

Attachment 1
Proposal to Support the Development and Implementation of
Hydromodification Control Criteria Methodology for the Central Coast Region and
Other California Municipalities

Central Coast Regional Water Quality Control Board
June 26, 2009

Summary

Hydromodification control is a critical step in achieving healthy watersheds, and protecting water quality and beneficial uses over the long term. Last fall, the National Research Council's report on Urban Stormwater Management in the U.S., after a two year review, said: "Integrate stormwater management and land management practices, focus less on chemical pollutants in the Stormwater and more on the increased flow of water."

California has been predicted to grow by 500,000 per year. This number may be slowing down a bit but growth and redevelopment will happen. It will happen in a way that protects our watersheds or destroys them. We need to ensure it's the former – protective- allowing watersheds to function ecologically and sustainably. We can write beautiful permits for the traditional point sources as we preside over the demise of our watersheds. Or we can act to sustain the viability of our watersheds. We are charged by AB 32 to consider sustainability in everything we do. Sustainable watersheds function hydrologically – hence the need for Hydromodification controls and Low Impact Development (LID).

The overall effort to develop a hydromodification control criteria methodology, and to implement the resulting criteria throughout the Central Coast, is a multi year, multi phase effort that will cost several million dollars. This first phase proposed today will provide real engineering tools that can be used by municipalities throughout California to help meet their stormwater requirements. The value of this effort to the entire state is greater than the \$600,000 requested from the Cleanup and Abatement Account (CAA).

The requested \$600,000 will help fund the second phase of a three phase effort. The project phases are as follows:

1. Form a Technical Advisory Committee of leading experts to do the initial groundwork for a statewide hydromodification control methodology. This effort is intended to provide input to the Phase II Stormwater Permit renewal process and also to lay the groundwork to integrate hydromodification control into multiple water quality regulations (e.g., TMDLs, NPDES permits). This phase is part of the State Board's statewide effort, and is the subject of a separate recently CAA funded Division of Water Quality project for \$120,000.
2. Develop the hydromodification control criteria methodology and apply it across the Central Coast Region including 30-60 municipalities. This phase intentionally overlaps with State Board staff's work to develop a statewide hydromodification control methodology, criteria, policy, and permit requirements, and will provide consistency among the Water Boards. This highly complex, scientific phase is the subject of this proposal, and is described in more detail below. The estimated total cost of this phase is between \$1.5 and \$2 million. This proposal requests \$600,000 to help initiate this phase. The Central Coast Water Board is also pursuing other funding sources to complete this phase.

3. Municipalities implement the resulting criteria in their jurisdictions. This phase requires municipalities to change their codes and regulations, create technical guidance and requirements, and create design standards and specifications. The Central Coast Water Board is pursuing other funding sources to assist municipalities with this phase. This phase is not discussed in this proposal.

If the State Water Board approves this funding request, the party or parties awarded the work (“Contractor”) will direct and implement the collaborative effort, with oversight by the Regional Board staff. The project will develop a science-based methodology that municipalities within Region 3 and across the state can use to determine their own specific hydromodification control criteria. For municipalities participating in the project, the necessary preliminary engineering and geomorphologic analyses required to determine the landscape-specific hydromodification controls will be conducted for those 30-60 municipalities. Municipalities can then propose the resulting hydromodification control criteria to the Central Coast Water Board to meet the requirements of their NPDES Stormwater Permit. This project is a key step in the Central Coast Water Board’s progressive, stepwise process to achieve healthy watersheds, and similarly, the State Board’s goals in its Strategic Plan for statewide healthy watersheds.

Additionally, the manner in which the entire project will be conducted is intended to maximize environmental benefits and increase the likelihood of success by:

- Being led by nationally recognized subject area experts.
- Leveraging municipal and Water Board resources.
- Using an approach that takes the subject of hydromodification control from a parcel-based approach to a broader watershed-based approach.
- Providing the necessary foundation for any Water Board or municipality to determine appropriate hydromodification control criteria, regardless of additional funding. That is, the results of this work will be readily useable by others to take these concepts and establish their own locally specific criteria for their developers to use in designing projects and for the municipalities to use in approving projects.
- Increasing regional coordination on stormwater management.
- Focusing on reasonable, scientifically based techniques with clear outcomes.
- Incorporating related management issues such as water supply, groundwater recharge, energy consumption, and climate change.
- Improving communication and coordination among the Water Boards and municipalities for greater consistency statewide in the stormwater program.
- Implementing a critical step in achieving watershed level protection through a well-developed and coordinated approach.

