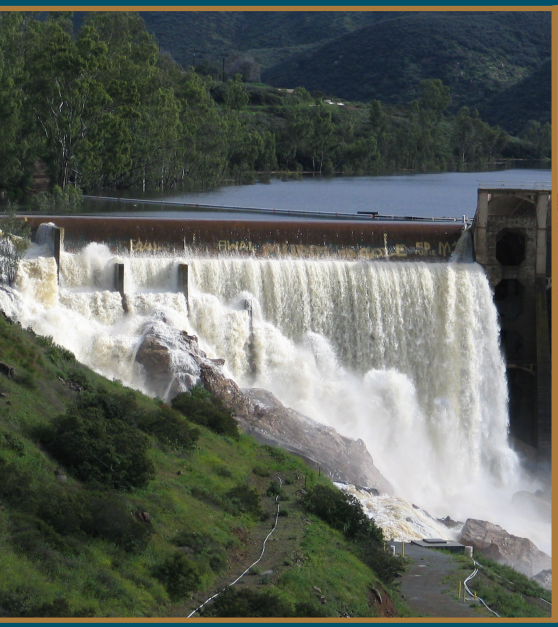
SAN DIEGO
Integrated Regional
Water Management

Opportunities for Integrated Watershed Management: Case Study on Hodges Catchment




Prepared for the Regional Water Management Group

City of San Diego

County of San Diego

San Diego County Water Authority

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SAN DIEGO Integrated Regional Water Management

Opportunities for Integrated Watershed Management:
Case Study on Hodges Catchment

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National Experience. Local Focus.

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Acronyms and Abbreviations

Basin Plan	Water Quality Control Plan for the San Diego Basin
BMPs	Best Management Practices
IRWM	Integrated Regional Water Management
JPA	Joint Powers Authority
MOU	Memorandum of Understanding
MWD	Municipal Water District
RWMG	Regional Water Management Group
San Diego Water Board	San Diego Regional Water Quality Control Board
SDCWA	San Diego County Water Authority
TMDL	Total Daily Maximum Load
WDR	Waste Discharge Requirement
WQG	Water Quality Goal
WQIP	Water Quality Improvement Plan

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San Dieguito River Park Conservancy

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This Case Study on Hodges Catchment is presented via the San Diego Integrated Regional Water Management (IRWM) Program's Regional Water Management Group (RWMG). The RWMG is responsible for administration and implementation of the San Diego IRWM Program. The San Diego IRWM Program is an interdisciplinary effort by water retailers, wastewater agencies, stormwater and flood managers, watershed groups, the business community, tribes, agriculture, and non-profit organizations to improve water resources planning and management in the San Diego IRWM Region.

Background

Management actions in water supply, water quality, ecosystem protection, flood control, land use and transportation are all interrelated. Watersheds are dynamic systems in which society interacts with the natural and built environment, and actions and activities in one geographic area have the potential to impact other geographies or activities. Although recognition of these interactions is growing, watershed management functions remain largely separate. In addition to jurisdictional challenges, significant specialization of knowledge and activities in the water resources system occurs at all levels within both the regulated community and regulatory agencies, creating the potential for knowledge gaps and reducing the ability to coordinate management activities. Watershed management is more integrated now than a few decades ago, but significant progress can still be made.

The San Diego IRWM Program provides a forum for identifying issues in the San Diego IRWM Region (defined as the Pacific-draining watersheds in San Diego County), collating regional priorities, and promoting an integrated approach to meet the Region's and State's priorities. Over time, the IRWM program has demonstrated how it can encourage and foster progress in achieving a truly integrated watershed approach, even if conflicting watershed management priorities pose a challenge. Of particular interest to the RWMG – comprising the San Diego County Water Authority (SDCWA), City of San Diego, and County of San Diego – was how these challenges could be addressed in the Hodges Catchment to foster holistic, integrated, cooperative management of surface waters, groundwater, runoff, water supply, and natural resources within the watershed (collectively referred to as "integrated watershed management" in this document). This paper briefly identifies the key challenges to integrated watershed management, using the Hodges Catchment as a case study, and demonstrates opportunities to address and overcome these challenges, with an emphasis on using an IRWM approach. The intrinsic value of the San Diego IRWM Program is that it is a non-regulatory group that incentivizes collaboration among watershed stakeholders and maximizes funding opportunities for water management projects.

