Appendix J

Technical Memorandum Compensatory Mitigation for Stormwater: An Evaluation of On-Site Mitigation, Advanced Mitigation (Banking) and Environmental Credit Trading Approaches

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DATE: August 15, 2001

Summary

As the impacts of human facilities and activities continue to degrade water resources and as our scientific understanding of water resource issues increases, regulations continue to become more complex to provide appropriate resource protection. In response, agencies and the public are striving to find ways to improve the effectiveness of stormwater mitigation and the process of evaluating and approving mitigation proposals. State policy requires avoidance and minimization as the preferred method of addressing potential impacts from new projects. If this is not adequate, compensatory mitigation is required. On-site, in-kind mitigation is the preferred method of compensatory mitigation. However, in many urban project locations and in certain rural situations, land is not available for standard or structural stormwater best management practices (BMPs), and structural mitigation solutions become particularly challenging and costly. On-site, structural, stormwater mitigation is not always adequate to protect the aquatic resource and may create disincentives for in-fill under provisions of the Growth Management Act. As a result, project proponents are seeking new approaches to providing stormwater mitigation.

Washington State Department of Transportation (WSDOT) and Washington State Department of Ecology (Ecology) requested a technical memorandum to assist in identifying the history, applications, benefits, and limitations of various mitigation approaches, and their potential for offsetting stormwater impacts. Two approaches were identified as of

particular interest: *advanced mitigation or banking* ("alternative mitigation" as defined and used by Washington state) and *environmental credit trading*. These approaches were identified as of interest because of the observations and recommendations documented in the "Interim Report, Stormwater Management Study "(WSDOT and Ecology, December 2000):

1) there exist a large number of state and federal regulatory authorities and programs that affect stormwater management;

2) the resulting challenges to program managers for coordination, and to planners and those regulated for tracking and meeting the multiple regulatory requirements;

3) concerns regarding documented effectiveness of ways to achieve environmental objectives through addressing potential beneficial and negative impacts of stormwater;

4) constraints (climate, geographic, land area, structural) to relying on traditional "best management practices" (BMPs) as mitigation activities, which require large land areas to achieve both water quality and quantity stormwater management for sometimes very short periods of time; and

5) cost of independent mitigation activities undertaken to address # 1 and 2 above, given uncertain benefits and multiple constraints.

This technical memorandum looks at advanced mitigation, mitigation banking and environmental credit trading. Each approach is described, and its regulatory context is analyzed. For advanced mitigation banking and environmental trading, project examples are provided. Policy implications and issues are identified, and a brief list of recommendations is provided.

Findings

The available information indicates successes and failures for each of these approaches. Each can be challenging to successfully implement and each is potentially feasible within existing regulations and financing. Tools to address the challenges are available. Each approach has the potential to offer better protection for aquatic resources and to be more cost-effective for project proponents. These concepts have not been applied to stormwater in Washington state, and the state has only general policy guidance for these approaches. Additional and more specific guidance is needed from the state to enable the use of the concepts. It will be necessary to gain more experience with these approaches in the state to clarify issues and to develop appropriate guidance.

Recommendations

Identify and fund project examples of mitigation using these approaches: advanced mitigation, mitigation banking and environmental credit trading.

Develop more specific state guidance for each approach based on the project experience and in the context of stakeholder group participation.

Introduction

In February 2000, the Washington State Departments of Ecology, Fish and Wildlife and Transportation stated in the *Alternative Mitigation Policy Guidance Interagency Implementation Agreement*:

"Stormwater management is a critical issue in implementing salmon recovery and watershed improvement efforts of the state. The emphasis for stormwater management should be on prevention of impacts to aquatic resources through appropriate development regulations, and best management practice applications for erosion control, water quantity and water quality treatment. The guiding principal should be to do no further harm to aquatic resources and the build into projects and plans the incremental improvements necessary to protect, restore and enhance the designated uses and functions of the state's water bodies.

"It is the general consensus of the resource agencies of the state, as discussed at the January, 1999 salmon summit, that the best way to set priorities, create effective and cohesive recovery strategies, and get the greatest gain is to use watersheds as fundamental planning/management units for applying stormwater management strategies."[1]

New approaches to stormwater management are emerging that hold promise to provide increased protection of aquatic resources while helping achieve cost-effective implementation, especially in geographic areas where traditional stormwater BMPs aren't effective or practical or are too costly. In some cases, interpreting the term "on-site" to include the impacted water body and the watershed area tributary to it can improve the effectiveness and process of mitigation. In other cases, other methods of mitigation may be beneficial. Two new stormwater mitigation approaches with potential benefits include advanced mitigation planning and environmental credit trading.

In any particular situation, to the maximum extent practicable, regulatory agencies emphasize avoidance and minimization of impacts (in stormwater regulations, this means minimizing change from pre-activity runoff quantity, quality, and timing and changes to aquatic habitat). Only when these options have been included or considered and changes from

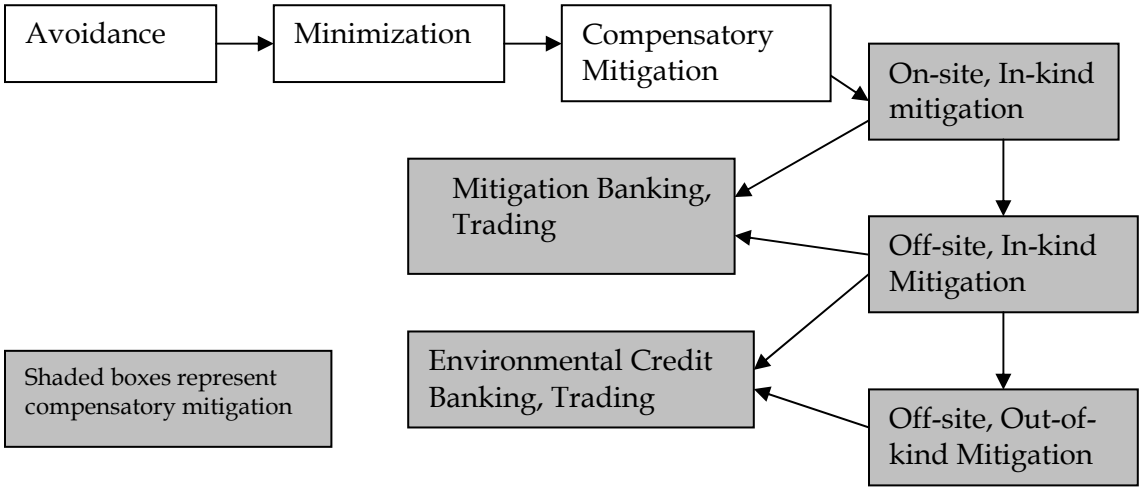
[1] P. 4, Alternative Mitigation Policy Guidance Interagency Implementation Agreement, Washington State Departments of Ecology, Fish and Wildlife and Transportation, 2/10/2000.

pre-activity levels cannot be avoided or adequately minimized, do regulatory agencies review any proposals for other forms of mitigation (also called **compensatory mitigation**).

When compensatory mitigation is required, the preferred method is on-site, in-kind mitigation. If on-site, in-kind mitigation is not feasible, other approaches may be necessary. Regulatory agencies have developed an order of preference or sequence of consideration for other types of compensatory mitigation. This "sequencing" encompasses questions that must be answered about a given mitigation alternative prior to considering any other mitigation alternative. The sequence, **in order of regulatory preference**, is: avoidance of impacts, minimization of impacts and compensatory mitigation. The order of preference for compensatory mitigation is; on-site and in-kind mitigation; off-site and in-kind mitigation; off-site and out-of-kind mitigation.

Advanced mitigation (banking) and environmental credit banking or trading are alternative approaches to providing compensatory mitigation. The diagram below depicts the sequence that a mitigation proponent should follow when deciding which compensatory mitigation alternative to use for a project.

Preferred Mitigation Sequence



Mitigation requirements could be triggered by numerous federal and state regulations. Advanced mitigation, banking, trading, off-site and out-of-kind mitigation approaches seek flexibility in location and objectives (beyond compliance requirements) of mitigation activity – especially critical in urban areas where space and design are highly constrained by existing infrastructure, but also important where climate, geography, and site-specific conditions preclude implementation or benefits from manual approaches. Both location and objectives (beyond compliance requirements) can be negotiated.

The approaches described above range across a gradient from mitigation actions that meet single regulatory requirements, to actions that meet multiple regulatory requirements. For example, environmental credit trading may be triggered by individual regulatory requirements, but because each project triggers multiple regulatory mechanisms, it is more often prompted by a project's multiple regulatory needs. The opportunities for meeting these needs are presented through watershed or regional priorities, either planned or negotiated.

Environmental credit trading is a market-based system, driven by supply (opportunities) and demand (regulatory requirements), within legally documented guidelines set by contract, legislation, rulemaking, policy, and/or guidance. It may be more or less regulated by agencies. Environmental credit trading may or may not involve banking of credits for others to "buy" in the future – simple trades may involve negotiated agreements among traders. In many cases, project transactional costs are low because of up-front regulatory guidance. Where a bank is involved, implementation costs may also be lower and outcome certainty higher, because of the combination of environmental objectives in each mitigation bank, the extent (likely broader than compensatory on-site mitigation for individual projects), consistent monitoring, and demonstration of success prior to credit certification. In fact, these are some of the reasons for mitigation failure: single objective not well defined or documented, extent too small to provide true environmental benefit, no monitoring or enforcement to determine whether the mitigation action met required level of benefit, and approval granted in advance for mitigation actions. Federal, state, and local agencies, banking parties, and stakeholders, as well as environmental conditions, determine the objectives and form of any given bank through negotiations, and public review.

This memorandum first discusses the concept of defining the term "on-site" as the portion of a watershed potentially impacted by a project and that portion of the watershed that is tributary to the site. Next, two new stormwater mitigation approaches, advanced mitigation (banking) and environmental credit trading, are discussed. Because of the limited experience in applying alternative mitigation approaches to stormwater compliance, with its multiple linkages to other regulatory programs, understanding how these approaches are used in related regulatory programs is instructive – as is understanding their track record. Therefore, the memorandum also identifies and evaluates analogous programs currently implemented or contemplated under selected national, state, and local environmental policy. These mitigation/trading programs include those under the Clean Water Act (including pollutant credit trading), the Federal Wetland Mitigation Banking Guidance, Endangered Species Act, and the Clean Air Act. Finally, the memorandum discusses the implications of these precedent programs for

mitigation alternatives under stormwater regulations in Washington state.

Definitions

Advanced mitigation: practices implemented prior to project construction or stormwater treatment methods using more sophisticated technologies applied on a watershed basis.

Compensatory mitigation: flow control and water quality treatment to attenuate hydrologic influences and prevent water quality impacts, including standard mitigation (structural treatments within the project boundaries) and advanced mitigation (structural and nonstructural treatments within the watershed).

Far field pollutants: pollutants that have an effect after complete mixing that may extend beyond the immediate project area or to the whole water body. The effect of far field pollutants is influenced by water body background levels and the effects often occur over time and some distance from the actual point of discharge. Because the impacts tend to occur over time and background levels are more significant, problems associated with far field pollutants can be addressed in the water body and not necessarily before discharge. Pollutants likely to be significant in far field impacts include nutrients and biological oxygen demand. Most pollutants can have both near field and far field consequences. Treatment before discharge is necessary to address the pollutants discharge at acutely toxic levels. At lower levels, impacts can be addressed by reducing background levels so that the net water quality of the water body is not compromised. Metals are an example of pollutants that can have both near field and far field effects.

Near field pollutants: pollutants that have an immediate effect and result in impacts that are very close to the point of discharge. To protect existing aquatic uses, mitigation of near field pollutants must occur before discharge. Acutely toxic metals or discharge flows that cause stream scouring are examples of near field pollutants.

On-site: on or adjacent to the impact site or in the same stream reach, based on resource needs. It is not to be limited to property ownership or city/county boundaries that do not restrict the needs and uses of the resources. On-site may be interpreted differently depending on the nature of the pollutant or factor being considered.

Watershed: the land area contributing surface water and groundwater discharge to the project site. It includes the topography of the catchment area, groundwater recharge and aquifer boundaries, and water quality mixing zones downstream of the project. Flow control and water quality treatment on a watershed basis is considered on-site.

Compensatory Stormwater Mitigation

What Regulations and Policies Are in Place in Washington?

Washington State Regulations

A variety of state and local laws and policies require and regulate stormwater impacts and mitigation. These include SEPA, the Shorelines Management Act, the Growth Management Act, the Hydraulic Code, the Puget Sound Water Quality Management Plan, the Ecology Puget Sound Stormwater Management Technical Manual, the WSDOT Highway Runoff Manual, and local drainage and flood control ordinances. In most locations, these require that new projects provide facilities to limit changes in the quantity of stormwater discharged from a site (flow control) and treatment to remove pollutants. **In accordance with Washington State Policy, when compensatory mitigation is required, on-site, in-kind mitigation is preferred.**

For stormwater projects, structural mitigation can be problematic because of limited space on the property controlled by the project proponents. For purposes of stormwater mitigation, state policy defines "on-site" as "on or adjacent to the impact site or in the same stream reach, based on resource needs. It is not to be limited to property ownership or city/county boundaries that do not restrict the needs and uses of the resources."[2] Although State policy, this interpretation is not widely considered.

On-site and off-site may be considered differently depending on the parameter involved and the location. For example some pollutants such as temperature or dissolved oxygen may impact a short reach or small area of a receiving water body whereas other pollutants such as nutrients may impact a larger area. These pollutants may be considered as near-field or far-field pollutants and the concept of "on-site" may need to be different for each. On-site may apply to a larger area for far field pollutants and to a smaller area for near field pollutants. This has implications for on-site mitigation as well as banking and trading discussed later in this document. For example, a watershed approach for planning and identifying solutions may increase the effectiveness of stormwater mitigation and reduce demand for off-site mitigation or environmental credit trading.

