 |
| CRMS0498 | 4/17/2007 | 12 to 16 | 3.50 | 420.10 | 18.10 | 2.92 |
| CRMS0498 | 4/17/2007 | 16 to 20 | 3.75 | 382.42 | 19.05 | 3.72 |
| CRMS0498 | 4/17/2007 | 20 to 24 | 3.54 | 367.23 | 19.69 | 4.87 |
| CRMS0498 | 4/17/2007 | 4 to 8 | 6.09 | 394.14 | 27.99 | 2.60 |

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|----------|------------|----------|-------|--------|-------|------|
| CRMS0498 | 4/17/2007 | 8 to 12 | 4.90 | 403.22 | 22.53 | 2.63 |
| CRMS0507 | 2/20/2008 | 0 to 4 | 5.25 | 637.00 | 24.81 | 1.13 |
| CRMS0507 | 2/20/2008 | 12 to 16 | 3.95 | 689.00 | 26.68 | 1.90 |
| CRMS0507 | 2/20/2008 | 16 to 20 | 3.40 | 958.00 | 22.91 | 2.00 |
| CRMS0507 | 2/20/2008 | 20 to 24 | 4.80 | 631.00 | 19.65 | 1.93 |
| CRMS0507 | 2/20/2008 | 4 to 8 | 3.15 | 889.50 | 27.00 | 1.23 |
| CRMS0507 | 2/20/2008 | 8 to 12 | 3.70 | 734.00 | 33.69 | 1.67 |
| CRMS0508 | 2/20/2008 | 0 to 4 | 16.10 | 809.60 | 53.14 | 0.93 |
| CRMS0508 | 2/20/2008 | 12 to 16 | 12.70 | 641.60 | 35.34 | 1.30 |
| CRMS0508 | 2/20/2008 | 16 to 20 | 11.60 | 601.90 | 26.54 | 1.22 |
| CRMS0508 | 2/20/2008 | 20 to 24 | 10.80 | 613.50 | 23.09 | 1.22 |
| CRMS0508 | 2/20/2008 | 4 to 8 | 13.90 | 711.10 | 49.23 | 0.97 |
| CRMS0508 | 2/20/2008 | 8 to 12 | 14.60 | 739.30 | 45.44 | 0.97 |
| CRMS0511 | 4/11/2008 | 0 to 4 | 16.66 | 991.55 | 44.24 | 0.97 |
| CRMS0511 | 4/11/2008 | 12 to 16 | 7.37 | 458.07 | 21.03 | 0.47 |
| CRMS0511 | 4/11/2008 | 16 to 20 | 5.41 | 377.88 | 14.27 | 0.45 |
| CRMS0511 | 4/11/2008 | 20 to 24 | 3.29 | 186.87 | 9.47 | 0.45 |
| CRMS0511 | 4/11/2008 | 4 to 8 | 15.87 | 885.57 | 42.26 | 0.57 |
| CRMS0511 | 4/11/2008 | 8 to 12 | 11.82 | 679.02 | 29.54 | 0.43 |
| CRMS0523 | 11/28/2007 | 0 to 4 | 7.49 | 786.92 | 30.39 | 3.23 |
| CRMS0523 | 11/28/2007 | 12 to 16 | 6.55 | 536.06 | 32.34 | 2.85 |
| CRMS0523 | 11/28/2007 | 16 to 20 | 6.43 | 459.73 | 34.89 | 2.85 |
| CRMS0523 | 11/28/2007 | 20 to 24 | 6.81 | 462.27 | 33.38 | 2.83 |
| CRMS0523 | 11/28/2007 | 4 to 8 | 7.77 | 695.95 | 31.02 | 3.20 |
| CRMS0523 | 11/28/2007 | 8 to 12 | 7.22 | 630.11 | 31.98 | 3.03 |
| CRMS0530 | 4/18/2007 | 0 to 4 | 4.62 | 691.48 | 19.45 | 2.53 |
| CRMS0530 | 4/18/2007 | 12 to 16 | 6.54 | 579.68 | 26.81 | 3.67 |
| CRMS0530 | 4/18/2007 | 16 to 20 | 7.18 | 520.54 | 29.80 | 4.08 |
| CRMS0530 | 4/18/2007 | 20 to 24 | 5.90 | 412.50 | 26.77 | 4.00 |
| CRMS0530 | 4/18/2007 | 4 to 8 | 6.26 | 474.54 | 20.41 | 2.65 |
| CRMS0530 | 4/18/2007 | 8 to 12 | 5.76 | 655.77 | 23.32 | 3.27 |
| CRMS0535 | 3/13/2008 | 0 to 4 | 12.18 | 975.85 | 40.09 | 0.63 |
| CRMS0535 | 3/13/2008 | 12 to 16 | 5.39 | 787.36 | 33.70 | 1.33 |
| CRMS0535 | 3/13/2008 | 16 to 20 | 5.49 | 676.77 | 30.85 | 1.43 |
| CRMS0535 | 3/13/2008 | 20 to 24 | 7.84 | 752.92 | 38.24 | 1.50 |
| CRMS0535 | 3/13/2008 | 4 to 8 | 8.06 | 919.60 | 33.61 | 0.68 |
| CRMS0535 | 3/13/2008 | 8 to 12 | 6.99 | 809.20 | 38.77 | 1.03 |
| CRMS0541 | 5/9/2008 | 0 to 4 | 0.77 | 614.46 | 6.23 | 1.07 |
| CRMS0541 | 5/9/2008 | 12 to 16 | 1.27 | 663.07 | 8.05 | 2.48 |
| CRMS0541 | 5/9/2008 | 16 to 20 | 1.37 | 647.27 | 7.89 | 3.10 |
| CRMS0541 | 5/9/2008 | 20 to 24 | 1.26 | 631.30 | 7.43 | 3.57 |
| CRMS0541 | 5/9/2008 | 4 to 8 | 1.27 | 645.74 | 6.37 | 1.67 |
| CRMS0541 | 5/9/2008 | 8 to 12 | 1.20 | 646.53 | 6.84 | 2.07 |

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|----------|------------|----------|-------|---------|-------|------|
| CRMS0545 | 10/16/2007 | 0 to 4 | 15.07 | 1404.38 | 46.34 | 0.63 |
| CRMS0545 | 10/16/2007 | 12 to 16 | 10.35 | 648.54 | 36.82 | 0.40 |
| CRMS0545 | 10/16/2007 | 16 to 20 | 11.41 | 610.37 | 36.84 | 0.33 |
| CRMS0545 | 10/16/2007 | 20 to 24 | 12.52 | 739.53 | 35.09 | 0.30 |
| CRMS0545 | 10/16/2007 | 4 to 8 | 14.85 | 1000.56 | 45.50 | 0.60 |
| CRMS0545 | 10/16/2007 | 8 to 12 | 11.41 | 723.41 | 34.99 | 0.43 |
| CRMS0549 | 6/29/2006 | 0 to 4 | 9.89 | 935.56 | 28.89 | 2.90 |
| CRMS0549 | 6/29/2006 | 12 to 16 | 8.79 | 910.67 | 27.70 | 2.75 |
| CRMS0549 | 6/29/2006 | 16 to 20 | 6.61 | 653.68 | 25.24 | 2.68 |
| CRMS0549 | 6/29/2006 | 20 to 24 | 5.51 | 547.76 | 25.10 | 2.90 |
| CRMS0549 | 6/29/2006 | 4 to 8 | 11.42 | 1027.56 | 29.92 | 2.67 |
| CRMS0549 | 6/29/2006 | 8 to 12 | 9.90 | 910.11 | 29.20 | 2.77 |
| CRMS0550 | 11/6/2007 | 0 to 4 | 11.96 | 1016.58 | 27.97 | 0.33 |
| CRMS0550 | 11/6/2007 | 12 to 16 | 7.18 | 684.34 | 19.35 | 0.27 |
| CRMS0550 | 11/6/2007 | 16 to 20 | 7.41 | 589.46 | 19.12 | 0.25 |
| CRMS0550 | 11/6/2007 | 20 to 24 | 6.67 | 600.15 | 18.61 | 0.23 |
| CRMS0550 | 11/6/2007 | 4 to 8 | 11.74 | 857.16 | 27.45 | 0.37 |
| CRMS0550 | 11/6/2007 | 8 to 12 | 9.67 | 718.68 | 23.68 | 0.37 |
| CRMS0551 | 11/27/2007 | 0 to 4 | 17.56 | 1120.69 | 56.66 | 0.10 |
| CRMS0551 | 11/27/2007 | 12 to 16 | 14.48 | 872.25 | 47.30 | 0.10 |
| CRMS0551 | 11/27/2007 | 16 to 20 | 19.54 | 803.58 | 66.21 | 0.10 |
| CRMS0551 | 11/27/2007 | 20 to 24 | 21.79 | 803.93 | 77.77 | 0.10 |
| CRMS0551 | 11/27/2007 | 4 to 8 | 17.26 | 926.40 | 51.29 | 0.10 |
| CRMS0551 | 11/27/2007 | 8 to 12 | 14.27 | 1027.06 | 41.96 | 0.10 |
| CRMS0552 | 12/6/2007 | 0 to 4 | 8.09 | 2050.94 | 24.73 | 0.60 |
| CRMS0552 | 12/6/2007 | 12 to 16 | 5.07 | 1954.52 | 19.88 | 0.60 |
| CRMS0552 | 12/6/2007 | 16 to 20 | 4.69 | 1507.26 | 19.28 | 0.60 |
| CRMS0552 | 12/6/2007 | 20 to 24 | 4.99 | 941.92 | 18.53 | 0.62 |
| CRMS0552 | 12/6/2007 | 4 to 8 | 12.03 | 1584.23 | 22.38 | 0.50 |
| CRMS0552 | 12/6/2007 | 8 to 12 | 6.40 | 1914.48 | 21.37 | 0.57 |
| CRMS0556 | 11/2/2007 | 0 to 4 | 25.00 | 1199.70 | 80.07 | 0.40 |
| CRMS0556 | 11/2/2007 | 12 to 16 | 23.70 | 768.73 | 79.77 | 0.37 |
| CRMS0556 | 11/2/2007 | 16 to 20 | 25.28 | 873.20 | 82.17 | 0.37 |
| CRMS0556 | 11/2/2007 | 20 to 24 | 24.08 | 829.82 | 80.80 | 0.43 |
| CRMS0556 | 11/2/2007 | 4 to 8 | 21.47 | 839.58 | 81.96 | 0.37 |
| CRMS0556 | 11/2/2007 | 8 to 12 | 22.26 | 698.46 | 78.26 | 0.37 |
| CRMS0557 | 12/4/2007 | 0 to 4 | 25.57 | 786.67 | 83.13 | 0.10 |
| CRMS0557 | 12/4/2007 | 12 to 16 | 26.40 | 555.33 | 85.71 | 0.10 |
| CRMS0557 | 12/4/2007 | 16 to 20 | 26.80 | 573.00 | 87.65 | 0.10 |
| CRMS0557 | 12/4/2007 | 4 to 8 | 26.30 | 716.33 | 83.43 | 0.10 |
| CRMS0557 | 12/4/2007 | 8 to 12 | 27.83 | 666.67 | 87.74 | 0.10 |
| CRMS0562 | 1/3/2007 | 0 to 4 | 23.95 | 1687.90 | 55.00 | 1.10 |
| CRMS0562 | 1/3/2007 | 12 to 16 | 11.60 | 831.80 | 54.35 | 1.67 |

