Enclosure

Detailed Comments on Proposed
PCS Phosphate Mine Expansion
Section 404 Permit

I. Introduction

This referral meets the criteria in Part IV of the 1992 EPA/Army Section 404(q) Memorandum of Agreement (1992 MOA). EPA finds that the proposed discharge would result in substantial and unacceptable impacts to waters of the United States, including wetlands, in the Albemarle Pamlico River estuary system, aquatic resources of national importance (ARNI). On February 24, 2009, the District Engineer for the U.S. Army Corps of Engineers Wilmington District (the Corps) issued a Notice of Intent to issue a Clean Water Act (CWA) Section 404 permit to the Potash Corporation of Saskatchewan Phosphate Division (PCS or the Applicant) to expand an existing phosphate mining operation (Action ID: AID 200110096). Pursuant to the Corps' authority under CWA Section 404, this permit would authorize the discharge of dredged and fill material to waters of the United States associated with a mine advance into the approximately 15,100 acre project area surrounding PCS's current mining operation adjacent to the Pamlico River, north of Aurora, Beaufort County, North Carolina (NC).

The proposed mine advance will involve mining and mining related activities within approximately 11,454 acres, resulting in direct adverse impacts to approximately 3,953 acres of wetlands and 25,727 linear feet of stream. The mining and mining related impacts would take place in three tracts identified as the NCPC, Bonnerton and South of NC Highway 33 (S33) tracts (see Figure 1).

EPA is very concerned with the magnitude of the direct and indirect impacts to wetlands and other waters which support the nationally significant Albemarle Pamlico Estuary System. Of particular concern are portions of a nonriverine wetland hardwood forest that have been designated as a Nationally Significant Natural Heritage Area by the NC Natural Heritage Program and would be directly impacted by the proposed project. The project would also result in the loss of approximately 70 percent of the watersheds of the project area streams which drain to estuaries of the Pamlico River resulting in indirect impacts to these important estuary systems. EPA also has specific concerns regarding the proposed project's indirect impacts to these estuary systems, four of which have been designated as Primary Nursery Areas by the NC Wildlife Resources Commission.

Based on EPA's review of the economic analysis included in the project's Final Environmental Impact Statement (FEIS), we continue to believe that there are less environmentally damaging practicable alternatives for mining the project site that would avoid and minimize impacts to important wetland and stream resources. In addition to the need to further avoid impacts to the site's high value aquatic resources, we also believe that additional measures can be taken to minimize the impact of the mining project on avoided aquatic resources by improving the quality of the reclamation area (i.e., re-using top soil and re-vegetating with target plant species). Further, all avoided aquatic resources should be provided permanent protection from future

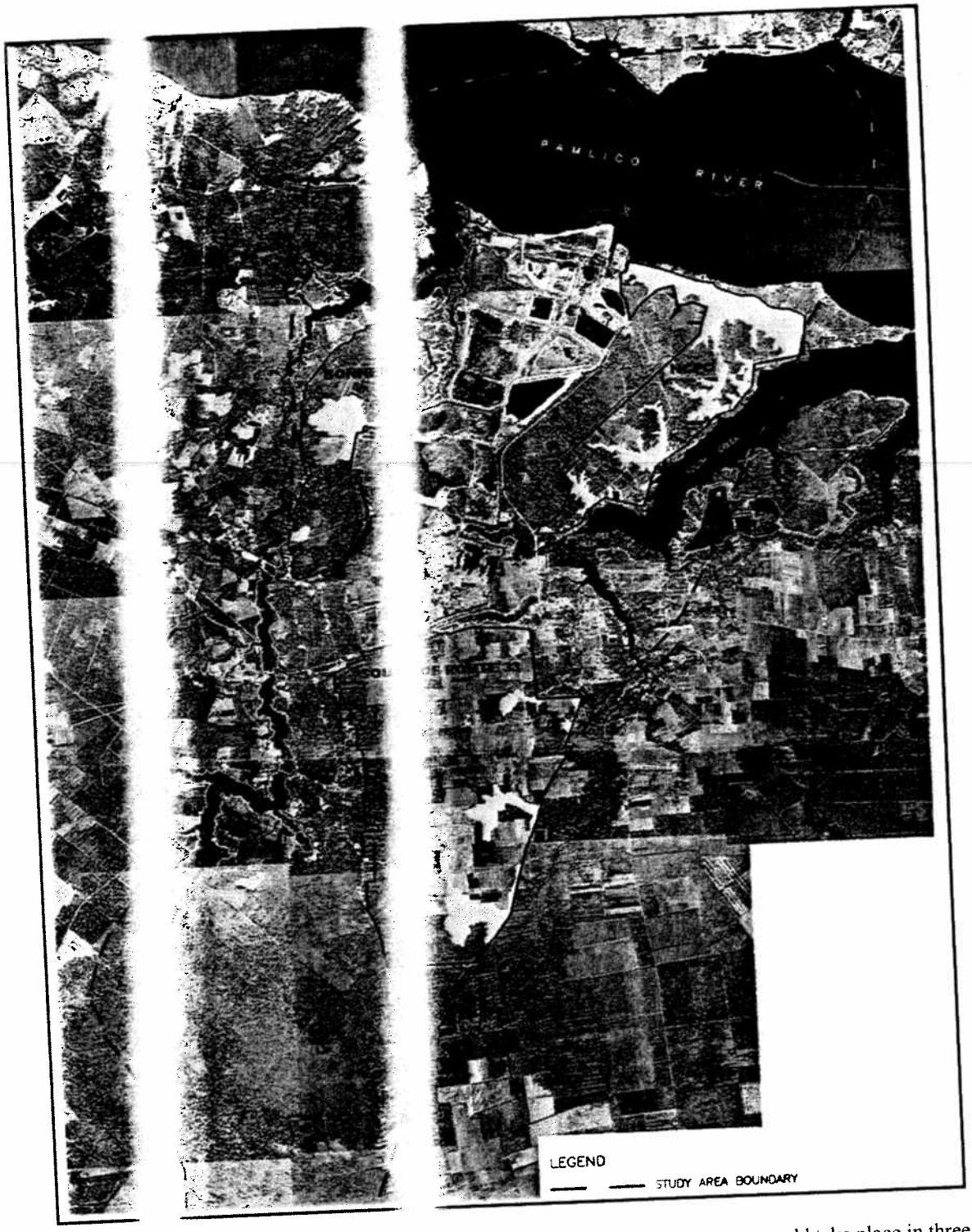


Figure 1 ...es the PCS project bou... ...s the NCPC, Bonnerto... . Mining and mining related impacts would take place in three tracts ide... South of NC Highway 33 (S33) tracts.

mining with appropriate binding real estate instruments such as conservation easements. We also have concerns regarding the adequacy of the proposed compensatory mitigation to offset authorized impacts to mature forested wetlands. Finally, we believe that additional measures are necessary to improve the monitoring and adaptive management of both the mining and mitigation sites.

Based on our review of the proposed project, we believe it fails to comply with the Section 404(b)(1) Guidelines (the Guidelines) for the following reasons:

1. There are less environmentally damaging practicable alternatives that meet the project purpose [40 CFR 230.10(a)];
2. The project's direct and indirect impacts to high value wetland and stream systems including areas designated as Nationally Significant Natural Heritage Areas and Primary Nursery Areas would cause or contribute to significant degradation of the Nation's waters [40 CFR 230.10(c)]; and
3. All appropriate and practicable steps have not been taken to minimize and compensate for the project's adverse impacts to waters of the United States [40 CFR 230.10(d)].

II. Project History

In August 1997, the Corps issued PCS a permit to impact approximately 1,268 acres of wetlands in order to mine phosphate next to its phosphate processing plant on the Hickory Point peninsula adjacent to the Pamlico River and South Creek in Beaufort County, NC. On November 2, 2000, PCS applied for a permit from the Corps to continue its phosphate mining operation into a 3,608-acre tract, known as the NCPC tract, situated east of PCS's current mining operation. The Corps issued a public notice describing this application on October 4, 2001. The requested authorization would impact 2,408 acres of wetlands and other waters of the United States, including wetlands that were "avoided" as part of the 1997 permit negotiations because of their high ecological value. In response to this pubic notice, EPA submitted comment letters on October 25, 2001 and November 20, 2001, pursuant to paragraphs 3(a) and (b) of Part IV of the 1992 MOA, stating that we determined that the project, as proposed, will result in substantial and unacceptable impacts to aquatic resources of national importance. We also stressed the need to avoid and minimize impacts to these valuable aquatic resources and highlighted the need to explore less environmentally damaging alternatives for mining the project site.

Based on the comments received in response to the October 2001 public notice, the Corps prepared an Environmental Impact Statement (EIS) and established an interdisciplinary team (Review Team).[1] The Review Team's role was to identify major issues to be addressed in the EIS and assist with the identification of potentially less environmentally damaging alternatives. EPA was an active participant in the Review Team which met over twenty times during the development of the project's EIS.

On October 20, 2006, the Corps released the Draft EIS (DEIS) and, via public notice, requested comments on both the DEIS as well as the proposed action. The DEIS examined mining impacts

[1] The Review Team was comprised of representatives from state and federal regulatory and commenting agencies, environmental advocacy groups, the Applicant and the Applicant's consultant, CZR Incorporated.

on the NCPC Tract and two additional sites known as the Bonnerton tract (2,806 acres) and the S33 tract (8,686 acres). Nine alternative mining alignments and a "No-Action" alternative were identified for further study in the DEIS. The Applicant's Preferred alternative (AP) was to mine solely on the NCPC tract. An additional Expanded Applicant-Preferred alternative (EAP) proposed mining on all three tracts (NCPC, Bonnerton, and S33) and was also considered practicable by PCS.

Following release of the DEIS, EPA provided a memorandum and two formal comment letters to the Corps. EPA's January 17, 2007 memorandum, prepared by Dr. Adam Daigneault, an EPA economist, provided recommendations for improving the presentation of the DEIS's economic analysis. EPA's February 9, 2007, letter from its National Environmental Policy Act (NEPA) Program Office provided additional comments regarding the DEIS's economic analysis and raised additional concerns regarding the adequacy of the DEIS. Specifically, EPA identified significant environmental concerns that were the basis for rating the AP alternative as "EO-2, Environmental Objections, Insufficient Information". The focus of EPA's concern was that, of all the alternatives considered, the AP and the EAP alternative were the most environmentally damaging. The AP alternative would impact approximately 2,408 acres of wetlands and 38,558 linear feet of stream on the NCPC tract, and the EAP alternative would impact approximately 5,667 acres of wetlands and 89,150 linear feet of stream across all three tracts (see Table 1). EPA further concluded that the economic modeling conducted by PCS to determine the fiscal viability of each of the nine mining alternatives failed to demonstrate why the less environmentally damaging Alternatives SCR and SJA were not feasible. EPA's February 9 and March 6, 2007, letters from its Region 4 Water Management Division reiterated concerns regarding the proposed project's direct and indirect adverse impacts on wetlands and other aquatic resources of national importance, the need to avoid and minimize these impacts and the availability of less environmentally damaging alternatives.

Table 1: Wetland and stream impacts for the ten alternatives evaluated in the DEIS

Alternative	*Total Area*	*Total Wetlands*	*Wetlands Impacted*	*% Wetlands Impacted*	*Total Streams*	*Streams Impacted*	*% Streams Impacted*
	acres	acres	acres	%	linear feet	linear feet	%
AP	3412	2500	2408*	96%	55528	38558	69%
EAPA	13961	6404	5667*	88%	115843	89150	77%
EAPB	13961	6404	5667*	88%	115843	89150	77%
No Action	5745	1691	0	0%	43209	0	0%
S33AP	7743	1691	1130	67%	43209	33486	77%
DL1B	9033	6404	2285	36%	115843	13854	12%
SCRA	10659	6404	3506	55%	115843	14360	12%
SCRB	10659	6404	3506	55%	115843	14360	12%
SJAA	12891	6404	5031	79%	115843	2508	2%
SJAB	12891	6404	5031	79%	115843	2508	2%

During the DEIS comment period, the Applicant proposed changes regarding how the cost of mine development activities are averaged, specifically the cost of mine relocation to S33 which is located south of NC Highway 33. The Applicant argued that this change was necessary to facilitate comparison of alternatives to the Applicant's original request for a 15 year mining plan in the NCPC tract (AP alternative) which is located, along with the Bonnerton tract, north of NC Highway 33. After evaluating the PCS proposal, the Corps incorporated the Applicant's

argument into the alternatives analysis identifying only those alternatives that provide at least 15 years of mining in the two tracts north of Highway 33 (i.e., NCPC and Bonnerton) as practicable. Then the Corps developed an additional alternative (Alternative L), fully contained within the project boundary, which provides 15 years of mining north of Highway 33. PCS, on its own initiative, submitted a separate additional alternative (Alternative M). Alternatives L and M were evaluated in a Supplemental DEIS (SDEIS) filed on November 16, 2007. The Corps' stated intent for this document was neither to respond to comments received on the DEIS nor to correct any information presented in the DEIS. Hence, the Corps did not address EPA's earlier concerns and requests for additional information, intending instead to address these issues in the FEIS.

On December 28, 2007, EPA provided comments in response to the SDEIS. We reiterated our concerns regarding the proposed project's adverse impacts to aquatic resources of national importance. Consistent with our rating of the AP alternative in the DEIS, EPA rated Alternative L as "EO-2, Environmental Objections, Insufficient Information" because of the magnitude of impacts on wetland resources. We also raised significant concerns regarding the Corps' decision to change a key aspect of the DEIS's economic analysis, specifically introduction of the criterion that only those alternatives that provide at least 15 years of mining in the two tracts north of Highway 33 (i.e., NCPC and Bonnerton) are practicable. This change creates inconsistencies in the FEIS's economic analysis that bias it in favor of the more extractive and environmentally damaging alternatives, by eliminating numerous alternatives in the SDEIS that had been determined to be practicable in the DEIS, alternatives that are much less environmentally damaging than the proposed project.

EPA believes the modification made to the economic analysis in the SDEIS was not appropriate and that the alternatives excluded from the SDEIS were indeed practicable. In an effort to illustrate this point, EPA requested that our National Center for Environmental Economics review the economic analysis included in the SDEIS. EPA's review of the economic analysis included in the SDEIS (discussed below) concluded that there are less environmentally damaging practicable alternatives to the proposed project. EPA met with the Corps on numerous occasions to share the results of its review and discuss our concerns regarding the modifications to the economic analysis in the SDEIS.

The project's FEIS was published on May 23, 2008. The FEIS identified Alterative L, which was introduced in the SDEIS, as the Applicant's proposal. Alternative L would impact approximately 4,115 acres of wetlands and 29,288 linear feet of stream. Although the FEIS acknowledges EPA's concerns with the changes that were made to the economic analysis in the SDEIS, the analysis was nevertheless carried forward in the FEIS.

On July 23, 2008, EPA provided comments on the FEIS. In this letter, we reiterate our continued concerns regarding the project's direct and indirect impacts to aquatic resources of national importance and the continued need to avoid and minimize impacts to these high value aquatic resources. EPA concluded that the proposed project "would have significant and long-term, direct and cumulative impacts to biocommunities in various waters of the United States which support the nationally significant Albemarle Pamlico Estuary System." The letter notes EPA's continued belief that, based on our review of the economic analysis included in the FEIS,

that there are less environmentally damaging practicable alternatives for mining the project site. EPA indicated that our remaining concerns regarding the project could be successfully resolved with greater evaluation of Alternative S33 and further modifications to Alternative L.

On January 15, 2009, the North Carolina Division of Water Quality (NCDWQ) issued its CWA Section 401 Water Quality Certification. In doing so it concluded that additional steps needed to be taken to avoid and minimize impacts to high value aquatic resources at the project site. NCDWQ did not issue its certification for Alternative L. Among a number of changes, it required additional avoidance of impacts to high value aquatic resources; specifically it protected a portion of the site's Nationally Significant Natural Heritage Area from mining and required that this avoided area be protected by a conservation easement. The project certified by NCDWQ, identified as Modified Alternative L, would impact approximately 3,953 acres of wetlands and 25,727 linear feet of stream. Thus, although the FEIS concludes that Alternative L is the least environmentally damaging practicable alternative (LEDPA), NCDWQ's certification of a project that further reduces aquatic resource impacts demonstrates that less environmentally damaging practicable alternatives to the project proposed in the FEIS (Alternative L) in fact exist. Although the NCDWQ's Modified Alternative L includes some additional measures designed to avoid and minimize impacts to important aquatic resources, we continue to believe that additional measures are necessary and practicable. Finally, on March 12, 2009, four environmental groups filed a petition challenging NCDWQ's certification citing, among other concerns, that the certification, which allows impacts to nearly 4,000 acres of wetlands, would result in violations of state water quality standards.