Federal Regulations

A number of federal laws potentially regulate stormwater discharges including the CWA and the Endangered Species Act (ESA). These are discussed at length below in the section on Advanced Stormwater Mitigation (Banking). In many cases the requirements for compliance are

[2] P. 9, Alternative Mitigation Policy Guidance Interagency Implementation Agreement, Washington State Departments of Ecology, Fish and Wildlife and Transportation, 2/10/2000.

the same as state and local regulations. In other cases, notably agency requirements in response to the ESA, there may be additional requirements for mitigation, conservation measures or additional treatment.

What Should be Considered?

The changes in flow created by, and the pollutants discharged by a project typically and primarily impact a reach of stream or river. If the definition of the project site is considered to be the reach of the river or stream that is impacted and the contributing area upstream, the opportunities for more effective or more efficient mitigation are greatly expanded. For example, it may be possible to acquire property upstream or downstream of the construction site and provide stormwater detention for flow control. Property upstream or downstream may be more available and may be less expensive yet provide the same or increased value for detention.

Potential challenges with this approach include:

- The potential to impact a stream reach between the construction site and the mitigation site
- The need for energy dissipation at the discharge point
- The potential to have impacts occur within one local jurisdiction and the mitigation to occur in another jurisdiction creating public opposition.

This approach does not require a change in regulations, merely a change in practice and appropriate discussion. A clarification of the term "reach" and possibly a broadening of the term by the Departments of Ecology and Fish and Wildlife may be helpful.

Advanced Stormwater Mitigation (Banking)

This section discusses the potential to provide compensatory mitigation off-site in advance of a construction project. This concept is often called **mitigation banking**. First, the applicable regulations are discussed, then potential changes followed by project examples are presented.

What Regulations and Policies Are in Place in Washington?

Washington State Policy

The Washington State Departments of Ecology, Fish and Wildlife and Transportation have developed and adopted policy guidance regarding off-site and advanced mitigation. The guidance is included in a document dated February 10, 2000. The document describes when off-site and advanced mitigation will be considered and under what conditions. The

document states: "The applicant must demonstrate to the permitting agencies that there will be a net gain to the resource. Local governments are encouraged to adopt these guidelines when requiring mitigation for impacts to critical areas." "The basic goal of mitigation is to achieve no net loss of habitat functions by offsetting losses at the impact site through gains of mitigation." The document further states:

"**Mitigation Banking:** Mitigation banking may be an acceptable form of mitigation for wetland, floodplain, habitat, and/or stream bank impacts. While these types of resource-banking proposals may be considered by project applicants and permitting agencies, no federal or state guidance defining the management, limitations or use of credits for resource banking has been undertaken, with the exception of wetlands."

"**Stormwater:** Ecology has approved an off-site mitigation strategy implemented by establishing Supplemental Treatment as an appropriate best management practice (BMP) per WAC 173-201(A) for discharges permitted under Section 401 of the CWA. Supplemental Treatment may be applied to stormwater projects to result in improvements to water-quality and quantity needs in watersheds. Please note the use of Supplemental Treatment to meet stormwater discharge requirements is only to be used after Ecology has ensured that all necessary avoidance and minimization measures have been incorporated into the design, construction, or operation of the proposed project. Additionally, in order to ensure compliance with the water quality standards, applicants must provide for agency approval, a justification of how any supplemental treatment approach will improve the water quality of the water body segment receiving the new discharge."

"Compliance with the water quality standards shall be obtained through on-site application of BMPs where reasonable as determined by Ecology. If after on-site application of BMPs, it is determined that the water quality standards can not reasonably be met, off-site Supplemental Treatment shall be applied…"

CWA

Under the CWA, EPA promulgated NPDES permit application regulations for various industrial facilities, construction sites, and urban areas to control the amount of pollutants entering their storm drain systems. In accordance with 1987 amendments to the CWA, U.S. EPA developed a tiered implementation strategy. Phase I, implemented first, covers municipal separate storm sewer systems (MS4s) and requires operators of "medium" and "large" MS4s (generally serving populations of 100,000 or greater), to implement a storm water management program to control their discharges. Phase I also requires permit applications, and therefore management programs, for construction activity that disturbs 5 or more acres of land and for several categories of industrial activities. Phase II, currently in a developmental phase by permitting authorities,

automatically covers all small MS4s located in "urbanized areas" as defined by the Bureau of the Census (unless waived by the NPDES permitting authority), and construction activities generally disturbing between 1 and 5 acres.

Under the Phase I program, most MS4s receive individual permits, while industrial and construction sites receive general permits. In contrast, the Phase II Final Rule describes three permitting options for small MS4s, but leaves to NPDES permitting authorities the discretion as to whether they will offer all three. The options include: a General Permit (encouraged by the EPA for the Phase II small MS4 program); an Individual Permit (not recommended by EPA for the Phase II small MS4 program); and Modification of a Phase I Individual Permit—i.e., participate as a co-permittee with a Phase I-permitted MS4). Implementation options also include sharing responsibility for stormwater management program development with a neighboring regulated small MS4 operator or taking advantage of existing local or State programs (i.e., relying on another entity).

The permitting program for medium and large MS4s differs from the program for small MS4s in that the medium and large MS4 program has permit *application requirements* rather than *permit requirements*. In addition, the program for medium and large MS4s centers on the issuance of individual permits with requirements tailored to each permittee, while the program for regulated small MS4s encourages general permits with blanket requirements for all permittees.

Phase I and Phase II MS4 stormwater management programs are required to meet the standard of "reducing pollutants to the Maximum Extent Practicable (MEP)." Note that requirements for anti-degradation and anti-backsliding must also be met.

All MS4 permit holders are required to:

- Identify major outfalls and pollutant loadings
- Detect and eliminate non-stormwater discharges to the storm sewer system
- Reduce pollutants in runoff from industrial, commercial and residential areas
- Control stormwater discharges from new development and redevelopment areas

In addition, medium and large MS4s must:

- Conduct analytical monitoring and visual examinations
- Submit to the NPDES permitting authority periodic program assessment reports that include the monitoring results

As outlined in the rule, Phase II permittees that obtain coverage under a general or an individual permit are required to implement a stormwater management program that includes, at a minimum, six control measures.

However, the operator has considerable flexibility in deciding which BMPs and approaches to use to implement these control measures. The six minimum control measures are:

- Public education and outreach on stormwater impacts
- Public participation/involvement
- Illicit discharge detection and elimination
- Construction site stormwater runoff control
- Post-construction stormwater management in new development/redevelopment
- Pollution prevention/good housekeeping for municipal operations

Because the CWA regulates stormwater specifically through NPDES Phase I and II regulations, but also requires compliance with water quality standards as associated with designated uses, stormwater discharges must meet both regulations. The specifics of these requirements are set at the state level. Any stormwater management approach must meet water quality standards in the discharge reach (WAC 173.201A.160(b)).

However, this does not disallow the benefits of increasing the stormwater discharge assimilative capacity of the whole watershed through mitigation or restoration activities.

Implications for Advanced Stormwater Mitigation (Banking)

CWA Municipal NPDES Permits

Stormwater mitigation is problematic, in that it involves both meeting CWA stormwater-specific requirements (see above discussion), and also coordinating with regulatory agencies with authority for protection of resources for which stormwater may be an essential ingredient or impacting factor. For example, the availability and distribution of stormwater in a watershed has sustained river floodplain wetlands (regulated under the CWA) and fish nurseries (regulated under the ESA). As a result, stormwater mitigation approaches involve meeting the mitigation requirements of all associated regulatory agencies. This level of complexity and need for coordination and integration (where possible) has driven the planning process and timeline, and costs, where stormwater runoff is involved in any project.

First taking the narrow stormwater regulation-specific perspective, whether a stormwater management project or best management practice would be considered off-site is relative to the geographic area covered by the permit and how an MS4 permit holder implements its program under that permit. Under the MS4 permit and stormwater management plan, there is some flexibility in selecting where and how management measures will be implemented. EPA's Storm Water Phase II Compliance Assistance Guide states that "There is no regulatory definition of MEP in

order to allow the permitting authority and regulated MS4s maximum flexibility in their interpretation of it as appropriate." It is up to the NPDES permitting authority to determine whether the overall management plan is sufficient and meets the MEP standards. Thus, a community could employ a combination of retrofitting and controls on new development. The Guidance also recommends the use of narrative effluent limitations that require the implementation of BMPs over numeric effluent limitations for stormwater discharges.

A description of the MS4's existing management programs is required for the permit application. The permit application requirements (found in 40 CFR 122.26) state that "such controls may include, but are not limited to: Procedures to control pollution resulting from construction activities; floodplain management controls; wetland protection measures; best management practices for new subdivisions; and emergency spill response programs." Therefore, there is a tool-kit of control programs that permitted agencies can draw from, but no definitive requirements for which ones (or how many) they put in place. These decisions, rather, are left up to the permittee and/or the permitting authority.

Once the MS4 permittee has established the mechanisms it will use to implement its program—e.g., building permit requirements; subdivision plan requirements; stormwater control retrofit requirements for industrial and commercial areas, as well as allocation of municipal funds for stormwater projects — then there may be less flexibility in allowing off-site mitigation. However, implementation of these programs off-site is not specifically disallowed. For example, a permittee may or may not allow developers to meet requirements by building a stormwater control facility off-site, or contributing to a municipal trust fund that is dedicated to stormwater abatement, because the permittee deems that it has allowed a sufficient range of on-site alternative options built in as program implementation mechanisms. The demonstration of the validity of the off-site option is then based on the lack of sufficient on-site options and the superior environmental benefit gained in the off-site option, as determined by the regulatory agency.

The Phase II Compliance Assistance Guide indicates that there are two alternative options for writing permit requirements. The permitting authority can "recognize that another governmental entity is responsible under an NPDES permit for implementing any or all of the minimum control measures" or reference a qualifying local program, defined as a "local, State or Tribal municipal storm water program that imposes requirements that are equivalent to those of the Phase II MS4 minimum measures." EPA cites several examples of permittees working with other entities that satisfy the minimum control measures:

- "A State DOT with limited regulatory legal authority can reference a local sewer district's illicit detection and elimination program in its

permit application, provided the program sufficiently addresses illicit discharges into the DOT's storm sewer system.

- The permittee or NPDES permitting authority can reference such programs as coastal nonpoint pollution control programs, State or local watershed programs, State or local construction programs, and environmental education efforts by public or private entities."

Therefore, MS4s are allowed to cite the efforts of others rather than implementing their own control measures that may duplicate efforts or may be difficult for a small MS4 to accomplish. This would require a DOT to work closely with the local agency to reach agreement on responsibility for program actions and funding. This demonstrates the flexibility of the rule to substitute one control measure or program for another, of equal or greater regulatory authority and effectiveness. It also establishes the importance of watershed-based programs, which are essential for off-site mitigation to take place.

The issue of out-of-kind is more difficult to define for stormwater because program performance measures are typically BMP-based, as opposed to effluent-based. That is, there are not necessarily specific limits on various pollutants that would be exchanged "out-of-kind." Out-of-kind could, however, be defined to refer to different types of BMPs. For example, perhaps high-efficiency street sweeping could be traded for water quality treatment vaults or perhaps purchase of riparian corridor could be traded for water quality treatment vaults. A program like TMDLs (total maximum daily loads) may be necessary to define trading parameters.

TMDLs

Under TMDLs, stormwater is treated as a non-point source component, and stormwater water quality parameters may be considered in the calculation of allowed loads (if they contribute to those parameters for which the water body is deemed water-quality limited). It is through this program that stormwater regulation and management are considered in the effluent and receiving water-based context. Ecology has indicated that effluent trading may be useful where TMDLs have been developed, thus including the potential for stormwater effluent trading in TMDL-regulated reaches.

One might conclude that although these TMDL-based trades would achieve improvement in TMDL-designated parameters of interest, activities might not necessarily involve water quality discharge changes alone (e.g., restoration leading to increased shading and pool/riffle structure in streams, which decrease temperature) and would not necessarily be implemented at the discharge point. Examining the linkages of stormwater mitigation with other regulatory mitigation requirements potentially brings in all requirements that are linked to

aquatic resources, including unique life forms, flooding and structure protection, access, and buffers.

ESA

In Washington, ESA regulations have touched on stormwater primarily through consideration of impacts on salmonids, as summarized in the 4D rule. Limit No. 12 addresses application to Municipal, Residential, Commercial, and Industrial (MRCI) Development (including redevelopment). National Marine Fisheries Service (NMFS) offers guidelines on evaluation considerations to determine adequacy of conservation measures for listed salmonids, and one of those specific items is to avoid stormwater effects. NMFS has allowed consideration of a list of measures that could offset impacts, and in fact references their input and guidance to Ecology in the revision of Washington's stormwater regulations (*Assessment Checklist to Identify Potential ESA Liabilities and How Programs Can Contribute to Protected Species Recovery*, NMFS, September 2000). In the meantime, NMFS recommends that current standards for this group be compared to these limits. Activities covered include discharge to streams and wetlands, maintenance/repair of stormwater pipes/infrastructure, maintenance/repair of stormwater ponds and constructed wetlands, and disposal of stormwater waste materials.