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|----------|------------|----------|-------|---------|-------|------|
| CRMS0562 | 1/3/2007 | 16 to 20 | 18.10 | 939.55 | 59.08 | 1.82 |
| CRMS0562 | 1/3/2007 | 20 to 24 | 17.05 | 907.35 | 50.45 | 1.85 |
| CRMS0562 | 1/3/2007 | 4 to 8 | 20.30 | 1484.30 | 54.42 | 1.03 |
| CRMS0562 | 1/3/2007 | 8 to 12 | 7.95 | 1091.25 | 52.11 | 1.37 |
| CRMS0568 | 2/7/2008 | 0 to 4 | 7.73 | 372.33 | 21.24 | 0.35 |
| CRMS0568 | 2/7/2008 | 12 to 16 | 6.07 | 333.67 | 29.58 | 1.07 |
| CRMS0568 | 2/7/2008 | 16 to 20 | 7.17 | 359.00 | 24.27 | 1.08 |
| CRMS0568 | 2/7/2008 | 20 to 24 | 6.63 | 343.67 | 25.00 | 1.20 |
| CRMS0568 | 2/7/2008 | 4 to 8 | 7.13 | 342.33 | 20.41 | 0.57 |
| CRMS0568 | 2/7/2008 | 8 to 12 | 6.33 | 330.33 | 30.00 | 0.97 |
| CRMS0574 | 7/12/2007 | 0 to 4 | 18.00 | 845.08 | 53.67 | 0.67 |
| CRMS0574 | 7/12/2007 | 12 to 16 | 15.60 | 425.03 | 43.72 | 0.93 |
| CRMS0574 | 7/12/2007 | 16 to 20 | 14.83 | 409.23 | 38.02 | 0.98 |
| CRMS0574 | 7/12/2007 | 20 to 24 | 12.87 | 379.61 | 36.28 | 1.23 |
| CRMS0574 | 7/12/2007 | 4 to 8 | 15.56 | 602.35 | 51.30 | 0.73 |
| CRMS0574 | 7/12/2007 | 8 to 12 | 14.85 | 474.44 | 48.98 | 0.82 |
| CRMS0580 | 2/19/2008 | 0 to 4 | 16.14 | 662.55 | 54.72 | 0.77 |
| CRMS0580 | 2/19/2008 | 12 to 16 | 14.81 | 536.29 | 52.54 | 1.08 |
| CRMS0580 | 2/19/2008 | 16 to 20 | 15.06 | 526.25 | 53.55 | 1.45 |
| CRMS0580 | 2/19/2008 | 20 to 24 | 15.99 | 543.52 | 59.61 | 1.60 |
| CRMS0580 | 2/19/2008 | 4 to 8 | 12.56 | 557.28 | 45.65 | 0.80 |
| CRMS0580 | 2/19/2008 | 8 to 12 | 13.67 | 598.30 | 52.56 | 0.88 |
| CRMS0588 | 1/3/2007 | 0 to 4 | 15.14 | 826.18 | 55.73 | 3.27 |
| CRMS0588 | 1/3/2007 | 12 to 16 | 14.42 | 574.94 | 50.03 | 4.70 |
| CRMS0588 | 1/3/2007 | 16 to 20 | 12.82 | 588.09 | 37.91 | 4.42 |
| CRMS0588 | 1/3/2007 | 20 to 24 | 13.13 | 498.91 | 40.62 | 4.83 |
| CRMS0588 | 1/3/2007 | 4 to 8 | 11.99 | 666.94 | 52.92 | 3.83 |
| CRMS0588 | 1/3/2007 | 8 to 12 | 15.15 | 712.29 | 56.94 | 4.43 |
| CRMS0595 | 3/26/2007 | 0 to 4 | 16.37 | 644.57 | 62.68 | 0.83 |
| CRMS0595 | 3/26/2007 | 12 to 16 | 16.77 | 463.41 | 44.20 | 0.58 |
| CRMS0595 | 3/26/2007 | 16 to 20 | 12.96 | 460.78 | 40.96 | 0.65 |
| CRMS0595 | 3/26/2007 | 20 to 24 | 17.07 | 382.41 | 39.07 | 0.77 |
| CRMS0595 | 3/26/2007 | 4 to 8 | 15.34 | 450.62 | 54.73 | 0.60 |
| CRMS0595 | 3/26/2007 | 8 to 12 | 15.35 | 442.52 | 50.07 | 0.60 |
| CRMS0600 | 12/11/2007 | 0 to 4 | 4.97 | 647.55 | 18.87 | 5.75 |
| CRMS0600 | 12/11/2007 | 12 to 16 | 2.45 | 532.68 | 12.82 | 6.73 |
| CRMS0600 | 12/11/2007 | 16 to 20 | 3.57 | 566.78 | 16.34 | 7.77 |
| CRMS0600 | 12/11/2007 | 20 to 24 | 3.88 | 469.12 | 18.45 | 7.62 |
| CRMS0600 | 12/11/2007 | 4 to 8 | 3.48 | 518.83 | 12.54 | 5.78 |
| CRMS0600 | 12/11/2007 | 8 to 12 | 2.59 | 496.22 | 13.14 | 7.40 |
| CRMS0603 | 7/12/2007 | 0 to 4 | 16.00 | 634.33 | 72.27 | 1.13 |
| CRMS0603 | 7/12/2007 | 12 to 16 | 20.07 | 554.00 | 71.19 | 1.67 |
| CRMS0603 | 7/12/2007 | 16 to 20 | 13.93 | 558.33 | 58.49 | 1.90 |