On February 24, 2009, the Corps sent EPA a Notice of Intent to issue a CWA Section 404 permit to PCS for the project certified by NCDWQ, Modified Alternative L. On March 17, 2009, EPA notified the Corps that, pursuant to Part IV, paragraph 3(d)(2) of the 1992 MOA, it was requesting review of the proposed permit by the Acting Assistant Administrator of EPA's Office of Water, and recommending that he request review of the permit by the Assistant Secretary of the Army for Civil Works.

Although the formal permit elevation process was initiated with the Corps' February 24, 2009, letter, EPA has continued to coordinate with the Corps and the Applicant in an effort to resolve our concerns regarding the proposed project. To this end, on March 24, 2009, representatives from EPA, the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) met with the Corps and the Applicant to discuss our continued concerns with the proposed project. At that meeting, EPA, FWS and NMFS presented a potential alternative plan for mining the site that would address the concerns raised by the agencies by avoiding and minimizing impacts to the aquatic ecosystem, consistent with the Guidelines. EPA, FWS and NMFS also noted that we had consulted with the environmental groups who are challenging the NCDWQ's CWA Section 401 certification of the project and had attempted to address many of the environmental groups' concerns in the alternative put forward at the March 24, 2009, meeting.

As discussed in more detail below, the EPA/FWS/NMFS proposal would provide:

- Additional avoidance designed to reduce the direct and indirect impacts of the mining project on the site's Nationally Significant Natural Heritage Area as well as the site's tidal creeks, including those identified as Primary Nursery Areas;
- Measures to ensure that avoided aquatic resources are provided permanent protection from future mining with appropriate binding real estate instruments such as conservation easements;
- Measures to be taken to minimize the impact of the mining project on avoided aquatic resources by improving the quality of the reclamation areas (i.e., re-using top soil and re-vegetating with target plant species); and
- Measures to be taken to improve the monitoring and adaptive management of both the mining and mitigation sites.

During the March 24, 2009, meeting, the Applicant requested more details regarding the agencies' proposal so that it could conduct a more thorough evaluation. The agencies agreed to provide the Corps and the Applicant with the Geographic Information System (GIS) coverages for the proposed new mining boundaries on the NCPC and Bonnerton tracts (the mining boundary on the South of 33 tract remained the same as Modified Alternative L). EPA/FWS/NMFS also agreed to provide additional language describing the proposed reclamation provisions and monitoring provisions presented at the meeting. This information was provided to the Corps and the Applicant on March 30, 2009. The Applicant expressed a desire to review the new alternative and noted that its evaluation could take a month or longer. We believe that we cannot conclude that this alternative proposal, or a modified version of it, is not practicable until we have heard back from the Applicant.

While we remain hopeful that there are opportunities to resolve our concerns with the proposal, discussions with the Corps and the Applicant have not yielded such a result. As we continue to have outstanding concerns, the timeframes outlined in our 1992 MOA dictate that we must share these concerns with the Assistant Secretary of the Army for Civil Works by April 6, 2009.

III. Aquatic Resources of National Importance

The 15,100 acre project area is located adjacent to the Pamlico River which is part of the nationally significant Albemarle Pamlico Estuary Complex (see Figure 2). The project area contains 6,293 acres of wetlands and 115,843 linear feet of streams that support the Albemarle Pamlico Estuary and collectively constitute aquatic resources of national importance (ARNI). The Albemarle Pamlico Estuary Complex is the largest lagoonal estuary and second largest estuarine complex in the United States and is itself an ARNI. The fringe marshes, creeks, and beds of submerged aquatic vegetation in the Albemarle Pamlico Estuary Complex provide essential nursery habitat for most commercial and recreational fish and shellfish in the North Carolina coastal area (Street et al., 2005) and important habitat for waterfowl[2], shorebirds and other migratory birds. The importance of wetlands to coastal fish is not unique to North Carolina. Over 95 percent of the finfish and shellfish species commercially harvested in the United States are wetland-dependent (Feierabend and Zelazny, 1987). More than 70 percent of

[2] See FWS waterfowl survey website: http://www.fws.gov/birddata/databases/mwi/mwidb.html

the commercially or recreationally valuable fish species of the Atlantic seaboard rely on the Albemarle-Pamlico system for some portion of their life cycle and more than 90 percent of the fish caught in NC depend on the estuary as a nursery habitat.[3] Further, the Albemarle-Pamlico Estuary Complex was designated as estuaries of "national significance" in 1987 and joined EPA's National Estuary Program. Since 2002, EPA has awarded over $7.7 million to the Albemarle-Pamlico National Estuary Program (APNEP) for wetlands, streams and shellfish area restoration projects, watershed assessment and mapping, and a multitude of other projects. In addition, during 2003-2008, the APNEP used its annual funding from EPA to secure an additional $84 million in leveraged resources from both public and private funders. The resources have been used to help address the priority problems facing the Albemarle-Pamlico Estuary.

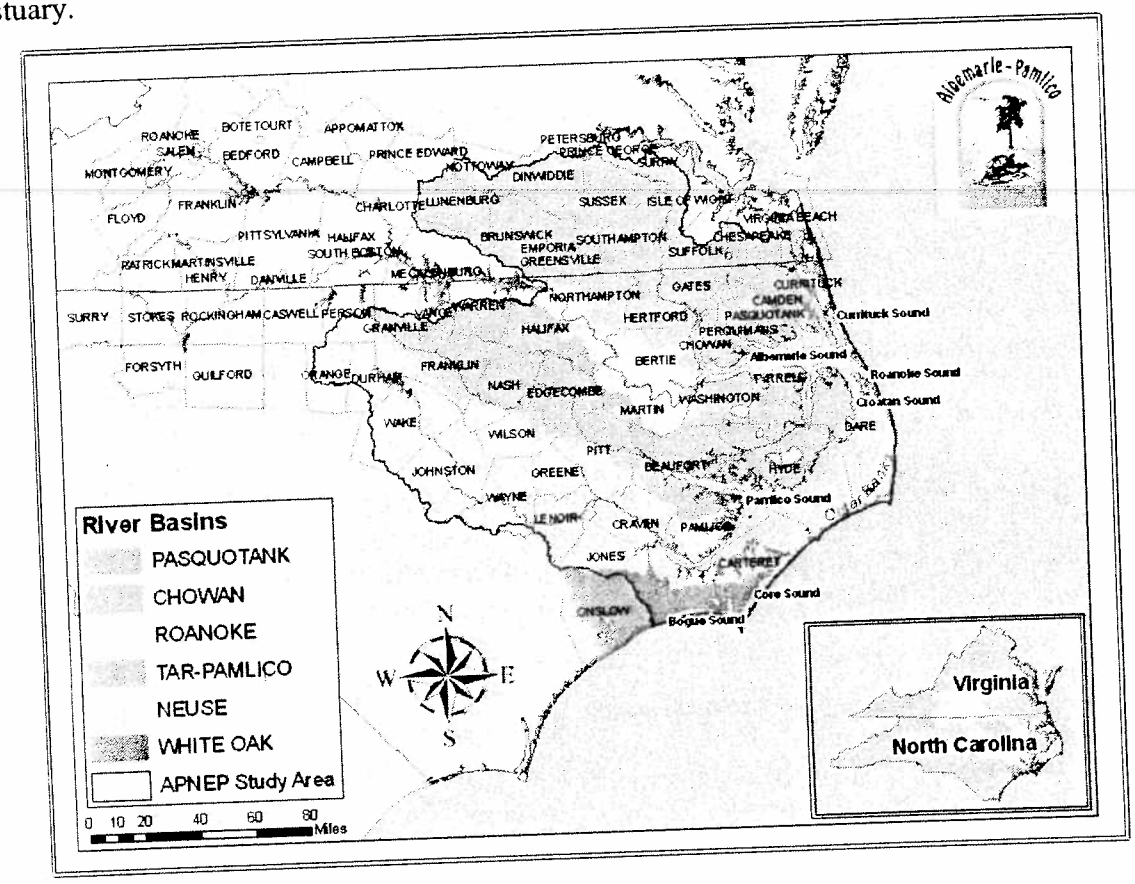


Figure 2 illustrates the boundary of the Albemarle-Pamlico National Estuary Program. The Albemarle-Pamlico estuarine system was designated as estuaries of national significance in 1987 and joined EPA's National Estuary Program.

As discussed earlier, the project site consists of three distinct tracts, NCPC, Bonnerton and S33. The NCPC tract is adjacent to the Pamlico River and South Creek. Seventy-one percent of this tract is designated as wetlands and it contains eight tidal creeks, including three inland Primary

[3] See Association of National Estuary Programs website: http://www.nationalestuaries.org/publications/factcards/albemarle.htm

Nursery Areas (Tooley Creek, Jacobs Creek, and Jacks Creek). The Bonnerton tract is adjacent to the Pamlico River, Durham Creek, and Porter Creek. Seventy-six percent of this tract is designated as wetlands and it contains the headwater drainage to one tidal creek designated as an inland Primary Nursery Area (Porter Creek). The Bonnerton tract also contains an approximately 271 acre nonriverine hardwood forested wetland that has been designated as a Nationally Significant Natural Heritage Area. The S33 tract is farther inland than either the NCPC or Bonnerton tracts and contains the headwaters of three creeks that drain into South Creek, one of which is a tidal creek. Approximately 20 percent of the S33 tract is delineated as wetland.

The Bonnerton and NCPC tracts include tidally influenced forested wetlands, creeks and salt marsh designated as Essential Fish Habitat (EFH) by the South Atlantic Fishery Management Council and Mid-Atlantic Fishery Management Council for federally managed fishery species. A subset of the areas designated as EFH is recognized by the NC Wildlife Resource Commission as inland Primary Nursery Areas and this state designation also makes these areas federally designated Habitat Area of Particular Concern (HAPC), the subset of EFH that warrants the highest protection under the Magnuson-Stevens Fishery Conservation and Management Act. The Primary Nursery Areas within the project area are Tooley Creek, Jacobs Creek, Jacks Creek and Porter Creek.

The FEIS classifies the site's wetlands into ten categories: brackish marsh complex, bottomland hardwood forest, herbaceous assemblage, shrub-scrub assemblage, hardwood forest, mixed pine-hardwood forest, pine forest, pocosin-bay forest, sand ridge forest, and pine plantation. All of the site's wetlands perform important ecological functions that support the Albemarle Pamlico Estuary such as temporary storage of surface water, nutrient cycling, organic carbon export, pollutant filtering/removal, and maintenance of biologically diverse plant and animal habitat. The FEIS classifies the site's stream resources into intermittent streams, perennial streams and pubic trust areas (i.e., navigable/canoeable creeks in coastal counties). All of the site's stream resources perform important ecological functions that support the Albemarle Pamlico Estuary such as the transport of water, nutrients and sediment downstream, pollutant processing and removal, and maintenance of biologically diverse plant and animal habitat. Of particular ecological importance are the wetland areas on the Bonnerton tract designated as a Nationally Significant Natural Heritage Area and the tidal creeks on the NCPC and Bonnerton tracts, four of which have been identified as Primary Nursery Areas.

Nationally Significant Natural Heritage Area

The Bonnerton tract contains an approximately 271 acre wetland area that has been designated by the NC Natural Heritage Program as a Nationally Significant Natural Heritage Area. The Natural Heritage Program designates areas in the state which it has determined to be important for conservation of the state's biodiversity as Significant Natural Heritage Areas. These areas can be classified as significant by the Natural Heritage Program at the county, regional, state or national level. The fact that the Bonnerton tract's Significant Natural Heritage Area has been classified as nationally significant means the Natural Heritage Program has determined it to be one of the five best examples of this community type in the nation. The 271 acre nonriverine

Wet Hardwood Forest (WHF) community type found on the Bonnerton tract is considered to be among the most threatened and endangered of NC's natural communities.

Nonriverine WHF communities are dominated by some of the same trees as wetland bottomland hardwood forests, and especially by several oak species, including swamp chestnut oak (*Quercus michauxii*), laurel oak (*Quercus laurifolia*), cherrybark oak (*Quercus pagoda*) and water oak (*Quercus nigra*). The nonriverine WHF is habitat for many species, including black bear (*Ursus americanus*) and wild turkey (*Meleagris gallopavo*) . The multi-layered structure characteristic of mature WHFs supports high densities and diversities of neotropical migrant birds such as wood thrush (*Hylocichla mustelina*), Swainson's warbler (*Limnothlypsis swainsonii*), worm-eating warbler (*Helmitheros vermivorus*), prothonotary warbler (*Protonotaria citrea*), hooded warbler (*Wilsonia citrina*) and white-breasted nuthatch (*Sitta pusilla*)

Some of the indicators of quality in a WHF are canopy maturity, canopy age structure, extent, and connection to other natural communities. Historically nonriverine WHFs naturally occurred in large patches and it is believed that some aspects of their ecosystem function are dependent on this large extent. The Natural Heritage Program also finds that the rate of loss of this community type is greater than all other community types in the state.

Tidal Creeks/Primary Nursery Areas

There are ten tidal creeks on the project site: Jacks Creek, Jacobs Creek, Drinkwater Creek, Tooley Creek, Huddy Gut, Huddles Cut, Sibyl Creek, Whitehurst Creek, Porter Creek, and Bailey Creek. All ten of these tidal creeks perform similarly critical biological support functions and have thus been a focus of concern throughout our review of the proposed project. Four of these tidal creeks (Jacks Creek, Jacobs Creek, Tooley Creek and Porter Creek) have been specifically designated as Primary Nursery Areas by the NC Wildlife Resources Commission. Primary Nursery Areas are defined as those areas inhabited by the embryonic, larval or juvenile life stages of marine or estuarine fish or crustacean species due to favorable physical, chemical or biological factors. The purpose of inland Primary Nursery Areas are to establish and protect those fragile inland waters which support embryonic, larval or juvenile populations of these species. The critical input to and function of Primary Nursery Areas are not contained just within the public trust waters but also includes the headwater drainages. Wetlands that surround or serve as headwaters for estuarine creeks are essential for the creeks to serve as Primary Nursery Areas.

Estuarine waters occur along three sides of the proposed mining site and support a wide range of fishery resources, including commercially or recreationally important species such as striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), Atlantic herring (*Clupea harengus*), summer flounder (*Paralichthys dentatus*), red drum (*Sciaenops ocellatus*), blue crab (*Callinectes sapidus*), shrimp *(Pennaeidae)* and oysters (*Crassostrea virginica).* The estuary also provides important habitat for anadromous fish, including the endangered shortnose sturgeon (*Acipenser breviorostrum*). Nursery areas located in the creeks and embayments of the estuarine system, such as those found on the project site, are important to over 75 species of fish and shellfish.[4]

[4] See Association of National Estuary Programs website: http://www.nationalestuaries.org/publications/factcards/albemarle.htm

IV. Substantial and Unacceptable Impacts

40 CFR 230.10(c): Significant Degradation

EPA believes that compliance with requirements of Section 230.10(c) of the Guidelines has not been demonstrated. Section 230.10(c) requires that no discharge of dredged or fill material shall be permitted which will cause or contribute to significant degradation of waters of the United States. The Guidelines explicitly require evaluation of all direct, secondary, (i.e., indirect), and cumulative impacts reasonably associated with the proposed discharge in determining compliance with Section 230.10(c). In accordance with the Guidelines, determining significant degradation requires specific consideration of effects on such functions and values as wildlife habitat, aquatic system diversity, stability and productivity, recreation, aesthetic and economic values.

Of the 15,100 acre project area, the proposed mine advance would impact approximately 11,454 total acres and result in direct impacts to approximately 3,953 acres of wetlands, 19 acres of open waters and 25,727 linear feet of streams. This would represent the single largest wetland impact ever authorized under the Clean Water Act in NC and would result in a significant loss of wetlands, streams and other waters of the United States within the nationally significant Albemarle Pamlico Estuary Complex.