Habitat conservation measures for stormwater mitigation include:

- Permanent removal of existing impervious surfaces that results in a net decrease in total impervious area in a sub watershed;
- Permanent property acquisition of wetlands , riparian areas, and upland areas (as infiltration reserves) that improves/protects hydrologic function or significantly increases overall vegetated area in subwatersheds (current science is suggesting watersheds contain 65% forested area and no more than 10% impervious area to avoid degradation to streams and aquatic biota;
- Plant riparian areas with native vegetation (current science suggests stream buffers be no less [and sometimes more than] 30 meters wide per each stream bank);
- Using soil amendment, mulch, and vegetation to help absorb stormwater rather than discharge stormwater to surface waters;
- Purchase/acquire (real and used) water rights;
- Identify and disconnect existing stormwater discharges to all surface waters (thus upgrading current stormwater management from retention/detention and vault systems to infiltration, disconnecting

ditches that convey stormwater to streams, and removal of existing curbs to promote infiltration of stormwater);

- Increase levels of water quality treatment to stormwater;
- Locate water quality treatment structures outside of riparian, shoreline, and wetland buffer areas;
- Use of stormwater treatment structures/techniques that are self maintaining (as maintenance often can be neglected, leading to failure) or are very low maintenance;
- When the impacts of urbanization on the hydrologic system are improved, placement of large woody debris in streams to help stabilize and rebuild channels as well as restore fish habitat;
- Reduce the number of or remove unnecessary stream crossings;
- Use of pervious pavement/surfaces where appropriate (sidewalks, bike/footpaths, parking lots, etc);
- Voluntary changes made by local government jurisdictions to land use regulations that help attain any or part of the above listed items;
- Voluntary collaboration between local government jurisdictions and transportation agencies that help significantly modify how current land use practices and transportation infrastructure are located (redevelopment, increased density, tax incentives, increased use of alternative transportation modes, etc.).

State and Local Regulations

State regulations also touch on stormwater, for example, the Growth Management Act (GMA). Stormwater mitigation, as applied in an urban setting, can take land that could be used for in-fill development out of the available land base. In-fill development itself generates increased detention needs. This dynamic creates opportunities for alternative mitigation approaches, both on-site through development approaches and off-site, through land use planning and watershed approaches.

State policy authorizes consideration of off-site and advanced mitigation and offers general guidance for this. Additional experience and more specific guidance will be needed to implement the concepts.

Project Examples of Advanced Mitigation from Other Areas

For the Blue Ball project in Delaware, jointly lead by the Delaware Department of Transportation, Department of Natural Resources and Environmental Control, and Economic Development Office, a novel approach was taken: they purchased 232 acres and proposed transportation (roadway, hiking and biking trails), recreation, historical, and stormwater improvements to the area. The Master Plan and

Environmental Assessment have been completed with the help of area residents, civic leaders, legislators (state and federal), New Castle County, and the City of Wilmington. The area includes several major state and federal highways and arterials, and existing industrial and commercial properties.

Stormwater planning was managed on a watershed basis – a major portion of the site is within the Brandywine Creek Watershed. Wetland habitat restoration, and 10-foot bioswales throughout the area will be used for environmental education, particularly where evident in local parks and greenways. Land use planning will manage impervious and pervious surfaces and storage reservoirs and wetlands, their impacts/opportunities, to maximize water resource benefits in the watershed. This combination of watershed-based, in some cases off-site, water resources improvements, has been determined to meet Clean Water Act requirements associated with the overall project Master Plan and is an example both of an alternative mitigation approach and managing to prevent sprawl.

Environmental Credit Trading

Environmental credit trading is a market-based system, driven by supply (opportunities) and demand (regulatory requirements), within legally documented guidelines set by contract, legislation, rulemaking, policy, and, or guidance. It may be more or less regulated by agencies. Environmental credit trading may or may not involve banking of credits for others to "buy" in the future – simple trades may involve negotiated agreements among traders.

What Regulations and Policies Are in Place in Washington?

Washington State Policy

As explained earlier, Washington State Policy requires avoidance and minimization as the preferred method to address impacts to aquatic resources. When this is not adequate, compensatory mitigation is required with on-site, in-kind mitigation the preferred approach. Adopted state policy does not provide specific guidance for environmental credit trading.

Pollutant Credit Trading Under the CWA[3]

Policy and Guidance

The CWA does not explicitly authorize pollutant trading (unlike the Clean Air Act), nor does it expressly preclude it. EPA, the General Accounting Office, and others have argued that reasonable

3 Note that "pollutant credit trading" is also commonly referred to as: "effluent trading", "water quality trading," and "watershed-based trading." It involves parameters regulated by the CWA in the medium of water.

interpretations of several provisions of the CWA, individually and collectively, in fact allow trading.[4] Many argue that TMDL process provides a legal framework for allocating pollutant control responsibilities among dischargers in a manner that constitutes or allows trading—i.e., off-site mitigation. For example, "EPA's regulations on TMDLs provide that if the nonpoint source pollution controls make more stringent nonpoint allocations practicable, then allocations for point sources can be made less stringent. In this regard, the regulations state that '….the TMDL process provides for nonpoint source control tradeoffs' (40 C.F.R. 130.2.i)." [5] Other arguments suggest that there is no preclusion for trading even without a TMDL in place — and EPA's Draft Framework policy allows for this — as long as credits can be established, and trading improves or maintains water quality. Under this interpretation, trading could be used to maintain water quality in a waterbody currently meeting standards, which is not on the 303(d) list and therefore not in line for a TMDL. For example, where a water body is not impaired but a change in land use may increase the potential for degradation (such as conversion from managed cropland to paved commercial development), a load exchange may allow significant reduction in reach impacts. The relatively ambiguous authorization for trading made many potential participants as well as regulators unwilling to pursue projects for fear that trades or trading programs would be overturned or disallowed in the courts. In an attempt to alleviate this concern, EPA published a policy statement in January 1996 on effluent trading in watersheds, indicating that the agency would "actively support and promote effluent trading within watersheds to achieve water quality objectives, including water quality standards, to the extent authorized by the Clean Water Act and implementing regulations." In May 1996, EPA published its *Draft Framework for Watershed-Based Trading*.[6] The Framework (available at www.epa.gov/owow/watershed/trading.htm) was not issued as formal guidance but rather as a primer or "how to" manual that, according to the document's foreword, "generally describes the benefits and types of trading, lays out the principles for trading, and addresses how the types of trading can be implemented within the existing statutory framework." Comments on this Framework and the 8 principles, plus other concepts put forth therein, received by EPA through December 1996, are also on the website – they in effect raise the issues that states need to examine and clarify in order for pollutant credit trading to be a viable option. To date, no additional policy or guidance has been set forth at the national level with regards to pollutant credit trading.

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[4] See for example: *Draft Framework for Watershed Based-Trading*, U.S. EPA. Office of Water. EPA 800-R-96-001, May 1996; *Incentive Analysis for Clean Water Act Reauthorization: Point Source/Nonpoint Source Trading for Nutrient Discharge Reductions*, U.S. EPA, April 1992; and *Water Pollution: Pollutant Trading Could Reduce Compliance Costs If Uncertainties are Resolved*, U.S. General Accounting Office, June 1992 (GAO/RCED-92-153).

[5] U.S. General Accounting Office, June 1992 (GAO/RCED-92-153).

[6] U.S. EPA. Office of Water. EPA 800-R-96-001, May 1996.

To date, most of the active trading programs have been enabled exclusively through NPDES permits. Others are using Memoranda of Understanding and/or state policies or guidance to establish the legal basis for trading. A handful are codified as pilot programs under state statute (e.g., three Wisconsin trading pilots in the Fox, Red Cedar, and Rock River watersheds), or are otherwise established in special regulation (e.g., Cherry Creek, Colorado). This is especially true for trading projects or programs that were put in place prior to 1996, including those operating in the Tar Pamlico (North Carolina), Lake Dillon (Colorado), Cherry Creek (Colorado), Tampa Bay (Florida), San Joaquin (California), Fox River (Wisconsin), and Boulder Creek (Colorado) watersheds. Newer initiatives have used EPA's policy and draft framework as the basis for their projects or programs, and generally provide more detailed guidance or rules for trading. This group includes initiatives in Michigan (draft rules pending), Long Island Sound, the Rahr Malting permit and the Minnesota Sugar Beet Cooperative permit (Minnesota), Oregon's recent policy, and the Chesapeake Bay Program's draft guidance issued for consideration by the Bay Agreement states (Maryland, Virginia, District of Columbia, Pennsylvania).

Precedents for Off-site and Out-of-Kind Mitigation and Credit Trading

EPA defines five categories of trades. As indicated below, all by definition (with the possible exception of intra-plant trading) involve off-site mitigation.

Intra-plant—a facility that reduces pollutant discharges beyond technology-based requirements at one or more outfalls need not meet technology-based requirements at other outfalls, provided that total discharges of pollutant(s) involved in such trades are less than would be discharged under normal uniform technology-based requirements.[7]

Pretreatment—an indirect industrial point source(s) that discharges to a publicly owned treatment works (POTW) arranges, through the local control authority (i.e., the POTW), for additional control by (an)other indirect point sources beyond the minimum requirements in lieu of upgrading its own onsite treatment for an equivalent or greater level of reduction.

Point-point—a point source(s) arranges for another point source(s) in a watershed to undertake greater than required control in lieu of upgrading or otherwise enhancing its own treatment beyond technology-based requirements for an equivalent or greater reduction in pollutant loading.

Point-nonpoint—a point source(s) arranges for a nonpoint source(s) in a watershed to implement BMPs that are otherwise not required in lieu of upgrading or otherwise enhancing its own treatment beyond technology-

[7] See the Draft Framework, and also *The Use and Impact of Iron and Steel Industry Intra-Plant Trades,* U.S. EPA, March 1994.

based requirements for an equivalent or greater reduction in pollutant loading; and

Nonpoint-Nonpoint—a nonpoint source arranges for another nonpoint source to implement BMPs that are otherwise not required in lieu of installing or upgrading its own treatment system or BMP(s).

Project Examples

Numerous relevant regulatory, legal, and policy examples of off-site mitigation and credit trading exist within surface water quality, air quality, wetlands, and endangered species programs, as is documented in this Technical Memorandum. Examples of out-of–kind mitigation and credit trading are infrequent, possibly because they are less evident since they are most often negotiated in specific permits or legal settlements rather than adopted as a general policy or in a banking agreement. A recent and prominent example is the settlement of the Blue Heron NPDES discharge permit renewal suit, for which salmonid habitat restoration was negotiated as acceptable mitigation for discharge of higher temperate water from the plant to the Willamette River (Oregon). Such out-of-kind offsets are sufficiently common, however, to establish that out-of-kind mitigation is being implemented. Furthermore, water programs are increasingly interested in and experimenting with ecosystem-based crediting/debiting protocols that establish currencies for mitigation based on the provision of environmental services and benefits within a watershed. This is in keeping with U.S. EPA's policies on watershed- and receiving water -based water quality management.

While these programs have a short track record, and many are currently only in the conceptual stages of development, selected examples may help the reader better envision how alternative mitigation might be applied to stormwater management.

Chesapeake Bay Nutrient Reduction, Maryland Application

An agreement signed by the Chesapeake Bay states and EPA in 1987 established a goal to reduce nutrient loadings to the Bay by 40% from 1985 loadings. In 1992, each Bay state agreed to develop "tributary strategies" that would outline the actions that jurisdictions planned to take for long-term reduction of phosphorus and nitrogen loadings. Maryland developed strategies for each of 10 basins through a stakeholder involvement process, using a combination of point and nonpoint source reductions to reach the target. Although considered primarily a point source because of treated effluent discharges, the publicly owned wastewater treatment facilities were offered the option of offsetting their effluent discharge loads with on-site nonpoint source (stormwater) improvements, along with potential purchase of reduction credits from another point or nonpoint source. To further program development, the Chesapeake Bay Program identified Nutrient Trading

Fundamental Principles and Guidelines (2001; see www.chesapeakebay.net/trading.htm).

The Water Environment Research Foundation (WERF) recently funded a study to model the potential trading market in Maryland, and to provide guidance for the design and implementation of a statewide trading program for nitrogen (results in draft form). Preliminary results suggest that, while agricultural credits are expected to outnumber resource (i.e., undeveloped land) and urban BMP nonpoint source credits in most tributaries, urban BMP nonpoint source credits range from 5% to over 50% of the total nonpoint source credits available. In some tributaries, they may be a key component of decreasing overall cost to attain the 40% reduction, even assuming that credits are only generated and certified where reductions have exceeded permit limits or comparable requirements (if not a permitted stormwater system). However, in general, urban BMP nonpoint source credits appear to be three to 10 times greater than other point and nonpoint source credit options, except urban tree planting.

Thus, a preliminary conclusion appears to be that urban stormwater BMPs would not be the preferred tool in this system for achieving nutrient reduction goals in Chesapeake Bay, although those water quality improvements could still be achieved. If the objectives of the trading program were redefined or coupled with other regulatory credits or environmental goals – such as addressing suspended sediment removal as an additional parameter, or habitat restoration as an objective, or decreased groundwater nutrient transport (a recent area of research not yet taken into consideration) – this economic scenario could change.

Other Project Examples of Environmental Credit Trading Across the U.S.

There are currently between 10 and 20 programs or projects across the U.S. that are trading or getting ready to trade off-site pollutant load reduction credits for application against onsite control requirements (Table 1). In addition, there are approximately 20 to 30 studies or programs that represent feasibility assessments, are still in the early stages of design, or are defunct. Nitrogen and/or phosphorus represent about three-fourths of programs/projects. Most of the remaining programs involve temperature, ammonia, or sediment/solids, while a handful address metals.