Through this Case Study effort, the RWMG completed a *Compendium of Water Resources Initiatives in the Hodges Catchment,* which identified seven key regulatory documents, twenty key watershed plans and programs, two key reservoir plans and programs, six projects to improve water quality in the Hodges Catchment, and twelve important stakeholders related to Hodges Reservoir. The process also included research on how IRWM or integrated planning approaches could address watershed management priorities. Work also included interviews conducted with regulators and stakeholders within the Hodges Catchment, and workshops held with local water supply and stormwater management agencies.

In general, challenges to integrated watershed management that were identified over the course of this study can be classified into one of eight categories:

1. **Regulatory and Legal:** Regulations, compliance, and other legal issues
2. **Jurisdictional:** Limits in agency jurisdictions or authority
3. **Coordination:** Coordinating stakeholders and management efforts
4. **Financial:** Financial constraints

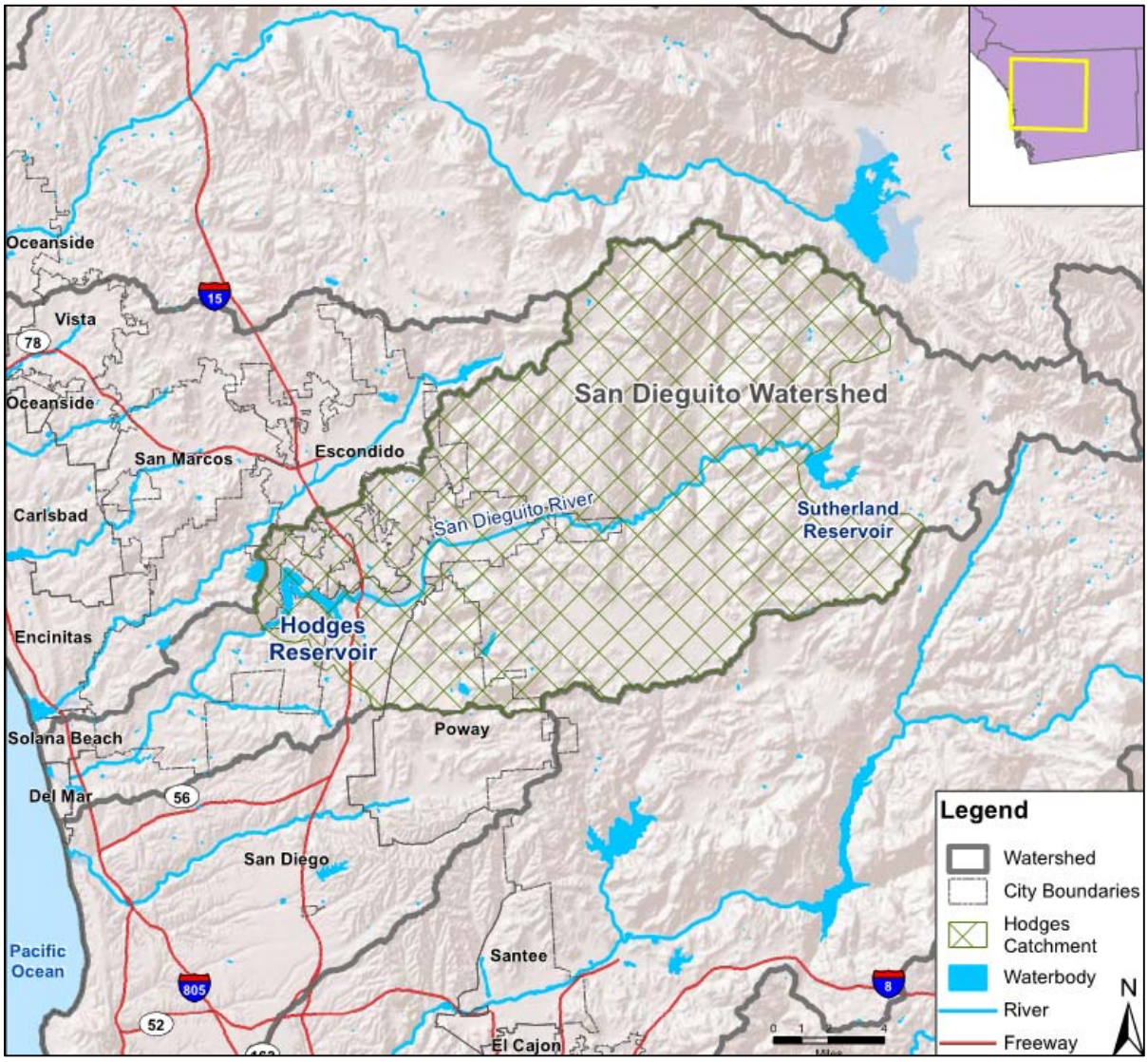
5. **Priorities:** Different and/or competing priorities within an agency or watershed
6. **Temporal:** Timing of projects, funds, and natural systems processes
7. **Knowledge of the Watershed:** Varied levels of stakeholder knowledge of the watershed
8. **Physical:** Physical and geographical characteristics of the watershed