As previously noted, all of the site's wetlands perform important ecological functions that support the Albemarle Pamlico Estuary such as temporary storage of surface water, nutrient cycling, organic carbon export, pollutant filtering/removal, and maintenance of biologically diverse plant and animal habitat. Also as previously noted, all of the site's stream resources perform important ecological functions that support the Albemarle Pamlico Estuary such as the transport of water, nutrients and sediment downstream, pollutant processing and removal, and maintenance of biologically diverse plant and animal habitat. We recognize that not all of the approximately 3,953 acres of wetlands and 25,727 linear feet of streams that would be impacted by the proposed project perform all of these respective functions to the same degree (because of their position in the landscape and/or their level of prior disturbance), however, the complete loss of this entire suite of wetland and stream functions on this scale raises serious ecological concerns.

The habitat functions provided by wetlands and streams that would be lost are particularly important in light of the ecological and economic value of the Albemarle Pamlico Estuary's commercial and recreational fishery/shellfish resources. Also, the state has designated the entire Tar-Pamlico River Basin as Nutrient Sensitive Waters because of problems associated with excessive levels of nutrients in the river such as harmful algal blooms, low oxygen levels, increased fish kills, and other symptoms of stress and diseases in the aquatic biota. The state developed a strategy to reduce nutrient inputs from around the basin to the estuary that is yielding improvements to water quality. Nonetheless, we are very concerned that loss of the water quality enhancement functions provided by the approximately 3,953 acres of wetlands and 25,727 linear feet of streams that would be completely eliminated by the proposed project could

exacerbate existing water quality problems in the Tar-Pamlico River and hamper the state's ongoing efforts to improve the river's water quality.

Direct Impacts to Nationally Significant Natural Heritage Area

EPA is concerned with the proposed project's direct impacts to the wetland area on the Bonnerton tract that has been designated by the NC Natural Heritage Program as a Nationally Significant Natural Heritage Area. As previously noted, the 271 acre nonriverine WHF found on the Bonnerton tract is an extremely unique and rare community type, one that has experienced a rate of loss higher than all other community types in the state. The fact that the Bonnerton tract's Significant Natural Heritage Area has been classified as nationally significant means the Natural Heritage Program has determined it to be one of the five best examples of this community type in the Nation.

As previously noted, some of the indicators of quality in a nonriverine WHF are canopy maturity, canopy age structure, extent, and connection to other natural communities. Historically, nonriverine WHFs naturally occurred in large patches and it is believed that some aspects of their ecosystem function are dependent on this large extent. The proposed project would directly impact approximately 97 acres[5] of this ecologically valuable and rare wetland system and would allow mining through the middle of the 271 acre area, bisecting it into two separate and smaller pieces, an eastern and a western piece. This large reduction in size and the fragmentation of the tract into two separate pieces would undermine some of the key ecological characteristics which make it ecologically valuable and "nationally significant." Although the NCDWQ's CWA Section 401 Water Quality Certification requires the mined out area between the eastern and western pieces to be restored after mining, we believe it will be extremely difficult, based on the current state of the science, to restore this area to its prior condition after mining and this will have a significant detrimental impact to the integrity of this rare and threatened biological community. In addition to reducing the size of the area and fragmenting it into two pieces, the large scale disturbances associated with allowing phosphate mining through the middle of the area (land clearing, groundwater extraction, pit excavation, road and support infrastructure construction, etc.) will further lower the ecological value of the remaining eastern and western pieces of the area.

Given the unique and valuable nature of this nationally significant resource, it is EPA's determination that the direct impacts of mining the 271 acre Significant Natural Heritage Area on the Bonnerton tract does not comply with Subparts C-F of the Guidelines, specifically Subpart C – Impacts on physical characteristics of the aquatic ecosystem, Subpart D – Impacts on the biological characteristic of the aquatic ecosystem, Subpart E – Impacts to special aquatic sites and Subpart F – Effects on human use characteristics (SNHA designation).

Indirect Impacts to Tidal Creeks/Primary Nursery Areas

EPA is also concerned with the proposed project's indirect impacts to the project area's ten tidal creeks, four of which have been classified by the NC Wildlife Resource Commission as Primary Nursery Areas. Although the proposed project would not directly impact the perennial reaches

[5] Based on the February 24, 2009, Notice of Intent letter from the Wilmington District Corps, page 6.

of the four Primary Nursery Areas, the headwater drainages of the project site's tidal creeks, including those designated as Primary Nursery Areas, would be reduced by approximately 70 percent. Our concerns regarding the proposed drainage basin reductions are amplified on the NCPC tract since its watersheds have already lost approximately 1,268 acres of wetlands as part of the Applicant's 1997 mining permit.

Eliminating the headwater streams and wetlands and significantly reducing the drainage areas of the project site's Primary Nursery Areas and other tidal creeks would:

- Reduce flow from ground water and increase variability in surface water flows to the tidal creeks, thereby increasing the frequency and magnitude of short-term salinity fluctuations;
- Reduce filtration of nutrients and other contaminants previously accomplished by the site's streams and wetlands, increasing sedimentation and turbidity in tidal creeks;
- Reduce productivity of native fish and shellfish in the downstream estuary by disrupting the estuarine food web (caused by a reduction of organic materials critical for biological activity in the surface water drainage); and
- Shift downstream estuarine productivity from the benthic community which is dominated by sensitive submerged aquatic vegetation and benthic invertebrate species to tolerant phytoplankton species. This would exacerbate ongoing environmental stress and create an open niche for problematic invasive plant and animal species to colonize and degrade the estuary.

We believe the disruption of these processes and functions in the drainage basin will significantly impact the site's tidal creeks and impair the ability of these systems to function as Primary Nursery Areas.

Estuarine animals exist in a community assemblage and the influence of a factor, such as salinity, on one species may be extended either directly or indirectly to affect other species. The cumulative effects of even small changes in an estuary may have a total systemic effect on the marine resources and the economic activities that depend on them. We believe the potential effect of Drainage Basin Reduction (DBR) on the production of marine fisheries resources is significant.

Besides its effect on fish production, DBR will likely result in increased sedimentation and turbidity, which are significant contributors to declines in populations of aquatic organisms. The direct effects of sedimentation and turbidity at various trophic levels are mortality, reduced physiologic functions and avoidance. Sedimentation can clog the gills of fish, reducing respiratory abilities. This stress may reduce tolerance levels to disease and toxicants and to changes in dissolved oxygen concentrations and salinity, compromising the health of local fisheries resources. Decreases in primary production are associated with increases in sedimentation and turbidity and produce negative cumulative effects through depleted food availability to zooplankton, insects, freshwater mollusks and fish. Decreases in available food at various trophic levels also results in depressed rates of growth, reproduction and recruitment. These effects lead to alterations in community density, diversity and structure.

Mining will directly affect the rate at which water is routed through the watershed. DBR will reduce contiguous sheet flow and as the mine expansion progresses there is an ever increasing

trend of diverting surface water drainage which once promoted estuarine productivity into National Pollutant Discharge Elimination System (NPDES) channels, pipes and outfalls. This redirection of surface flows contributes to estuarine degradation because it removes natural watershed drainage patterns that 1) promote infiltration and trapping of sediments and other pollutants, and 2) provide a beneficial diffuse source of water to the estuary and subsequently decreases the buffering capacity of the system. These changes will likely increase the amount of sediment, nutrients and toxics entering the system. Nitrogen and phosphorus can accelerate eutrophication resulting in algal blooms, reduced water clarity, shifts in algal and fish populations and fish kills. Currently South Creek, which is stressed with water quality problems including algal blooms and increases in suspended solids, is designated as a Nutrient Sensitive Water (NSW) by the state, as is the entire Tar-Pamlico River Basin. We believe the reduction of the South Creek's buffering capacity associated with the large scale removal of wetlands and streams from the watersheds draining to the creek will likely exacerbate its existing water quality problems by removing the system's nutrient uptake capability. Hypoxic conditions caused by excess nutrients can result in reduced commercial and recreational fisheries production.

EPA believes the proposed mining operations will negatively impact estuarine trophic structure through disruption of substrate inputs crucial to primary producers; reduction of energy sources that fuel estuarine productivity; and degradation of the nutrient sequestration capacity of the estuarine system. Estuary productivity is dependent on the complex interactions among the various components of the aquatic food web; with epiphytes (attached to wetland macrophytes) and submerged aquatic vegetation (SAV) forming the foundation of the estuarine food web. SAV populations have recently declined by as much as 50 percent, possibly because of anthropogenic impacts. As a result, detritus supplied by wetland macrophytes has become more important as an epiphytic substrate. While phytoplankton are also important for productivity, the role of wetland plants and SAV detritus is of greater importance to the overall stability of shallow aquatic food webs. It is our belief that the proposed mining operations will negatively impact both types of epiphytic substrates.

Also of importance to estuarine food webs is the gradual and episodic release of Dissolved Organic Matter (DOM) from the contributing basins and wetlands immediately adjacent to the Albemarle Pamlico Estuary Complex. This energy source fuels bacterial communities that, through mineralization, provide inorganic nitrogen, phosphorous and carbon, supporting productivity. In addition, DOM supported bacteria are an important component of the "microbial loop." This part of aquatic food web links DOM (of autochthonous and/or allochthonous origin) to higher trophic levels, via bacteria-protist-metazoan-zooplankton interactions. The impacts associated with the proposed project would decrease the quantity and quality of allochthonous DOM supplied to the estuary because of the close proximity of PCS's proposed mining operations.

Most of the drainage basin wetlands that would be subjected to impacts are wet forests, including bottomland hardwood forests. These areas are subjected to repeated periods of inundation and desiccation. This is important from a biogeochemical perspective as it allows for the accumulation of particulate organic matter and its subsequent processing (dissolution and mineralization). This leads to episodic exports of dissolved organic materials to the estuary. Wetlands impacted by the proposed project also retain nutrient loads carried by high flow events, which are later sequestered into forest biomass. Wet forests are also important for denitrification

and these areas also provide refugia and nursery habitat for aquatic organisms during high flow periods.

The Applicant provided a December 2007 report prepared for PCS by Entrix, on *Potential Effects of Watershed Reduction on Tidal Creeks – An Assessment*. EPA believes that, while the report clarifies currently known characteristics of the South Creek tributaries, it does not support the conclusion that current and future DBRs from mining activities would have no significant effect on downstream ecosystems. Data collected by NC Wildlife Resource Commission in November 2006 to determine species present in Jacks, Jacobs and South Creeks does not support that fish production originates from downstream estuarine environments. The Applicant's report does not address freshwater species nor did it establish a connection between biota and previous mining impacts in the area including watershed reduction and ground water draw down. The report used "baseline" data for Jacks Creek collected after the watershed had already been reduced by almost 20 percent. Small reductions in watershed area may have large biotic impacts and, therefore, it is problematic using these data as a baseline to determine DBR impacts. The Applicant's report also makes a troubling extrapolation that since past smaller DBRs did not adversely impact the tidal creeks, the much larger DBRs associated with the proposed project (i.e., 70 to 80 percent DBRs) also would not adversely impact the tidal creeks. However, data do not exist to draw this conclusion.

The Entrix report and the Corps' February 24, 2009, Notice of Intent letter both present the success of the PA II man-made marsh on the PCS project area to hypothesize that the DBRs will not cause significant loss of habitat value and nursery functions of the tidal creeks. The West (2000) study evaluating PA II is frequently cited in these discussions and is used by the Entrix report to argue broad scale functional equivalency of PA II to local tidal creeks. EPA does not believe it is valid to use the West study to make these inferences. The study's objective was to assess how well PA II could provide suitable habitat for fish, benthic and plant species and not to evaluate the effects of DBR on these populations. The data were collected from the lower reaches of the stream channel and did not fully assess the upper channel's biota. These results support the potential for species repopulation in the lower reaches of the creeks but do not support the proposition that DBR will not impact the upper channel's biota. The report does not provide data on the functional equivalence of factors, such as stream substrate, biogeochemical processes, wetland plants, etc. and in fact, there was no evidence of accretion of natural sediment structure (woody detrital covering, large peat component, etc) or organic carbon in the 10 years of the study. EPA believes the data presented do not overcome the large body of scientific information showing that mining through the headwaters of estuarine streams and their riverine habitat will have a significant negative impact on the functioning and structure of the creeks impacted by the proposed mining activities. There is, however, a large amount of scientific data supporting the importance of headwater streams and wetlands on downstream water quality (Meyer and Wallace, 2001; Gomi *et al.*, 2002; Alexander *et al.*, 2007; Meyer *et al.*, 2007; and Wipfli *et al.*, 2007).

Summary of Impacts

In summary, the proposed project would eliminate critical ecological functions provided by approximately 3,953 acres of wetlands and 25,727 linear feet of streams within the nationally

significant Albemarle Pamlico Estuary. Wetland functions include temporary storage of surface water, nutrient cycling, organic carbon export, pollutant filtering/removal, and maintenance of biologically diverse plant and animal habitat. Stream functions include transport of water, nutrients and sediment downstream, pollutant processing and removal, and maintenance of biologically diverse plant and animal habitat. Of particular concern are the proposed projects:

- Direct impacts to portions of a nonriverine hardwood wetland forest that has been designated as a Nationally Significant Natural Heritage Area by the NC Natural Heritage Program, and
- Indirect impacts to the site's tidal creeks, four of which have been designated as Primary Nursery Areas by the NC Wildlife Resources Commission, associated with the 70 percent reduction in the drainage basins for these creeks.

EPA believes that impacts to these ecological functions at the scale associated with this project would cause or contribute to significant degradation [40 CFR 230.10(c)] of the Nation's waters. Further, as discussed below, we do not believe the proposed compensatory mitigation would reduce these adverse impacts to an acceptable level.

V. Alternatives Analysis

40 CFR 230.10(a): Alternatives Analysis

A key provision of the Guidelines is the practicable alternatives test which provides that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem" [40 CFR 230.10(a)]. An alternative is practicable if "it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."[6] [40 CFR 230.10(a)(2)].

The FEIS evaluated eleven alternative mining alignments and a "No-Action" alternative. A central component of the FEIS's alternatives analysis was the evaluation of each alternative to determine if it was practicable in light of its costs. Though the Guidelines do not consider cost in terms of economics, here, the evaluation looked at the alternatives in terms of their economic viability. Throughout our review of the DEIS, SDEIS, and FEIS, EPA has consistently cited concerns regarding the economic analysis. The concerns became heightened after aspects of the economic analysis were modified in the SDEIS and FEIS, changes that we believe inappropriately bias the economic analysis in favor of more extractive and more environmentally damaging mining alternatives and effectively obscure identification of the least environmentally damaging practicable alternative (LEPDA) as required by the Guidelines.

FEIS Economic Analysis

Our primary concern with the FEIS's economic analysis is its inconsistent treatment of the practicability of mining the southern portion of the S33 tract. The development of the long-term

[6] The CWA Section 404(b)(1) Guidelines use the term "basic purpose" and "overall project purposes" interchangeably. For a detailed discussion of this issue see EPA's Final Determination Pursuant to Section 404(c) of the CWA Concerning the Two Forks Water Supply Impoundments, Jefferson and Douglas Counties, Colorado.

alternatives that have been evaluated in the DEIS, SDEIS, and FEIS relied on an assumption that mining in the southern portion of S33 would become practicable while the FEIS's economic analysis relies on a contradictory assumption regarding those same mining costs. Although not currently practicable from a cost standpoint, mining the southern portion of S33 was included in the mine alternatives evaluated in the FEIS because mining these areas would become practicable. Specifically, the FEIS states that "[t]he applicant has also indicated that it believes the market will eventually become favorable; a reasonable position based on [U.S. Geological Survey] USGS information regarding the rate of depletion of domestic production capacity and the applicant's future shift to higher margin products. The Corps has determined that it is therefore appropriate to include this area [the lower portion of S33] in the evaluation" (FEIS at 2-26). Similarly, the FEIS states that the Applicant has indicated that while it does not find the cost associated with mining the southern portions of S33 practicable now, "it expects they will become practicable at some point in the future" (FEIS at 2-29). Thus, mining alternatives that include mining in the southern portion of S33 were included for evaluation throughout the EIS process based on the expectation affirmed by the Applicant, agreed to by the Corps, and supported by USGS information that changes in market conditions and product shifts would make mining these areas practicable.

