2006 PLANNING ASSOCIATES CLASS

CRITICAL THINK PIECE

TEAM PATHFINDERS

CONSIDERATIONS FOR INCORPORATING THE HUMAN COST OF FLOODING IN CORPS PROJECT ANALYSIS

SEPTEMBER 2006

TABLE OF CONTENTS

BACKGROUND

Katrina

The tragic impacts of Hurricane Katrina – economic losses in the billions; social upheaval and disorder, significant loss of human life, and massive emergency population relocations impacting the entire nation have focused public attention on the Federal government's role in providing flood damage prevention. The devastation resulting from Katrina has raised the awareness of the human consequences of providing a limited level of protection in high-risk areas.

Risk

Even in our technically sophisticated society we cannot control hurricane surges or flood levels. Thus, there is always the chance that an event will occur that will exceed a selected design level. Unfortunately the remaining risk associated with a selected project design level may be significant. When an event occurs that exceeds the design level in a densely populated area we can expect human suffering and loss of life to be the inevitable tragic outcome.

Current Corps Policy

Current Corps policy relies on the NED (National Economic Development) account to evaluate and justify Corps flood and storm damage prevention projects. This account uses the ratio of economic damages prevented to project cost to determine the recommended design level. Human costs and the value of human life are not included in the analyses. This is in direct opposition to the National Academy of Science findings that "To ensure that the Corps's flood damage reduction projects{should} provide adequate social and environmental benefits, the committee recommends that the Corps explicitly address potential loss of life, other social consequences, and environmental consequences in its risk analysis."[1]

[1] Risk Analysis and Uncertainty in Flood Damage Reduction Studies Committee on Risk-Based Analysis for Flood Damage

If human costs were included in the Corps analysis, then recommendations may provide for projects with a more robust design level and/or projects relocating population centers away from high flood risk areas resulting in a reduction in disasters such as Katrina.

PURPOSE

The purpose of this discussion paper is to discuss past Corps policy on justification of flood damage reduction projects, the concept of the human cost of flooding, and examine potential alternatives to account for the human cost of flooding in project justification and benefit/cost analysis.

.

POLICY DEVELOPMENT

History

Federal participation in flood damage reduction coalesced when serious flooding on the Mississippi River in the 1920's and 1930's ushered in the Flood Control Act of 1936, which called damaging floods "menace(s) to national welfare" and established flood control[2] as a federal purpose in the national interest. [3] Since this purpose was established, numerous flood control projects have been constructed in cooperation with state and local government.

In 1968, Congress recognized the need for federal involvement to supplement on-going efforts to reduce flood damages, and passed the National Flood Insurance Act.

---

[2] "Flood Control" and "Flood Damage Reduction" are considered similar terms, however terminology has shifted toward using "flood damage reduction".

[3] Reduction, Water Science and Technology Board, National Research Council ISBN: 0-309-07136-4, 216 pages, 6 x 9, paperback (2000)

This act created the National Flood Insurance Program, with the intent of limiting federal disaster relief assistance: property owners would be able to insure their property, while local government would develop codes and requirements limiting development in flood hazard areas. The gold standard of this system was the 100-Year Floodplain.

At the same time water resource policy continued to evolve. The 1965 Water Resources Planning Act established the Principles and Standards for evaluating projects.

This policy was further defined in 1983 by the Water Resources Council and the resulting Principles & Guidelines (P&G) for Water and Related Resources Implementation was established for use by federal agencies in justifying federal investment in flood damage reduction projects.[4] This P&G guidance is the basis for Corps project justification policy, and establishes the evaluation accounts for Corps projects.

Evaluation Accounts

Implementation procedures and methodologies for P&G are established in the Planning Guidance Notebook (PGN). While P&G states that the National Economic Development (NED) account is to be used for project justification it also allows for the display of several other accounts including the Environmental Quality (EQ), Regional Economic Development (RED) and Other Social Effects (OSE) accounts.