In interviews with watershed stakeholders and regulators, management of water quality within the Hodges Catchment rose to the top as the highest priority watershed goal. Although different entities may focus resources on different priority constituents, improvement of water quality is widely acknowledged as the watershed's greatest need. As such, many of the opportunities identified in this Case Study focus on how the IRWM Program can help to accomplish this priority watershed goal.

San Dieguito Watershed and Hodges Catchment

The San Dieguito Watershed stretches from the mountains in eastern San Diego County to the Pacific Ocean, covering 346 square miles, and includes portions of five cities and the County of San Diego. The watershed is home to four reservoirs, two of which are located on the San Dieguito River: Sutherland Reservoir and Hodges Reservoir. Both reservoirs are located in the upper watershed, with Sutherland Reservoir in the eastern portion of the upper watershed, and Hodges Reservoir in the western portion of the upper watershed immediately west of Interstate-15. As shown in Figure 1, the Hodges Catchment is the area of the upper watershed draining into Hodges Reservoir (where water is stored), downstream of Sutherland Reservoir. Owned by the City of San Diego, Hodges Reservoir is part of the water supply systems for City of San Diego, San Dieguito Water District, and Santa Fe Irrigation District, as well as part of the regional Emergency Storage Project that is managed by SDCWA. Hodges Reservoir is also connected to Olivenhain Reservoir (in the Carlsbad Watershed) as part of a pumped storage project to generate electricity when needed. Due to the importance of Hodges Reservoir to the region, this paper emphasizes the Hodges Catchment portion of the San Dieguito Watershed in the case study.

Figure 1: Hodges Catchment in the San Dieguito Watershed



At present, Hodges Reservoir is listed on Clean Water Act's 303(d) list of impaired waterbodies as impaired for color, manganese, nitrogen, pH, phosphorus, mercury, and turbidity. Nutrient loading is a critical issue in the reservoir, both internally generated within the reservoir through cycling from the sediments and from the local watershed runoff. Regional water treatment facilities are not designed to treat the level of nutrient-related contamination currently present in Hodges Reservoir. The quality of the runoff from the local watershed is an important factor for Hodges Reservoir to maintain the reliability of water resources for the San Diego region, which imports most of its drinking water.

The Hodges Catchment includes a wide range of land uses, as shown in **Table 1**. Watershed land use is dominated by vacant / undeveloped lands, open space / recreation, residential, and agricultural. Areas in Table 1 represent zoning by jurisdictions and may not reflect the actual use of the land. Multiple land use jurisdictions and agencies within the Hodges Catchment influence water quantity and quality within the reservoir. As shown in **Figure 2**, upstream sources include discharges from, but not limited to: Caltrans, City of San Diego, County of San Diego, Cleveland National Forest, SDCWA, City of Poway, City of Escondido, Ramona Municipal Water District (MWD), Rincon del Diablo MWD, agriculture, confined

animal facilities, and tribal lands. Some of these entities are municipal stormwater permittees for stormwater management, while others are subject to various Waste Discharge Requirements (WDRs) for recycled water/wastewater and commercial agriculture.