Perplexingly, the FEIS reverses this fundamental assumption for the alternatives when it eliminates all alternatives that provide less than 15 years of mining in the NCPC and Bonnerton tracts, leaving only the AP, EAP, SJAA, M and L alternatives for consideration. To be practicable, the FEIS states that an alternative must "provide the applicant with the certainty of practicable costs for at least 15 years" (FEIS at 2-29). According to the FEIS, the SCRA, SCRB and SJAB alternatives do not experience "high cost" (presumably this means impracticable costs) "until at or after 15 years" (FEIS at 2-30). If the assumption, discussed above, that the southern portions of S33 will become practicable were consistently applied, there would be no basis for the determination that these alternatives are impracticable since they all provide at least 15 years of practicable mining costs. However, the FEIS rejects these alternatives when it concludes that "SCRA, SCRB and SJAB are not practicable due to the required commitment to the higher mining costs within the initial 10-12 years of the plan without the expectation of fully recovering these development costs" (FEIS at 2-30). This determination contradicts the fundamental assumption used to include the southern portion of S33 in each of the mining alternatives. The southern portion of S33 was included specifically because the Applicant, the Corps and USGS expect that those predicted higher costs will be practicable in the future and the Applicant will fully recover the development costs associated with opening S33 to mining. EPA believes it is inappropriate that the FEIS assumes that mining S33 is practicable for the proposed alternatives yet this same assumption does not apply to its economic analysis.

Practicable Alternatives

EPA was very concerned when these inconsistencies first appeared in the SDEIS. EPA stated that such inconsistencies were not appropriate and that the alternatives excluded from the SDEIS were indeed practicable. In an effort to illustrate this point, EPA requested that our National Center for Environmental Economics review the economic analysis included in the SDEIS. EPA met with the Corps on numerous occasions to share the results of its review and discuss our concerns regarding the modifications to the economic analysis in the SDEIS. Despite these

efforts, no substantive changes were made to the economic analysis included in the FEIS. EPA's review of the economic analysis included in the SDEIS and the FEIS concludes that there are less environmentally damaging practicable alternatives to the proposed project (See Appendix 1).

EPA's review of the FEIS's cost practicability analysis used expected cost and value data from the FEIS to calculate the expected profit per year for every year of every alternative. EPA then calculated the Net Present Value (NPV) of the stream of annual profits for each alternative. This allows for the comparison of projects of differing lengths in equal terms (current year dollars). An alternative with a positive NPV will add positive value to the Applicant if undertaken and therefore demonstrates at least a minimum level of cost practicability.

A NPV analysis assumes that a dollar in the future is worth less than a dollar today due to the time value of money and investment risk (among other things). The amount that the value of a future dollar is discounted is given by the discount rate. The NPV of an alternative is the value of the stream of future profits in today's dollars.

$$NPV = \sum_{t}^{T} \frac{profit_t}{(1+r)^t}$$

where t (t=1 .... T) indexes the years of an alternative and r is the discount rate. Following White House Office of Management and Budget (OMB) guidance we have used a 3% and 7% discount rate

Our NPV analysis utilized the:

- 1991 to 2007 USGS adjusted price per ton estimates from Table 2-7 on page 6-12 of Volume 1 of the FEIS
- Cost per ton estimates for each year for each alternative from Table 2-6 on page 6-11 of the FEIS
- Expected tons extracted from each alternative for each year from the tables in Appendix D of the FEIS.

As the first step in the NPV procedure, a time trend was regressed on 1991 to 2007 USGS adjusted price per ton estimates to predict expected future prices per ton for the next 50+ years. Next, estimated cost per ton for each alternative for each year was subtracted from the estimated expected price per ton to give expected profit per ton per year for each alternative (i.e., price per ton - cost per ton = profit per ton). Then, expected profit per ton per year for each alternative was multiplied by the number of expected tons mined per year for each alternative to get total expected profit per year for each alternative (i.e., profit per ton * number of tons per year = total annual expected profits). Finally, using both a 3% and 7% discount rate, annual total profits for each year for each alternative are discounted back to their 2008 value. The NPV of each alternative is then the sum of its discounted annual total profits.

The results of the NPV analysis, presented in Table 2, highlight that contrary to the conclusions drawn in the FEIS, many of the alternatives evaluated in the FEIS are indeed economically viable and should not have been eliminated from further consideration. According to the FEIS,

an alternative is reasonable if it provides "the applicant with the certainty of practicable costs for at least 15 years" (FEIS at 2-29). Assuming this criterion is appropriate for use in a practicability determination made under the Guidelines, only the "No Action" and the S33AP and DL1B alternatives should have been eliminated from further consideration since they are the only three alternatives that do not provide at least 15 years of economically viable mining. If the 15 year criterion is not relevant for purposes of evaluating alternatives under the Guidelines and is not used, even the S33AP and DL1B options have a positive net present value and would be a better use of the land for the Applicant than letting it remain unused.

A number of the alternatives that are economically viable, based on the NPV analysis, involve far fewer impacts to aquatic resources than the FEIS's Alternative L or the proposed project (Modified Alternative L). EPA finds that the inconsistencies in the FEIS's economic analysis coupled with the results of the NPV evaluation strongly indicate that the proposed project is not the least environmentally damaging practicable alternative.

Table 2. Net Present Value evaluation for the twelve alternatives evaluated in the FEIS

PCS Phosphate Mine Economics Evaluation			
NET PRESENT VALUE OF EACH ALTERNATIVE			
Mine Alternatives	3% Discount Rate	7% Discount Rate	# Years of Profitable Mining
AP	$364,300,909.71	$277,903,276.63	15
EAPA	$524,097,625.97	$352,411,515.70	35
EAPB	$480,656,851.35	$328,416,387.22	27
SCRA	$322,546,488.93	$253,026,944.10	19
SCRB	$293,339,783.09	$231,303,419.79	15
ALT L	$358,954,836.17	$271,764,925.74	23
ALT M	$445,195,180.08	$321,454,432.72	26
SJAA	$346,132,934.40	$266,988,898.53	23
SJAB	$353,940,971.53	$247,989,896.39	20
S33AP	$121,250,674.62	$122,320,107.39	12
No Action	($15,417,603.86)	$7,000,403.73	5
DL1B	$211,886,850.05	$154,818,541.01	10

VI. Minimizing and Compensating for Adverse Impacts

40 CFR 230.10(d): Minimizing and Compensating for Adverse Impacts

The Guidelines require that adverse environmental impacts associated with the proposed discharge of fill material to waters of the United States first be avoided to the maximum extent practicable and then minimized to the extent appropriate and practicable. For unavoidable impacts which remain, compensatory mitigation is required to offset wetland and other aquatic resource losses. EPA and other agencies, most notably the FWS, have recommended additional measures that should be taken to minimize the impact of the mining project on avoided aquatic resources by improving the quality of the reclamation area.

EPA recommends that a topsoil cover be added to the reclaimed areas utilizing, to the extent appropriate and practicable, the topsoil removed prior to site mining. Reuse of on-site topsoil

takes advantage of the soil structure, organic matter, nutrients, and seed sources available in that material (i.e., the A Horizon) which is removed as mining operations advance. According to FWS, there is support for such an approach in the published literature (Farmer and Blue, 1978; Schuman and Power, 1981) and addition of topsoil to phosphate reclamation sites in Florida has yielded better environmental results than traditional methods. Adding approximately one foot of topsoil on average (no less than six inches) would allow the site to recover at a greatly accelerated pace in contrast to not having topsoil and would make the reclaimed area suitable for a broader array of tree species. While EPA recognizes that adequate amounts of topsoil will likely not be available to re-cover the entire reclamation area because of losses during removal and site preparation, reasonable targets for the percent of the reclamation site amended with topsoil should be established.

EPA also recommend that upland portions of the reclamation area be replanted, to the extent appropriate and practicable, in longleaf pine *(Pinus palustris)* and wetland areas be replanted in bald cypress *(Taxodium distichum)* and/or Atlantic white cedar *(Chamaecyparis thyoides)* if Atlantic white cedar is shown to do well on the reclamation sites. All three of these species will grow on low fertility sites and longleaf pine and bald cypress are long lived species that despite slow growth rates can be expected to live long enough to eventually establish moderate stand coverage even on sterile sites. These species will also produce decay resistant litter that over the very long term will rebuild soil. All of these species provide wildlife habitat and all occur naturally in monotypic stands. Reasonable targets for the percent of the reclamation site replanted with these species should be established. It should be noted that these improvements would be in addition to the already agreed-upon 3-foot site cap needed to address the cadmium risk assessment recommendations. Finally, we recommend that all avoided aquatic resources be provided permanent protection from future mining with appropriate binding real estate instruments such as conservation easements.

EPA appreciates the work that the Applicant has put into the proposed compensatory mitigation plan and the steps taken to address concerns raised by EPA during the review of the DEIS, SDEIS and FEIS. However, we continue to have a number of concerns regarding the compensatory mitigation and whether it can effectively offset the proposed impacts. We have previously described our concerns regarding the project's direct impacts to the Nationally Significant Natural Heritage Area. As previously noted, this area was designated by the NC Natural Heritage Program as "nationally significant" which means that it is one of the five best examples of this community type in the nation. In light of the very unique and rare qualities of this area, it is not clear that its attributes could be replaced by compensatory mitigation, raising concerns regarding significant degradation [40 CFR 230.10(c)].

Additionally, for impacts to other mature forested wetlands, not located in the Nationally Significant Natural Heritage Area, we continue to have concerns that the proposed compensatory mitigation will not adequately offset impacts to these systems. Plant communities drive many physical, chemical, and biological processes within wetlands such as 1) sedimentation, and, because of adsorption, nutrient retention; 2) transpiration through hydrological demand; 3) nutrient (inorganic nitrogen and phosphorous) cycling; 4) denitrification, by providing the soil conditions for the appropriate microbial communities; and 5) flood mitigation because mature communities are stable sources of hydraulic roughness. Even if proposed efforts to replace mature forested wetlands with immature restored or created wetlands are successful, the

replacement wetlands will not provide the same level of physical, chemical, and biological processes and functions as the impacted forested wetland systems for a very long time (e.g., 60 to 80 years). Offsets for impacts to mature forested wetlands through the proposed compensatory mitigation are not adequate to maintain wetland functions within the watershed. The current plan requires 2:1 compensation ratios for these impacts. EPA believes that impacts to mature forested wetlands should be offset at compensation ratios of 3:1 to better address the temporal losses associated with the replacement of this wetland type.

VII. EPA/FWS/NMFS Recommended Alternative

Although the formal permit elevation process was initiated with the Corps' February 24, 2009, letter, EPA has continued to coordinate with the Corps and the Applicant in an effort to resolve our concerns regarding the proposed project. To this end, on March 24, 2009, representatives from EPA, FWS and NMFS met with the Corps and the Applicant to discuss our continued concerns with the proposed project. At that meeting, EPA, FWS and NMFS presented a potential alternative plan for mining the site that would address the concerns raised by the agencies by avoiding and minimizing impacts to the aquatic ecosystem, consistent with the Guidelines.

Key Components of the EPA/FWS/NMFS Alternative

The EPA/FWS/NMFS proposal includes four key components:

1) Additional Aquatic Resource Avoidance: The alternative reduces impacts to wetlands from the approximately 3,953 acres of impacts associated with the proposed project down to approximately 2,787 acres of impacts.[7] As previously discussed, EPA has significant concerns regarding the proposed project's direct and indirect adverse impacts to the site's high value aquatic resources, specifically the site's Nationally Significant Natural Heritage Area as well as the site's estuaries, including those identified as Primary Nursery Areas. The additional avoidance was designed to reduce the project's direct and indirect impacts to these resources down to an acceptable level and avoid causing or contributing to significant degradation [40 CFR 230.10(c)]. It should be noted that this alternative which would allow impacts to approximately 2,787 acres of wetlands continues to be extraordinarily large, and would represent the single largest wetland fill authorized to date in the state of NC, amplifying the need to pay very close attention to the execution, monitoring and adaptive management of the project's compensatory mitigation so that the Nation's waters are not significantly degraded.

2) Protection of Avoided Aquatic Resources: The alternative provides permanent protection from mining to the site's avoided areas through the use of appropriate binding real estate instruments such as conservation easements. We are open to discussion regarding compensatory mitigation credit for the permanent protection of these avoided areas. We also note that many of the aquatic resource areas avoided under this alternative provide restoration and enhancement opportunities. We are open to discuss the Applicant's

[7] This alternative would also involve approximately 7.4 acres of impacts to other waters of the United States.

recommendations regarding the appropriate level of compensation credit for the preservation, enhancement, and/or restoration of avoided aquatic resources.

3) Improvements to Site Reclamation: The alternative includes additional measures, consistent with 40 CFR 230.10(d), to minimize the impact of the mining project on avoided aquatic resources by improving the quality of the reclamation areas. Specifically, these measures include the reuse of topsoil from mined areas to re-cover reclaimed areas to the extent appropriate and practicable and the replanting of reclaimed areas with target tree species (longleaf pine, bald cypress and/or Atlantic white cedar) that are expected to improve soil quality and habitat over the long-term (see also Section VI).

4) Improvements to Monitoring and Adaptive Management Plan: The alternative includes additional measures to improve the monitoring and adaptive management of both the mining and mitigation sites. While the footprint of the mining alternative does not extend into the Primary Nursery Areas, we are concerned that the extensive mining of wetlands and streams that serve as the headwaters of these creeks may impair the function of these Primary Nursery Areas. Accordingly, a monitoring program coupled with an adaptive management process is proposed to gauge the impacts to the Primary Nursery Areas from the mining so that appropriate adjustments can be made to mine operations. The monitoring provisions also require the establishment of an independent panel of scientists and engineers to annually evaluate whether direct and indirect impacts from mining and benefits from the compensatory mitigation are in accordance with expectations at the time of permitting.

Development of the EPA/FWS/NMFS Alternative

In the development of this alternative, we assumed that pursuant to evaluation of alternatives under the Guidelines, the basic project purpose, in this instance, is to continue mining at the Applicant's existing mining operation. Practicable alternatives are those which could meet this basic purpose and are available and capable of being done after taking into consideration cost, existing technology, and logistics.

The FEIS argues that 15 years represents an adequate planning horizon for this phosphate mining project and that an alternative is reasonable if it provides "the applicant with the certainty of practicable costs for at least 15 years" (FEIS at 2-29). From the standpoint of logistics, it would seem appropriate to limit the evaluation of alternatives pursuant to the Guidelines to those which provide at least 15 years of economically viable mining. Based on EPA's NPV analysis (see Table 2), the AP, EAPA, EAPB, SCRA, SCRB, ALT L, ALT M, SJAA, and SJAB alternatives would be considered practicable. Of these the SCRA and SCRB alternatives, which involve the same level of aquatic resource impacts, would be considered the least environmentally damaging practicable alternatives.

EPA/FWS/NMFS, however, continue to be concerned that the level of impacts associated with the SCRA and SCRB alternatives would allow an unacceptable level of 1) direct impacts to the site's Nationally Significant Natural Heritage Area and 2) indirect impacts to the site's tidal

creeks, including those identified as Primary Nursery Areas. Thus, the agencies developed a mining alternative, within the boundaries of the existing array of alternatives evaluated in the FEIS, that attempts to maximize protection of these ecologically valuable areas while continuing to ensure 15 years of economically viable mining. While we do not have precise economic data for the mining boundary proposed, since it was not specifically evaluated in the FEIS, our proposed boundary was developed based on comparing it to the economic data generated for those alternative mine plans that involved both greater and lesser mining impacts on each of the three tracts. Based on our best professional judgment, we estimate that our proposed alternative maximizes protections for high value aquatic resources, to a greater extent than either the SCRA or SCRB alternatives, while continuing to provide at least 15 years of economically viable mining, making it the apparent LEDPA.

GIS coverages illustrating our proposed mining boundaries for the NCPC and Bonnerton tracts have been provided to the Corps and the Applicant so that a detailed economic analysis can be developed. Our alternative does not alter the proposed mining boundary on the S33 tract; it continues to be the boundary associated with the Modified L Alternative.