Background

Hydromodification Control

The term “hydromodification” has appeared in the engineering, scientific, and regulatory literature since the early 1990’s. It was first applied to human modifications made to channels and shorelines, such as bank armoring, in response to hydrologic alteration (e.g., Frederick and Dressing 1993). The term has subsequently evolved to describe alterations of the hydrologic regime as a result of land-use changes or dams (U.S. EPA 1997). Most analyses of hydromodification in urbanizing watershed have emphasized the *physical* changes in stream channels that have resulted from an altered flow and/or sediment regime, reflecting the history of such studies beginning with those of Hammer (1972) and Leopold (1973). This limited focus persists to the present day and is displayed in the recent assessments and predictions of the “hydromodification effects” for various cities and counties throughout California. This focus on physical channel stability (or change), while valuable in the context of achieving overall watershed health, does not reflect the scientific advances of the last 35 years.

This project will contribute to achieving a broader suite of improved watershed conditions. Channel stability is certainly important: it minimizes the release of excessive sediment into downstream systems (along with adsorbed pollutants), it results in greater stability of aquatic habitats, and it reduces the demand for infrastructure-protecting measures that result in rigid in-stream structures and damaged riparian areas. However, the effects of an urban-modified hydrograph reach beyond simply the potential for greater bank erosion: we need a more integrative approach to hydrology, geomorphology, biology, engineering, and land use in urbanizing areas. Because the consequences of “hydromodification” are greater than an eroded channel, the benefits of correcting those consequences or avoiding them altogether can offer genuine progress toward improving overall watershed health. For example, increased stormwater runoff can result in decreased groundwater recharge because rain water that would otherwise infiltrate is lost and is transported as surface or piped flow directly to a receiving water such as a stream, river, lake, or ocean. Stormwater management strategies, such as hydromodification control and LID, offer opportunities to improve the functions across the entire hydrologic cycle (e.g., use of bioinfiltration swales to achieve surface water quality protection and groundwater recharge benefits) as well as addressing broader environmental issues (e.g., water supply, energy, climate change).

There is much existing literature that can offer a broadened understanding of these challenges, but most is not specific to California and none can speak to our tremendous statewide diversity. Conversely, a number of local “hydromodification” studies have been developed across the state, but they do not fully encompass the scope of what the present effort needs to be. And, though California-specific, they do not encompass the range of landscape and watershed conditions that can be found here. These existing pieces need to be merged: what have others recognized as the key issues, and the relevant metrics, to evaluate the consequences of hydromodification on watershed health? What portion of those needs have been addressed by recent, local studies? What benefits do the various approaches offer? Are some more suited to certain regions, or particular watershed settings, than others? And finally, which conditions and needs appear to be largely or wholly unaddressed to date? These are the questions that will be answered through this proposed work.

Adverse effects of urbanization and hydromodification are well documented, and regulatory controls are mandated by the Clean Water Act, Porter Cologne Water Quality Control Act, Water Board Plans and Policies, the California Coastal Act, and various permits, all of which require action to protect resources for future generations. Current efforts to regulate hydromodification range from narrative criteria to numeric standards for specific parameters. California regulatory programs currently establish post-development hydromodification criteria that, if not precisely tailored to local conditions, attempt to be reasonable from a technical, economic and social context, and put in place improved stormwater regulations to protect the biological and physical integrity of watersheds. The longer-term effort must be an adaptive management process that refines hydromodification control requirements based on regionally-specific conditions and effectiveness. This refinement of post-construction hydromodification requirements has precedent in other U.S. cities (e.g., Seattle, Portland) where changes to flow control requirements are enacted as part of updates to the local stormwater regulations.