Table 1. Summary Initiatives[8]

Initiative	Location	Pollutant	Type of Trade(s)	Status
Acton, Town of POTW	Massachusetts	Phosphorus	P-NP	Offset implemented for one discharger on Assabet River.
Bear Creek	Colorado	Phosphorus	P-NP	Control regulation allowing trading in place. No trades have occurred.
Blue Plains WWTP	District of Columbia	Nitrogen	P-P	POTW's new permit allows for point-point trading with nearby POTWs and transfer payments. No trades have occurred.
Boone Reservoir	Tennessee	Nutrients	P-NP	Study in 1989. No program developed.
Boulder Creek	Colorado	Nitrogen, ammonia	P-NP	POTW paid for in-stream restoration in lieu of plant upgrade
Cargill and Ajinomoto Plants	Indiana	Ammonia, CBOD	P-P	Two neighboring industrial plants meet joint effluent limits.
Chatfield Reservoir	Colorado	Phosphorus	P-NP	Feasibility study conducted. Control regulation allowing trading in place. No trades have occurred.
Chehalis River	Washington	BOD, DO	P-NP, P-P	Draft implementation plan for trading. Not implemented.
Cherry Creek	Colorado	Phosphorus	P-NP, P-P	WERF trading demonstration project. Basin Authority member POTWs fund nonpoint source Pollution Reduction Facilities that generate credits for member use.
Chesapeake Bay	Maryland, District of Columbia, Virginia, Pennsylvania, Delaware	Nutrients	P-P, P-NP	The Chesapeake Bay Program sponsored a year-long, stakeholder process to develop guidelines for trading in Chesapeake Bay Agreement states.
Clear Creek	Colorado	Multiple	P-NP	Feasibility study examining using a credit system to encourage "adoption" and clean up of orphan mining sites in exchange for credit toward other pollutant load reduction requirements.
Clermont County	Ohio	Phosphorus	P-NP	Project under discussion. Data collection, analysis, and consideration ongoing.
Delaware River Basin Simulation	Pennsylvania	Multiple	P-P, P-NP	Feasibility study in early stages.
Fox-Wolf River Basin	Wisconsin	BOD	P-P; P-NP	One of three state pilots and WERF trading demonstration project.

[8] Sources for table information: *Draft Framework for Watershed-Based Trading*, U.S. EPA Office of Water, EPA 800-R-96-001, May 1996; A Qualitative Model for Designing and Implementing Trading Programs, A.J. Edwards, 1999; A Summary of U.S. Effluent Trading and Offset Projects, Environomics, November 1999; and various presentations by Lisa Bacon/CH2M HILL.

Initiative	Location	Pollutant	Type of Trade(s)	Status
Henry County Public Service Authority and City of Martinsville Agreement	Virginia	TDS	P-P	Discussions ongoing. Trade approved in concept but not yet implemented.
Illinois Pretreatment Trading Program	Illinois	Multiple	Pretreatment	Feasibility study. No trades conducted.
Iron and Steel Industry	Multiple states	Multiple	Intra-plant	Plants allowed to "bubble" outfalls for purposes of determining compliance across all.
Kalamazoo River	Michigan	Phosphorus	P-NP, P-P	WERF trading demonstration project. Point sources buy credits from agricultural sources. Selected point sources also have conducted creditable stream restoration.
Lake Dillon	Colorado	Phosphorus	P-NP, P-P	Nation's first watershed trading program. Four POTWs allowed to offset loads with nonpoint source reductions. Several trades have occurred.
Long Island Sound	Connecticut	Nitrogen	P-P	WERF trading demonstration project. Point sources secured alternative allocation system to meet watershed goals that involves point-point trading and prioritization of investments in POTW upgrades based on relative cost and location.
Lower Boise River	Idaho	Phosphorus	P-P, P-NP	Seven POTWs, three industrial dischargers, and eight irrigation districts will conduct trading to meet a TMDL for the River. Trading pending finalization of TMDL.
Maryland Nutrient Trading Framework	Maryland	Nitrogen	P-P, P-NP	WERF trading demonstration project. Market analysis of supply and demand. Will evaluate CBP guidelines. Due Fall 2001.
Neuse River	North Carolina	Nutrients	P-P, P-NP	Plan provides option for joint cap for point sources. Allocations have been met to date and no trades have occurred.
New York City's Drinking Watershed	New York	Phosphorus	P-NP	Feasibility study and plan to use trading to avoid upgrades to NYC drinking water treatment facilities.
Passaic Valley Sewerage Commission	New Jersey	Multiple	Pretreatment	Effluent trading program for POTW's industrial users. Several trades have occurred involving heavy metals.
Puyallup River	Washington	BOD, ammonia	P-P, P-NP	Project completed. Resulted in trade between two municipal facilities. Accommodated through permit modifications.

Initiative	Location	Pollutant	Type of Trade(s)	Status
Rahr Malting Company/Minnesota River	Minnesota	CBOD	P-NP	Rahr Malting has purchased credits from agricultural sources (BMPs).
Red Cedar	Wisconsin	Phosphorus	P-NP, P-P	One of three state pilots. In feasibility study stage.
Rock River	Wisconsin	Phosphorus	P-NP, P-P	One of three state pilots. In feasibility study stage.
Saginaw River	Michigan	Phosphorus, other	P-NP, P-P	Feasibility study beginning in 2001.
San Francisco Bay	California	Copper, mercury	P-NP, P-P	Feasibility study examined options to reduce loadings. Additional water quality monitoring obviated need to trade.
San Joaquin Valley	California	Selenium	P-NP, P-P	Established tradable discharge permit system to reduce selenium "discharges" among participating irrigators.
Southern Minnesota Sugar Beet Cooperative	Minnesota	Phosphorus	P-NP	The Beet Cooperative purchases credits from agricultural sources (BMPs).
Specialty Minerals, Inc. -- Town of Adams	Massachusetts	Temperature	P-NP	Offset implemented for one discharger on Hoosic River.
Tampa Bay Cooperative Nitrogen Management	Florida	Nitrogen	P-NP, P-P	Cooperative trading part of on-going estuary management strategy. Embodied in an MOA among Bay jurisdictions
Tar Pamlico River	North Carolina	Nitrogen	P-NP, P-P	Selected point sources under a "bubble" and subject to a group cap. Point sources must trade with each other to stay under cap or contribute to state agricultural cost-share fund per specified trading ratios and cost per credit.
Truckee River	Nevada	Nitrogen, flow	P-NP	Feasibility study involving increasing flow in exchange for higher nitrogen load allocation.
Virginia Water Quality Improvement Act and Tributary Strategy	Virginia	Nutrients	P-P only, initially; P-NP maybe later	Guidance being developed to use trading to help meet tributary strategy goals. No trades have occurred.
Wayland Business Center Treatment Plant Permit	Massachusetts	Phosphorus	P-NP	Offset implemented for one discharger on Sudbury River.
Wicomico River	Maryland	Phosphorus	P-NP	Study in 1987. No program developed.

KEY:

BOD = biochemical oxygen demand; DO = dissolved oxygen; CBOD = carbonaceous biochemical oxygen demand; TDS = total dissolved solids

P-P = point-point source trade; P-NP = point-nonpoint source trade

Figure 1. Locations of Trading Programs, Pilots, and Projects

EPA's policy and framework state that trades should generally occur within the same watershed. Hydrologic watershed units vary in size, as do watershed units, basins, and sub-basins demarcated for management purposes. The exact extent, or distance between the source purchasing credits and the credit-generating site can vary from several hundred yards to several miles.

Thus far, trading programs have had a good deal of flexibility in defining the watershed for trading purposes. For example, in the Cherry Creek, Colorado program, trades occur in a 384-square-mile watershed around an 850-acre reservoir, while the Tar Pamlico, North Carolina program covers a 5,400-square-mile watershed encompassing 180 miles of river. When TMDLs are involved, presumably trades must occur within the same boundary for which the TMDL was developed. Without a TMDL, the partners or program managers have had to provide reasonable justification for the watershed unit selected as the trading boundary. Those programs which have shown most active trading and mitigation, have watershed boundaries that encompass enough players (dischargers, mitigators, and potential projects) to make the system worthwhile over changing growth patterns and economic conditions. The most appropriate geographic area for watershed-based or wetland trading

depends on: site-specific hydrogeologic conditions; water chemistry; ecological parameters; and the location, number, and type of sources. The boundaries must also be of a manageable size to ensure that analyses predicting and assessing trading results are reliable.

There are currently few examples of out-of-kind watershed-based trading. However, there is evidence that several existing and developing programs are considering a broader scheme of crediting and debiting that would support what might otherwise be referred to as out-of-kind (e.g., Chesapeake Bay, Boulder Creek, Colorado, Delaware River Basin). For instance, among the trading programs under development or being implemented, seven involve more than one pollutant. In addition, one program —Clear Creek, Colorado—contemplated "cross-pollutant" or "cross-parameter" trading, as out-of-kind trading is frequently referred to within the watershed-based trading context.

The Clear Creek project was launched by Colorado Department of Public Health and Environment to investigate the feasibility of creating incentives to clean up orphan mine sites. Such clean-ups would reduce metals loadings by enabling point sources with requirements to reduce conventional pollutants (e.g., nutrients) to receive credit toward their non-metal effluent limits with metal loading reductions elsewhere in the watershed. This project made some good contributions to the body of methodologies that could be used to evaluate the relative value of reductions of different pollutants. Target ranges for various pollutants were established and potential trades were evaluated based on the percent by which trades would bring ambient concentrations into their target ranges. The project did not attempt to establish a common "base" currency into which all reductions would be translated then compared. [9] The stakeholders did not move forward with further development on the cross-pollutant trading program following completion of the initial feasibility study due to concerns about the lack of clear legal authority in the CWA to implement cross-pollutant (out-of-kind) trading.[10]

Despite this limited experience to date, there are indications that regulators, watershed managers, and scientists are looking to more advanced systems that will help evaluate and provide incentives for actions to restore and maintain watershed health. In March 2001, at the Western Governor's Association meeting some participants expressed support for launching a pilot program to experiment with watershed-based and multi-credit trading, in all of its possible forms. Out-of-kind trading did not generate as much support as multi-credit trading, because

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[9] Orphan Sites Feasibility Study, Phase III Task 3 and Task 4 reports, *Possible Approaches to Evaluating and Implementing Unlike Transactions* (March 1997) and *Approaches to Evaluating and Implementing Transactions Involving Banking* (September 1997), both prepared for The Conservation Fund by Hydrosphere Resource Consultants

[10] *A Summary of U.S. Effluent Trading and Offset Projects*, prepared for US EPA by Environomics, November 1999, and other personal communications with stakeholders and regulators.

of uncertainties about whether equivalency methodologies were supported by CWA and other legal authority.

Net environmental benefits analysis (NEBA) is one equivalency method that uses a suite of economic valuation tools and environmental or dollar metrics to measure changes in *ecological services* – these changes can be positive or negative. Habitat value is commonly assessed using Habitat Equivalency Analysis (HEA), which can translate a variety of habitat-related benefits into common units. Often, HEA is combined with net environmental benefits analysis. Note that HEA and NEBA are accepted methods approved by the National Oceanic and Atmospheric Administration (NOAA) for determining mitigation and restoration requirements, and setting mitigation equivalencies.

Some programs have included requirements for retiring credits and for credits to expire. For example, a state may require that a set percentage of credits for each trade (e.g. an additional 10%) be retired for each transaction. This might be viewed as another form of factor-of-safety ratio for mitigation. In some cases the value or effectiveness of credits may decline over time. In these cases, it may be appropriate to assign a life for each credit.

Effectiveness of Pollutant Credit Trading Programs[11]

After a relatively slow start compared to air emissions trading and wetland mitigation banking, the number of pollutant trading programs established to help achieve local water quality objectives has grown from about five in 1990 to over 40 today. These initiatives are in various stages of development, ranging from feasibility studies to full-blown implementation. Almost a dozen are well into the implementation phase, with trades underway or completed. Programs for the Tar Pamlico River in North Carolina and the Cherry Creek Reservoir in Colorado were early pioneers that are still leading the way. Long Island Sound, Kalamazoo River, and the Lower Boise River programs are recent entrants providing lessons about success for others.

Meaningful conclusions and lessons learned from these programs that can be applied to future programs include:

Trading shows promise as one way to achieve water quality goals, given the following constraints typical to most watersheds: (1) the NPDES permit program is the primary (often the only) leverage tool; (2)

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[11] Evaluation compiled from the following sources: Rogers, Wallace, and Bacon, *Using Environmental Credit Markets to Improve and Maintain Watershed Quality: A Prospectus for Piloting a Multi-Credit Trading System*, presented at Western Watershed/TMDL Management Issues, Environmental Credit Trading as a Tool for Meeting TMDLs, a Western Governors Association-Sponsored Workshop; WERF's Cherry Creek Trading Demonstration Project draft report, excerpted program evaluation written by Elise Bacon; Clair Schary, USEPA, a presentation given to a workshop hosted by CH2M HILL in Portland on February 2, 2001; and Lisa Bacon, a presentation given to a workshop hosted by CH2M HILL in Portland on February 2, 2001.

since many point sources have already implemented secondary treatment or beyond, their cost per pound to reduce pollution is relatively high; and (3) nonpoint source leverage is limited to some required actions, subsidy-based incentives for voluntary good practices, and government-led restoration/preservation programs. Under these circumstances, trading can often be used to reduce compliance costs for point sources and/or to direct resources to nonpoint source reductions.

Many believe the lack of clear authorization from the federal level until 1996 when EPA's *Draft Framework for Watershed-Based Trading* was released caused states and local stakeholders to proceed slowly and cautiously. Additionally, few funding sources were available to those pioneers that did proceed. After 1996, a number of states began developing their own pilot programs or draft trading regulations, including Illinois, Maryland, Minnesota, Michigan, New York, North Carolina, Oregon, and Wisconsin. About the same time, these and other states, the Water Environment Research Foundation, and several environmental grant-making foundations began to make monies available to support development and implementation of watershed-based trading programs.