In support of the other accounts the Water Resources Development Act (WRDA) of 1986 also requires the Corps to consider the *well-being of the people of the United States* and… *the prevention of loss of life* in the formulation and evaluation of water resources projects, and that the benefits, both quantifiable and unquantifiable, should be demonstrated in the benefit-cost analysis report.

4 Reference: Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. U.S. Water Resources Council, 1983. signed by President Ronald Regan.)

NED Account Failings

A variety of benefits and costs have traditionally been monetarily considered in flood damage reduction projects. Generally, Corps flood damage reduction and storm damage reduction projects, barring specific Congressional directive, must have at least as many benefits as costs to be justified. When a potential sponsor is interested in pursuing a project, the Corps examines the potential alternatives for solving the problem and compared the cost and economic benefits to determine the plan that maximizes the net economic benefits. While various important monetary elements are considered in this analysis such as the dollar value associated with damage to a flooded structure and loss of household contents the cost to human health, safety, and life are generally not included. This results in an analysis that does not adequately display the full benefits of a given alternative.

Recognition of Non-NED Benefits

While the P&G and WRDA 1986 direct the Corps to consider other factors such as human health and welfare [usually under the (OSE) account], policy guidance has been unclear regarding how to utilize and quantify these considerations. Consequently, they have been addressed at a less rigorous level, generally in narrative form, and currently do not figure significantly in the recommendation process.

The National Environmental Policy Act (NEPA) process also requires that the human cost of flooding be considered; but again, it generally has been just that a consideration, rather than a primary element in alternatives development and selection. Additionally Executive Order 12898 requires federal agencies to account for environmental justice as a mission[5]. Sometimes, the human cost of flooding is glossed over in our NEPA documents, birthing the critique that we will count “the birds, the bunnies, and the bees, but not my family and me”.

[5] Federal Register VOL. 59, No. 32 Presidential Documents Executive Order 12898 of February 11, 1994

An example where loss of life has been successfully incorporated in design is in the Dam Safety Program. For example, dam spillway are designed to pass the probable maximum flood in order to prevent damages from dam failure due overtopping. Also, in the dam safety program, we quantify but do not value the number of lives threatened by a failure.

The Way Forward

In summary, current policy places emphasis on the NED account. Other accounts are identified but are rarely evaluated as Corps budgeting criteria do not consider the other accounts. The other accounts help to tell the story; they do not push a project over the threshold for budgeting by the Corps and OMB. However, there is sufficient justification in existing policy to allow the Corps to consider benefits or values beyond NED. This is recognized in Susan Durden's recent work on Collaborative Planning[6] and also recognized and verbally discussed by Corps experts in flood damage reduction (FDR). During the PA 2006 training on FDR, instructors noted examples of loss of life and human trauma associated with flooding events. Thus the concept of considering the human cost of flooding in Corps analysis is not new but perhaps needs fuller and broader discussion, while developing of consensus within the Corps on how best to incorporate it in Corps operating procedures.

As noted above there is precedence for incorporating human costs as illustrated by the dam safety program and by its inclusion in other Federal agency decision making and in U.S. court system decisions. The following elaborates on the concept of the human cost of flooding, evaluation methods, and implications and consequences of adopting this concept in Corps decision making.

---

[6] Susan Durden: Collaborative Planning Draft Interim Implementation Procedures EC 1105-2-40918 January 2006, Section V discusses the need for further work on the human cost of flooding and provides references and ideas on this issue. Specifically in here Susan references George Antle and the term "Human Cost of Flooding" concept.

HUMAN COST OF FLOODING (HCoF)

There are many categories that might be included in placing a value on the human cost of flooding (term coined by George Antle in 2005). Many of these categories can be identified by simply reading the newspaper reports related to Hurricane Katrina or talking with those involved in emergency response.

Number of Lives Saved

The most obvious category is numbers of lives saved. This is self-explanatory and could be easily determined by overlaying a current floodplain map on development, though better data may exist at local and county levels.