The Central Coast Water Board’s Vision of Healthy Watersheds

The Central Coast Water Board is implementing a progressive, stepwise process to achieve healthy watersheds, as follows:

1. Basic Permit Requirements: These requirements include the basics such as education and outreach, elimination of illicit discharges, street sweeping, etc.
2. Low Impact Development Requirements: This step requires municipalities to incorporate LID principles into their stormwater management plans.
3. Hydromodification Requirements: This step requires municipalities to incorporate hydromodification criteria into their stormwater management plans and to utilize LID design principles to achieve those criteria.

4. **Planning and Design for Healthy Watersheds Requirements:** This step requires municipalities to coordinate with other entities in their watershed and to design for future growth, including green infrastructure, to ensure healthy watersheds over the long term.

Statewide, we are working on implementing the first two steps and we are requiring municipalities to develop criteria for step 3. This proposal focuses *only* on the initial tasks in step 3, above, which collaborate with the State Board staff's work to develop statewide policy and permit requirements. The Central Coast Water Board and the municipalities in the Central Coast Region are currently at step three in this process. Hydromodification control is a critical, complex step toward achieving healthy watersheds, water quality, and beneficial uses for future generations.

What Regional and Statewide Benefits are Achieved by the Proposed Collaborative Hydromodification Effort?

While there are various efforts statewide to develop hydromodification control criteria, the focus has generally been on the large Phase I communities. Most municipalities, especially the Phase II communities, do not have the expertise or resources to develop numeric hydromodification control criteria. By supporting a collaborative effort led by subject area experts, we will help municipalities move forward in a productive fashion and thereby achieve higher environmental protection than if each municipality were to "go it on their own".

This project will create the necessary scientific/engineering foundation that municipalities must have for stormwater permit compliance, and thereby provide the critical tool and conduct the basic analysis needed to develop clear, science-based stormwater control criteria for Phase II municipalities in Region 3. Region 3 contains the most designated MS4s (Region 5 contains the most potential Phase II municipalities, but they have not designated all their entities). Region 3 set permit compliance deadlines which are driving the hydromodification control requirements to be integrated into their program sooner than the next generation Phase II permit is scheduled for adoption (Summer 2010). This proposed Region 3 work can serve as a model for other regions around the state. Additionally, this work intentionally overlaps and coordinates with State Board staff's work to develop a statewide hydromodification control methodology, criteria, policy, and permit requirements, and will provide consistency among the Water Boards.

This project will include a review of, and build on, work already done by some municipalities, such as City of Santa Maria, Contra Costa County, San Diego County, etc. Water Board staff are key stakeholders in the process, so the methodology will be consistent with the Water Board's expectations. The Contractor and municipalities will derive local hydromodification criteria from local climatic and landscape conditions, including field verification. This effort, which will be applied to 30-60 municipalities within Region 3, will provide the critical tool (i.e., hydromodification control methodology) and conduct the basic analysis needed to develop clear, science-based stormwater control criteria. This is not a study or research exercise but the actual nuts-and-bolts tasks needed to move municipalities toward improved stormwater management. More specific examples of these tasks are included in Table 1, below.

Specific deliverables resulting from the proposed \$600,000 benefit both regional and state stormwater programs and include:

- Regional Scale: Hydromodification control methodology and preliminary engineering analysis for 30-60 municipalities in Region 3. This product will assist the Region 3 Phase II municipalities to incorporate hydromodification criteria into their stormwater management plans and to utilize LID design principles to achieve those criteria.
- Statewide Scale: Development guidelines that will assist State and Regional Boards in directing municipalities how to successfully develop scientifically sound and understandable hydromodification criteria.

- **Statewide Scale:** A white paper report providing the foundation for the development of cap-and-trade tools necessary to evaluate the impact of hydromodification management controls to achieve real, quantifiable, and cost-effective environmental benefits (e.g., improved surface water quality, water supply replenishment, and reductions of greenhouse gases).

The \$600,000 requested to support this effort is a strategic, cost-efficient way to help municipalities integrate hydromodification control principles into their programs. Alternatively, these nascent, unprepared municipalities could be required to spend millions to develop hydromodification program elements (i.e. Contra Costa, Santa Clara MS4s). We believe the value of this effort is greater than the \$600,000 being requested.