EPA believes that this alternative, if practicable, would also address the primary concerns of those who are challenging the NCDWQ's CWA Section 401 certification of the project, and threatening litigation. The Applicant expressed a desire to review the new alternative and noted that its evaluation could take a month or longer. We believe that we cannot conclude that this alternative proposal, or a modified version of it, is not practicable until we have heard back from the Applicant.

VIII. Conclusions and Recommendations

In summary, we believe that the permit, as proposed, would fail to comply with the Guidelines for the following reasons:

1. There are less environmentally damaging practicable alternatives that meet the project purpose [40 CFR 230.10(a)];
2. The project's direct and indirect impacts to high value wetland and stream systems including areas designated as Nationally Significant Natural Heritage Areas and Primary Nursery Areas would cause or contribute to significant degradation of the Nation's waters [40 CFR 230.10(c)]; and
3. All appropriate and practicable steps have not been taken to minimize and compensate for the project's adverse impacts to waters of the United States [40 CFR 230.10(d)].

Therefore, EPA requests that the ASA (Civil Works) direct the Wilmington District to do the following: 1) in coordination with the Applicant, withdraw the NOI letter and initiate further analysis of the new proposed alternative to determine whether such alternative or a modification of it, would be practicable, and thus the "LEDPA"; **or** 2) revise the proposed permit consistent with the following: a) revise its alternatives analysis for the proposed project to address inconsistencies that bias identification of the LEDPA, b) in development of the LEDPA, avoid direct impacts to the Nationally Significant Natural Heritage Area and indirect impacts to the site's tidal creeks, including those identified as Primary Nursery Areas, to the maximum extent

practicable, c) incorporate all appropriate and practicable measures to minimize the impact of the mining project on avoided aquatic resources by improving the quality of the reclamation areas (i.e., re-using top soil and re-vegetating with target plant species), d) ensure that all avoided aquatic resources are provided permanent protection from future mining with the appropriate binding real estate instruments such as conservation easements, e) revise the compensatory mitigation plan to effectively offset impacts to mature forested wetlands and f) include measures to ensure effective monitoring and adaptive management of both the mining and mitigation sites.

Citations

Alexander, R.B., Boyer, E.W., Smith, R.A., Schwartz, G.E., and R.B. Moore. 2007. The role of headwater streams in downstream water quality. Jounral of the American Water Resources Association 43(1): 41-59.

Farmer, E.E. and W.G. Blue. 1978. Reclamation of lands mined for phosphate. Pages 585-608 In: F.W. Schaller and P. Sutton (eds.). Reclamation of Drastically Disturbed Lands. American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, Madison, WI.

Gomi, T., Sidle, R.C., and J.S. Richardson. 2002. Understanding processes and downstream linkages of headwater systems. BioScience 52(10): 905-916.

Meyer J.L. and J.B. Wallace. 2001. Lost linkages and lotic ecology: Rediscovering small streams. In: *Ecology: Achievement and Challenge*, M.C. Press, N.J. Huntly, and S.Levin (Editors). Blackwell Science, Malden, Massachusetts, pp 295-317.

Meyer, J.L., Strayer, D.L., Wallace, B., Eggert, S.L., Helfman, G.S., and N.E. Leonard. 2007. The contribution of headwater streams to biodiversity in river networks. Journal of the American Water Resources Association 43(1): 86-103.

Feierabend, S.J. and J.M. Zelazny. 1987. Status report on our nation's wetlands. National Wildlife Federation, Washington, D.C., 50pp.

Schuman, G.E. and J.F. Power. 1981. Topsoil management of mined soils. Journal of Soil and Water Conservation 36: 77-78.

Street, M.W., A.S. Deaton, W.S. Chappell, and P.D. Mooreside. 2005. North Carolina Coastal Habitat Protection Plan. N.C. Department of Environment and Natural Resources, Division of Marine Fisheries. Morehead City. 630 pp.

West, T.L., Clough, L.M., Ambrose Jr, W.G. 2000. Assessment of function in an oligohaline environment: Lessons learned by comparing created and natural habitats. Ecological Engineering 15: 303-321.

Wipfli, M.S., Richardson, J.S., and R.J. Naiman. 2007. Ecological linkages between headwaters and downstream ecosystems: Transport of organic matter, invertebrates, and wood down headwater channels. Journal of the American Water Resources Association 43(1): 72-85.

Appendix 1: EPA's Analysis of the FEIS Economic Evaluation

This appendix contains three sections. The first briefly details the U.S. Environmental Protection Agency's (EPA) primary concerns with the U.S. Army Corps of Engineers, Wilmington District's (the Corps) Economic Evaluation included in the Final Environmental Impact Statement (FEIS) for the proposed Section 404 permit to the Potash Corporation of Saskatchewan Phosphate Division (PCS or the Applicant) to expand an existing phosphate mining operation (Action ID: AID 200110096) in Beaufort County, NC. It should be noted that the Preamble (Federal Register Vol. 45 No. 249, page 85339, dated December 24, 1980) for the Clean Water Act (CWA) Section 404(b)(1) Guidelines (the Guidelines) addresses the issue of cost and economics. The Preamble makes it clear that the cost factor for purposes of practicability is in terms of what is reasonable in light of overall scope/cost of the proposed project and that it is not to be construed as an economics factor which would consider such matters as the applicant's financial standing, or investment, or market share. However, matters such as economic viability may be considered in the question of whether or not the project is available and logistically practicable. The second section describes the alternative evaluation method suggested by EPA and its results. The final section addresses the Corps' comments regarding EPA's method from its February 24, 2009, Notice of Intent (NOI) letter.

I. Concerns Regarding the Corps' FEIS Economic Evaluation

The FEIS evaluated eleven alternative mining alignments and a "No-Action" alternative. A central component of the FEIS's alternatives analysis was the evaluation of each alternative to determine if it was reasonable and feasible in light of its costs (i.e., economically viable). One of EPA's primary concerns regarding the Corps' FEIS Economic Evaluation is that the Corps intends to decide economic viability based solely on cost estimates without any consideration of the revenues the operation will bring in while incurring the costs. EPA does not contest the validity of the cost estimates produced by the Marston Cost Model (in fact all cost estimates used in the analysis done by EPA come directly from the Marston Cost Model), however consideration of expected costs without considering the accompanying expected revenue provides limited information on economic viability. For example, one cannot make any judgment on economic viability if all we know is that costs of an alternative is $1,000,000. However, we can make an informed decision if we compare the expected costs to expected revenues (i.e., revenues of less than $1,000,000 would mean the project is clearly not economically viable while revenues greater than $1,000,000 would suggest the project at least passes an initial hurdle of practicability under the Guidelines). EPA agrees with the Corps' assessment that "no or negative cash flow" is not practicable (FEIS Section 2.7.4. pg 2-22). The expected level of costs that would cause the applicant to break even would effectively set the upper cost bound for economic viability (i.e., the highest level of costs a firm could potentially endure).

As is pointed out numerous times in the FEIS, phosphate prices are determined by the (global and national) market and not influenced by the applicant's production levels. Comparing costs (which the applicant can control) to expected prices (which the firm does not control) simply adds context to the cost numbers and allows for better decision making.

A second major issue with the FEIS Economics Evaluation concerns the Corps' use of a 15 year time frame for alternative evaluation. If a project is expected to last longer than 15 years, then the entire length of the project should be included in the evaluation. No convincing reason has yet been given as to why a 37 year permit should be awarded based on evaluation of only the first 15 years of a potential project. Calculating the net present value (NPV) of each alternatives stream of future profits allows the equal comparison of different length alternatives. Evaluating only the first 15 years of a 15+ year project ignores the effects of those later years and weights the decision criteria in favor of those alternatives with the most profitable early years. In many cases, potential alternatives include higher cost mining areas in later years where they are not subject to evaluation. Their inclusion as part of the alternatives clearly signals that mining those areas is in the applicant's plans and therefore should be evaluated as part of the value of the alternative.

It is also important to note that the cost estimates presented in the FEIS do not account for any impacts the alternatives may have on recreational opportunities (hunting, fishing, bird watching, hiking, etc), unique cultural and environmental resources, and other environmental quality issues (like water quality). Degradation or loss of these types of resources has real effects on peoples' well being that have been estimated extensively in the economic literature. These losses may be partially or fully offset by mitigation undertaken, but they (as well as accounting production costs) should be considered and quantified when possible when evaluating alternatives.

II. Explanation of EPA's Analysis

The most straight forward and theoretically correct way to evaluate the economic viability of multiple alternatives of different lengths is to compare the discounted NPV of each alternative's stream of expected profits. By calculating the NPV of each alternative it is possible to compare the total value of each project in equal terms (current year dollars). An alternative with a positive NPV will add positive value to the applicant's company if undertaken and therefore demonstrates at least a minimum level of economic viability. EPA's review of the FEIS's Economic Evaluation uses expected cost and value data from the FEIS to calculate both the total NPV and the expected profit per year for every year of every alternative.

NPV analysis works by discounting future profits or losses back to the current (or any assumed baseline) year value and then summing the discounted years values to get the total current value. Discounting assumes that a dollar in the future is worth less than a

dollar today due to the time value of money and investment risk (among other things). The amount that the value of a future dollar is discounted is given by the discount rate.

Each step used in calculating the NPV of alternatives is described below.

1. Using 1991 to 2007 USGS adjusted price per ton estimates from Table 2-7 on page 6-12 of Volume 1 of the FEIS (and reproduced on pages 8 and 9 of this appendix), future value per ton is predicted using an ordinary least squares regression.

Table A1: Predicted Adjusted Price Per Ton

	Year	Intercept
Coefficient Estimate	-0.0063	27.90081
Standard error	0.12767	1.308226

The fitted line predicts that prices will be relatively constant in the future (declining less than one cent per year). The estimated price intercept and year slope term are then used to predict the adjusted price per ton out into the future for the years the alternatives are assumed to be in operation. The estimate is likely conservative based on the recent increases in prices. The predictions assume that sales from this operation do not affect the overall market price. A graphic depiction of the historic prices and fitted line is given in Figure A1.

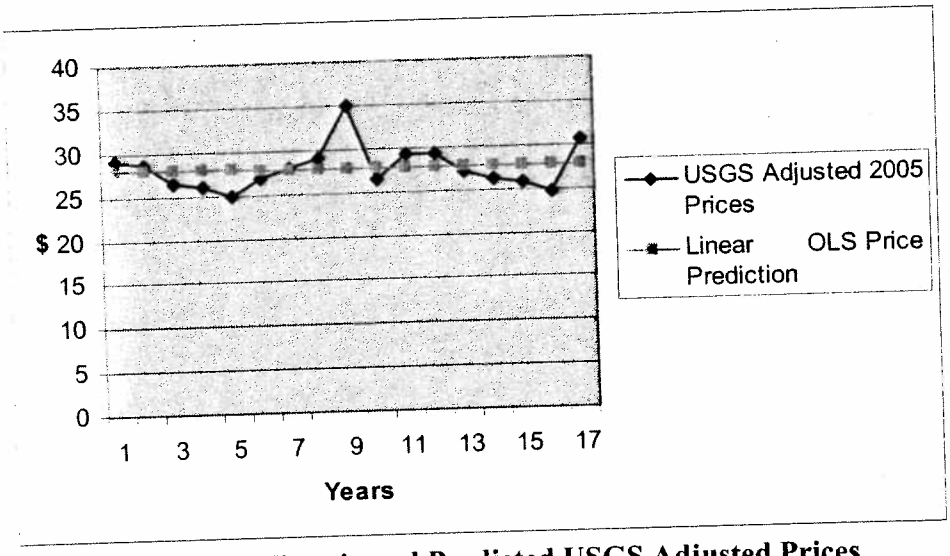


Figure A1: Historic and Predicted USGS Adjusted Prices

2. Next, the profit per ton per year for each alternative is computed. Cost per ton estimates for each year for each alternative from Table 2-6 on page 6-11 of the FEIS (and reproduced on pages 11 and 12 of this appendix) are subtracted from the value per ton per year estimates (from step 1) to get estimates of the profit per ton per year for each year for all alternatives. (Price per ton – cost per ton = profit per ton). Profit

per ton results for all years for all alternatives are presented on pages 15 and 16 of this appendix.

3. Then, total profit per year for each alternative is computed. Estimates of expected concentrated tons extracted from each alternative for each year from the tables in Appendix D of the FEIS (and reproduced on pages 13 and 14 of this appendix) are multiplied by the corresponding profit per concentrated ton for each year for each alternative (from step 2) to get estimates of total profit per year for each year for each alternative. (Profit per ton in a year * number of tons extracted in that year = total profit that year). Profit per year estimates for each alternative are presented on pages 17 and 18 of this appendix. The profit per year estimates for each alterative can also be used to understand the timing of annual profits for each alternative.

4. The net present value of the stream of annual profits over the life of each alternative is then calculated for each option. NPV is calculated

$$NPV = \sum_{t}^{T} \frac{profit_t}{(1+r)^t}$$

where t (t=1 .... T) indexes the years of an alternative, $profit_t$ is profit in year t (from step 3), and r is the discount rate. Following White House Office of Management and Budget (OMB) guidance we have used both a 3% and 7% discount rate. The NPV results are presented in Table A2.

Table A2. Net Present Value evaluation for the twelve alternatives evaluated in the FEIS

PCS Phosphate Mine Economics Evaluation			
NET PRESENT VALUE OF EACH ALTERNATIVE			
Mine Alternatives	3% Discount Rate	7% Discount Rate	# Years of Profitable Mining
AP	$364,300,909.71	$277,903,276.63	15
EAPA	$524,097,625.97	$352,411,515.70	35
EAPB	$480,656,851.35	$328,416,387.22	27
SCRA	$322,546,488.93	$253,026,944.10	19
SCRB	$293,339,783.09	$231,303,419.79	15
ALT L	$358,954,836.17	$271,764,925.74	23
ALT M	$445,195,180.08	$321,454,432.72	26
SJAA	$346,132,934.40	$266,988,898.53	23
SJAB	$353,940,971.53	$247,989,896.39	20
S33AP	$121,250,674.62	$122,320,107.39	12
No Action	($15,417,603.86)	$7,000,403.73	5
DL1B	$211,886,850.05	$154,818,541.01	10

The results of the NPV analysis, presented in Table A2, highlight that contrary to the conclusions drawn in the FEIS, many of the alternatives evaluated in the FEIS are indeed economically viable and should not have been eliminated from further consideration.

According to the FEIS, an alternative is reasonable if it provides "the applicant with the certainty of practicable costs for at least 15 years" (FEIS 2-29). Assuming this criterion is appropriate for use in determining whether an alternative is available and logistically practicable under the Guidelines, only the "No Action" and the S33AP and DL1B alternatives should have been eliminated from further consideration since they are the only three alternatives that do not provide at least 15 years of economically viable mining. If the 15 year criterion is not relevant for purposes of evaluating alternatives under the Guidelines and is not used, even the S33AP and DL1B options have a positive net present value and would be a better use of the land for the applicant than letting it remain unused. Discounted annual profit estimates for each alternative are presented on pages 20 through 23 of this appendix.

A number of the alternatives that are economically viable, based on the NPV analysis, involve far fewer impacts to aquatic resources than the FEIS's Alternative L or the proposed project (Modified Alternative L). EPA finds that the inconsistencies in the FEIS's economic analysis coupled with the results of the NPV evaluation strongly indicate that the proposed project is not the least environmentally damaging practicable alternative.

In order to check the sensitivity of results to the price estimate, the NPV of all alternatives was also calculated assuming both a 10% increase and decrease in predicted prices every year.[1] When predicted prices are assumed to decrease by 10% every year the S33AP, DL1B, and No Action alternatives do have negative NPV's, however all the other remaining alternatives do have positive NPV's signaling that even with depressed prices and profits a number of alternatives with fewer impacts to aquatic resources than the FEIS's Alternative L are still economically viable. If prices are assumed to increase 10% over predicted prices for all years then all alternatives have positive NPV's. The sensitivity results are presented below in Table A3.

[1] The 1991 to 2007 USGS adjusted price data used to estimate future prices had a standard deviation of roughly $2.50 or 10% of the sample's mean value.