Table 1: Zoning in Hodges Catchment

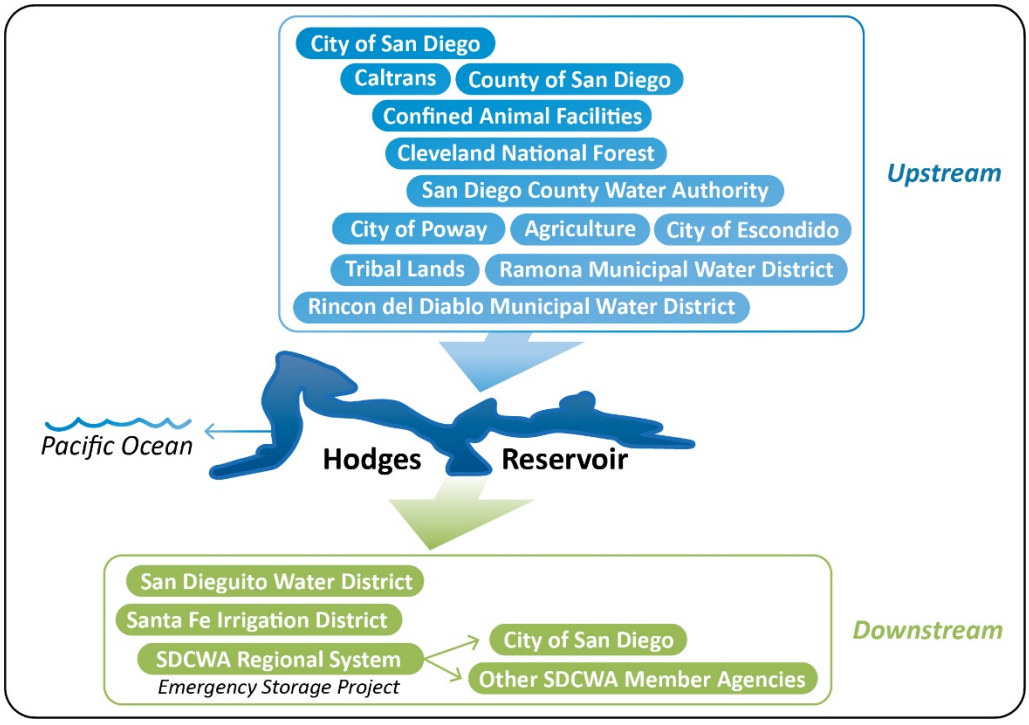
Aggregate Land Use*	Area (Acres)	Percentage of Total (%)
Vacant / Undeveloped	39,621	25.1%
Open Space / Recreation	53,213	33.8%
Residential	34,617	22.0%
Agriculture	22,965	14.6%
Highway / Road / Transportation	4,293	2.7%
Water	1,003	0.6%
Office / Institutional	627	0.4%
Commercial	982	0.6%
Industrial	295	0.2%
Total	**157,616**	**100.0%**

*Area includes Hodges Reservoir to below Sutherland Reservoir, 2015 Land Use.

Note: This table presents planned land uses per local zoning designations, which may differ from actual land uses.

Source: SanGIS (zoning)

Figure 2: Entities with Interest in Hodges Catchment



Note: This figure is not to scale, and arrows do not represent relative magnitudes of flows.

Objectives

The objectives of this Case Study are to:

1. Initiate a discussion of watershed management issues and create a dialogue among stakeholders with diverse perspectives;
2. Identify challenges and steps toward holistic watershed management, using Hodges Catchment as an example; and
3. Provide insights for how an IRWM approach, and specifically the San Diego IRWM Program, is helping to overcome barriers to holistic watershed management in Hodges Catchment, while maintaining compliance with applicable regulations.

Challenges to Integrated Watershed Management

An initial list of challenges for integrated watershed management (both generally and in Hodges Catchment) was identified in consultation with local water supply, wastewater and municipal stormwater managers. A series of interviews conducted with a variety of stakeholder and interest groups working within the watershed, as well as with people working on similar challenges in other watersheds, provided additional perspectives on the challenges facing integrated watershed management. Regulators were also interviewed to provide their perspectives on challenges to integrated watershed management.