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|----------|------------|----------|-------|---------|-------|-------|
| CRMS0603 | 7/12/2007 | 20 to 24 | 13.90 | 513.67 | 50.57 | 2.13 |
| CRMS0603 | 7/12/2007 | 4 to 8 | 13.33 | 531.00 | 69.16 | 1.17 |
| CRMS0603 | 7/12/2007 | 8 to 12 | 13.90 | 563.50 | 73.51 | 1.40 |
| CRMS0605 | 5/23/2006 | 0 to 4 | 17.63 | 829.58 | 47.64 | 11.75 |
| CRMS0605 | 5/23/2006 | 12 to 16 | 27.54 | 460.80 | 40.61 | 3.82 |
| CRMS0605 | 5/23/2006 | 16 to 20 | 30.61 | 462.64 | 35.28 | 3.38 |
| CRMS0605 | 5/23/2006 | 20 to 24 | 24.01 | 399.50 | 34.09 | 3.27 |
| CRMS0605 | 5/23/2006 | 4 to 8 | 21.68 | 661.88 | 47.38 | 5.25 |
| CRMS0605 | 5/23/2006 | 8 to 12 | 17.90 | 510.01 | 42.40 | 4.23 |
| CRMS0609 | 12/11/2007 | 0 to 4 | 9.05 | 716.46 | 28.98 | 4.87 |
| CRMS0609 | 12/11/2007 | 12 to 16 | 4.71 | 427.08 | 25.85 | 5.90 |
| CRMS0609 | 12/11/2007 | 16 to 20 | 9.57 | 485.44 | 38.23 | 5.73 |
| CRMS0609 | 12/11/2007 | 20 to 24 | 13.59 | 524.31 | 42.38 | 5.97 |
| CRMS0609 | 12/11/2007 | 4 to 8 | 6.68 | 547.46 | 24.58 | 5.12 |
| CRMS0609 | 12/11/2007 | 8 to 12 | 5.02 | 454.23 | 26.95 | 5.50 |
| CRMS0610 | 6/8/2006 | 0 to 4 | 14.00 | 970.12 | 38.22 | 21.53 |
| CRMS0610 | 6/8/2006 | 12 to 16 | 2.76 | 837.97 | 13.98 | 6.90 |
| CRMS0610 | 6/8/2006 | 16 to 20 | 3.22 | 569.49 | 14.22 | 6.07 |
| CRMS0610 | 6/8/2006 | 20 to 24 | 3.38 | 521.15 | 15.23 | 5.65 |
| CRMS0610 | 6/8/2006 | 4 to 8 | 4.66 | 619.33 | 17.14 | 9.95 |
| CRMS0610 | 6/8/2006 | 8 to 12 | 2.79 | 837.86 | 14.83 | 8.42 |
| CRMS0614 | 7/11/2007 | 0 to 4 | 5.47 | 765.87 | 26.92 | 6.57 |
| CRMS0614 | 7/11/2007 | 12 to 16 | 5.43 | 570.89 | 28.49 | 8.15 |
| CRMS0614 | 7/11/2007 | 16 to 20 | 5.30 | 480.75 | 24.86 | 7.97 |
| CRMS0614 | 7/11/2007 | 20 to 24 | 4.71 | 414.35 | 21.90 | 7.97 |
| CRMS0614 | 7/11/2007 | 4 to 8 | 5.15 | 602.58 | 33.25 | 7.53 |
| CRMS0614 | 7/11/2007 | 8 to 12 | 5.21 | 558.81 | 26.91 | 7.82 |
| CRMS0615 | 6/20/2006 | 0 to 4 | 6.56 | 609.49 | 23.12 | 4.63 |
| CRMS0615 | 6/20/2006 | 12 to 16 | 5.89 | 380.01 | 20.16 | 4.40 |
| CRMS0615 | 6/20/2006 | 16 to 20 | 3.84 | 344.93 | 16.16 | 4.78 |
| CRMS0615 | 6/20/2006 | 20 to 24 | 4.05 | 366.24 | 17.76 | 5.08 |
| CRMS0615 | 6/20/2006 | 4 to 8 | 3.80 | 399.38 | 22.33 | 5.83 |
| CRMS0615 | 6/20/2006 | 8 to 12 | 6.64 | 393.53 | 23.44 | 4.42 |
| CRMS0618 | 6/15/2006 | 0 to 4 | 15.04 | 855.00 | 47.87 | 12.13 |
| CRMS0618 | 6/15/2006 | 12 to 16 | 12.25 | 533.19 | 41.33 | 4.87 |
| CRMS0618 | 6/15/2006 | 16 to 20 | 10.28 | 530.35 | 38.32 | 4.30 |
| CRMS0618 | 6/15/2006 | 20 to 24 | 10.25 | 415.71 | 34.72 | 4.02 |
| CRMS0618 | 6/15/2006 | 4 to 8 | 12.36 | 727.50 | 51.33 | 5.50 |
| CRMS0618 | 6/15/2006 | 8 to 12 | 12.97 | 589.16 | 45.75 | 5.23 |
| CRMS0619 | 1/21/2008 | 0 to 4 | 21.80 | 1116.80 | 86.88 | 0.40 |
| CRMS0619 | 1/21/2008 | 12 to 16 | 15.10 | 671.70 | 63.39 | 0.63 |
| CRMS0619 | 1/21/2008 | 16 to 20 | 19.20 | 649.80 | 77.12 | 0.73 |
| CRMS0619 | 1/21/2008 | 20 to 24 | 20.40 | 628.70 | 79.56 | 0.88 |

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|----------|------------|----------|-------|--------|-------|------|
| CRMS0619 | 1/21/2008 | 4 to 8 | 21.10 | 854.10 | 74.33 | 0.47 |
| CRMS0619 | 1/21/2008 | 8 to 12 | 16.20 | 704.50 | 67.30 | 0.57 |
| CRMS0622 | 10/10/2007 | 0 to 4 | 6.78 | 575.63 | 26.38 | 0.57 |
| CRMS0622 | 10/10/2007 | 12 to 16 | 4.69 | 422.39 | 15.37 | 1.07 |
| CRMS0622 | 10/10/2007 | 16 to 20 | 4.07 | 383.00 | 12.71 | 1.23 |
| CRMS0622 | 10/10/2007 | 20 to 24 | 3.24 | 298.66 | 10.73 | 1.45 |
| CRMS0622 | 10/10/2007 | 4 to 8 | 7.69 | 597.83 | 28.33 | 0.83 |
| CRMS0622 | 10/10/2007 | 8 to 12 | 6.35 | 559.54 | 21.92 | 1.03 |
| CRMS0626 | 1/5/2007 | 0 to 4 | 15.14 | 744.46 | 35.18 | 0.83 |
| CRMS0626 | 1/5/2007 | 12 to 16 | 6.12 | 676.74 | 21.92 | 1.87 |
| CRMS0626 | 1/5/2007 | 16 to 20 | 10.75 | 602.36 | 25.31 | 1.77 |
| CRMS0626 | 1/5/2007 | 20 to 24 | 8.42 | 466.88 | 18.67 | 1.68 |
| CRMS0626 | 1/5/2007 | 4 to 8 | 6.61 | 454.55 | 21.96 | 1.53 |
| CRMS0626 | 1/5/2007 | 8 to 12 | 8.62 | 589.77 | 28.79 | 2.37 |
| CRMS0635 | 2/28/2007 | 0 to 4 | 17.11 | 760.62 | 65.04 | 1.40 |
| CRMS0635 | 2/28/2007 | 12 to 16 | 13.16 | 533.58 | 50.58 | 2.15 |
| CRMS0635 | 2/28/2007 | 16 to 20 | 13.70 | 470.19 | 52.19 | 2.52 |
| CRMS0635 | 2/28/2007 | 20 to 24 | 13.96 | 551.43 | 50.22 | 2.88 |
| CRMS0635 | 2/28/2007 | 4 to 8 | 16.01 | 625.51 | 62.01 | 1.63 |
| CRMS0635 | 2/28/2007 | 8 to 12 | 14.10 | 607.59 | 55.54 | 1.80 |
| CRMS0641 | 6/1/2006 | 0 to 4 | 11.98 | 555.36 | 44.32 | 8.93 |
| CRMS0641 | 6/1/2006 | 12 to 16 | 12.22 | 476.09 | 46.58 | 4.10 |
| CRMS0641 | 6/1/2006 | 16 to 20 | 13.03 | 476.53 | 43.91 | 3.92 |
| CRMS0641 | 6/1/2006 | 20 to 24 | 13.25 | 447.78 | 44.44 | 3.55 |
| CRMS0641 | 6/1/2006 | 4 to 8 | 12.77 | 581.93 | 48.54 | 6.23 |
| CRMS0641 | 6/1/2006 | 8 to 12 | 12.70 | 511.58 | 47.39 | 4.77 |
| CRMS0644 | 4/29/2008 | 0 to 4 | 7.20 | 462.81 | 21.90 | 5.95 |
| CRMS0644 | 4/29/2008 | 12 to 16 | 13.35 | 504.57 | 52.37 | 6.42 |
| CRMS0644 | 4/29/2008 | 16 to 20 | 12.17 | 493.02 | 43.68 | 5.47 |
| CRMS0644 | 4/29/2008 | 20 to 24 | 8.78 | 352.50 | 29.46 | 5.53 |
| CRMS0644 | 4/29/2008 | 4 to 8 | 6.09 | 429.09 | 28.62 | 6.37 |
| CRMS0644 | 4/29/2008 | 8 to 12 | 9.76 | 470.22 | 38.64 | 6.10 |
| CRMS0650 | 11/9/2007 | 0 to 4 | 14.98 | 864.55 | 62.27 | 1.63 |
| CRMS0650 | 11/9/2007 | 12 to 16 | 13.54 | 582.76 | 53.69 | 2.28 |
| CRMS0650 | 11/9/2007 | 16 to 20 | 11.21 | 688.89 | 48.17 | 2.48 |
| CRMS0650 | 11/9/2007 | 20 to 24 | 11.66 | 559.72 | 47.43 | 2.90 |
| CRMS0650 | 11/9/2007 | 4 to 8 | 14.03 | 682.62 | 57.11 | 1.85 |
| CRMS0650 | 11/9/2007 | 8 to 12 | 14.96 | 617.69 | 62.53 | 2.07 |
| CRMS0651 | 3/30/2007 | 0 to 4 | 12.22 | 608.04 | 50.40 | 2.30 |
| CRMS0651 | 3/30/2007 | 12 to 16 | 9.01 | 404.91 | 30.56 | 2.42 |
| CRMS0651 | 3/30/2007 | 16 to 20 | 7.88 | 350.30 | 26.83 | 2.67 |
| CRMS0651 | 3/30/2007 | 20 to 24 | 6.43 | 244.87 | 20.67 | 2.63 |
| CRMS0651 | 3/30/2007 | 4 to 8 | 11.39 | 584.09 | 44.21 | 2.10 |