Some of the issues that seemed confusing or problematic several years ago now have been clarified or solved. Effective models are now available for the following areas, through review of the Table 1 examples:

- Regulatory—allocating pollutant reduction responsibilities, permitting techniques;
- Economics—capital, operation and maintenance, and unit costs; amortization and valuation techniques;
- Science/Technical—efficiencies, trading ratios, BMP and restoration design;
- Stakeholders—interests, incentives, roles, processes, involvement, input;
- Institutional—roles, responsibilities, arrangements, partnerships;
- Administrative—tracking, registering, certification, transaction facilitation; and

- Performance and Oversight—monitoring, measurement, benchmarks, liability.

Examples of Different Forms of Environmental Credit Trading

Trading ratios—Cherry Creek, Long Island Sound, Chesapeake Bay Program, Lower Boise

Retirement mechanisms—Michigan, Oregon

Point Source bubbling—Tar Pamlico, Tampa Bay, Maryland

Pre-qualified BMPs—Oregon, Lower Boise

Broker/clearinghouse functions—Cherry Creek, Tampa Bay, Michigan

Upstream/downstream issues—Chesapeake Bay Program, Oregon

Liability arrangements—Cherry Creek, Tar Pamlico, Oregon, Maryland

Industry participation—Rahr, Southern Minnesota Beet Sugar, Des Moines

State roles—Colorado, Maryland, Wisconsin, Virginia

Third-party roles—San Joaquin, Tar Pamlico

As shown in the following table, there are several examples of different forms of environmental credit trading:

However, there is no such thing as an "off-the-shelf" or "just add water" trading program. Stakeholders in each watershed go through a process to select the options that best meet local environmental, institutional, and political circumstances.

The following are key factors that determined the success of pollutant trading programs to date:

- ***Leadership and Involvement—Champions are Persistent, Stakeholders Must Have Access and Role.*** A core group with consensus building skills and technical expertise is needed to educate participants and other stakeholders, answer critical procedural and scientific questions, and drive the design and implementation process forward. Most often, it is best to engage as many stakeholders as appropriate from the beginning. It is incumbent upon the leaders to issue broad invitations for participation. Exclusion generally carries greater risks down the road than inclusion. Even if inclusion makes the road longer, it will more likely lead to success, buy-in, acceptance, ownership, endorsement, and participation.

- ***Specific Environmental Objectives—A Target and a Baseline.*** Whether in the form of a TMDL or similar analysis, the environmental objective must be articulated in clear and measurable terms. Some programs have established a loading cap that they are now under and want to remain below, while others have set loading targets that they must achieve significant reductions in order to meet. A clear baseline

sets in motion incentives to trade and the benchmark from which equity is measured.

- ***Sufficient Reduction Capacity in Alternative Sources—Provides Tradable Reductions.*** Loading reductions must be available for which trading is a politically feasible activity. These tradable options may be the only reductions being implemented in the area. More commonly, tradable options supplement ongoing pollutant control efforts (i.e., technology-based controls). Such loading reduction capacity typically is found among nonpoint sources, but several programs are examining ways to take advantage of temporary or purposeful point source loading reductions – such as from industries that are changing processes or turning to reuse. To date, agriculture is the most common source of tradable options.

- ***Favorable Economics—Creates Incentives to Trade.*** To generate interest in trading and design a workable program, the relative difference in control costs among some sources must be significantly different—significant enough so that when transaction costs and any operation and maintenance costs are factored in, the trade is still a good deal. Point sources have typically found such differentials with nonpoint source partners. While significant differentials between point sources have not been identified to date, point-point trading can offer opportunities to take advantage of timing and scheduling differentials, which translate into better financing deals and cost-savings.

- ***Strong Data Collection and Monitoring Program—Measurable and Verifiable Results.*** Sufficient data and monitoring are critical to establishing a baseline and evaluating the potential and actual impacts of trades on water quality. Baseline may be set by water quality standards and by site-specific criteria, such as determined by use attainability studies. It is particularly important to quantify nonpoint source loadings and BMP effectiveness rates in order to provide sufficient assurance that environmental benefits will result from point-nonpoint source trades. From the very beginning, a trading initiative that includes the performance criteria and program evaluation process to review effectiveness, document results, and adjust rules or policies if necessary, is more likely to document environmental improvements. Developing a data system to record and track trades is a key part of this process.

- ***Workable Regulatory Framework—Flexible but Firm.*** Especially for point-nonpoint source trading, accountability and enforceability have been sticking points and deal breakers. The programs examined represent several different approaches to solving this problem. Some rely on permit-based provisions, alone or in combination with other

mechanisms. Contracts and other binding agreements that specify roles, responsibilities, and recourse also are gaining acceptance.

- ***State Buy-In – As an Active or Passive Participant.*** Regardless of whether the state actively participates in program design and implementation, or plays a narrower role as regulator and observer, state acceptance has been a key component in each program examined. In many instances, state staff played a critical part in conducting technical analysis and crafting viable solutions. In others, they reviewed proposals through the existing permitting process. Resource allocations to state regulatory authorities, including legislative appropriations and direction, and federal grants, have greatly facilitated the implementation of such programs – especially when they involve multiple agencies.

- ***Point Source Must See Benefits—Outweighing Political and Technical Obstacles.*** So far, most trading has involved point sources "buying" reductions from nonpoint sources that do not face nearly the same regulatory requirements, relatively speaking, that point sources operate under. Politically, then, many point sources are reluctant to come to the table and discuss trading opportunities when they feel nonpoint sources have not been held accountable for "their fair share." Most point sources that have come forward have done so because of compelling economic opportunities, or because they believe that if something doesn't get done, regulatory requirements are likely to become more stringent and new sources may be disallowed.

- ***Resources to Support Design and Piloting—Also Implementation.*** So far, no one can really say that getting a trading program off the ground is cheap. Most of the programs discussed here have, or will have, spent somewhere between several hundred thousand and one million dollars on data collection, technical analysis, development, and design efforts (including workshops, education, and alternatives analysis) to support trading. As more trading programs come on line, significantly more information and models will be available to interested parties, and development costs should begin to decrease.

Summary of Findings Related to Advanced, Off-Site Mitigation and Environmental Credit Trading

Advantages and Limitations

There are several advantages to these alternative mitigation approaches. Off-site and multi-credit mitigation or credit purchases allow permittees and regulators to:

(1) target projects to locations where they are most likely to succeed, needed, and/or valued, within the framework of land use planning;

(2) pool funding for projects in a way that minimizes transaction costs – particularly for banking - hence more money to the projects;

(3) increase the likelihood of long-term monitoring and achievement of performance standards;

(4) combine many small mitigations into larger, more environmentally meaningful and sustainable mitigation actions; and

(5) protect and restore designated uses, habitats, and ecosystems, through increasing assimilative capacity throughout the watershed.

Out-of-kind mitigation or credit purchases, whether partially or completely out-of-kind, provide additional opportunities to select and site mitigation projects according to the value of the environmental benefits they provide relative to the ecosystem and watershed's priority needs.

There are also limitations, barriers, and concerns to applying these alternative mitigation approaches to stormwater:

(1) neither legal authority nor objectives are clearly stated across all of the relevant legislation (federal and state);

(2) no impairment to designated uses, habitat, protected species or ecosystems (such as wetlands) is allowed (antidegradation);

(3) because state regulations differ significantly, the number of precedent-setting examples that might provide lessons learned under similar circumstances is limited – hence the need for pilot projects;

(4) initial projects in each state require time and regulatory agency resource allocation to reach policy decisions, to develop guidance, and to perform reviews of bank plans and certifications, unless they are entirely developed by a private party (as might occur in a private bank before specific banking rules were laid out); and

(5) identification of environmental objectives (which may also be watershed management objectives, regulatory TMDLs, or other),

determination of key environmental parameters affected by stormwater, and characterization of existing and historical conditions need to be accomplished – which may entail data collection and watershed plan or TMDL preparation; and

(6) the changing economic context needs to be assessed, particularly for environmental credit trading or banking, to ascertain the viability and local economic effects.

Note that regulatory uncertainty is high for all parties (regulating authority, regulated, stakeholders) until several projects have been undertaken in a given state, although it may not be any higher than the uncertainty currently generated by the combination of regulatory requirements which affects stormwater management. Antidegradation and anti-backsliding provisions are of particular concern , necessitating that particular thresholds of protection or source control be achieved on-site, to avoid downstream impacts or decreases in compliance probability.

Regulatory and Policy Conditions In Place in Washington State

In Washington state, many conditions that make mitigation alternatives (the full gradient) both desired and feasible are either in place or under development. The state has:

1) completed several TMDLs and is in the process on many others, with a trend towards more parameters addressed in each TMDL planning activity;

2) is planning an effluent credit trading pilot project in TMDL watersheds, with funding assistance from US EPA Region 10, and recognizes the opportunity for using effluent trading based on TMDLs or other equivalent analysis that clearly identifies the environmental goal(s) to be achieved;

3) begun watershed planning (authorized by the legislature and including public input) for numerous watersheds, including stormwater management plans, water resources planning for people and endangered salmonids, species restoration planning, and some water quality planning;

4) stormwater technical manuals;

5) a policy for implementation of Supplemental Treatment BMPs, which are a mechanism for implementing off-site stormwater BMPs;

6) cost/benefit evaluations on stormwater technical standards completed, and soon to be completed on transportation applications;

7) completed the rulemaking process for wetland mitigation banking, with several banks approved and more in the process;

8) clearly identified a hierarchy of wetland values;

9) a legislative-mandated water rights program (surface and groundwater);

10) a Governor-issued directive, in response to Blue Ribbon Commission on Transportation recommendations, that stipulates development of an interagency alternative mitigation policy for stormwater, and applies this policy to transportation pilot projects;

11) an Alternative Mitigation multi-agency initial policy;

12) a feasibility review commissioned by WSDOT to evaluate the efficacy of an Alternative Mitigation Review Panel;

13) a 2001 legislative mandate for developing a streamlined approach to environmental permitting for transportation projects, including use of Washington's alternative mitigation policy guidance and low-impact development methodology;

14) a land use planning that is locally implemented;

15) permit decisionmaking for transportation projects; and

16) an air quality program with some credit trading.

The federal and state regulatory drivers are clearly present in the CWA and ESA and associated programs. Ecology and Fish and Wildlife in 2000 adopted alternative mitigation policy guidance for aquatic permitting. Finally, Washington has espoused a policy of "net environmental benefit," embodied in rules and guidance from Ecology during the past 5 years (e.g., Washington Department of Ecology and Department of Health, *Water Reclamation and Reuse Standards*, Pubn. No. 97-23, September 1997).

Economic conditions, while looking forward to slower growth than that which has occurred in the last 10 years, can be expected to drive continued pressure on available land and resources, and provide a steady flow of permittees. In particular, the need for energy efficiency and sources will stimulate mitigation efforts—as energy utilities have the longest history with both alternative mitigation and environmental credit trading, experienced players are likely to be active participants. Governor Locke cited the possibilities of basing permit streamlining on "net environmental benefit" in his 2001 energy Executive Order.

The scope of alternative mitigation and environmental credit trading can address many of the stormwater regulatory issues identified in the Interim Stormwater Management Study Report for Washington (December 2000). However, barriers and concerns do currently exist in the Washington regulatory and stormwater management system that limit implementation of mitigation alternatives. The lack of a clear state endorsement of these mitigation approaches, across all state resource agencies and addressing upland and aquatic impacts, implemented on a

watershed basis, is a significant deterrent to development and application of such principles to projects and watersheds. Within each regulatory authority, there is some interest in the opportunities that alternative mitigation approaches might afford, and Ecology in particular has pursued additional funding to pilot an effluent credit trading project in a watershed where TMDLs have been established. Guidance regarding minimum requirements for trading/banking projects other than for wetlands is lacking, at this time, and alternative mitigation approaches are negotiated on a case-by-case basis. Technical assistance in educating others to the development and implementation of such programs is also not available, due to limited experience and resources.

Policy Needs

Prior to full-scale environmental banking/trading implementation, the following policies will need to be evaluated and clarified by the state, as highlighted but not dictated by US EPA (1996):

1) Requirement that trades meet applicable CWA technology-based requirements;

2) Consistency of trades relative to water quality standards in watersheds and under CWA (including antidegradation and anti-backsliding);

3) Development of trades within TMDL or other sufficiently equivalent analytical and management framework, and what constitutes the latter;

4) Context of existing regulatory and enforcement mechanisms for trades;

5) Trading boundaries and trading area size;

6) Monitoring requirements, relative to existing ambient monitoring;

7) Types of pollutants traded;

8) Stakeholder involvement and public participation requirements;

9) Achievement of trades through negotiated agreements separate from a bank, or through privately funded/developed mitigation banks (apart from a program set up by a regulatory agency).

Washington has the opportunity to implement policy, from merely reaching agreement around acceptable conditions for a bartering and bundling credit system as might be found in the fledgling "alternative mitigation" approach, to identifying essential ingredients for a market-driven approach in each individual regulatory area, to identifying essential requirements for a market-driven environmental credit trading approach. This continuum represents a gradient of investment in transactional time and expense to achieve the same regulatory and

performance predictability, with individual project mitigation requiring the largest investment, alternative mitigation requiring intermediate investment (by all parties over the life of the project), and environmental credit trading the least investment. (Note: market based banking and trading are presumed to be the least investment because they depend on that to be viable.) In alternative mitigation, each arrangement is negotiated separately, while with environmental credit trading the conditions are determined when the rules of the market place are set.

Within a watershed context, Washington may be able to implement the highest priority and most cost-effective projects using the spectrum of approaches. The alternative mitigation approach will develop over time, once resource agencies (state with federal approval) have espoused the basic tenets, with precedent set by each application and agency interpretation. A fully implemented environmental credit trading approach will require legal framework development time and effort up front, but watershed features, priorities, and economic conditions and drivers will ensure flexibility and local applicability.