Table A3. Net Present Value Sensativity to Price Estimation Analysis

PCS Phosphate Mine Economics Evaluation				
NET PRESENT VALUE OF EACH ALTERNATIVE				
	10% Decrease in Mean Predicted USGS Prices		10% Increase in Mean Predicted USGS Prices	
Mine Alternatives	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate
AP	$199,692,806	$152,096,957	$528,909,013	$403,709,596
EAPA	$172,703,927	$161,903,126	$875,491,325	$542,919,905
EAPB	$129,263,152	$137,907,998	$832,050,551	$518,924,777
SCRA	$41,554,309	$78,150,857	$603,538,668	$427,903,032
SCRB	$12,347,604	$56,427,332	$574,331,963	$406,179,507
ALT L	$53,061,028	$90,235,035	$664,848,644	$453,294,816
ALT M	$125,184,502	$136,707,141	$765,205,858	$506,201,725
SJAA	$11,528,380	$79,332,534	$680,737,489	$454,645,263
SJAB	$19,334,672	$60,332,773	$688,547,271	$435,647,019
S33AP	($119,099,609)	($38,885,328)	$361,600,958	$283,525,543
No Action	($173,111,811)	($114,811,873)	$142,276,603	$128,812,681
DL1B	($148,326,103)	($10,593,356)	$572,099,803	$320,230,438

III. Responses to the Corps NOI letter:

- **The Corps**: "The Corps has also concluded that comparison of these cost estimates to an independently generated industry estimate of product value (the USGS value) is the most appropriate gauge available for determining cost practicability."

  Response: EPA analysis does compare the Marston Cost model estimates to USGS value estimates. Costs are predicted by the Marston Model and historic USGS estimates are used to extrapolate future values. EPA analysis then looks at the difference between expected costs and revenues to give a measure of economic viability. To our knowledge, the Corps and/or Applicant's analysis have never directly compared costs to product value.

- **The Corps**: "Finally, the Corps has determined that alternatives that give the applicant approximately 15 years of operation within the less costly Tracts (NCPC and Bonnerton) are practicable while alternatives that would require mining within the S33 Tract within the initial approximately 15 years are not practicable."

  Response: It is still unclear (and unjustified) why the Corps has determined that a 15 year time frame should be used in aspects of the decision making. EPA's NPV analysis demonstrates that a number of alternatives that do not provide 15 years of operation in NCPC and Bonnerton and require mining within S33 are economically viable and practicable, including SCRA and SCRB. Further, if a project is expected to last longer than 15 years, then the entire length of the

project should be included in the evaluation. For all mining alternatives except AP, SCRB, S33AP and DL1B, roughly the first 20 years have positive expected profits. In the case of S33AP the first 12 years have positive expected profits and in the case of the DL1B the first 10 years have positive profits. Net present value methods allow comparison of projects of different lengths in equal terms (current year dollars) and therefore would allow full evaluation of alternatives.

- **The Corps**: "The NPV arguments presented to the USACE were largely cash flow analyses (i.e., sales less cost) and should not be confused with final income statements or profits."

  Response: Sales price less cost (on a per unit basis or in terms of totals) equals profit. EPA only used terms like sales minus costs because the Corps was resistant to the word profit. Further, two sentences later the Corps states: "Using this total NPV for each alternative suggests that practically all of the alternatives can yield profitable results over the period of the life of the mine." This sentence seems to admit/agree that the NPV analysis looks at profitability which contradicts the Corps' earlier statement.

- **The Corps**: "The problem with this approach is that it obviously does not allow consideration of costs on an annual basis. In this case we are considering a private enterprise, costs extended over very long periods of time, and costs which fluctuate substantially over the years. Regardless of the analysis used, it is clear that while many years of mining are likely to be profitable under most of the alternatives, there are also many consecutive years in which mining is likely not to be cost effective."

  Response: One of the strengths of the EPA approach is that is does allow consideration of costs on a yearly basis. Annual costs, expected revenues, and profits are all calculated as part of the analysis. The summed value of annual discounted profit estimates (the NPV) gives an overall value of an alternative, but simply looking at the discounted yearly estimates (before summing) shows how costs and revenues are fluctuating each year.

  The timing and sequence of profits is something that should be considered in evaluation options. As stated earlier, the first 15 to 20 years of all mining alternatives except the S33AP and DL1B have positive profits (S33AP has positive profits for the first 12 and DL1B has positive profits for the first 10 years).

PREDICTED VALUE PER TON: (USGS adjusted price per ton estimates from Table 2-7 on page 6-12 of Volume 1 of the FEIS):

YEAR	USGS Adjusted 2005 Prices	Renumbered Years	Linear OLS Price Prediction
1991	29.16	1	27.8945098
1992	28.56	2	27.88821078
1993	26.49	3	27.88191176
1994	26.03	4	27.87561275
1995	24.83	5	27.86931373
1996	26.91	6	27.86301471
1997	28.08	7	27.85671569
1998	29.02	8	27.85041667
1999	34.91	9	27.84411765
2000	26.38	10	27.83781863
2001	29.24	11	27.83151961
2002	29.21	12	27.82522059
2003	27.16	13	27.81892157
2004	26.26	14	27.81262255
2005	25.88	15	27.80632353
2006	24.6	16	27.80002451
2007	30.63	17	27.79372549
2008		18	27.78742647
2009		19	27.78112745
2010		20	27.77482843
2011		21	27.76852941
2012		22	27.76223039
2013		23	27.75593137
2014		24	27.74963235
2015		25	27.74333333
2016		26	27.73703431
2017		27	27.73073529
2018		28	27.72443627
2019		29	27.71813725
2020		30	27.71183824
2021		31	27.70553922
2022		32	27.6992402
2023		33	27.69294118
2024		34	27.68664216
2025		35	27.68034314
2026		36	27.67404412
2027		37	27.6677451
2028		38	27.66144608
2029		39	27.65514706
2030		40	27.64884804
2031		41	27.64254902
2032		42	27.63625
2033		43	27.62995098
2034		44	27.62365196

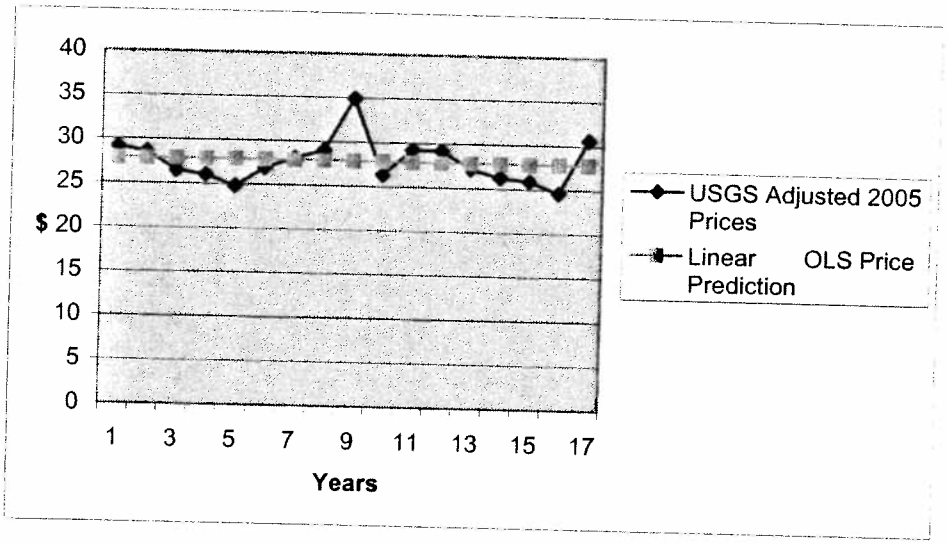
2035	45	27.61735294
2036	46	27.61105392
2037	47	27.6047549
2038	48	27.59845588
2039	49	27.59215686
2040	50	27.58585784
2041	51	27.57955882
2042	52	27.5732598
2043	53	27.56696078
2044	54	27.56066176
2045	55	27.55436275
2046	56	27.54806373
2047	57	27.54176471
2048	58	27.53546569
2049	59	27.52916667
2050	60	27.52286765
2051	61	27.51656863
2052	62	27.51026961
2053	63	27.50397059
2054	64	27.49767157
2055	65	27.49137255
2056	66	27.48507353
2057	67	27.47877451
2058	68	27.47247549
2059	69	27.46617647
2060	70	27.45987745
2061	71	27.45357843
2062	72	27.44727941
2063	73	27.44098039
2064	74	27.43468137
2065	75	27.42838235

OLS REGRESSION RESULTS: (Using USGS adjusted 2005 prices and Year from Predicted value per ton pages)

Linear

	Year	Intercept
Coefficient Estimate	-0.0063	27.90081
Standard error	0.12767	1.308226
	0.000162	2.578804
	0.002434	15
	0.016188	99.75342

*** Based on the data from 1991 through 2007, I have used a simple trend to predict future USGS Adjusted Prices into the future through the year 2065. These are likely conservative estimates since the recent phosphate prices seem to be rising.**



PREDICTED COST PER TON: (from Table 2-6 on page 6-11 of the FEIS)

YEAR	AP	EAPA	EAPB	SCRA	SCRB	ALT L	ALT M	SJAA
1	19.83	19.83	19.83	22.11	22.11	22.11	20.78	21.97
2	22.06	22.06	22.06	21.53	21.53	21.53	20.83	22.75
3	22.58	22.58	22.58	22.15	22.15	22.15	21.18	22.79
4	22.44	22.44	22.44	23.7	23.7	23.7	22.84	23.93
5	21.42	21.42	21.42	20.73	20.73	20.73	23.03	21.89
6	22.65	22.65	22.65	21.32	21.32	21.32	20.96	21.86
7	21.95	21.95	21.95	22.12	22.03	22.23	21.46	21.95
8	22	22	22	22.75	22.86	22.28	21.3	21.79
9	22.07	22.07	22.07	21.86	22.02	21.14	20.88	20.69
10	20.98	20.98	20.98	22.86	22	21.88	21.81	21.75
11	20.83	20.83	20.83	24.65	22.28	23.22	20.96	22.28
12	20.94	20.94	20.94	24.78	24.31	26.25	22.57	23.63
13	21	21	21	22.28	23.71	24.71	21.29	24.32
14	21.17	21.43	21.39	22.65	23.5	23.43	22.2	25.17
15	21.96	21.67	21.37	22.46	26.99	23.72	23.83	24.35
16		22.67	23.43	24.36	30.32	23.13	26.13	22.57
17		21.66	22.18	23.3	27.06	22.8	25.07	23.42
18		22.4	22.33	23.16	27.45	22.69	22.96	22.58
19		22.17	22.96	25.04	28.58	23.8	23.73	22.59
20		24.85	23.79	29.25	28.85	24.96	23.16	24.48
21		24.37	23.3	29.09	29.1	23.61	22.82	23.51
22		24.28	23.46	27.65	29.15	23.25	22.63	23.75
23		22.6	24.98	27.85	28.13	27.44	23.91	23.76
24		24.06	27.4	28.9	29.51	29.62	24.94	28.75
25		22.3	27.36	28.39	28.19	27.52	23.46	27.82
26		22.64	26.81	28.71	29.29	27.78	24.01	27.73
27		23.06	26.75	29.85	29.44	26.14	27.82	27.41
28		24.09	28.91	29.09	26.94	30.34	29.28	29.76
29		23.77	29.48	28.04	23.98	29.2	27.59	29.46
30		23.19	28.61	29.32	24.18	28.63	27.63	28.78
31		24.53	28.32	28.86	25.03	30.21	26.51	30.58
32		26.41	28.28	31.38	26.9	29.47	30.68	30.02
33		27.25	29.31			28.88	28.88	28.98
34		26.18	28.55			28.2	28.91	27.67
35		26.79	29.91			29.35	30.48	29.37
36		27.63	28.96			28.46	28.83	29.51
37		28.77	28.1			30.43	28.92	31.04
38		30.05	28.97				28.12	28.68
39		28.5	29.51				29.31	28.91
40		28.52	29.04				28.64	27.6
41		28.33	24.53				30.92	29.3
42		29.88	23.37					29.44
43		28.45	23.58					30.97
44		30.13	23.74					28.61
45		28.23	23.59					
46		28.62	24.63					
47		28.8	24.94					
48		30.49	23.67					
49		28.72	23.33					
50								

YEAR	SJAB	S33AP	No Action	DL1B
1	21.97	22.02	23.63	22.62
2	22.75	22.21	23.43	22.02
3	22.79	22.11	23.83	22.23
4	23.93	23.87	26.8	22.91
5	21.89	23.24	27.67	22.07
6	21.86	22.5	29.22	22.56
7	21.95	23.98	28.18	23.41
8	21.79	25.98	29.87	24
9	20.6	26.96	30.16	23.25
10	22.21	26.63	29.36	27.47
11	22.29	26.78	29.36	29.58
12	23.25	27.2	29.45	28.24
13	23.42	28.62	31.3	27.7
14	23.17	29.67	32.96	28.64
15	23.63	28.82	35.15	27.95
16	25.01	29.41		30.05
17	28.04	27.88		29.27
18	27.36	29.78		28.11
19	27.65	28.32		28.81
20	27.02	30.81		29.09
21	29.22	28.17		29.17
22	29.28	28.5		29.62
23	29	28.89		25.47
24	31.49	30.44		24.6
25	28.73	29.08		23.84
26	28.9			25.37
27	27.84			25.47
28	30.04			
29	29.13			
30	30.46			
31	26.77			
32	23.93			
33	24.37			
34	24.25			
35	24.65			
36	25.81			
37	24.01			
38	23.77			
39	23.87			
40	23.75			
41	24.15			
42	25.31			
43	23.51			
44	23.27			
45				
46				
47				
48				
49				
50				

EXTRACTED CONCENTRATE TONS PER YEAR: (from the tables in Appendix D of the FEIS)

YEAR	AP	EAPA	EAPB	SCRA	SCRB	ALT L	ALT M	SJAA
1	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
2	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
3	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
4	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
5	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
6	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
7	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
8	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
9	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
10	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
11	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
12	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
13	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
14	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
15	4431000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
16		5000000	5000000	5000000	5000000	5000000	5000000	5000000
17		5000000	5000000	5000000	5000000	5000000	5000000	5000000
18		5000000	5000000	5000000	5000000	5000000	5000000	5000000
19		5000000	5000000	5000000	5000000	5000000	5000000	5000000
20		5000000	5000000	5000000	5000000	5000000	5000000	5000000
21		5000000	5000000	5000000	5000000	5000000	5000000	5000000
22		5000000	5000000	5000000	5000000	5000000	5000000	5000000
23		5000000	5000000	5000000	5000000	5000000	5000000	5000000
24		5000000	5000000	5000000	5000000	5000000	5000000	5000000
25		5000000	5000000	5000000	5000000	5000000	5000000	5000000
26		5000000	5000000	5000000	5000000	5000000	5000000	5000000
27		5000000	5000000	5000000	5000000	5000000	5000000	5000000
28		5000000	5000000	5000000	5000000	5000000	5000000	5000000
29		5000000	5000000	5000000	5000000	5000000	5000000	5000000
30		5000000	5000000	5000000	5000000	5000000	5000000	5000000
31		5000000	5000000	5000000	5000000	5000000	5000000	5000000
32		5000000	5000000	3649000	3649000	5000000	5000000	5000000
33		5000000	5000000			5000000	5000000	5000000
34		5000000	5000000			5000000	5000000	5000000
35		5000000	5000000			5000000	5000000	5000000
36		5000000	5000000			5000000	5000000	5000000
37		5000000	5000000			5000000	5000000	5000000
38		5000000	5000000			5000000	5000000	5000000
39		5000000	5000000			5000000	5000000	5000000
40		5000000	5000000			5000000	5000000	5000000
41		5000000	5000000			5000000	5000000	5000000
42		5000000	5000000			5000000	5000000	5000000
43		5000000	5000000			5000000	5000000	5000000
44		5000000	5000000			5000000	5000000	5000000
45		5000000	5000000			5000000	5000000	5000000
46		5000000	5000000			5000000	5000000	5000000
47		5000000	5000000			5000000	5000000	5000000
48		5000000	5000000			5000000	5000000	5000000
49		2754000	2754000			3846000	5000000	5000000
50							5000000	5000000
							5000000	5000000
							5000000	5000000
							5000000	5000000
							2902000	5000000
								5000000
								4923000
								3626000