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|----------|------------|----------|-------|--------|-------|-------|
| CRMS0651 | 3/30/2007 | 8 to 12 | 10.10 | 518.84 | 37.50 | 2.47 |
| CRMS0662 | 4/23/2009 | 0 to 4 | 12.64 | 630.58 | 38.16 | 2.07 |
| CRMS0662 | 4/23/2009 | 12 to 16 | 14.65 | 575.57 | 48.66 | 2.75 |
| CRMS0662 | 4/23/2009 | 16 to 20 | 13.83 | 586.06 | 42.68 | 2.97 |
| CRMS0662 | 4/23/2009 | 20 to 24 | 14.04 | 503.26 | 38.78 | 2.98 |
| CRMS0662 | 4/23/2009 | 4 to 8 | 13.79 | 719.64 | 47.90 | 2.23 |
| CRMS0662 | 4/23/2009 | 8 to 12 | 13.97 | 668.39 | 52.57 | 2.52 |
| CRMS0669 | 5/10/2006 | 0 to 4 | 16.85 | 684.43 | 58.49 | 10.87 |
| CRMS0669 | 5/10/2006 | 12 to 16 | 17.52 | 621.53 | 58.69 | 6.03 |
| CRMS0669 | 5/10/2006 | 16 to 20 | 17.11 | 577.91 | 54.31 | 5.35 |
| CRMS0669 | 5/10/2006 | 20 to 24 | 14.96 | 489.33 | 47.74 | 4.77 |
| CRMS0669 | 5/10/2006 | 4 to 8 | 12.18 | 585.68 | 52.78 | 6.92 |
| CRMS0669 | 5/10/2006 | 8 to 12 | 11.67 | 577.07 | 51.20 | 6.28 |
| CRMS0672 | 5/24/2006 | 0 to 4 | 6.97 | 549.00 | 21.72 | 8.10 |
| CRMS0672 | 5/24/2006 | 12 to 16 | 7.07 | 474.00 | 29.13 | 4.55 |
| CRMS0672 | 5/24/2006 | 16 to 20 | 8.37 | 467.67 | 27.48 | 4.47 |
| CRMS0672 | 5/24/2006 | 20 to 24 | 5.27 | 407.00 | 20.19 | 3.77 |
| CRMS0672 | 5/24/2006 | 4 to 8 | 5.43 | 521.33 | 25.30 | 7.35 |
| CRMS0672 | 5/24/2006 | 8 to 12 | 5.70 | 483.67 | 30.68 | 6.08 |
| CRMS0682 | 11/19/2007 | 0 to 4 | 9.05 | 670.07 | 29.60 | 1.02 |
| CRMS0682 | 11/19/2007 | 12 to 16 | 7.54 | 498.02 | 36.67 | 1.63 |
| CRMS0682 | 11/19/2007 | 16 to 20 | 6.41 | 403.78 | 31.29 | 1.73 |
| CRMS0682 | 11/19/2007 | 20 to 24 | 5.14 | 308.84 | 23.20 | 1.63 |
| CRMS0682 | 11/19/2007 | 4 to 8 | 5.07 | 517.07 | 22.19 | 1.22 |
| CRMS0682 | 11/19/2007 | 8 to 12 | 8.70 | 580.98 | 40.38 | 1.53 |
| CRMS0685 | 5/9/2006 | 0 to 4 | 5.13 | 594.09 | 18.04 | 6.87 |
| CRMS0685 | 5/9/2006 | 12 to 16 | 3.50 | 382.00 | 21.68 | 8.83 |
| CRMS0685 | 5/9/2006 | 16 to 20 | 4.12 | 350.60 | 21.63 | 8.95 |
| CRMS0685 | 5/9/2006 | 20 to 24 | 3.70 | 339.24 | 20.31 | 8.72 |
| CRMS0685 | 5/9/2006 | 4 to 8 | 3.26 | 483.05 | 11.60 | 7.00 |
| CRMS0685 | 5/9/2006 | 8 to 12 | 2.42 | 390.37 | 14.68 | 7.65 |
| CRMS0691 | 5/19/2011 | 0 to 16 | 23.56 | 954.62 | 69.87 | 2.27 |
| CRMS1130 | 3/5/2008 | 0 to 4 | 18.20 | 812.74 | 49.70 | 0.43 |
| CRMS1130 | 3/5/2008 | 12 to 16 | 10.52 | 477.63 | 31.30 | 0.63 |
| CRMS1130 | 3/5/2008 | 16 to 20 | 11.26 | 500.31 | 38.56 | 0.75 |
| CRMS1130 | 3/5/2008 | 20 to 24 | 14.90 | 591.18 | 40.96 | 0.90 |
| CRMS1130 | 3/5/2008 | 4 to 8 | 13.60 | 569.39 | 47.07 | 0.40 |
| CRMS1130 | 3/5/2008 | 8 to 12 | 13.87 | 567.09 | 40.37 | 0.50 |
| CRMS1205 | 1/13/2009 | 0 to 4 | 13.37 | 637.72 | 48.11 | 3.43 |
| CRMS1205 | 1/13/2009 | 12 to 16 | 12.73 | 573.37 | 46.96 | 4.75 |
| CRMS1205 | 1/13/2009 | 16 to 20 | 13.61 | 535.31 | 54.42 | 5.00 |
| CRMS1205 | 1/13/2009 | 20 to 24 | 16.20 | 591.47 | 63.12 | 5.20 |
| CRMS1205 | 1/13/2009 | 4 to 8 | 13.07 | 657.32 | 45.81 | 4.00 |