Value of Human Life

Placing a value on human life is controversial although there are many examples where life is assigned a value. Examples of existing valuation methods are discussed below. In general, the cost of a human life ranges from a few dollars to several million, depending on the metric you choose. The amount spent to save a statistical life logically depends on what value is assigned to that life.

The two main models for calculating the value of human life appear to be:

1. The willingness to pay model: this model estimates the dollars one is willing to pay to reduce risk of death.
2. The human capital model: this model estimates the value of human life based on the earning potential of an individual.

Some examples of the willingness to pay model to consider are:

- U.S. EPA--$3.7 Million (2002 dollars)/EPA Calculated based on increase in pay provided to workers is higher risk jobs, on assumption that workers are willing to accept greater risk if they are compensated at a higher rate.

- U.S. DOT --$3 Million/Loss of life prevented through traffic signals.

- OXFAM International --$2.40 (2002 dollars)/ Based on cost to purchase sufficient bullets to kill an opponent in Baghdad.

The willingness to pay model considers how much expense society is wiling to pay for each potential life that could be saved. For example, adding traffic lights to a dangerous intersection may save lives but how much are taxpayers willing to pay to do this?

The Human Capital model is used by the U.S. Court System and by Life Insurance Agencies. The Courts use the human capital model to determine damages in cases of wrongful death. This approach views people as machines - a stream of income – to make [the plaintiffs] whole, they look at what the deceased would have earned and passed on to them.

There are problems with both methods. The first method may be somewhat subjective and related to the perceived risk by an individual rather than the actual risk, and relies on a somewhat subjective assignment of values. The second method considers your most important asset to be your ability to earn a paycheck and does not account for other non-dollar values that an individual provides to society such as knowledge, caring, and importance to a community or family structure. The second method may also result in a greater value assigned to a younger life with greater future earning potential, and less value assigned to an older life.

The second method might employ average salaries and years left to work to come up with a value for human life in the project area. Using simple calculations including current annual salary expected growth in salary and inflation rate, and number of earning years remaining it would be relatively easy to calculate this value.

Valuing human life raises social justice issues based on tying human worth to socio-economic status and physical capability e.g. should the life of an unemployed, unskilled worker or an elderly or disabled person valued at the same rate as a fully functioning wage earner?

Some may argue that money may be the wrong yardstick to use when valuing human life as the amount of dollars we assign to a statistical life may be less than the amount we are willing to spend to save an actual life in jeopardy. However, as some metric is needed to compare projects it is prudent to consider some measure rather than none at all.

Induced Disabilities

Susan Durden has noted that one way to calculated willingness to pay for impairment might be based on the American Medical Association impairment classification system and the Veteran's Administration impairment payment scale. Estimated dollar values can be utilized as a measure of the nation's willingness to pay for impairment. Expected impairment rates might be estimated for a population at risk and impairments prevented associated for various levels of protection.

Cost of Medical Treatment

Another category that could be included is the cost of medical treatment and social services. There is greater incidence of waterborne diseases attendant to flooding, as well as increased injuries and illnesses suffered by both residents and recovery workers due to pathogens and exposure to contaminated air and water.

Cost of Displacement

A major cost of flooding that was painfully obvious following Katrina was the cost of displacement. Included would be the cost of relocating people from a flooded area to safety, perhaps permanently. Currently, Federal relocation benefits can be up to $22,500 per household. There is also a huge array of costs to the communities accepting the displaced residents. Since they are not paying taxes for a period after reallocation,

there is a significant resource drain on the accepting community – in health and human services, law enforcement, etc. When citizens are displaced, businesses often fail because their customer base is removed. New Orleans has lost a large collection of businesses to this effect, while others are unable to attract enough staff to stay open regularly – not only are the customers gone, but the workforce as well. There is also a significant cost to service providers, as their resources taxed severely by the loss of capacity due to the closing of other institutions before/following the flood event

Other Categories

Additional categories that may need to be considered include loss of quality of life, separation and disruption of family structure, increased divorce rate and increased child abuse and neglect, and effects on institutions including schools and hospitals.