Steps Forward for Alternative Mitigation

As concluded in a meeting of Washington state and federal agencies (May 21, 2001), exploration of alternative mitigation approaches through simulations, modeling, and pilot projects is recommended as a next step. Rules, policy, and guidance for the state may be developed from these experiences within the Washington stormwater regulatory context.

NOTE: *The following sections discuss mitigation banking and environmental trading programs for other parameters than stormwater. Many of the findings are relevant and provide helpful guidance when considering the potential of applying these concepts to stormwater.*

Wetland Mitigation Banking Under Federal Guidance

Policy and Guidance

Since 1995, wetland mitigation banking has been subject to federal uniform guidance promulgated by the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Natural Resources Conservation Service, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service.[12] Prior to that time, mitigation banks were established, operated, and regulated in an ad hoc manner by Corps districts, other federal agencies, and state and local governments through independent operating agreements or Memoranda of Understanding.

There are hundreds of wetland banks creating and offering mitigation credits to help achieve no net loss goals. Transportation agencies, port authorities, and other public agencies sponsor banks for their own use, and a number of states and non-profits have established wetland mitigation trusts to achieve conservation goals. Since the 1995 guidance was issued, hundreds of private entrepreneurs have launched wetlands credit ventures to serve local markets.

Many states have promulgated laws, policies, or regulations for wetland mitigation banking that are similar to the federal guidance.

Off-site Issues

"In 1990, the Corps and EPA signed a MOA that expressed a preference for onsite over off-site mitigation. The 1995 Guidance however concludes that the 1990 memorandum 'should not preclude the use of a mitigation bank when there is not practical opportunity for onsite compensation, or when the use of a bank is environmentally preferable to onsite compensation.' Thus the preference expressed in 1990 for onsite mitigation may not in fact be as strong as it first appears."[13] In fact, the preponderance of mitigation banks offering compensatory credits (236 active banks in U.S., as of Spring 2000[14]) is evidence of the acceptability of off-site mitigation, at least in the form of banks.

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[12] USACE et al, Federal Guidance for the Establishment, Use and Operation of Mitigation Banks, 60 Fed. Reg. 58605-614 (November 28, 1995), Admin. Mat. 35632.

[13] Bean, Michael J. and Lynn E. Dwyer, *Mitigation Banking as an Endangered Species Conservation Tool*, in Environmental Law Reporter, 7-2000 30 ELR 10537 – 10556. P. 10542.

[14] Wetland Mitigation Bank Inventory, Spring 2000, Institute for Water Resources, U.S. Army Corp of Engineers

The question then becomes: How far off-site may you mitigate? The answer is found in a bank's "geographic service area," which must be defined in the mitigation banking instrument. Impacts occurring within the service area are eligible to purchase credits from the bank, subject to regulatory approval, while impacts occurring outside the service generally are not.

There is a great deal of flexibility given to bankers and regulators in establishing service areas. The 1995 Guidance states that the "designation of the service area should be based on consideration of hydrologic and biotic criteria" but adds the qualifying "to the extent environmentally desirable." Specific mention is made of several specific guides to hydrologic unit maps and ecoregion maps, but the Guidance also states that "it may be appropriate to use other classification systems developed at the state or regional level." The Guidance further states that: "In the interest of integrating banks with other resource management objectives, bank service areas may encompass larger watershed areas if the designation of such areas is supported by local or regional management plans."

While the 1995 Guidance clearly prefers "in-service area" mitigation, it does not preclude "out-of-service area" mitigation: "Use of a mitigation bank to compensate for impacts beyond the designated service area may be authorized, on a case-by-case basis, where it is determined to be practicable and environmentally desirable."

In conclusion, between the flexibility given in establishing service areas and the authorization for out-of-service area mitigation, there is substantial authorization for off-site mitigation of wetlands impacts.

Out-Of-Kind Mitigation

The Corps strongly prefers in-kind mitigation to out-of-kind mitigation. "One rationale for this preference is that the suite of species associated with each particular type of wetland differs from the suite of species associate with other types of wetlands. Requiring in-kind mitigation therefore attempts to maintain ecological values."[15]

Nonetheless, the 1995 Guidance establishes clear authorization for out-of-kind mitigation, particularly within the context of wetland banking, subject to determinations of environmental acceptability and preference by the permitting authority:

In the interest of achieving functional replacement, in-kind compensation of aquatic resource impacts should generally be required. Out-of-kind compensation may be acceptable if it is determined to be practicable and environmentally preferable to in-kind compensation (e.g., of greater ecological value to a particular region). However, non-tidal wetlands should typically not be used to compensate for the loss or degradation of

[15] Bean at 10538.

tidal wetlands. Decisions regarding out-of-kind mitigation are typically made on a case-by-case basis during the permit evaluation process. The banking instrument may identify circumstances in which it is environmentally desirable to allow out-of-kind compensation within the context of a particular mitigation bank (e.g., for banks restoring a complex of associated wetland types). Mitigation banks developed as part of an area-wide management plan to address a specific resource objective (e.g., restoration of a particularly vulnerable or valuable wetland habitat type) may be such an example.

It clearly is within the permit authority's discretion to approve out-of-kind mitigation, while the burden to justify the technical practicability and environmental acceptability or preference rests with the permittee. As with the in- or out-of-service area issue, how a banking instrument is established in the first place may also play a key role in supporting, or not supporting, out-of-kind mitigation.

A specific bank's ability to support out-of-kind mitigation will be established for the most part in its banking instrument, where it defines the wetland classes or other aquatic resource impacts suitable for compensation, and in the methods for determining credits and debits. The more broadly that impacts of concern are defined, and the more that credit definitions incorporate measures of ecological function, environmental services, and habitat support (encompassing multiple types of suitable habitat, and/or different habitats for different life stages), the more likely it is that out-of-kind mitigation can be approved.

Habitat Mitigation Banking Under the ESA

Policy and Guidance

Mitigation under the ESA generally falls under three approaches:

- **Onsite mitigation**—the permit applicant mitigates for the authorized taking of federally listed species on or near the property where the impact occurs. The mitigation property is typically protected through a conservation easement and its use is restricted in some manner which benefits the species adversely affected by the taking.
- **Off-site, local government sponsored**—land (or water) is deeded to a public or nonprofit agency for conservation purposes, or mitigation takes the form of monetary payments to a public or nonprofit agency for use in acquiring land for conservation, to manage already acquired land, or to perform some other specific task. Funds for the acquisition and management are often generated from special assessments the local government levies on developed land (e.g., wildlife impact fees or *in lieu* fees); and
- **Mitigation banking**—a third party (i.e., not the permitting local government) acquires suitable property and preserves, restores, or creates habitat and sells "credits" to permit applicants in need of mitigation .

In situations where onsite mitigation is infeasible or not preferable, the U.S. Fish and Wildlife Service (USFWS) has allowed the use of mitigation banks to mitigate the adverse impacts of authorized incidental take of federally endangered species. The decision for onsite versus off-site mitigation is determined primarily on the basis of which approach will contribute most significantly to the conservation of the affected species. Until recently, the USFWS had neither a formal policy nor any official guidance pertaining to the use of mitigation banks for endangered species conservation purposes. Without policy or guidance, decisions about mitigation banks have been ad hoc and uncoordinated. In 2000, the USFWS published a *Draft Policy on the Establishment, Use, and Operation of Mitigation Banks under the Endangered Species Act*, in order to provide better coordination within the USFWS and more consistent and useful information to parties outside the USFWS. An example of guidelines in use under this policy in California is the "Method for Determining the Number of Available Vernal Pool Preservation Credits in ESA Conservation Banks in the California Central Valley," June 26, 1999, USFWS Sacramento Office.

Although existing mitigation banking policies related to wetlands and other aquatic resources have issues common to any form of mitigation banking, their conclusions are not necessarily transferable to endangered species mitigation. The draft policy applies to the use of mitigation banks

by nonfederal parties to meet requirements to minimize, mitigate and compensate for adverse impacts to listed species from activities authorized by permits under Section 10(a)(1)(B) and Section 7 of the ESA.[16] At a state level, California is the only state that has adopted a policy governing endangered species mitigation banking.[17] Only three pages in length, it provides guidance on the use of banks to compensate for impacts on both wetlands and endangered species, as well as on "Environmentally Sensitive Habitat Areas, mudflats, sub-tidal areas, and less sensitive resources." The policy implements several different state laws that may require mitigation, including the California Environmental Quality Act, the California Coastal Act, and the California Endangered Species Act.

On the issue of in-kind mitigation, in 1996, the California Department of Fish and Game and USFWS jointly issued a *Supplemental Policy Regarding Conservation Banks Within the Natural Community Conservation Planning Area of Southern California.* This policy offers guidance on what has become a contentious issue regarding the interchangeability of species and their habitats. According to the supplemental policy, in general only in-kind mitigation (involving the same habitat and species) is permitted. However, an exception to this in-kind mitigation requirement will be made when "the bank is located within a jurisdiction that has an approved subarea plan, or if the wildlife agencies determine that the bank achieves regional conservation goals."[18] Thus, an abundance or shortage of particular habitat types and their value relative to regional conservation goals, may lead to out-of-kind mitigation in California.

Concepts Specific to Mitigation Banking

Several features distinguish mitigation banks from other forms of endangered species mitigation:

- In a mitigation bank, the mitigation is typically carried out prior to the action that causes the impact (and need for mitigation). Mitigation banks are therefore anticipatory, established in anticipation of some future demand for mitigation to compensate for the effects of future actions.

- Mitigation banks are aggregative in that they consolidate the impacts of future activities at smaller, widely dispersed sites at a single, larger site. Mitigation banks can be designed to meet the future mitigation needs of either those who establish them or third parties. Every mitigation bank must specify the geographic area within which credits earned by the bank can be sold to mitigate project impacts.

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[16] USFWS, *Draft Policy on the Establishment, Use, and Operation of Mitigation Banks under the Endangered Species Act,* 2000.

[17] California Environmental Protection Agency, Official Policy on Conservation Banks, April 7, 1995.

[18] Bean and Dwyer, Environmental Law Reporter, 30 ELR 10537.

This is referred to as a bank's "service area." Generally, banks should be located within areas designated in recovery plans as focal, or core, areas for recovery efforts. The service area should then correspond to the recovery area in which the bank is located.

- When mitigation banks have been established to meet the future mitigation needs of third parties, the sale of the bank's credits to third parties is typically at a price dictated by the market and is negotiated between the bank and the third party.
- Once USFWS has approved mitigation through the purchase of bank credits by a third party, the legal responsibility for the mitigation, including the responsibility to remedy any failings of the mitigation efforts, is assumed by the bank.
- Credits are often, but not always, assigned to conservation banks on a credit per acre basis which varies by habitat type. The units of currency may also take the form of surrogates for the extent of impact on population viability, such as occupied acres or nesting pairs beneficially or detrimentally affected. In evaluating credits or debits, the same types of activities may be weighted differently depending on where they occur. Credit assignment is typically determined through collaborative discussions between the bank owner and a committee comprised of representatives from major state and federal resource agencies. Credits for preserving existing habitat are available for use as soon as an easement, title transfer, or other mechanism ensuring dedication of the site to conservation is in place. Credits for creating or restoring habitat are available for use only after the creation or restoration activities have been successfully implemented and a mechanism is in place to assure the long-term protection and management of the property.

Benefits and Limitation of Mitigation Banks

Mitigation banks that are carefully designed and appropriately sited can contribute to the conservation of threatened or endangered species by: (1) Providing funding for ongoing management to reduce threats to the species; (e.g., non-native species removal, maintaining natural disturbance regimes); (2) providing habitat large enough to maintain self-sustaining species populations that are buffered from external threats; (3) protecting currently unoccupied habitat that is important for the species recovery; and (4) mitigating the loss of isolated habitat with replacement habitat in core recovery areas that will benefit the species at a population level. The two most important issues in planning mitigation banks are the siting of the bank and its management program. Siting mitigation banks in or near core recovery areas for listed species not only contributes to the conservation of the species, it also provides additional mitigation options to the regulated public.

As for limitations, even large banks, by themselves, are often too limited in size to support a viable population of a listed species over time. For this reason, banks are best located next to an existing area managed for the conservation of that species. Similarly, banks should be sited to encourage dispersal between two areas managed for the conservation of the species, to increase the likelihood of the species surviving at both locations. Current and future land use is an important consideration in siting a bank. An otherwise good location may be inappropriate given anticipated land use changes in the surrounding area that would leave the site isolated and fragmented from the core population centers. Neglect to effectively manage a property for a listed species can be as damaging as improperly siting a mitigation bank. An active management program is essential to ensure that the potential conservation value of a particular property is realized and maintained. Seldom will the needs of a threatened or endangered species be met on a completely unmanaged piece of property.

Effectiveness of Endangered Species Mitigation Programs

There are, as yet, no formal studies assessing the effectiveness of traditional endangered species mitigation efforts. However, anecdotal evidence and informal assessment have identified several factors that may contribute to the ineffectiveness of these efforts, including diffuse and poorly coordinated mitigation activities, technical challenges, and limited resources for monitoring and enforcement. Whether mitigation banking will achieve better results than traditional, project-by-project mitigation is not yet clear. Nevertheless, mitigation banking is a mitigation strategy that has been accepted and, in some cases, encouraged by the U.S. Fish and Wildlife Service at a national level, and several endangered species mitigation banks are already in existence in various parts of the country.