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|----------|------------|----------|-------|---------|-------|------|
| CRMS1205 | 1/13/2009 | 8 to 12 | 12.52 | 592.56 | 43.11 | 4.27 |
| CRMS1413 | 5/23/2006 | 0 to 4 | 18.64 | 851.41 | 55.99 | 5.97 |
| CRMS1413 | 5/23/2006 | 12 to 16 | 20.30 | 569.60 | 60.08 | 3.62 |
| CRMS1413 | 5/23/2006 | 16 to 20 | 26.09 | 566.00 | 69.27 | 3.72 |
| CRMS1413 | 5/23/2006 | 20 to 24 | 20.99 | 478.71 | 61.54 | 3.97 |
| CRMS1413 | 5/23/2006 | 4 to 8 | 16.34 | 775.88 | 60.18 | 3.85 |
| CRMS1413 | 5/23/2006 | 8 to 12 | 14.84 | 596.88 | 54.67 | 3.62 |
| CRMS1738 | 10/21/2008 | 0 to 4 | 12.25 | 530.72 | 37.39 | 6.12 |
| CRMS1738 | 10/21/2008 | 12 to 16 | 9.50 | 400.46 | 34.47 | 6.67 |
| CRMS1738 | 10/21/2008 | 16 to 20 | 12.13 | 562.03 | 42.13 | 6.43 |
| CRMS1738 | 10/21/2008 | 20 to 24 | 11.80 | 519.31 | 40.18 | 6.57 |
| CRMS1738 | 10/21/2008 | 4 to 8 | 8.16 | 502.10 | 31.00 | 6.98 |
| CRMS1738 | 10/21/2008 | 8 to 12 | 10.02 | 432.57 | 31.70 | 6.88 |
| CRMS1858 | 3/7/2007 | 0 to 4 | 9.88 | 595.83 | 33.04 | 2.22 |
| CRMS1858 | 3/7/2007 | 12 to 16 | 9.04 | 437.84 | 38.23 | 3.10 |
| CRMS1858 | 3/7/2007 | 16 to 20 | 9.58 | 460.34 | 42.12 | 3.20 |
| CRMS1858 | 3/7/2007 | 20 to 24 | 9.21 | 513.42 | 35.70 | 3.43 |
| CRMS1858 | 3/7/2007 | 4 to 8 | 6.12 | 559.88 | 21.65 | 2.40 |
| CRMS1858 | 3/7/2007 | 8 to 12 | 5.15 | 463.00 | 24.36 | 2.77 |
| CRMS1965 | 4/9/2012 | 0 to 4 | 18.90 | 1009.89 | 53.00 | 1.83 |
| CRMS1965 | 4/9/2012 | 12 to 16 | 13.28 | 554.28 | 46.71 | 2.63 |
| CRMS1965 | 4/9/2012 | 16 to 20 | 14.67 | 608.33 | 51.79 | 3.05 |
| CRMS1965 | 4/9/2012 | 20 to 24 | 16.56 | 636.69 | 51.42 | 3.23 |
| CRMS1965 | 4/9/2012 | 4 to 8 | 14.79 | 739.32 | 44.64 | 2.02 |
| CRMS1965 | 4/9/2012 | 8 to 12 | 11.17 | 612.08 | 40.03 | 2.37 |
| CRMS2156 | 5/10/2006 | 0 to 4 | 11.96 | 568.33 | 54.07 | 3.72 |
| CRMS2156 | 5/10/2006 | 12 to 16 | 12.59 | 443.00 | 60.29 | 4.15 |
| CRMS2156 | 5/10/2006 | 16 to 20 | 15.54 | 510.00 | 60.12 | 3.92 |
| CRMS2156 | 5/10/2006 | 20 to 24 | 13.27 | 532.67 | 54.34 | 4.00 |
| CRMS2156 | 5/10/2006 | 4 to 8 | 10.77 | 513.67 | 54.61 | 3.80 |
| CRMS2156 | 5/10/2006 | 8 to 12 | 10.51 | 431.67 | 55.03 | 3.93 |
| CRMS2189 | 3/9/2007 | 0 to 4 | 8.59 | 642.16 | 35.02 | 0.97 |
| CRMS2189 | 3/9/2007 | 12 to 16 | 10.14 | 426.66 | 49.92 | 2.17 |
| CRMS2189 | 3/9/2007 | 16 to 20 | 9.51 | 416.96 | 42.29 | 2.72 |
| CRMS2189 | 3/9/2007 | 20 to 24 | 7.68 | 371.50 | 32.15 | 2.87 |
| CRMS2189 | 3/9/2007 | 4 to 8 | 6.39 | 532.07 | 39.70 | 1.28 |
| CRMS2189 | 3/9/2007 | 8 to 12 | 7.27 | 436.77 | 42.26 | 1.87 |
| CRMS2219 | 2/24/2009 | 0 to 4 | 6.55 | 628.86 | 20.59 | 5.07 |
| CRMS2219 | 2/24/2009 | 12 to 16 | 5.93 | 521.05 | 22.92 | 5.58 |
| CRMS2219 | 2/24/2009 | 16 to 20 | 4.65 | 366.06 | 18.59 | 4.95 |
| CRMS2219 | 2/24/2009 | 20 to 24 | 2.84 | 309.03 | 12.95 | 5.33 |
| CRMS2219 | 2/24/2009 | 4 to 8 | 5.15 | 463.79 | 21.17 | 5.67 |
| CRMS2219 | 2/24/2009 | 8 to 12 | 4.69 | 467.22 | 23.98 | 6.33 |

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|----------|-----------|----------|-------|---------|-------|------|
| CRMS2334 | 6/1/2006 | 0 to 4 | 13.84 | 604.22 | 49.76 | 4.00 |
| CRMS2334 | 6/1/2006 | 12 to 16 | 14.50 | 567.75 | 55.51 | 3.75 |
| CRMS2334 | 6/1/2006 | 16 to 20 | 15.63 | 548.43 | 60.02 | 4.12 |
| CRMS2334 | 6/1/2006 | 20 to 24 | 14.35 | 485.42 | 54.63 | 4.27 |
| CRMS2334 | 6/1/2006 | 4 to 8 | 13.21 | 590.94 | 46.26 | 3.60 |
| CRMS2334 | 6/1/2006 | 8 to 12 | 12.62 | 578.56 | 50.25 | 3.33 |
| CRMS2418 | 11/7/2007 | 0 to 4 | 16.97 | 673.12 | 41.99 | 4.23 |
| CRMS2418 | 11/7/2007 | 12 to 16 | 11.95 | 537.31 | 46.99 | 5.17 |
| CRMS2418 | 11/7/2007 | 16 to 20 | 13.03 | 567.01 | 43.15 | 5.12 |
| CRMS2418 | 11/7/2007 | 20 to 24 | 16.37 | 469.93 | 40.04 | 5.05 |
| CRMS2418 | 11/7/2007 | 4 to 8 | 15.34 | 630.97 | 35.78 | 4.33 |
| CRMS2418 | 11/7/2007 | 8 to 12 | 12.90 | 499.87 | 40.96 | 5.00 |
| CRMS2568 | 6/7/2007 | 0 to 4 | 14.86 | 607.05 | 35.38 | 0.27 |
| CRMS2568 | 6/7/2007 | 0 to 4 | 14.86 | 607.05 | 35.38 | 0.27 |
| CRMS2568 | 6/7/2007 | 12 to 16 | 9.32 | 649.20 | 24.14 | 0.10 |
| CRMS2568 | 6/7/2007 | 12 to 16 | 9.32 | 649.20 | 24.14 | 0.10 |
| CRMS2568 | 6/7/2007 | 16 to 20 | 10.04 | 510.83 | 24.10 | 0.10 |
| CRMS2568 | 6/7/2007 | 16 to 20 | 10.04 | 510.83 | 24.10 | 0.10 |
| CRMS2568 | 6/7/2007 | 20 to 24 | 8.00 | 432.84 | 20.06 | 0.10 |
| CRMS2568 | 6/7/2007 | 20 to 24 | 8.00 | 432.84 | 20.06 | 0.10 |
| CRMS2568 | 6/7/2007 | 4 to 8 | 15.90 | 948.11 | 35.27 | 0.13 |
| CRMS2568 | 6/7/2007 | 4 to 8 | 15.90 | 948.11 | 35.27 | 0.13 |
| CRMS2568 | 6/7/2007 | 8 to 12 | 11.24 | 679.86 | 26.69 | 0.10 |
| CRMS2568 | 6/7/2007 | 8 to 12 | 11.24 | 679.86 | 26.69 | 0.10 |
| CRMS2608 | 7/10/2009 | 0 to 4 | 3.95 | 644.21 | 11.70 | 0.10 |
| CRMS2608 | 7/10/2009 | 12 to 16 | 2.51 | 667.02 | 7.25 | 0.10 |
| CRMS2608 | 7/10/2009 | 16 to 20 | 2.26 | 689.48 | 7.30 | 0.10 |
| CRMS2608 | 7/10/2009 | 20 to 24 | 1.94 | 680.53 | 6.08 | 0.20 |
| CRMS2608 | 7/10/2009 | 4 to 8 | 3.52 | 656.13 | 10.63 | 0.10 |
| CRMS2608 | 7/10/2009 | 8 to 12 | 2.81 | 717.46 | 8.37 | 0.10 |
| CRMS2614 | 6/26/2007 | 0 to 4 | 8.07 | 1130.26 | 20.83 | 0.23 |
| CRMS2614 | 6/26/2007 | 12 to 16 | 3.49 | 482.99 | 12.33 | 0.23 |
| CRMS2614 | 6/26/2007 | 16 to 20 | 3.06 | 459.70 | 10.38 | 0.30 |
| CRMS2614 | 6/26/2007 | 20 to 24 | 2.88 | 543.69 | 10.27 | 0.33 |
| CRMS2614 | 6/26/2007 | 4 to 8 | 6.35 | 643.48 | 16.76 | 0.15 |
| CRMS2614 | 6/26/2007 | 8 to 12 | 4.31 | 580.52 | 13.99 | 0.13 |
| CRMS2785 | 3/19/2007 | 0 to 4 | 12.73 | 907.43 | 61.34 | 0.37 |
| CRMS2785 | 3/19/2007 | 12 to 16 | 7.60 | 438.73 | 58.55 | 0.67 |
| CRMS2785 | 3/19/2007 | 16 to 20 | 9.33 | 461.55 | 56.96 | 0.80 |
| CRMS2785 | 3/19/2007 | 20 to 24 | 10.24 | 485.29 | 64.73 | 0.80 |
| CRMS2785 | 3/19/2007 | 4 to 8 | 11.68 | 776.73 | 59.78 | 0.40 |
| CRMS2785 | 3/19/2007 | 8 to 12 | 10.12 | 650.15 | 59.32 | 0.53 |
| CRMS2825 | 5/2/2008 | 0 to 4 | 14.46 | 749.37 | 46.75 | 2.17 |