The collaborative hydromodification effort is supported by the overwhelming majority of Phase II municipalities in Region 3. Additionally, several stakeholder groups such as the California Stormwater Quality Association (CASQA), the Homebuilder's Association, and local environmental organizations support the effort. State Board stormwater program staff as well as the Central Coast LID Center have been contacted by other municipalities in other Regions who are expressing interest in this effort.

Budget Requirements and Funding Sources

The estimated total cost of to develop the Hydromodification Control Criteria (within Step 3, described on the preceding page), is between \$1.5 and \$2 million. This proposal would provide \$600,000 of that total amount. The Central Coast Water Board is seeking additional funding including Central Coast Water Board Settlement Funds, Proposition 84 Stormwater Funds, American Recovery and Reinvestment Act (ARRA) dollars, and direct contribution from participating municipalities. Lastly, an additional resource to contribute to this effort may exist in the Central Coast Low Impact Development (CCLID) Center, which was established by the Central Coast Water Board in 2008 to provide services within Region 3 including hydromodification support. However, if additional funding beyond this proposal is not obtained, the work done under this proposal will provide a vital foundation for municipalities to do the remaining work on their own or in collaboration to comply with the Central Coast Water Board's hydromodification requirements.

Central Coast Water Board Settlement Funds

The Central Coast Water Board has approximately \$1 million in unallocated settlement funds remaining from a 1998 consent decree regarding the Guadalupe Oil Field (the court authorized the Board to allocate funds to water quality projects in the region), which could also be directed to support the hydromodification effort.

Why doesn't the Central Coast Water Board pay for today's proposal with these funds?

1. The Central Coast Water Board has already allocated \$2.35 million to establish and partially support the CCLID Center (20% of funding is from the Maryland LID Center).
2. Because of the overlap, the LID Center is providing services to State Board staff to develop statewide permits, approaches, and policy, which is a statewide benefit, so CAA funding makes sense for this overlapping work.
3. The Guadalupe Consent Judgment says the funds can only be used in Region 3.
4. Per the Enforcement Policy, SEP funds have to be used locally.
5. The Central Coast Water Board could fund this phase, and direct the CCLID Center to not assist state board staff, but that doesn't make sense.

The already allocated \$2.35 million is the base funding that allows the CCLID Center to operate and provide a wide range of services to the Regional Board and State Board, municipalities, and other stakeholders. This allocation has been paying for 80% of the Center's cost while the remainder has been funded by "headquarters," the LID Center of Maryland. The Center's work includes providing technical, regulatory, and policy support on hydromodification control and LID implementation. Figure 1 illustrates the breakdown of work tasks being conducted by the CCLID Center. The current work plan for the CCLID Center prioritizes providing support on hydromodification and LID issues for municipal regulatory compliance. The Central Coast Water Board has an additional approximately \$1 million in unallocated settlement funds, which will be directed to support priorities within Region 3. Regarding this hydromodification criteria methodology project, the State Board encouraged the Central Coast Water Board to apply for CAA funds to help defer costs because the work strongly overlaps the State Board's work in the same area, and will provide a statewide benefit. State Board staff are also seeking the CCLID Center's assistance in this area on a regular basis. Since the consent decree dollars are to be spent for Central Coast Region work, yet the State Board has been and will be receiving services from the Center (e.g., this work will provide a statewide methodology), it is appropriate for CAA funds to be used for some of this work. Central Coast Water Board staff have