WHERE SHOULD THE HUMAN COST OF FLOODING BE ACCOUNTED IN CORPS ANALYSES?

Once the economic value of human cost of suffering is quantified the next question is where best to account for this in Corps project evaluation. We considered four options.

1. The no-action alternative – Leave the HCoF in the OSE account

   Advantages are it's easy, status quo, and not controversial. Disadvantages are its lack of a true and complete economic analysis; it leaves the public at risk; it doesn't account for changing climate conditions; and it results in a failure to learn from past lessons.

2. NED + OSE – Leave HCoF in OSE but truly value it.

   Advantages are a greater level of protection than NED alone; it may result in increase in non-structural projects (easier to justify); it is not a radical change. Disadvantages

are increased project cost and creating a need to determine policy regarding who pays for the increased level of protection.

3. OSE over NED

Advantages are an ability to justify protection in lower socio-economic areas/environmental justice; it may result in an increase in non-structural projects (easier to justify); it is not a radical change (Section 202); and it will increase flood hazard awareness. The significant disadvantage is the need to determine policy regarding who will pay for these projects.

4. Include HCoF in NED

Advantages are it accounts for more of the project benefits and incorporates economic value of human life; it increases hazard awareness; it leads to improved decisions on Federal expenditures. Disadvantages are that monetizing human life is controversial; it is a seemingly radical change from Corps norm; and it increases the cost of projects—more projects to be built, and how to prioritize projects.

Including the HCoF costs in the OSE account would be simpler and result in less change to the Corps processes, but whether the ASA's office and OMB would support a project that was not the NED plan but which had significant human costs of flooding in the OSE account is unclear. Because of the significant costs in resources for both the Corps and our Sponsors in pursuing a project alternative other than the NED plan through the project approval process, we may wish to consider altering our benefit-cost analyses to account for the economic benefit of lives saved and other measurable HCoF economic benefits in the NED account (option 4.)

POSITIVE CONSIDERATIONS

The costs of flood events are increasing in real dollars due to expanding development in the floodplain, population increases, and people choosing to live in

hazardous areas due to a lack of public knowledge of risk and/or over-reliance on twenty to thirty year old 100 year flood protection maps which have not been updated. These maps were developed with the technology and knowledge of the era and are in need of revision and updating. The Federal Emergency Management Agency (FEMA) mapping primarily encompasses areas where development had occurred at the time of the mapping. Often, new development has occurred in areas that were unmapped due to lack of development and therefore had no need to produce maps. Predictably, the reason development did not occur previously in these areas is because significant natural hazards often exist at these sites. Original settlers learned painful lessons regarding where water moved and when; structures were built to deal with the large-scale and frequent problems; and either those crucial lessons weren't passed down or people believed they were safe behind flood damage reduction structures or beyond the magical line at the edge of the 100-year floodplain. This lack of awareness of residual risk has led to increased development in hazardous areas in the absence of a clear policy of hazard avoidance. For example, large scale development continues occurring in areas like Yuba County, California where 20,000 new units are being constructed, placing on the order of 60,000 lives, and numerous public facilities such as hospitals, schools and associated infrastructure at risk.

Changing Corps project analyses to more demonstrably quantify the human cost of flooding could build on the nation's flood-hazard awareness that was awakened with Katrina. With the nation's flood damage reduction structures aging, it is important to convey to the public that these structures are not infallible, and to educate the public on the concept of residual risk. Also, demonstrably including the human cost of flooding in both our decision documents, and perhaps more importantly, discussing it at all applicable public meetings, could slowly alter the way local communities and the public view construction in flood-hazard areas, and lessen this development in the future.