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|----------|-----------|----------|-------|---------|-------|------|
| CRMS2825 | 5/2/2008 | 12 to 16 | 19.38 | 590.94 | 62.84 | 2.53 |
| CRMS2825 | 5/2/2008 | 16 to 20 | 21.17 | 671.04 | 68.84 | 2.85 |
| CRMS2825 | 5/2/2008 | 20 to 24 | 24.49 | 605.96 | 72.81 | 2.53 |
| CRMS2825 | 5/2/2008 | 4 to 8 | 13.50 | 523.39 | 40.89 | 2.05 |
| CRMS2825 | 5/2/2008 | 8 to 12 | 16.43 | 536.25 | 52.59 | 2.28 |
| CRMS3054 | 6/4/2008 | 0 to 4 | 17.70 | 1069.97 | 47.14 | 0.20 |
| CRMS3054 | 6/4/2008 | 12 to 16 | 20.88 | 707.63 | 54.46 | 0.30 |
| CRMS3054 | 6/4/2008 | 16 to 20 | 26.40 | 1047.41 | 52.95 | 0.27 |
| CRMS3054 | 6/4/2008 | 20 to 24 | 24.54 | 843.87 | 46.93 | 0.30 |
| CRMS3054 | 6/4/2008 | 4 to 8 | 17.09 | 945.17 | 41.84 | 0.17 |
| CRMS3054 | 6/4/2008 | 8 to 12 | 17.56 | 642.31 | 47.29 | 0.20 |
| CRMS3166 | 6/5/2008 | 0 to 4 | 23.36 | 1797.85 | 67.37 | 0.23 |
| CRMS3166 | 6/5/2008 | 12 to 16 | 28.08 | 835.88 | 81.49 | 0.20 |
| CRMS3166 | 6/5/2008 | 16 to 20 | 28.81 | 605.70 | 83.81 | 0.20 |
| CRMS3166 | 6/5/2008 | 20 to 24 | 29.83 | 571.65 | 85.30 | 0.20 |
| CRMS3166 | 6/5/2008 | 4 to 8 | 17.61 | 853.21 | 63.34 | 0.27 |
| CRMS3166 | 6/5/2008 | 8 to 12 | 20.77 | 833.59 | 68.73 | 0.20 |
| CRMS3169 | 6/5/2008 | 0 to 4 | 11.35 | 1281.87 | 31.62 | 0.20 |
| CRMS3169 | 6/5/2008 | 12 to 16 | 3.25 | 1032.23 | 27.02 | 0.20 |
| CRMS3169 | 6/5/2008 | 16 to 20 | 6.26 | 569.74 | 37.26 | 0.30 |
| CRMS3169 | 6/5/2008 | 20 to 24 | 9.00 | 568.67 | 42.30 | 0.20 |
| CRMS3169 | 6/5/2008 | 4 to 8 | 6.54 | 853.95 | 25.97 | 0.20 |
| CRMS3169 | 6/5/2008 | 8 to 12 | 4.19 | 1110.75 | 21.49 | 0.17 |
| CRMS3296 | 5/17/2007 | 0 to 4 | 6.95 | 467.40 | 29.88 | 4.82 |
| CRMS3296 | 5/17/2007 | 12 to 16 | 2.31 | 347.77 | 25.28 | 6.13 |
| CRMS3296 | 5/17/2007 | 16 to 20 | 3.86 | 399.82 | 29.35 | 5.68 |
| CRMS3296 | 5/17/2007 | 20 to 24 | 10.32 | 485.29 | 41.94 | 5.83 |
| CRMS3296 | 5/17/2007 | 4 to 8 | 5.94 | 409.84 | 30.91 | 5.60 |
| CRMS3296 | 5/17/2007 | 8 to 12 | 4.09 | 314.80 | 28.83 | 5.60 |
| CRMS3565 | 6/13/2006 | 0 to 4 | 6.52 | 512.77 | 30.30 | 5.40 |
| CRMS3565 | 6/13/2006 | 12 to 16 | 6.57 | 496.05 | 36.13 | 4.83 |
| CRMS3565 | 6/13/2006 | 16 to 20 | 7.79 | 422.24 | 31.76 | 4.62 |
| CRMS3565 | 6/13/2006 | 20 to 24 | 7.02 | 455.17 | 38.30 | 4.40 |
| CRMS3565 | 6/13/2006 | 4 to 8 | 3.79 | 421.14 | 29.92 | 5.28 |
| CRMS3565 | 6/13/2006 | 8 to 12 | 3.64 | 407.35 | 31.54 | 5.07 |
| CRMS3617 | 9/12/2007 | 0 to 4 | 11.15 | 669.17 | 27.40 | 2.90 |
| CRMS3617 | 9/12/2007 | 12 to 16 | 9.34 | 491.74 | 36.82 | 6.33 |
| CRMS3617 | 9/12/2007 | 16 to 20 | 9.65 | 510.20 | 40.15 | 6.30 |
| CRMS3617 | 9/12/2007 | 20 to 24 | 9.34 | 449.50 | 31.77 | 6.20 |
| CRMS3617 | 9/12/2007 | 4 to 8 | 9.94 | 687.97 | 22.83 | 4.07 |
| CRMS3617 | 9/12/2007 | 8 to 12 | 9.78 | 512.98 | 29.21 | 4.78 |
| CRMS3641 | 6/2/2008 | 0 to 4 | 17.30 | 820.51 | 49.85 | 0.72 |
| CRMS3641 | 6/2/2008 | 12 to 16 | 13.71 | 649.02 | 47.93 | 0.73 |

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|----------|-----------|----------|-------|---------|-------|------|
| CRMS3641 | 6/2/2008 | 16 to 20 | 17.08 | 681.43 | 51.88 | 0.87 |
| CRMS3641 | 6/2/2008 | 20 to 24 | 15.63 | 631.64 | 46.33 | 1.00 |
| CRMS3641 | 6/2/2008 | 4 to 8 | 13.54 | 665.77 | 40.18 | 0.63 |
| CRMS3641 | 6/2/2008 | 8 to 12 | 12.36 | 617.00 | 41.02 | 0.68 |
| CRMS3650 | 6/10/2008 | 0 to 4 | 7.37 | 931.36 | 22.24 | 1.33 |
| CRMS3650 | 6/10/2008 | 12 to 16 | 2.96 | 709.50 | 11.10 | 1.52 |
| CRMS3650 | 6/10/2008 | 16 to 20 | 3.59 | 513.03 | 15.07 | 1.70 |
| CRMS3650 | 6/10/2008 | 20 to 24 | 6.22 | 1008.34 | 18.60 | 1.80 |
| CRMS3650 | 6/10/2008 | 4 to 8 | 5.36 | 747.69 | 20.00 | 1.27 |
| CRMS3650 | 6/10/2008 | 8 to 12 | 4.29 | 916.32 | 14.10 | 1.40 |
| CRMS3667 | 6/20/2008 | 0 to 4 | 7.93 | 662.74 | 36.20 | 1.97 |
| CRMS3667 | 6/20/2008 | 12 to 16 | 8.03 | 468.39 | 37.01 | 1.80 |
| CRMS3667 | 6/20/2008 | 16 to 20 | 10.77 | 528.82 | 41.42 | 1.73 |
| CRMS3667 | 6/20/2008 | 20 to 24 | 11.75 | 525.89 | 45.19 | 1.90 |
| CRMS3667 | 6/20/2008 | 4 to 8 | 6.45 | 514.34 | 29.70 | 1.70 |
| CRMS3667 | 6/20/2008 | 8 to 12 | 6.55 | 428.46 | 32.60 | 1.67 |
| CRMS3784 | 6/19/2008 | 0 to 4 | 6.41 | 539.68 | 20.46 | 1.13 |
| CRMS3784 | 6/19/2008 | 12 to 16 | 2.81 | 395.24 | 19.33 | 1.57 |
| CRMS3784 | 6/19/2008 | 16 to 20 | 3.88 | 395.66 | 21.93 | 1.67 |
| CRMS3784 | 6/19/2008 | 20 to 24 | 4.86 | 395.29 | 26.17 | 1.73 |
| CRMS3784 | 6/19/2008 | 4 to 8 | 4.25 | 536.91 | 14.29 | 1.08 |
| CRMS3784 | 6/19/2008 | 8 to 12 | 2.98 | 385.86 | 17.55 | 1.37 |
| CRMS3913 | 9/29/2008 | 0 to 4 | 19.92 | 1018.86 | 63.13 | 0.77 |
| CRMS3913 | 9/29/2008 | 12 to 16 | 24.80 | 773.95 | 67.39 | 0.87 |
| CRMS3913 | 9/29/2008 | 16 to 20 | 24.41 | 761.54 | 67.51 | 0.90 |
| CRMS3913 | 9/29/2008 | 20 to 24 | 26.57 | 747.02 | 69.25 | 0.98 |
| CRMS3913 | 9/29/2008 | 4 to 8 | 21.53 | 856.18 | 61.86 | 0.80 |
| CRMS3913 | 9/29/2008 | 8 to 12 | 22.64 | 838.77 | 61.80 | 0.83 |
| CRMS3985 | 6/6/2008 | 0 to 4 | 25.03 | 1203.24 | 68.49 | 0.30 |
| CRMS3985 | 6/6/2008 | 12 to 16 | 20.25 | 768.02 | 57.35 | 0.62 |
| CRMS3985 | 6/6/2008 | 16 to 20 | 24.24 | 756.68 | 58.94 | 0.77 |
| CRMS3985 | 6/6/2008 | 20 to 24 | 18.27 | 617.29 | 48.75 | 0.80 |
| CRMS3985 | 6/6/2008 | 4 to 8 | 22.83 | 928.26 | 68.10 | 0.40 |
| CRMS3985 | 6/6/2008 | 8 to 12 | 20.05 | 905.42 | 66.58 | 0.53 |
| CRMS4014 | 6/6/2007 | 0 to 4 | 12.83 | 988.77 | 36.14 | 0.12 |
| CRMS4014 | 6/6/2007 | 0 to 4 | 12.83 | 988.77 | 36.14 | 0.12 |
| CRMS4014 | 6/6/2007 | 12 to 16 | 6.35 | 500.30 | 21.72 | 0.20 |
| CRMS4014 | 6/6/2007 | 12 to 16 | 6.35 | 500.30 | 21.72 | 0.20 |
| CRMS4014 | 6/6/2007 | 16 to 20 | 6.48 | 540.24 | 20.49 | 0.17 |
| CRMS4014 | 6/6/2007 | 16 to 20 | 6.48 | 540.24 | 20.49 | 0.17 |
| CRMS4014 | 6/6/2007 | 20 to 24 | 7.45 | 541.53 | 23.51 | 0.17 |
| CRMS4014 | 6/6/2007 | 20 to 24 | 7.45 | 541.53 | 23.51 | 0.17 |
| CRMS4014 | 6/6/2007 | 4 to 8 | 11.36 | 815.25 | 32.86 | 0.13 |