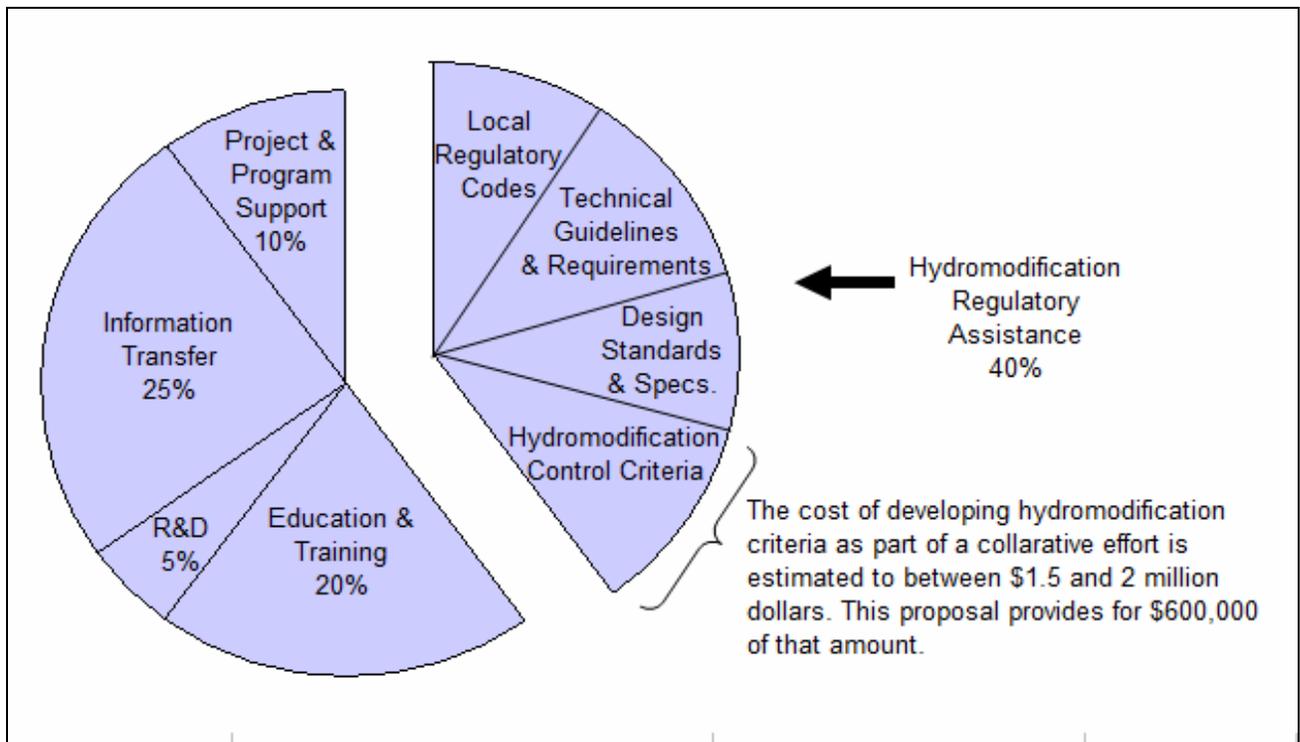


Figure 1 Breakdown of Work Plan Items for the CCLID Center showing Hydromodification Regulatory Assistance as a Priority Service.

recommended to the Central Coast Water Board that the remaining \$1 million in unallocated settlement funds be reserved for high priority projects, which includes the next step beyond hydromodification control. The next step is watershed level planning and design, including green infrastructure (the ultimate long term effort to protect healthy watersheds for future generations). Note that at approximately the same time as the above referenced consent decree for the Guadalupe Oil Field settlement that established the Central Coast Region's Water Quality Fund, the Central Coast Board, working again with the Attorney General's Office, successfully prosecuted another large case that culminated with the largest settlement of a Clean Water Act case in the nation's history. Part of that settlement sent \$5 million to the Cleanup and Abatement Account. Since that time, the Central Coast Water Board has continued to pursue enforcement cases that have resulted in more

funds for the CAA. The Board just settled a case for \$170,000, and is in the process for another case for \$25,000 with all dollars from both of those cases going to the CAA. The Board has a hearing scheduled in September for a complaint for \$8.6 million.

Proposition 84 Stormwater Funds

If new Proposition 84 Stormwater grants proposals are solicited, the Contractor and/or participating municipalities will likely be applying for \$1 million in funds to help do the work described in this proposal.

American Recovery and Reinvestment Act (ARRA)

The CCLID Center has been evaluating the eligibility for obtaining stimulus funds to support hydromodification needs within Region 3. With a heavy emphasis on “brick and mortar” projects, the collaborative hydromodification project did not directly qualify for these funds. Additionally, the project was not selected for non brick and mortar stimulus funds through 604(b)3. The CCLID Center will continue to pursue funding resulting from any new stimulus dollars.