YEAR	SJAB	S33AP	No Action	DL1B
1	5000000	5000000	5000000	5000000
2	5000000	5000000	5000000	5000000
3	5000000	5000000	5000000	5000000
4	5000000	5000000	5000000	5000000
5	5000000	5000000	5000000	5000000
6	5000000	5000000	5000000	5000000
7	5000000	5000000	5000000	5000000
8	5000000	5000000	5000000	5000000
9	5000000	5000000	5000000	5000000
10	5000000	5000000	5000000	5000000
11	5000000	5000000	5000000	5000000
12	5000000	5000000	5000000	5000000
13	5000000	5000000	4578000	5000000
14	5000000	5000000	3648000	5000000
15	5000000	5000000	2383000	5000000
16	5000000	5000000		5000000
17	5000000	5000000		5000000
18	5000000	5000000		5000000
19	5000000	5000000		5000000
20	5000000	5000000		5000000
21	5000000	5000000		5000000
22	5000000	5000000		5000000
23	5000000	5000000		5000000
24	5000000	5000000		5000000
25	5000000	4236000		5000000
26	5000000			5000000
27	5000000			3236000
28	5000000			
29	5000000			
30	5000000			
31	5000000			
32	5000000			
33	5000000			
34	5000000			
35	5000000			
36	5000000			
37	5000000			
38	5000000			
39	5000000			
40	5000000			
41	5000000			
42	5000000			
43	5000000			
44	3549000			
45				
46				
47				
48				
49				
50				

Total Tons Removed	
AP	74431000
EAPA	242754000
EAPB	242754000
SCRA	158649000
SCRB	158649000
ALT L	183846000
ALT M	202902000
SJAA	218549000
SJAB	218549000
S33AP	124236000
No Action	70609000
DL1B	133236000

PROFIT PER TON: (Expected Price Per Ton – Predicted Cost Per Ton for every year for every alternative)

YEAR	AP	EAPA	EAPB	SCRA	SCRB	ALT L	ALT M
1	7.957426	7.957426	7.957426	5.677426	5.677426	5.677426	7.007426
2	5.721127	5.721127	5.721127	6.251127	6.251127	6.251127	6.951127
3	5.194828	5.194828	5.194828	5.624828	5.624828	5.624828	6.594828
4	5.328529	5.328529	5.328529	4.068529	4.068529	4.068529	4.928529
5	6.34223	6.34223	6.34223	7.03223	7.03223	7.03223	4.73223
6	5.105931	5.105931	5.105931	6.435931	6.435931	6.435931	6.795931
7	5.799632	5.799632	5.799632	5.629632	5.719632	5.519632	6.289632
8	5.743333	5.743333	5.743333	4.993333	4.883333	5.463333	6.443333
9	5.667034	5.667034	5.667034	5.877034	5.717034	6.597034	6.857034
10	6.750735	6.750735	6.750735	4.870735	5.730735	5.850735	5.920735
11	6.894436	6.894436	6.894436	3.074436	5.444436	4.504436	6.764436
12	6.778137	6.778137	6.778137	2.938137	3.408137	1.468137	5.148137
13	6.711838	6.711838	6.711838	5.431838	4.001838	3.001838	6.421838
14	6.535539	6.275539	6.315539	5.055539	4.205539	4.275539	5.505539
15	5.73924	6.02924	6.32924	5.23924	0.70924	3.97924	3.86924
16		5.022941	4.262941	3.332941	-2.62706	4.562941	1.562941
17		6.026642	5.506642	4.386642	0.626642	4.886642	2.616642
18		5.280343	5.350343	4.520343	0.230343	4.990343	4.720343
19		5.504044	4.714044	2.634044	-0.90596	3.874044	3.944044
20		2.817745	3.877745	-1.58225	-1.18225	2.707745	4.507745
21		3.291446	4.361446	-1.42855	-1.43855	4.051446	4.841446
22		3.375147	4.195147	0.005147	-1.49485	4.405147	5.025147
23		5.048848	2.668848	-0.20115	-0.48115	0.208848	3.738848
24		3.582549	0.242549	-1.25745	-1.86745	-1.97745	2.702549
25		5.33625	0.27625	-0.75375	-0.55375	0.11625	4.17625
26		4.989951	0.819951	-1.08005	-1.66005	-0.15005	3.619951
27		4.563652	0.873652	-2.22635	-1.81635	1.483652	-0.19635
28		3.527353	-1.29265	-1.47265	0.677353	-2.72265	-1.66265
29		3.841054	-1.86895	-0.42895	3.631054	-1.58895	0.021054
30		4.414755	-1.00525	-1.71525	3.424755	-1.02525	-0.02525
31		3.068456	-0.72154	-1.26154	2.568456	-2.61154	1.088456
32		1.182157	-0.68784	-3.78784	0.692157	-1.87784	-3.08784
33		0.335858	-1.72414			-1.29414	-1.29414
34		1.399559	-0.97044			-0.62044	-1.33044
35		0.78326	-2.33674			-1.77674	-2.90674
36		-0.06304	-1.39304			-0.89304	-1.26304
37		-1.20934	-0.53934			-2.86934	-1.35934
38		-2.49564	-1.41564				-0.56564
39		-0.95194	-1.96194				-1.76194
40		-0.97824	-1.49824				-1.09824
41		-0.79453	3.005466				-3.38453
42		-2.35083	4.159167				
43		-0.92713	3.942868				
44		-2.61343	3.776569				
45		-0.71973	3.92027				
46		-1.11603	2.873971				
47		-1.30233	2.557672				
48		-2.99863	3.821373				
49		-1.23493	4.155074				
50							

YEAR	SJAA	SJAB	S33AP	No Action	DL1B
1	5.817426	5.817426	5.767426	4.157426	5.167426
2	5.031127	5.031127	5.571127	4.351127	5.761127
3	4.984828	4.984828	5.664828	3.944828	5.544828
4	3.838529	3.838529	3.898529	0.968529	4.858529
5	5.87223	5.87223	4.52223	0.09223	5.69223
6	5.895931	5.895931	5.255931	-1.46407	5.195931
7	5.799632	5.799632	3.769632	-0.43037	4.339632
8	5.953333	5.953333	1.763333	-2.12667	3.743333
9	7.047034	7.137034	0.777034	-2.42297	4.487034
10	5.980735	5.520735	1.100735	-1.62926	0.260735
11	5.444436	5.434436	0.944436	-1.63556	-1.85556
12	4.088137	4.468137	0.518137	-1.73186	-0.52186
13	3.391838	4.291838	-0.90816	-3.58816	0.011838
14	2.535539	4.535539	-1.96446	-5.25446	-0.93446
15	3.34924	4.06924	-1.12076	-7.45076	-0.25076
16	5.122941	2.682941	-1.71706		-2.35706
17	4.266642	-0.35336	-0.19336		-1.58336
18	5.100343	0.320343	-2.09966		-0.42966
19	5.084044	0.024044	-0.64596		-1.13596
20	3.187745	0.647745	-3.14225		-1.42225
21	4.151446	-1.55855	-0.50855		-1.50855
22	3.905147	-1.62485	-0.84485		-1.96485
23	3.888848	-1.35115	-1.24115		2.178848
24	-1.10745	-3.84745	-2.79745		3.042549
25	-0.18375	-1.09375	-1.44375		3.79625
26	-0.10005	-1.27005			2.259951
27	0.213652	-0.21635			2.153652
28	-2.14265	-2.42265			
29	-1.84895	-1.51895			
30	-1.17525	-2.85525			
31	-2.98154	0.828456			
32	-2.42784	3.662157			
33	-1.39414	3.215858			
34	-0.09044	3.329559			
35	-1.79674	2.92326			
36	-1.94304	1.756961			
37	-3.47934	3.550662			
38	-1.12564	3.784363			
39	-1.36194	3.678064			
40	-0.05824	3.791765			
41	-1.76453	3.385466			
42	-1.91083	2.219167			
43	-3.44713	4.012868			
44	-1.09343	4.246569			
45					
46					
47					
48					
49					
50					

PROFIT PER YEAR: (Profit Per Ton multiplied by Extracted Concentrate Tons Per Year for every year for every alternative)

YEAR	AP	EAPA	EAPB	SCRA	SCRB	ALT L
1	39787132.35	39787132.35	39787132.35	28387132.35	28387132.35	28387132.35
2	28605637.25	28605637.25	28605637.25	31255637.25	31255637.25	31255637.25
3	25974142.16	25974142.16	25974142.16	28124142.16	28124142.16	28124142.16
4	26642647.06	26642647.06	26642647.06	20342647.06	20342647.06	20342647.06
5	31711151.96	31711151.96	31711151.96	35161151.96	35161151.96	35161151.96
6	25529656.86	25529656.86	25529656.86	32179656.86	32179656.86	32179656.86
7	28998161.76	28998161.76	28998161.76	28148161.76	28598161.76	27598161.76
8	28716666.67	28716666.67	28716666.67	24966666.67	24416666.67	27316666.67
9	28335171.57	28335171.57	28335171.57	29385171.57	28585171.57	32985171.57
10	33753676.47	33753676.47	33753676.47	24353676.47	28653676.47	29253676.47
11	34472181.37	34472181.37	34472181.37	15372181.37	27222181.37	22522181.37
12	33890686.27	33890686.27	33890686.27	14690686.27	17040686.27	7340686.27
13	33559191.18	33559191.18	33559191.18	27159191.18	20009191.18	15009191.18
14	32677696.08	31377696.08	31577696.08	25277696.08	21027696.08	21377696.08
15	25430573.31	30146200.98	31646200.98	26196200.98	3546200.98	19896200.98
16		25114705.88	21314705.88	16664705.88	-13135294.12	22814705.88
17		30133210.78	27533210.78	21933210.78	3133210.78	24433210.78
18		26401715.69	26751715.69	22601715.69	1151715.69	24951715.69
19		27520220.59	23570220.59	13170220.59	-4529779.41	19370220.59
20		14088725.49	19388725.49	-7911274.51	-5911274.51	13538725.49
21		16457230.39	21807230.39	-7142769.61	-7192769.61	20257230.39
22		16875735.29	20975735.29	25735.29	-7474264.71	22025735.29
23		25244240.20	13344240.20	-1005759.80	-2405759.80	1044240.20
24		17912745.10	1212745.10	-6287254.90	-9337254.90	-9887254.90
25		26681250.00	1381250.00	-3768750.00	-2768750.00	581250.00
26		24949754.90	4099754.90	-5400245.10	-8300245.10	-750245.10
27		22818259.80	4368259.80	-11131740.20	-9081740.20	7418259.80
28		17636764.71	-6463235.29	-7363235.29	3386764.71	-13613235.29
29		19205269.61	-9344730.39	-2144730.39	18155269.61	-7944730.39
30		22073774.51	-5026225.49	-8576225.49	17123774.51	-5126225.49
31		15342279.41	-3607720.59	-6307720.59	12842279.41	-13057720.59
32		5910784.31	-3439215.69	-13821839.61	2525680.39	-9389215.69
33		1679289.22	-8620710.78			-6470710.78
34		6997794.12	-4852205.88			-3102205.88
35		3916299.02	-11683700.98			-8883700.98
36		-315196.08	-6965196.08			-4465196.08
37		-6046691.18	-2696691.18			-11035474.85
38		-12478186.27	-7078186.27			
39		-4759681.37	-9809681.37			
40		-4891176.47	-7491176.47			
41		-3972671.57	15027328.43			
42		-11754166.67	20795833.33			
43		-4635661.76	19714338.24			
44		-13067156.86	18882843.14			
45		-3598651.96	19601348.04			
46		-5580147.06	14369852.94			
47		-6511642.16	12788357.84			
48		-14993137.25	19106862.75			
49		-3400987.50	11443072.50			
50						

YEAR	ALT M	SJAA	SJAB	S33AP	No Action	DL1B
1	35037132.35	29087132.35	29087132.35	28837132.35	20787132.35	25837132.35
2	34755637.25	25155637.25	25155637.25	27855637.25	21755637.25	28805637.25
3	32974142.16	24924142.16	24924142.16	28324142.16	19724142.16	27724142.16
4	24642647.06	19192647.06	19192647.06	19492647.06	4842647.06	24292647.06
5	23661151.96	29361151.96	29361151.96	22611151.96	461151.96	28461151.96
6	33979656.86	29479656.86	29479656.86	26279656.86	-7320343.14	25979656.86
7	31448161.76	28998161.76	28998161.76	18848161.76	-2151838.24	21698161.76
8	32216666.67	29766666.67	29766666.67	8816666.67	-10633333.33	18716666.67
9	34285171.57	35235171.57	35685171.57	3885171.57	-12114828.43	22435171.57
10	29603676.47	29903676.47	27603676.47	5503676.47	-8146323.53	1303676.47
11	33822181.37	27222181.37	27172181.37	4722181.37	-8177818.63	-9277818.63
12	25740686.27	20440686.27	22340686.27	2590686.27	-8659313.73	-2609313.73
13	32109191.18	16959191.18	21459191.18	-4540808.82	-16426604.56	59191.18
14	27527696.08	12677696.08	22677696.08	-9822303.92	-19168272.94	-4672303.92
15	19346200.98	16746200.98	20346200.98	-5603799.02	-17755160.61	-1253799.02
16	7814705.88	25614705.88	13414705.88	-8585294.12		-11785294.12
17	13083210.78	21333210.78	-1766789.22	-966789.22		-7916789.22
18	23601715.69	25501715.69	1601715.69	-10498284.31		-2148284.31
19	19720220.59	25420220.59	120220.59	-3229779.41		-5679779.41
20	22538725.49	15938725.49	3238725.49	-15711274.51		-7111274.51
21	24207230.39	20757230.39	-7792769.61	-2542769.61		-7542769.61
22	25125735.29	19525735.29	-8124264.71	-4224264.71		-9824264.71
23	18694240.20	19444240.20	-6755759.80	-6205759.80		10894240.20
24	13512745.10	-5537254.90	-19237254.90	-13987254.90		15212745.10
25	20881250.00	-918750.00	-5468750.00	-6115725.00		18981250.00
26	18099754.90	-500245.10	-6350245.10			11299754.90
27	-981740.20	1068259.80	-1081740.20			6969217.75
28	-8313235.29	-10713235.29	-12113235.29			
29	105269.61	-9244730.39	-7594730.39			
30	-126225.49	-5876225.49	-14276225.49			
31	5442279.41	-14907720.59	4142279.41			
32	-15439215.69	-12139215.69	18310784.31			
33	-6470710.78	-6970710.78	16079289.22			
34	-6652205.88	-452205.88	16647794.12			
35	-14533700.98	-8983700.98	14616299.02			
36	-6315196.08	-9715196.08	8784803.92			
37	-6796691.18	-17396691.18	17753308.82			
38	-2828186.27	-5628186.27	18921813.73			
39	-8809681.37	-6809681.37	18390318.63			
40	-5491176.47	-291176.47	18958823.53			
41	-9821918.58	-8822671.57	16927328.43			
42		-9554166.67	11095833.33			
43		-16970232.57	20064338.24			
44		-3964782.16	15071072.06			
45						
46						
47						
48						
49						
50						

DISCOUNTED RATES AND TOTAL NET PRESENT VALUE OF ALTERNATIVES:

YEAR	3% Discount rate	7% Discount Rate
1	0.97087379	0.93457944
2	0.94259591	0.87343873
3	0.91514166	0.81629788
4	0.88848705	0.76289521
5	0.86260878	0.71298618
6	0.83748426	0.66634222
7	0.81309151	0.62274974
8	0.78940923	0.5820091
9	0.76641673	0.54393374
10	0.74409391	0.50834929
11	0.72242128	0.4750928
12	0.70137988	0.44401196
13	0.68095134	0.41496445
14	0.66111781	0.38781724
15	0.64186195	0.36244602
16	0.62316694	0.3387346
17	0.60501645	0.31657439
18	0.58739461	0.29586392
19	0.57028603	0.27650833
20	0.55367575	0.258419
21	0.53754928	0.24151309
22	0.5218925	0.22571317
23	0.50669175	0.21094688
24	0.49193374	0.19714662
25	0.47760557	0.18424918
26	0.46369473	0.17219549
27	0.45018906	0.16093037
28	0.43707675	0.15040221
29	0.42434636	0.14056282
30	0.41198676	0.13136712
31	0.39998715	0.12277301
32	0.38833703	0.11474113
33	0.37702625	0.1072347
34	0.3660449	0.10021934
35	0.3553834	0.09366294
36	0.34503243	0.08753546
37	0.33498294	0.08180884
38	0.32522615	0.07645686
39	0.31575355	0.07145501
40	0.30655684	0.06678038
41	0.297628	0.06241157
42	0.28895922	0.05832857
43	0.28054294	0.05451268
44	0.27237178	0.05094643
45	0.26443862	0.04761349
46	0.25673653	0.04449859
47	0.24925876	0.04158747
48	0.2419988	0.03886679
49	0.23495029	0.0363241
50	0.22810708	0.03394776