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|----------|-----------|----------|-------|---------|-------|------|
| CRMS4014 | 6/6/2007 | 4 to 8 | 11.36 | 815.25 | 32.86 | 0.13 |
| CRMS4014 | 6/6/2007 | 8 to 12 | 7.64 | 628.01 | 27.76 | 0.17 |
| CRMS4014 | 6/6/2007 | 8 to 12 | 7.64 | 628.01 | 27.76 | 0.17 |
| CRMS4016 | 6/7/2007 | 0 to 4 | 13.86 | 1476.02 | 35.61 | 0.13 |
| CRMS4016 | 6/7/2007 | 0 to 4 | 13.86 | 1476.02 | 35.61 | 0.13 |
| CRMS4016 | 6/7/2007 | 12 to 16 | 12.01 | 615.93 | 29.26 | 0.13 |
| CRMS4016 | 6/7/2007 | 12 to 16 | 12.01 | 615.93 | 29.26 | 0.13 |
| CRMS4016 | 6/7/2007 | 16 to 20 | 10.69 | 543.02 | 24.07 | 0.10 |
| CRMS4016 | 6/7/2007 | 16 to 20 | 10.69 | 543.02 | 24.07 | 0.10 |
| CRMS4016 | 6/7/2007 | 20 to 24 | 11.71 | 497.05 | 28.49 | 0.17 |
| CRMS4016 | 6/7/2007 | 20 to 24 | 11.71 | 497.05 | 28.49 | 0.17 |
| CRMS4016 | 6/7/2007 | 4 to 8 | 13.65 | 1064.63 | 34.42 | 0.10 |
| CRMS4016 | 6/7/2007 | 4 to 8 | 13.65 | 1064.63 | 34.42 | 0.10 |
| CRMS4016 | 6/7/2007 | 8 to 12 | 14.77 | 785.97 | 37.17 | 0.10 |
| CRMS4016 | 6/7/2007 | 8 to 12 | 14.77 | 785.97 | 37.17 | 0.10 |
| CRMS4045 | 5/23/2008 | 0 to 4 | 25.79 | 1757.28 | 56.75 | 0.35 |
| CRMS4045 | 5/23/2008 | 12 to 16 | 15.13 | 656.45 | 51.89 | 1.20 |
| CRMS4045 | 5/23/2008 | 16 to 20 | 15.67 | 586.16 | 39.79 | 1.32 |
| CRMS4045 | 5/23/2008 | 20 to 24 | 18.08 | 610.27 | 41.34 | 1.37 |
| CRMS4045 | 5/23/2008 | 4 to 8 | 19.23 | 1101.64 | 50.93 | 0.70 |
| CRMS4045 | 5/23/2008 | 8 to 12 | 17.86 | 811.39 | 54.29 | 1.07 |
| CRMS4094 | 12/3/2008 | 0 to 4 | 14.92 | 997.90 | 46.18 | 1.67 |
| CRMS4094 | 12/3/2008 | 12 to 16 | 14.43 | 606.04 | 41.16 | 1.22 |
| CRMS4094 | 12/3/2008 | 16 to 20 | 13.97 | 599.68 | 35.63 | 1.07 |
| CRMS4094 | 12/3/2008 | 20 to 24 | 12.76 | 564.25 | 31.03 | 0.98 |
| CRMS4094 | 12/3/2008 | 4 to 8 | 12.74 | 792.81 | 41.48 | 1.53 |
| CRMS4094 | 12/3/2008 | 8 to 12 | 12.81 | 551.40 | 39.37 | 1.37 |
| CRMS4218 | 6/4/2008 | 0 to 4 | 11.08 | 666.06 | 37.48 | 0.43 |
| CRMS4218 | 6/4/2008 | 12 to 16 | 7.74 | 486.74 | 34.56 | 0.62 |
| CRMS4218 | 6/4/2008 | 16 to 20 | 10.77 | 508.43 | 41.28 | 0.67 |
| CRMS4218 | 6/4/2008 | 20 to 24 | 10.88 | 502.76 | 42.66 | 0.73 |
| CRMS4218 | 6/4/2008 | 4 to 8 | 10.12 | 834.12 | 35.96 | 0.52 |
| CRMS4218 | 6/4/2008 | 8 to 12 | 7.32 | 485.19 | 34.24 | 0.48 |
| CRMS4245 | 6/6/2008 | 0 to 4 | 14.22 | 647.17 | 39.12 | 0.20 |
| CRMS4245 | 6/6/2008 | 12 to 16 | 6.13 | 375.39 | 29.54 | 0.37 |
| CRMS4245 | 6/6/2008 | 16 to 20 | 10.31 | 436.55 | 34.91 | 0.43 |
| CRMS4245 | 6/6/2008 | 20 to 24 | 12.75 | 499.08 | 38.11 | 0.43 |
| CRMS4245 | 6/6/2008 | 4 to 8 | 8.32 | 440.79 | 34.76 | 0.27 |
| CRMS4245 | 6/6/2008 | 8 to 12 | 8.89 | 480.13 | 36.07 | 0.30 |
| CRMS4448 | 6/25/2008 | 0 to 4 | 3.05 | 777.16 | 9.42 | 0.23 |
| CRMS4448 | 6/25/2008 | 0 to 4 | 3.05 | 777.16 | 9.42 | 0.23 |
| CRMS4448 | 6/25/2008 | 12 to 16 | 2.95 | 850.93 | 8.05 | 0.37 |
| CRMS4448 | 6/25/2008 | 12 to 16 | 2.95 | 850.93 | 8.05 | 0.37 |