California is one of the states in which mitigation banking has been more readily accepted, and several banks have been in existence for 5 or more years. The California Department of Fish and Game stated that as of October 1998, there were 43 conservation banks in existence or in the process of being created in California, 3 in Northern California, 11 in Central California, and 29 in Southern California. The banks cover 13 counties of the state, and have a total estimated land value of at least $40 million.[19] Since that time several other banks have been approved for use or are under development. Banks have been developed by public agencies or private corporations for their own use in meeting ongoing endangered species mitigation as a result of their activities (e.g., California Department of Transportation, Sacramento Municipal Utility

[19] California Department of Fish and Game, A Catalogue of Conservation Banks in California (http://ceres.ca.gov/topic/banking/banking_report.html)

District, Chevron USA.) These banks and other selected endangered species mitigation banks in California are included in Table 2 below.

Table 2. California Endangered Species Mitigation Banks

Name & Owner/ Operator	Bank Type	County	Status	Area & Number of Credits	Service Area
Northern California					
Cottonwood Creek; CA Dept. of Fish & Game	Freshwater emergent wetlands	Shasta	Created April, 1994	90 acres; 90 credits (1 acre=1 credit)	Sacramento Valley floor in Shasta & Tehama Counties
Stillwater Plains; Glenn Hawes	Vernal pools and wetlands	Shasta	Under Development	900 acres (will be phased); Credits under development	Valley floor in Shasta and Tehama Counties
Central California					
Wildlands Inc.; Steve Morgan	Vernal pools, open water, marsh, stream, riparian	Placer	Created October, 1994	315 acres; 1 acre=1 credit for vernal pools and wetland; 1 acre=3 credits for riparian	40-miles radius
Barten Ranch; AKT Development Corp.	Vernal pools	Sacramento	Under Development	1,440 acres; credits under development	S. Sacramento County & N. San Joaquin County
Beach Lake; CA Dept. of Transportation	Seasonal wetlands	Sacramento	Created in 1993	142 acres; 142 credits	40-mile radius Created for DOT's use only
Grizzly Slough; CA Dept. of Water Resources	Riparian, wetlands, oak woodlands	Sacramento	Under Development	448 acres; credits under development	Under Development
Sacramento Municipal Utility District	Vernal pools	Sacramento	Under Development	1,509 acres; credits under development	S. Sacramento County and N. San Joaquin County
Fitzgerald Ranch; Lane Family Ltd.	Seasonal wetlands	San Joaquin	Created in November, 1999	803 acres; 62 credits	Information not available
Wikiup Partners	Seasonal wetlands	Sonoma	Created in 1995	12 acres; 1 credit=0.1 acres	Sonoma County N. of Petaluma
Santa Rosa Plains Preservation Bank; Golden Bear Biostudies	Vernal pools, oak savanna, annual grassland	Sonoma	Created in June, 1997	40 acres; 208.24 credits	Sonoma County
Southern California					

Name & Owner/ Operator	Bank Type	County	Status	Area & Number of Credits	Service Area
Chevron Lokern Conservation Bank; Chevron USA	San Joaquin Valley saltbrush scrub	Kern	Under Development	18,000 acres; 3 acres compensation; 1 acre permanent disturbance; 1.1:1 for temporary impacts	Kern County (intended for use by Chevron only)
Kern Water Bank; Kern Water Bank Authority	Valley saltbrush scrub and valley sink scrub	Kern	Created in October, 1997	3,267 acres; 3,267 credits	Portions of Kern, Tulare, and Kings Counties
Gaviota Tarplant Mit. Bank; All American Pipeline Co.	Gaviota tarplant, grassland, coastal sage scrub	Santa Barbara	Created in October, 1995	35 acres; 35 credits	Gaviota coastline
Boden Canyon; Environmental Trust	Coastal sage scrub; chaparral, woodland	San Diego	Created in 1995	40 acres; 40 credits	Western San Diego County (mitigation for public works projects)

Financial Considerations for Mitigation Banking

The viability of a proposed mitigation bank will be determined by three variables: the number of credits allowed by permitting agencies, the market price of credits, and the market demand.

Planning-level estimates of costs are needed for a preliminary feasibility analysis to determine the cost of restoration. Restoration costs cover those activities needed to initiate operation, including permitting, design, and construction. Two approaches can be used to estimate restoration cost. The first approach uses unit costs (dollars per acre) for a series of individual restoration activities. Unit costs are estimated for each habitat type for an array of activities from investigations and permitting through compliance monitoring for success. Unit costs are multiplied by land area to estimate restoration cost by habitat type.

The second approach makes a whole project estimate for a complete restoration effort based on type of habitat and size for restoration area. This estimate can be based on knowledge gained from related project experience and recognition of cost savings accrued with the economy of scale for larger projects.

Summary

Mitigating authorized impacts to endangered species through the sale of credits from endangered species mitigation banks is a practice that has already begun and is likely to become more common in the future. If guided by well-conceived policies, mitigation banking has the potential to

contribute positively to endangered species conservation efforts, and afford the regulated community an additional, and more expedient means of meeting their mitigation requirements under the ESA. Mitigation banking can furnish a useful incentive for private-sector cooperation in government efforts to prevent the extinction, and foster the recovery, of imperiled species. [20]

[20] Bean and Dwyer, Environmental Law Reporter, 30 ELR 10551.

Air Emissions Trading

The National Acid Rain Allowance Program [21]

The Clean Air Act Acid Rain Program establishes an annual nationwide cap on emissions of sulfur dioxide (SO_2) from electric utilities and allows sources to trade emission allowances to meet their individual caps.[22] SO_2 is a pollutant found to cause acid rain resulting in environmental degradation in forests and waterbodies. Congress created the trading program as part of the Clean Air Act Amendments of 1990. As such, it is the only trading program directly created by statute and is the most well-known.

A Focus On Electric Utilities

The Acid Rain Program addresses electric utilities in the continental United States, which number about 1,000 and create approximately 70 percent of all SO_2 emissions.[23] The program regulates existing utility units with an output capacity of 25 megawatts or greater, and all new utility units using fuel with a sulfur content greater than 0.05 percent.[24] Phase I of the program began in 1995 and affects 110 large and relatively dirty utility plants located in the East and Midwest. After the year 2000, Phase II tightens the annual emissions limits on Phase I utilities and also sets restrictions on small and relatively cleaner plants.

The program does not require non-utility sources to reduce SO_2 emissions. However, such sources could voluntarily enter the program if they find they can reduce SO_2 emissions more cheaply than utilities. An opt-in source would receive a number of transferable emission allowances based on its historical emissions, reduce its emissions, and then sell its allowances to a utility source.[25]

Emissions Capped, Allowances Issued, Allowances Traded

The program established an annual cap of 5.7 million tons of SO_2 emissions from major electric utilities effective 1995, rising to a cap of 8.95 million after the program expands to cover smaller utilities in the year 2000. The cap is approximately 40 percent of 1980 levels. Scientific analyses indicated that this emission level would result in significantly less damage from acid rain. The level also is low enough to prevent

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[21] This section is excerpted from *Acid Rain Allowance Trading: Lessons for Watershed-Based Trading*, a white paper written by Elise Bacon (CH2M HILL) and Donna Downing for EPA's Office of Water, 1997. Other examples of trading programs operating under the Clean Air Act, state statute, or special regional programs include: Los Angeles' RECLAIM program; the Ozone Transport Commission's NOx trading program; Michigan's air emission trading program; and New Jersey's OMET program.

[22] Clean Air Act Title IV, 42 U.S.C. § 7561 et. seq.

[23] Id.

[24] Clean Air Act §§404 –405.

[25] Clean Air Act §410.

undesirable "hot spots" that might have been caused by trading changing the geographic distribution of emissions.[26]

"Allowances" are the central feature of the SO_2 trading program. An allowance is an authorization issued by EPA that allows an affected utility unit to emit one ton of SO_2, during or after a specified calendar year. An allowance does not automatically expire unless used, and so is fully "bankable" for use in future years. To be in compliance, sources must have at least as many allowances as tons of SO_2 emitted.

Utilities obtain allowances in three ways. Every year, all covered sources receive allowances from EPA according to Phase I or II allocation rules spelled out in the Clean Air Act (each utility receives an allocation based on past fuel usage and statutory emissions limitations).[27] Sources also may purchase allowances for the winning bid at an EPA annual auction run by the Chicago Board of Trade.[28] Finally, utilities may purchase allowances for a mutually agreeable price from another allowance holder—i.e., trade. At the outset of the program, allowances also were available by direct sale from EPA for $1,500, but that option has been eliminated due to low demand.[29]

Utilities can meet the new, lower emissions rates either by reducing tons of emissions, or by purchasing allowances sufficient to "cover" a higher emissions rate. If a utility's emission controls reduce SO_2 more than is necessary given the number of allowances the utility holds, it has allowances to sell.

Whether a utility will be a net buyer or seller of allowances depends in part on the relative cost of controlling one ton of SO_2 compared to the market price for an allowance. Electric utilities vary widely in plant types, age, and fuel mixes. As a result, the industry has sizable variations in costs per ton of SO_2 reduction and, therefore, substantial potential cost savings from trading are possible.

Analogies for Off-site, But Not Out-of-Kind Trading in The National Acid Rain Allowance Program

Trading may occur among utilities anywhere in the continental United States; there are no regional submarket boundaries. Congress justified a single national market on two grounds: environmental impacts and industry structure. **So, by definition all trades are off-site. Because the program only covers SO_2 emissions, it also is by definition exclusively in-kind.**

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[26] Rico, Renee, "Designing and Implementing a National Emission Trading System for Sulfur Dioxide," paper presented at the Air & Waste Management Association Conference, Rochester, NY, 1994.

[27] Clean Air Act §403(a).

[28] *See* Clean Air Act §416(d)(2).

[29] Clean Air Act §416(c)(7) requires EPA to terminate the direct sale account if, in two consecutive years, less than 20% of allowances set aside for that account have been purchased.

Atmospheric models indicated that environmental effects from SO_2 emissions were similar regardless of where in the United States SO_2 is released. Models also showed that the SO_2 emissions cap was low enough to prevent trading from causing "hot spots," or localized health problems.[30] Congress further reduced the potential for hot spots by requiring that trading take place in the context of the existing Clean Air Act regulatory system.

The structure of the utility industry, in combination with low SO_2 limits, also justified a single national market. The industry is characterized by a combination of small independent producers, multi-plant utilities serving regional areas, national companies serving selected regional markets, and large holding companies with numerous plants in many contiguous and non-contiguous service areas throughout the country. Additionally, small and large firms alike often have power sharing arrangements with other utilities to buy additional power for peak periods or sell excess capacity when not needed to meet local demand.

This transmissibility of electric power across a national grid makes intra- and inter-utility transactions possible and economical. However, it also means that under a program with regional markets, utilities could use transmission networks to shift electricity generation and the resulting SO_2 emissions as a way of avoiding regional SO_2 caps. Thus, a national market more accurately reflected electric utility structure and operations.

The Acid Rain Program covers a vastly larger geographic area than that envisioned for any watershed-based trading program to date. Acid rain allowances may be traded anywhere within the contiguous United States. As a result of SO_2's limited localized effects, the single market avoids adverse environmental impacts while increasing the number of potential trading participants.

In contrast, the geographical focus of watershed-based trading and wetland banking reflects aquatic system dynamics, the potential for adverse localized effects (including "hot spots"), and the need to meet water quality standards throughout a waterbody/wetland in order to support its designated functional or designated uses (e.g., swimming, fishing, non-contact recreational activity, drinking water, etc.). The different scale of potential impact creates differences between the two programs in the size of the market, and the scale at which policy and political differences must be resolved.

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[30] National Acid Rain Precipitation Assessment, "Integrated Assessment Report" (1990). NAPAP was a governmental research program established in 1980 to study the causes and impacts of acid rain in North America.

State and Regional Emission Trading Programs: Off-site, But Not Out-of-Kind

There are examples of state or regional emission trading programs, as well as offset requirements and emission averaging provisions (e.g., bubbles and/or netting) that are usually facility- or industry-specific. By program design and credit definition all involve off-site trades, but none explicitly authorize out-of-kind trades and most appear to preclude it. Facility bubbling or netting is technically on-site, and also always in-kind, though the site may be quite large and involve multiple stacks and plants occupying the same site or area. Examples of offsetting, bubbling, and netting are numerous, site-specific, and permit-enabled; a few include the Los Angeles Regional Clean Air Incentives Market ("RECLAIM"[31]), Ozone Transport Commission's (OTC) NO_x Trading Program[32] (New England and Atlantic states), Illinois' VOC Program[33], and Michigan's Emission Trading Program[34].

For all, the issues relating to off-site and out-of-kind mitigation are very similar to those described for the national acid rain trading program, except on a smaller scale. The scale of these programs is still much larger than most watersheds or service areas where effluent trading, wetland mitigation, endangered species mitigation, or stormwater mitigation has been or will be contemplated.

Evaluation of the Effectiveness of Air Trading Programs

Summary of Programs

Trading and mitigation programs are well represented in the air arena. At the national level, federal law authorizes the acid rain trading program, as well as site-specific offset and bubbling provisions that are enabled through permits and involve plant-plant trading (i.e., off-site) or intra-plant trades across stacks (i.e., onsite trading). At the regional level, the OTC program on the East Coast designed to reduce ozone and its precursors and Los Angeles' RECLAIM program are examples of a multi-state regional trading program and a sub-state regional program. To implement OTC, nine states have established conforming state regulations to govern trading under the OTC compacts. A handful of

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[31] http://www.aqmd.gov/reclaim/reclaim.html

[32] http://www.epa.gov/airmarkets/otc/

[33] http://www.epa.state.il.us/air/erms/index.html

[34] http://www.deq.state.mi.us/aqd/eval/e_trade/etbank.html. The Michigan program is enabled through statute and rules: "By authority conferred on the director of the department of environmental quality by sections 5503 and 5512 of Act No. 451 of the Public Acts of 1994, as amended, and Executive Reorganization Order No. 1995-16, being §§324.5503, 324.5512, and 324.99903 of the Michigan Compiled Laws). R 336.2201, R 336.2203, R 336.2204, R 336.2206 to R 336.2209, R 336.2211, and R 336.2213 to R 336.2218 of the Michigan Administrative Code are amended to read as follows: PART 12. EMISSION AVERAGING AND EMISSION REDUCTION CREDIT TRADING et al.

other states, notably Michigan and Illinois have also established air emission trading programs that cover specific pollutants.