One of the troublesome criticisms of our current cost-benefit analysis system is that it is biased against protecting lives in low income communities, raising the question of environmental justice as referenced in *Executive Order 12898*. Because the cost-benefit analysis for flood and storm damage reduction projects focuses so closely on the

value of the properties at risk, low income individuals living in economically depressed areas are less likely to realize an *economicall*y justified project. By accounting for the value of human health, life, and welfare, regardless of socio-economic status, projects can be justified based on their ability to reduce this threat, rather than just the value of the property in the potentially flooded area.

NEGATIVE CONSIDERATIONS

While changing Corps project analysis to meaningfully quantify the human cost of flooding has merit, there are several negative factors that must be considered. First, placing a monetary value on human life or welfare is difficult, and inherently open to public criticism. As stated above, a number of Federal agencies have already taken this step; but the potential public interest and/or outcry over deciding whether or not, for example, to reduce drowning deaths by building stronger levees in New Orleans is significantly more inflammatory and dangerous on a regional and even national stage than whether to straighten a highway section in Montana to reduce automobile fatalities.

Projects generally are considered justified if they exceed a 1-1 benefit-cost ratio. The possibility of quantifying and including the value of human health, life, and welfare in benefit-cost analysis raises the question of whether this threshold of justification should be raised higher. Risk and uncertainty analysis has encouraged scientists and policy makers to develop estimates of the value of a life, which can then be used for assessing "the benefits of risk reduction efforts." Is the additional risk reduction worth the incremental increase in costs? Is society willing to pay for the benefits? Is there some pivot point where no cost is too high to achieve a particular benefit, or where a particular cost is too high regardless of how significant the benefit is? Studies have generally placed the value of a human life in the million dollar range. It is hard to imagine many projects that would not be justified if construction costs were compared to the benefit of saving even a handful of lives. Would including this cost result in an increase in the benefit-cost threshold that would be acceptable to the Office of

Management and Budget (OMB), and for a determination on whether to move forward on a project?

In any event, this would result in a trade-off analysis. In an environment with stable or declining resources, how do we compare risk reduction with other uses for federal funds? Would the value of a human life need to be standardized across agencies, and across authorities?

IMPLICATIONS TO NATIONAL POLICY

Unfortunately, there is currently no overarching national flood damage reduction policy. We continue to rely on policies developed in the past that are unsuitable to address today's high risk areas. This is an opportune time for the Corps to take the lead and support setting guidelines for a more comprehensive, coordinated national policy.

Without a national policy, the various Federal agencies are forced to muddle through on their own – weighing projects benefits and costs differently. When projects are viewed against each other within a common authority we can come to sound economic decisions. When projects in the national interest, but within different authorities and different agencies, are compared, it is difficult to reach sound economic judgments, and all care should be taken to insure that the most rigorous analysis is taking place. Not meaningfully including the human cost of flooding in Corps project analyses does the nation a disservice by withholding vital information that could weigh significantly in deciding whether to construct new structures, and whether to repair or replace the old ones.

A cross-check of this has occurred with Hurricane Katrina. When the original structures were constructed, the human cost of flooding was not figured into project analyses. The structures were built to withstand a certain category of storm, without an economic consideration of the cost the nation would have to bare if they did indeed fail.

Perhaps if the human cost of flooding had figured into the analysis, the difficult economic decision to spend additional funds to build them to withstand a higher magnitude event would have been made. Or perhaps not. The important thing is that it would have been a reasoned decision, encompassing the important benefit-cost information that was left out. Our agency has neither the power nor the authority to set a national flood policy, but by changing our cost/benefit analyses, we can better convey to Congress and the nation the information necessary to make reasoned judgments on what projects to construct, and to what degree.

RECOMMENDATIONS

1. In the future, the human cost of flooding (HCoF) should be incorporated in Corps project evaluations.
2. In order to make this concept work, the Corps will need to engage in discussions with ASA and OMB to determine the administration's willingness to budget for projects that provide for a more robust level of protection than justified by NED alone.
3. If a national flood policy is developed, HCoF will need to be included in this policy along with traditional economic considerations.