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|----------|-----------|----------|-------|--------|-------|------|
| CRMS4448 | 6/25/2008 | 16 to 20 | 2.51 | 737.97 | 7.25 | 0.40 |
| CRMS4448 | 6/25/2008 | 16 to 20 | 2.51 | 737.97 | 7.25 | 0.40 |
| CRMS4448 | 6/25/2008 | 20 to 24 | 2.08 | 746.61 | 7.04 | 0.43 |
| CRMS4448 | 6/25/2008 | 20 to 24 | 2.08 | 746.61 | 7.04 | 0.43 |
| CRMS4448 | 6/25/2008 | 4 to 8 | 6.75 | 749.48 | 8.55 | 0.23 |
| CRMS4448 | 6/25/2008 | 4 to 8 | 6.75 | 749.48 | 8.55 | 0.23 |
| CRMS4448 | 6/25/2008 | 8 to 12 | 2.83 | 770.31 | 8.22 | 0.27 |
| CRMS4448 | 6/25/2008 | 8 to 12 | 2.83 | 770.31 | 8.22 | 0.27 |
| CRMS4455 | 5/12/2006 | 0 to 4 | 6.44 | 541.60 | 23.64 | 8.07 |
| CRMS4455 | 5/12/2006 | 12 to 16 | 3.65 | 434.73 | 19.57 | 7.15 |
| CRMS4455 | 5/12/2006 | 16 to 20 | 2.89 | 441.72 | 18.83 | 6.85 |
| CRMS4455 | 5/12/2006 | 20 to 24 | 4.15 | 407.18 | 24.24 | 7.17 |
| CRMS4455 | 5/12/2006 | 4 to 8 | 4.13 | 357.42 | 19.07 | 7.47 |
| CRMS4455 | 5/12/2006 | 8 to 12 | 4.62 | 423.96 | 20.33 | 7.32 |
| CRMS4529 | 6/3/2008 | 0 to 4 | 6.22 | 556.41 | 19.95 | 1.87 |
| CRMS4529 | 6/3/2008 | 12 to 16 | 3.11 | 439.41 | 20.28 | 3.87 |
| CRMS4529 | 6/3/2008 | 16 to 20 | 4.14 | 458.04 | 19.71 | 4.03 |
| CRMS4529 | 6/3/2008 | 20 to 24 | 4.27 | 423.96 | 19.86 | 4.12 |
| CRMS4529 | 6/3/2008 | 4 to 8 | 4.84 | 502.03 | 20.93 | 2.60 |
| CRMS4529 | 6/3/2008 | 8 to 12 | 4.07 | 469.55 | 20.15 | 3.40 |
| CRMS4557 | 6/18/2008 | 0 to 4 | 10.53 | 748.49 | 31.40 | 4.15 |
| CRMS4557 | 6/18/2008 | 0 to 4 | 10.53 | 748.49 | 31.40 | 4.15 |
| CRMS4557 | 6/18/2008 | 12 to 16 | 7.75 | 445.86 | 33.39 | 4.33 |
| CRMS4557 | 6/18/2008 | 12 to 16 | 7.75 | 445.86 | 33.39 | 4.33 |
| CRMS4557 | 6/18/2008 | 16 to 20 | 9.85 | 445.33 | 39.59 | 4.63 |
| CRMS4557 | 6/18/2008 | 16 to 20 | 9.85 | 445.33 | 39.59 | 4.63 |
| CRMS4557 | 6/18/2008 | 20 to 24 | 10.46 | 557.77 | 42.14 | 4.67 |
| CRMS4557 | 6/18/2008 | 20 to 24 | 10.46 | 557.77 | 42.14 | 4.67 |
| CRMS4557 | 6/18/2008 | 4 to 8 | 7.70 | 447.07 | 31.26 | 4.13 |
| CRMS4557 | 6/18/2008 | 4 to 8 | 7.70 | 447.07 | 31.26 | 4.13 |
| CRMS4557 | 6/18/2008 | 8 to 12 | 6.66 | 416.82 | 31.27 | 4.13 |
| CRMS4557 | 6/18/2008 | 8 to 12 | 6.66 | 416.82 | 31.27 | 4.13 |
| CRMS4626 | 6/26/2007 | 0 to 4 | 2.68 | 925.19 | 10.27 | 1.12 |
| CRMS4626 | 6/26/2007 | 0 to 4 | 2.68 | 925.19 | 10.27 | 1.12 |
| CRMS4626 | 6/26/2007 | 12 to 16 | 2.54 | 748.48 | 9.40 | 1.03 |
| CRMS4626 | 6/26/2007 | 12 to 16 | 2.54 | 748.48 | 9.40 | 1.03 |
| CRMS4626 | 6/26/2007 | 16 to 20 | 1.90 | 778.35 | 8.74 | 1.53 |
| CRMS4626 | 6/26/2007 | 16 to 20 | 1.90 | 778.35 | 8.74 | 1.53 |
| CRMS4626 | 6/26/2007 | 20 to 24 | 1.52 | 741.00 | 7.50 | 1.57 |
| CRMS4626 | 6/26/2007 | 20 to 24 | 1.52 | 741.00 | 7.50 | 1.57 |
| CRMS4626 | 6/26/2007 | 4 to 8 | 2.11 | 714.28 | 8.98 | 0.97 |
| CRMS4626 | 6/26/2007 | 4 to 8 | 2.11 | 714.28 | 8.98 | 0.97 |
| CRMS4626 | 6/26/2007 | 8 to 12 | 3.04 | 758.22 | 10.92 | 1.03 |

| | | | | | | |
|----------|------------|----------|-------|--------|-------|------|
| CRMS4626 | 6/26/2007 | 8 to 12 | 3.04 | 758.22 | 10.92 | 1.03 |
| CRMS4690 | 6/6/2006 | 0 to 4 | 8.81 | 530.00 | 30.67 | 6.23 |
| CRMS4690 | 6/6/2006 | 0 to 4 | 8.81 | 530.00 | 30.67 | 6.23 |
| CRMS4690 | 6/6/2006 | 12 to 16 | 11.03 | 478.32 | 37.89 | 5.73 |
| CRMS4690 | 6/6/2006 | 12 to 16 | 11.03 | 478.32 | 37.89 | 5.73 |
| CRMS4690 | 6/6/2006 | 16 to 20 | 9.65 | 529.09 | 35.84 | 5.60 |
| CRMS4690 | 6/6/2006 | 16 to 20 | 9.65 | 529.09 | 35.84 | 5.60 |
| CRMS4690 | 6/6/2006 | 20 to 24 | 11.58 | 597.89 | 37.53 | 5.30 |
| CRMS4690 | 6/6/2006 | 20 to 24 | 11.58 | 597.89 | 37.53 | 5.30 |
| CRMS4690 | 6/6/2006 | 4 to 8 | 7.90 | 621.96 | 31.27 | 5.68 |
| CRMS4690 | 6/6/2006 | 4 to 8 | 7.90 | 621.96 | 31.27 | 5.68 |
| CRMS4690 | 6/6/2006 | 8 to 12 | 7.58 | 465.11 | 30.03 | 5.63 |
| CRMS4690 | 6/6/2006 | 8 to 12 | 7.58 | 465.11 | 30.03 | 5.63 |
| CRMS6301 | 11/10/2008 | 0 to 4 | 5.26 | 574.79 | 16.92 | 5.77 |
| CRMS6301 | 11/10/2008 | 0 to 4 | 5.26 | 574.79 | 16.92 | 5.77 |
| CRMS6301 | 11/10/2008 | 12 to 16 | 2.42 | 676.65 | 8.63 | 4.05 |
| CRMS6301 | 11/10/2008 | 12 to 16 | 2.42 | 676.65 | 8.63 | 4.05 |
| CRMS6301 | 11/10/2008 | 16 to 20 | 2.46 | 483.10 | 9.18 | 4.43 |
| CRMS6301 | 11/10/2008 | 16 to 20 | 2.46 | 483.10 | 9.18 | 4.43 |
| CRMS6301 | 11/10/2008 | 20 to 24 | 2.48 | 444.37 | 9.14 | 4.90 |
| CRMS6301 | 11/10/2008 | 20 to 24 | 2.48 | 444.37 | 9.14 | 4.90 |
| CRMS6301 | 11/10/2008 | 4 to 8 | 3.57 | 635.70 | 10.85 | 3.98 |
| CRMS6301 | 11/10/2008 | 4 to 8 | 3.57 | 635.70 | 10.85 | 3.98 |
| CRMS6301 | 11/10/2008 | 8 to 12 | 2.67 | 885.96 | 9.00 | 3.60 |
| CRMS6301 | 11/10/2008 | 8 to 12 | 2.67 | 885.96 | 9.00 | 3.60 |

Biographical Sketch

Rakib Hassan was born in Jhalakathi, Bangladesh. He graduated from the University of Dhaka in 2016 with a Bachelor of Science degree in soil, water, and environment, concentrating on soil and water, and in 2017 with a Master of Science degree in soil science. In Fall 2023, he entered the master's degree program in environmental resource science at UL Lafayette, accepting a position as a Graduate Teaching Assistant. He conducted research to evaluate the variations in total nitrogen, total phosphorus, and organic matter across marsh types and basins in coastal Louisiana and to compare these soil properties between restored and natural marshes while assessing the effects of different restoration techniques. He graduated in Spring 2025 with a Master of Science degree in environmental resource science.

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