Municipalities

Municipalities may be asked to contribute budget to this effort based on their ability to contribute. However, a significant reason for pushback on Water Board stormwater requirements, particularly for hydromodification controls, is that MS4s typically do not have the in-house expertise, and see a need to hire out or staff up to meet the requirements, at a time when their budget revenues are severely strapped. This proposal would provide a more cost effective approach (through a consolidated effort rather than hundreds of individual efforts) and some financial assistance to partially counteract the MS4s’ perception of added costs of compliance. The \$600,000 requested to support this effort is a strategic, cost-efficient way to help municipalities integrate hydromodification control principles into their programs. Alternatively, these nascent, unprepared municipalities could be required to spend millions to develop hydromodification program elements (i.e. Contra Costa, Santa Clara MS4s).

Additional Funding Sources

The Central Coast Water Board has also identified this work as a top priority for future Supplemental Environmental Project (SEP) funding.

Strategic Plan Implementation

The CCLID Center has been providing assistance to not only the Central Coast Region, but also has been working collaboratively with State Board staff on stormwater and LID program development, as envisioned in the State Board’s Strategic Plan:

“Methods of reducing or mitigating stormwater/urban runoff need refinement to promote infrastructures that sustain water quality protection. The Central Coast Regional Water Board is leading our efforts to establish a center that will provide interdisciplinary technical expertise in support of low impact and other sustainable development techniques.”
(pg. 13)

That is, the Central Coast Water Board has already allocated nearly four times the amount requested today, and in doing so, has provided for assistance on a statewide basis. Table 1 outlines current and planned efforts by the CCLID that provide both Region 3 and statewide Hydromodification and LID benefits. Today’s proposal will continue to provide valuable assistance to the entire State stormwater program, and toward the Strategic Plan goal of Healthy Watersheds:

“Healthy watersheds, or drainage basins, that provide clean and plentiful surface water and groundwater, and support healthy riparian and wetland habitat, are essential to support the State’s resources and economic future. A watershed approach is hydrologically-focused, recognizes the degree to which groundwater and surface water bodies are connected physically, recognizes the linkages between water quantity and water quality, and requires a comprehensive, long-term approach to water resources management that takes system interactions into account. State efforts alone cannot support a comprehensive watershed protection approach. Success depends on the integration of State, federal, and local programs, most importantly local land use decisions made by local officials, stakeholder involvement, and the actions of millions of individuals, which, when taken together, can make enormous impacts.” (pg. 2).

Table 1. CCLID Work Plan Items that Benefit Statewide Stormwater Programs.

CCLID Funding Source	CCLID Work Items	Description of product
CCLID Endowment (80%)		
	Capital Project Support	Includes development of guidelines to determine MEP for parcel based BMP design.
	Information Transfer	LID Parking Lot Design Guidance – creates a template to design a green parking lot. Virtual LID Center- CCLID Center has partnered with CASQA to make Region 3 LID products available to stakeholders statewide.
	Research and Development	
	Education and Training	LID Frequently Asked Questions- A compilation of commonly asked questions related to LID projects and programs will be available to users statewide.
	Hydromodification Management <ul style="list-style-type: none"> • Local regulations (e.g., codes, ordinances) • Technical Guidelines • Design Standards • Hydromodification control numeric criteria 	Statewide benefits described in this proposal specific to the hydromodification control criteria.
CCLID Work not funded by the Region 3 Endowment (20%)		
	Southern California LID BMP Manual	The LID Center is developing the Southern California LID BMP Manual, which will be posted on the CASQA website and promoted as a model statewide for LID BMP design.

	State Board Stormwater Phase II NPDES Permit	CCLID Center has been collaborating with State Board stormwater staff on the development of the Phase II SW NPDES Permit with a focus on hydromodification management.
	City of Elk Grove Master Plan	The CCLID Center is working with the City of Elk Grove to integrate hydromodification, LID, and sustainability principles into their city's Master Drainage Plan. The effort will provide a model for other city's to use when updating or developing their Master Drainage Plans.
	Statewide Hydromodification and LID Collaboration	The CCLID Center has been collaborating with various stormwater stakeholders throughout the state including EPA Region 9, California Coastal Commission, California Stormwater Quality Association (CASQA), Homebuilder's Association, and various environmental organizations. Presence of the CCLID Center has allowed for their expertise to be shared in workshops, conferences, and various venues (e.g., AB 32 Workshop on Climate Change, EPA Region 9 Ground and Source Waters Conference, NEMO).