NET PRESENT VALUE OF EACH ALT

	3%	7%
AP	$364,300,910	$277,903,277
EAPA	$524,097,626	$352,411,516
EAPB	$480,656,851	$328,416,387
SCRA	$322,546,489	$253,026,944
SCRB	$293,339,783	$231,303,420
ALT L	$358,954,836	$271,764,926
ALT M	$445,195,180	$321,454,433
SJAA	$346,132,934	$266,988,899
SJAB	$353,940,972	$247,989,896
S33AP	$121,250,675	$122,320,107
No Action	($15,417,604)	$7,000,404
DL1B	$211,886,850	$154,818,541

RANKED NET PRESENT VALUE OF EACH ALT

	3%	7%
EAPA	$524,097,626	$352,411,516
EAPB	$480,656,851	$328,416,387
ALT M	$445,195,180	$321,454,433
AP	$364,300,910	$277,903,277
ALT L	$358,954,836	$271,764,926
SJAB	$353,940,972	$247,989,896
SJAA	$346,132,934	$266,988,899
SCRA	$322,546,489	$253,026,944
SCRB	$293,339,783	$231,303,420
DL1B	$211,886,850	$154,818,541
S33AP	$121,250,675	$122,320,107
No Action	-$15,417,604	$7,000,404

DISCOUNTED ANNUAL PROFITS FOR EACH ALTERNATIVE

YEAR	AP -- 3%	AP -- 7%	EAPA -- 3%	EAPA -- 7%	EAPB -- 3%	EAPB -- 7%	SCRA -- 3%
1	38628283.84	37184235.84	38628283.84	37184235.84	38628283.84	37184235.84	27560322.67
2	26963556.65	24985271.43	26963556.65	24985271.43	26963556.65	24985271.43	29461435.81
3	23770019.55	21202637.1	23770019.55	21202637.1	23770019.55	21202637.1	25737574.12
4	23671646.83	20325547.88	23671646.83	20325547.88	23671646.83	20325547.88	18074178.43
5	27354318.24	22609613.08	27354318.24	22609613.08	27354318.24	22609613.08	30330318.55
6	21380685.7	17011488.33	21380685.7	17011488.33	21380685.7	17011488.33	26949956.01
7	23578159.18	18058597.75	23578159.18	18058597.75	23578159.18	18058597.75	22887031.39
8	22669201.85	16713361.45	22669201.85	16713361.45	22669201.85	16713361.45	19708917.22
9	21716549.6	15412455.92	21716549.6	15412455.92	21716549.6	15412455.92	22521287.17
10	25115905.27	17158657.54	25115905.27	17158657.54	25115905.27	17158657.54	18121422.47
11	24903437.27	16377485.05	24903437.27	16377485.05	24903437.27	16377485.05	11105190.89
12	23770245.48	15047870.01	23770245.48	15047870.01	23770245.48	15047870.01	10303751.78
13	22852176.2	13925871.24	22852176.2	13925871.24	22852176.2	13925871.24	18494087.62
14	21603806.73	12672973.94	20744353.58	12168811.52	20876577.14	12246374.97	16711534.97
15	16322917.31	9217210.073	19349699.27	10926370.55	20312492.19	11470039.58	16814344.58
16			15650654.39	8507219.796	13282620.03	7220028.324	10384893.76
17			18231088.09	9539402.837	16658045.33	8716309.422	13269953.23
18			15508225.43	7811315.001	15713813.54	7914867.371	13276125.92
19			15694397.26	7609570.319	13441767.45	6517362.404	7510792.772
20			7800585.711	3640794.392	10735067.21	5010415.107	-4380280.881
21			8846572.281	3974636.511	11722460.91	5266731.525	-3839590.631
22			8807319.697	3809075.628	10947078.95	4734499.605	13431.05701
23			12791048.2	5325193.792	6761416.396	2814925.88	-509610.1935
24			8811883.624	3531437.15	596590.2273	239088.5969	-3092912.795
25			12743113.59	4915998.368	659692.6925	254494.1765	-1799975.989
26			11569069.8	4296235.346	1901034.732	705959.3166	-2504065.179
27			10272530.84	3672150.931	1966542.756	702985.6547	-5011387.608
28			7708619.854	2652608.432	-2824929.897	-972084.8877	-3218298.975
29			8149686.295	2699546.766	-3965402.349	-1313521.613	-910108.54
30			9094102.831	2899768.122	-2070738.352	-660280.7528	-3533291.349
31			6136714.542	1883617.773	-1443041.859	-442930.7039	-2523007.151
32			2295376.45	678210.058	-1335574.819	-394619.4864	-5367532.2
33			633136.1102	180078.0733	-3250234.231	-924439.3246	
34			2561506.846	701314.3408	-1776125.216	-486284.8939	
35			1391787.652	366812.0761	-4152193.353	-1094329.772	
36			-108752.8673	-27590.83276	-2403218.494	-609701.6217	
37			-2025538.369	-494672.7807	-903345.5303	-220613.1724	
38			-4058232.511	-954042.9189	-2302011.288	-541175.8845	
39			-1502886.271	-340103.0691	-3097441.678	-700950.8579	
40			-1499423.606	-326634.6283	-2296471.393	-500263.619	
41			-1182378.297	-247940.6738	4472553.718	937879.176	
42			-3396474.879	-685603.7458	6009147.863	1212991.242	
43			-1300502.162	-252702.3614	5530718.329	1074681.476	
44			-3559124.807	-665725.0308	5143153.644	962013.5015	
45			-951622.5719	-171344.3746	5183353.499	933288.5639	
46			-1432627.581	-248308.6627	3689266.151	639438.1598	
47			-1623083.882	-270802.6906	3187610.282	531835.3847	
48			-3628321.238	-582735.1135	4623837.874	742622.4172	
49			-799063.0068	-123537.8188	2688553.227	415659.3393	
50							

YEAR	SCRA -- 7%	SCRB -- 3%	SCRB -- 7%	ALT L -- 3%	ALT L -- 7%	ALT M -- 3%
1	26530030.24	27560322.67	26530030.24	27560322.67	26530030.24	34016633.35
2	27299884.06	29461435.81	27299884.06	29461435.81	27299884.06	32760521.5
3	22957677.53	25737574.12	22957677.53	25737574.12	22957677.53	30176011.17
4	15519308.04	18074178.43	15519308.04	18074178.43	15519308.04	21894672.74
5	25069415.4	30330318.55	25069415.4	30330318.55	25069415.4	20410317.53
6	21442664.12	26949956.01	21442664.12	26949956.01	21442664.12	28457427.67
7	17529260.47	23252922.57	17809497.86	22439831.06	17186748.12	25570233.38
8	14530827.31	19274742.14	14210722.3	21564028.92	15898548.71	25432134.17
9	15983586.35	21908153.79	15548439.35	25280387.41	17941747.82	26276729.16
10	12380174.19	21321026.3	14566076.15	21767482.65	14871085.73	22027915.52
11	7303212.635	19665883.02	12933062.27	16270503.02	10700126.13	24433863.44
12	6522840.395	11951994.5	7566268.5	5148609.66	3259352.495	18053999.46
13	11270098.77	13625285.54	8303102.969	10220528.84	6228280.73	21864796.76
14	9803126.352	13901784.29	8154903.078	14133175.52	8290639.112	18199050.03
15	9494708.775	2276171.467	1285306.43	12770614.31	7211298.851	12417590.24
16	5644912.444	-8185481.031	-4449378.57	14217370.43	7728130.221	4869866.346
17	6943492.835	1895644.053	991894.2942	14782494.35	7734928.811	7915557.689
18	6687032.119	676511.5836	340751.1134	14656503.24	7382312.322	13863520.52
19	3641675.74	-2583269.903	-1252521.754	11046566.14	5356027.405	11246166.25
20	-2044423.67	-3272929.372	-1527585.664	7496064.047	3498663.941	12479145.83
21	-1725072.336	-3866468.094	-1737147.99	10889259.53	4892386.241	13012579.17
22	5808.794692	-3900762.7	-1687039.944	11495066.08	4971498.429	13112932.83
23	-212161.896	-1218978.641	-507487.5327	529107.8907	220279.2148	9472217.251
24	-1239511.053	-4593310.691	-1840808.244	-4863874.246	-1949238.884	6647375.184
25	-694389.0878	-1322370.42	-510139.9103	277608.2371	107094.8344	9973001.293
26	-929897.867	-3848779.888	-1429264.797	-347884.6962	-129188.8245	8392760.916
27	-1791435.038	-4088500.044	-1461527.785	3339619.377	1193823.275	-441968.6919
28	-1107446.879	1480276.121	509376.9047	-5950028.682	-2047460.707	-3633521.891
29	-301469.3421	7704122.615	2551955.81	-3371317.441	-1116733.671	44670.77515
30	-1126634.019	7054768.371	2249500.892	-2111937.028	-673417.4645	-52003.23067
31	-774417.822	5136746.679	1576685.256	-5222920.38	-1603135.617	2176841.805
32	-1585933.464	980815.2327	289799.4165	-3646180.172	-1077329.196	-5995619.229
33				-2439627.801	-693884.7221	-2439627.801
34				-1135546.641	-310901.0406	-2435006.035
35				-3157119.84	-832073.5428	-5165036.037
36				-1540637.431	-390862.9792	-2178947.418
37				-3696695.777	-902799.3778	-2276775.572
38						-919800.1403
39						-2781688.132
40						-1683357.711
41						-2923277.99
42						
43						
44						
45						
46						
47						
48						
49						
50						

YEAR	ALT M – 7%	SJAA – 3%	SJAA -- 7%	SJAB – 3%	SJAB -- 7%	S33AP – 3%
1	32744983.51	28239934.32	27184235.84	28239934.32	27184235.84	27997215.88
2	30356919.6	23711600.77	21971907.81	23711600.77	21971907.81	26256609.72
3	26916722.23	22809120.81	20345524.33	22809120.81	20345524.33	25920602.45
4	18799757.45	17052418.33	14641978.55	17052418.33	14641978.55	17318964.44
5	16870074.34	25327187.6	20934095.56	25327187.6	20934095.56	19504578.31
6	22642080.12	24688748.51	19643540.11	24688748.51	19643540.11	22008798.89
7	19584334.62	23578159.18	18058597.75	23578159.18	18058597.75	15325280.34
8	18750393.32	23498081.54	17324471.01	23498081.54	17324471.01	6959958.083
9	18648861.69	27004825.06	19165598.74	27349712.59	19410368.93	2977660.498
10	15049007.98	22251143.69	15201512.77	20539727.69	14032309.39	4095252.171
11	16068674.73	19665883.02	12933062.27	19629761.96	12909307.63	3411404.295
12	11429172.54	14336686.09	9075909.161	15669307.86	9919531.884	1817055.229
13	13324172.79	11548383.96	7037461.403	14612664.99	8904801.419	-3092069.853
14	10675715.14	8381450.614	4916629.116	14992628.67	8794801.526	-6493700.017
15	7011953.541	10748749.17	6069593.889	13059452.18	7374399.56	-3596865.352
16	2647111.254	15962237.86	8676587.095	8359601.205	4544025.002	-5350071.458
17	4141809.479	12906943.37	6753548.201	-1068936.532	-559320.219	-584923.3752
18	6982896.035	14979570.28	7545037.476	940839.1571	473889.8758	-6166635.595
19	5452805.321	14496796.6	7028902.82	68560.12161	33241.99445	-1841898.068
20	5824434.966	8824885.857	4118869.547	1793203.778	836948.2116	-8698951.763
21	5846362.933	11158034.17	5013142.784	-4188997.66	-1882055.842	-1366863.961
22	5671209.241	10190334.82	4407215.516	-4239992.825	-1833753.502	-2204612.072
23	3943491.706	9852236.062	4101701.868	-3423087.747	-1425106.475	-3144407.285
24	2663992.022	-2723962.493	-1091651.088	-9463454.681	-3792559.781	-6880802.565
25	3847353.138	-438800.1168	-169278.9318	-2611905.457	-1007612.69	-2920904.32
26	3116696.219	-231961.0144	-86139.95128	-2944575.17	-1093483.585	
27	-157991.8103	480918.8724	171915.4426	-486987.5975	-174084.8471	
28	-1250328.981	-4682506.098	-1611294.291	-5294413.553	-1821857.388	
29	14796.99245	-3922967.712	-1299465.331	-3222796.215	-1067536.686	
30	-16581.87876	-2420927.098	-771942.8024	-5881615.878	-1875426.586	
31	668165.0066	-5962896.599	-1830265.679	1656858.516	508560.0979	
32	-1771513.019	-4714107.016	-1392867.298	7110755.673	2101000.042	
33	-693884.7221	-2628140.924	-747502.0716	6062314.063	1724257.736	
34	-666679.7143	-165527.6569	-45319.7772	6093840.129	1668431.017	
35	-1361269.148	-3192658.179	-841439.8366	5194390.009	1369005.523	
36	-552803.5747	-3352057.663	-850424.1284	3031042.201	768981.8258	
37	-556029.4094	-5827594.703	-1423203.095	5947055.53	1452377.571	
38	-216234.237	-1830433.367	-430313.4401	6153868.674	1446702.429	
39	-629495.8502	-2150181.04	-486585.8348	5806808.319	1314080.359	
40	-366702.8569	-89262.13893	-19444.87565	5811957.046	1266077.459	
41	-613001.3691	-2625874.1	-550636.7934	5038046.919	1056461.161	
42		-2760764.586	-557280.8894	3206243.39	647204.1031	
43		-4760878.87	-925092.9128	5628908.356	1093760.915	
44		-1079894.783	-201991.5083	4104934.761	767817.3619	
45						
46						
47						
48						
49						
50						

YEAR	S33AP -- 7%	No Action -- 3%	No Action -- 7%	DL1B -- 3%	DL1B -- 7%
1	26950590.98	20181681.9	19427226.5	25837132.35	24146852.67
2	24330192.38	20506774.68	19002216.14	28805637.25	25159959.17
3	23120937.11	18050384.18	16100775.37	27724142.16	22631158.38
4	14870847.11	4302629.189	3694432.255	24292647.06	18532744.13
5	16121438.85	397793.7323	328794.9747	28461151.96	20292408
6	17511245	-6130672.131	-4877853.725	25979656.86	17311342.33
7	11737687.87	-1749641.403	-1340056.706	21698161.76	13512524.64
8	5131380.272	-8394051.525	-6188696.812	18716666.67	10893270.41
9	2113275.912	-9285007.219	-6589663.969	22435171.57	12203246.84
10	2797790.038	-6061629.767	-4141177.8	1303676.47	662723.011
11	2243474.353	-5907830.173	-3885222.72	-9277818.63	-4407824.796
12	1150295.689	-6073468.423	-3844838.853	-2609313.73	-1158566.5
13	-1884274.226	-11185718.39	-6816456.891	59191.18	24562.23386
14	-3809258.807	-12672486.55	-7433786.727	-4672303.92	-1812000.016
15	-2031074.65	-11396361.97	-6435287.292	-1253799.02	-454434.4641
16	-2908136.15			-11785294.12	-3992086.863
17	-306060.7067			-7916789.22	-2506252.72
18	-3106063.512			-2148284.31	-635599.8104
19	-893060.9211			-5679779.41	-1570506.337
20	-4060091.892			-7111274.51	-1837688.468
21	-614112.1369			-7542769.61	-1821677.571
22	-953472.1573			-9824264.71	-2217465.882
23	-1309085.689			10894240.20	2298106.016
24	-2757540.026			15212745.10	2999141.276
25	-1126817.301			18981250.00	3497279.701
26				11299754.90	1945766.866
27				7315.739412	1121558.772
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					