These programs share common goals and approaches:[35]

- Achieve an environmental goal—set fixed, measurable target, use strong enforcement tools to ensure compliance;
- Encourage cost-effective reductions—allow sources to determine best ways to meet reduction requirements;
- Promote innovations in control technologies and monitoring—opportunity to trade rewards innovators and those who can measure better performance; and
- Reduce program administration costs for sources and regulators—establish a program that is easily implemented through simple and documented mechanisms.

Results Observed or Documented to Date

By most accounts, the air emission trading programs that have been underway for long enough to have a track record have been effective in achieving their goals. Preliminary results from newer programs also indicated likely success meeting environmental targets.

The Acid Rain Program is generally held up as one of the best examples of harnessing market forces to achieve an environmental goal more cost-effectively than under traditional command and control regulation. The program allows utilities significant flexibility to find the most cost-effective means of meeting the 8.95 million ton cap on SO_2. This flexibility is a key reason why utilities appear to have identified less expensive compliance approaches than EPA initially anticipated. The EPA originally estimated that transferable allowances would produce a nationwide cost saving of 50 percent in Phase I, and 14 to 20 percent cost saving in 2010.[36] Those cost savings estimates were based on predicted allowance prices and so are likely to be lower than what has in fact occurred. Current allowance prices have fallen from the original estimate of mid $400s to approximately $110. Even so, it is unlikely that sources would have identified less expensive ways of reducing emissions if the trading program that rewards innovation and cost-effectiveness had not been implemented.

Principal Factors Influencing Success

Compared to other types of trading and mitigation, air emission trading programs have benefited from the relatively large geographic area in

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[35] Clair Schary, US EPA Region 10 (Involved in designing Acid Rain Trading Program and currently coordinating Region 10's water quality trading pilots).

[36] 136 Cong.Rec. S16979 (daily ed. Oct. 27, 1990)(statement of Sen. Baucus).

which credit trading can create measurable emission reductions and environmental benefits. This has brought commensurate resources to program design, implementation, and oversight from government and private sources. This investment coupled with the significant economic gain that sources can capture as buyers (cost-savings) or sellers (revenue) of credits has contributed to these programs' success.

Key success factors of the air programs include:[37]

- Extensive environmental, economic analysis prior to program design
- Environmental problem due to total emissions (loadings) justifying a new and separate approach
- Clear, quantifiable environmental goal(s)
- Program need not convey "property right" status to credits to create a commodity
- Well-designed program integrates environmental, economic, compliance tools
- Information is critical, and further, centrally available information helps reduce transaction costs
- Large, well-defined reduction area that also supports trading
- Reductions from regulated point sources from single industry (acid rain program) able to pass on costs to consumers
- Statute(s) provide clear authority to trade, innovative permit, continuous emissions monitoring, and automatic enforcement mechanisms
- Accurate monitoring systems available, affordable, and reliable
- Government pre-approval of trades is not necessary with appropriate monitoring, documentation, reporting, reconciliation, and enforcement provisions in place
- Letting the market set prices provides the most flexibility and promotes activity, including use of free market as well as auction mechanisms
- State and local health-based standards can address local impacts and issues from trading

[37] Compiled from analysis prepared by Clair Schary, USEPA, and Bacon and Downing white paper cited above.

Programmatic Implications for Washington State Learned from Air and Wetlands Banking and Environmental Credit Trading Projects

There are certain lessons learned or conclusions that can be drawn based on the foregoing review of wetlands and habitat banking and air emissions trading experience. These conclusions have implications for potential implementation of advanced mitigation or trading concepts for stormwater in Washington State.

Relative to the basic tenets of alternative mitigation (off-site and out-of-kind mitigation): There are numerous examples for establishing off-site mitigation for water, air, wetlands, and habitat throughout the United States, and the regulatory authority is available.

Examples of out-of-kind mitigation or cross-media mitigation are uncommon, and such banks are currently nonexistent. While multiple credits may be recognized on a permit by permit basis, they are not applied or purchased across permits (i.e., such credits are not treated like water rights). This is primarily driven by the different mandates and separation of the various regulatory authorities, i.e., it is both a legislative and an institutional result.

In fact, in many mitigation projects, regulatory benefits are "bundled" to achieve some efficiency and economy of scale, but these projects do not necessarily receive any such recognition or significantly benefit the watershed. Stormwater projects may improve water quality, floodwater retention, and aquatic and riparian habitat, but are recognized only for meeting stormwater mitigation requirements – and siting and conceptual design do not examine the relative significance to the watershed.

Relative to both alternative mitigation and environmental credit trading, because of their base in mitigation requirements: Sufficient basic similarities exist across the differing media from the programs presented in this technical memorandum, that media-specific guidelines for success can defensibly be synthesized into general conditions necessary for effectiveness in any type of mitigation program. In spite of differences in ecosystem type, regulatory framework, programmatic structure, and depth and breadth of experience, meaningful and practical lessons emerge from the evaluation of the mitigation and trading experiences detailed above in water quality, wetlands, air, and habitat arenas. These are summarized below under six major concept conditions, listed roughly in order from program authorization, through design and planning, to implementation, management, and oversight.

Authorization, policy, and guidelines are needed to convey legitimacy and set a clear framework.

Whether such authorization is needed at the federal, state, or local level is for the most part directly related to the scale of the program. Lack of such authorization is one reason for delayed activity and mixed results in the early days of water quality trading and wetland mitigation—both programs have been helped by recent promulgation of federal policy and guidelines. In many states, federal guidance was followed by state policy and rules that provided further guidance, before alternative mitigation or trading programs were initiated. In contrast, air trading programs have benefited from clear authorization since their inception, and habitat mitigation continues to struggle in the absence of federal guidance for project developers and regulators (particularly for anadromous fish species under NMFS).

Regardless of the scale, all those involved in mitigation generally need some kind of clear indication that the proposed program is legitimate and not subject to invalidation. This authority can take form in one or more mechanisms including statute, regulation, rule, policy, Memoranda of Understanding, other documents of varying contractual strength, management plans, or permit language. Experience to date demonstrates that federal authority or policy proclamations approving or otherwise endorsing mitigation and trading approaches are helpful to ascertain project acceptability.

The Federal Highway Administration (FHWA) has endorsed the exploration of various environmental permit streamlining approaches. WSDOT has sought support from the FHWA to provide funding assistance for pilot projects in alternative stormwater mitigation approaches as an important streamlining tool. Support of this approach for transportation projects could encourage the development of necessary authorization, policy, and guidelines by all regulatory agencies, both at the federal level and in Washington.

Sufficient scientific and technical information is needed to set environmental goals and objectives, and to define credits.

Only when environmental objectives are clearly established can alternative approaches be considered. Even if scientific data or technical capabilities are not as high as stakeholders would like under traditional approaches, the bar is usually set higher for more innovative programs. It will be up to the program or project proponents to demonstrate that the alternative is as good or better than the standard approach. It also is generally expected that the proponents will be able to show that the alternative will not negatively impact existing conditions (beneficial, functional, habitat, or ecosystem functions), ancillary benefits, nor contribute to cumulative impacts. If there are trade-offs within a "net environmental benefit" equation, it is necessary to detail those trade-offs and explain the net benefit calculation.

For stormwater, in order for any equivalency of mitigation approaches to be determined, the performance achievement of the required BMP must be determined. The extent to which downstream impacts might occur that cannot be assimilated by the system needs to be determined, i.e., the threshold requirement for on-site source control and treatment that must be met before other mitigation approaches can be taken.

These same data will be needed to define credits and establish any trading ratios. Sometimes, it may be necessary to establish credits with less-than-perfect information. In these situations, stakeholders may agree to set up a process that will gather better data as the program is implemented and revise credits as necessary later, an "adaptive management" approach.

Stakeholder involvement in planning, design, and implementation provides critical input and support of watershed management priorities, as well as resources that can be leveraged.

All the successful initiatives have stakeholder involvement as one of their program cornerstones. Many of the water quality trading programs have had significant stakeholder involvement. Some have included formal planning and design processes and a number have had targeted public education and outreach components. Likewise, wetland mitigation banks generally involve a broad cross-section of stakeholders in establishing the banking instrument, along with other local-level planning hearings that may be part of the siting and permitting process. Involvement of the right stakeholders in the right way is frequently cited as one of the major reasons for many of the air emission trading program successes.

Exactly who should be involved, at what juncture, to what extent, and in what role will depend on the specific situation. However, several rules of thumb are clear. It is often useful to establish a core group of stakeholders. These are the people who know the most, who always attend meetings, and who can help educate (and lobby if necessary) other stakeholders. Alternatively, a more wide-open, all-votes-are-equal approach can be taken. It is incumbent upon the proponents to invite everyone with a stake, even if they may have a negative view. Who can benefit from the program, who can impede or stop the program? These are the people to invite to participate. A comprehensive stakeholder process may take longer than a streamlined one, but comprehensive approaches generally have higher success rates when it comes to program initiation and implementation because they have higher levels of support, ownership, and better relationships with skeptics and any remaining opponents.

Clearly, adequate stakeholder involvement includes dedication of staff resources from the appropriate state regulatory agencies. Ecology has already made this commitment.

The finances of the mitigation or trading approach are clearly understood, planning-level estimates made, and sensitivity analyses performed to predict consequences of alternative market and economic conditions, and provide certainty and contingencies.

Economics and finance come into play in two places. First, in most mitigation or programs, the relative cost-effectiveness between a trading and non-trading option must be favorable. Further, it may be necessary to consider the relative cost-effectiveness among several non-trading options. To the extent this is not known up front, or changes along the way, it will be difficult to design a program that takes advantage of the relative economics to create the proper incentives for trading or mitigation. The air trading programs have clearly demonstrated that market mechanisms can help sectors achieve environmental goals at less cost than under a traditional program. Likewise, the watershed trading programs are successful due to significant differences in relative costs driving investments to less-expensive options. By the same token, several watershed trading programs have stalled or faltered because cost-savings were not achievable through trading.

The second issue involves financial capability of the sellers to deliver the promised credits and for the buyers to pay for the credits they need. Sufficient due diligence or similar analysis is performed to assure trading partners that the credits placed on the table will have the credit life advertised. This includes sufficient investment in planning, design, and execution of the project or activity generating the credit, as well as sufficient resources available or pledged for on-going maintenance and monitoring. It also may include a performance bond, or some other mechanism to protect the buyer and seller in the event a credit can no longer be verified. Further, when considering what the mitigation market is likely to be, an analysis of potential buyers' other options, incentives set, and economic or financial pivot points will help determine whether there will be sufficient demand for the available credits. Situations where supply drastically exceeds demand are often considered failures. These conditions play out a little differently where banks are designed for single users. In these cases, the most important thing is to try to match up supply and demand temporally and ensure funding is available as needed to construct credits ahead of need, if required.

The mitigation or trading area is clearly defined, justifiable, makes environmental and economic sense, and is integrated with a pre-existing or concurrently developed area management plan that is endorsed by key stakeholders.

The mitigation or trading area must be appropriate to the environmental goals the program is seeking to support and meet. If it is too small, there may not be enough degrees of freedom in selecting credit-generating sites. If it is too large, there may not be a strong enough real (or perceived) ecological relationship between the onsite impact and the off-

site credit benefit. Relatively larger sites also will require more management resources, both human and technical, although economies of scale come into play.

Size also influences economic and financial success. In trading programs, sufficient size is necessary to include a balance between the supply and demand for credits. A sufficient number of buyers and sellers also is necessary to have a well-functioning market, including relatively stable and predictable prices, competitive pricing, as well as incentives for credit creation and enough deals to keep transaction costs as low as possible. For mitigation-oriented programs, as distinct from air or water trading programs, it is important that the bank size be sufficient to capture economies of scale, functionality, and diversity in flora and fauna consistent with mitigation needs.

More and more, water quality trading and wetland mitigation programs are being linked or directly integrated with pre-existing watershed management plans or plans under development. This helps better ensure alignment with area objectives and provides the programs with a framework of planning, support, and evaluation that can enhance success and effectiveness. This link is most powerful where trading programs use such management plans to help identify, locate, and prioritized investments that created credits. This helps mitigation programs select the sites/projects that have the highest chance for success—sometimes these also are the most cost-effective. The approach helps implement the management plan by directing resources to priority problems and locations, and allows a higher return on investment – including the intangible of meeting local preferences.

Performance benchmarks, measures, enforcement, oversight, and liability are clearly established and documented.

One of the most critical conditions to getting a program off the ground and ensuring its long-term success is to track and document performance vis-a-vis established environmental objectives. As with stakeholder involvement (see above), it is incumbent upon the project proponent to demonstrate that the alternative approach meets or exceeds expectations. Furthermore, often no other entity will have the resources to track performance in the manner and at the optimal level, so it is generally the responsibility of the program or project manager. And, even if others are tracking success, it is advisable to establish a strong self-tracking element. One of the reasons for the acid rain trading program's endorsement and subsequent success was the requirement and ability for sources to monitor their emissions and document performance, either backing up credit creation or verifying level of credits needed. In contrast, watershed trading programs, individually and as a group, continue to struggle with how to measure and verify nonpoint source reductions. For this reason many are taking longer to implement, and some are deemed less

successful than they might otherwise be as evaluators factor uncertainty into their assessment.