With the Central Coast funds already providing statewide assistance through establishment of the CCLID Center, and today's proposal providing additional statewide assistance in developing the LID and Hydromodification components of the state's stormwater program, it is very reasonable for the State Board to allocate CAA funds to this proposal. Table 2 depicts contractor's assistance from this proposal.

Specific Tasks, Budget, and Schedule

The Contractor will use the CAA funds to do the following tasks of the Phase II hydromodification effort:

Table 2. Breakdown of Tasks, Cost, and Schedule for the \$600,000 CAA Budget Request.

Task	Title	Description	Cost	Time
1	Statement of Problem and Objectives	<ul style="list-style-type: none"> • Characterize the problem of "hydromodification" to encompass the downstream impacts of urbanization, including impaired water quality, channel instability, and altered water budgets. • Layout objectives of the project, focusing on data reduction techniques, assessment methods, and providing municipal hydromodification control implementation strategies. 	\$40K	100 days
2	Data Availability, Literature Review, and creation of the	<ul style="list-style-type: none"> • Assessment of local climate and landscape conditions. • Review and obtain most useful products of existing studies. 	\$60K	130 days

	Hydromodification Control Methodology	<ul style="list-style-type: none"> Define Hydromodification Control Criteria development methodology (i.e. the engineering and geomorphologic “recipe” municipalities will use to develop their numeric hydromodification control criteria). 		
3	Region-wide Watershed Characterization for Hydromodification Control	<ul style="list-style-type: none"> Gather watershed data, including meteorological data, channel characteristics, special species, fish use, land use, impervious areas, land use, soil types, slope, water quality, and groundwater conditions. Collect field data to fill gaps. Identify and classify representative subwatershed areas with similar characteristics (a.k.a. hydrologic response units [HRUs]). Identify and classify representative receiving waterbodies with similar biological and physical characteristics. 	\$500K	340 days

Additional funding from other sources, such as those outlined in the preceding paragraphs, will be required to do the additional tasks listed below. The estimated cost to do these tasks for 30-60 municipalities is between \$900K and \$1.4 million.

Table 3. Additional Tasks required to Develop Hydromodification Criteria and Implementation Tools for Region 3.

Task	Title	Description	Cost
1	Data Analysis/Assessment	<ul style="list-style-type: none"> Define modeling objectives, select modeling tools, and establish model calibration criteria appropriate to decision needs. Build watershed models/assessment tools. Calibrate and validate models with local field data. Evaluate linkage between HRU characteristics and downstream conditions (builds or relies on previous studies). Simulate impacts of projected development. Simulate effectiveness of different management strategies on different HRUs. Identify optimum management approach and BMP performance criteria for each HRU. Assess impacts to water budget. 	650k-1000k
2	Establish Implementation Strategy	<ul style="list-style-type: none"> Develop tiered, user-friendly assessment tools (simple for small projects, more complicated for large ones). Develop guidelines and user manuals. Educate regional MS4s. 	250k-400k

Conclusion

Hydromodification control is a critical step in achieving protection of healthy watersheds, water quality, and beneficial uses over the long term. This proposal requests \$600,000 from the Cleanup and Abatement Account to support the development and implementation of hydromodification control criteria methodology for Central Coast Region municipalities. The work done under this proposal will be applicable statewide, and regardless of any additional funding, will be the foundation for Regional Boards and municipalities to continue development of local, effective, scientifically based hydromodification control criteria.

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Hammer, T. R. 1972. Stream and channel enlargement due to urbanization. *Water Resources Research* 8: 1530-1540.

Leopold, L. B. 1973. River channel change with time—an example. *Geological Society of America Bulletin* 84: 1845-1860.

USEPA (U. S. Environmental Protection Agency). 1997. Guidelines for preparation of the comprehensive state water quality assessments (305(b) reports) and electronic updates. EPA 841-B-97-002B. Washington, D. C.

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