Although there were varying opinions as to which challenges are the most significant to integrated watershed management in Hodges Catchment, water management experts, regulators, and stakeholders generally agreed that five specific challenges posed potential impediments to implementing a more integrated approach. These challenges were the ones most commonly cited by Hodges Catchment stakeholders as barriers to integrated watershed management. They were used to inform development of the potential opportunities described on the following pages. **Table 2**, below, identifies which of the five specific challenges are addressed by each of the potential opportunities.

1. The *Water Quality Control Plan for the San Diego Basin* (Basin Plan) does not prioritize beneficial uses, which creates challenges associated with prioritization of water management resources, as agencies cannot practically address all water quality issues throughout every watershed.
2. The San Diego Regional Water Quality Control Board (San Diego Water Board) places regulatory requirements on various types of discharges at the point of discharge, but discharge requirements are specific to the permit(s) and may not consider broader watershed functions or adequately address nonpoint and other sources outside the control of the regulated community.
3. Individual Total Maximum Daily Loads (TMDLs), incorporated into the permit(s), drive efforts and resources of both the regulated community and regulatory agencies. However, conditions addressed by the TMDL may not necessarily align with the issues identified by stakeholders.
4. Groups interested in watershed management may have limited effectiveness in advocating and implementing comprehensive management programs across the watershed.
5. Limited financial resources are available for implementation of watershed and water quality projects and programs.

Table 2: Specific Challenges Addressed by Potential Opportunities

Opportunities	Challenges				
	Basin Plan priorities	Specific Requirements beyond control of the entity	TMDLs do not align with stakeholder issues	Watershed group limitations	Financial constraints
Solutions align with *Practical Vision*	●				
Leverage existing watershed groups		●		●	●
Regulatory flexibility	●	●	●		
Multiple benefit solutions	●	●	●		
Science and data	●	●	●		
Grant funding	●		●	●	●

Potential Opportunities

Based on the challenges to integrated watershed management identified for Hodges Catchment, potential opportunities were identified that could be applied to watersheds in the region and those facing similar challenges in California. The mechanisms listed below could be used to overcome both general and specific challenges to integrated watershed management and to help facilitate a paradigm shift in water and watershed management that would move toward increased integration. Each mechanism was vetted through a series of interviews conducted with members of the regulatory community, as well as workshops held with local water management experts. Through this process, six mechanisms were identified that could be promoted, facilitated, and supported by the IRWM Program:

Potential Opportunities for Integrated Watershed Management

1. Develop watershed-based solutions that align with existing IRWM program efforts and San Diego Water Board's *Practical Vision.*
2. Leverage existing watershed management and advisory groups.
3. Pursue innovative, stakeholder-driven approaches to compliance that provide regulatory flexibility.
4. Focus on implementation of multi-benefit solutions to achieve a sustainable and holistic watershed vision.
5. Improve scientific knowledge and data collection and sharing.
6. Continue to explore and pursue grant funding.

The next sections describe how these six mechanisms can help overcome the challenges to integrated management and provide examples of early implementation of each mechanism in Hodges Catchment.

1. Develop Watershed-based Solutions that Align with Existing IRWM Program Efforts and San Diego Water Board's Practical Vision[1]

San Diego IRWM aligns with many elements of the San Diego Water Board's Practical Vision, including: proactive outreach, communication, support for projects that promote healthy waters, sustainable and safe water supply, and projects with measurable and meaningful outcomes.

The existing IRWM Program aims to align watershed management with the San Diego Water Board's Practical Vision, and in many ways already does this on a regional scale. The San Diego Water Board's Practical Vision sets forth plans to achieve water quality objectives through collaboration, reliance on the latest science, prioritization of issues and actions, and prudent use of authorities. Some of the priorities in the Practical Vision align with projects oriented to healthy waters and water supply, including potable reuse, that the IRWM Program has supported and for which the Program has obtained significant grant funding. Proactive public outreach and communication, and support for sustainable water supplies, are elements of the Practical Vision that are also fundamental to the IRWM Program.

The IRWM Program is a regionally-oriented collaborative effort that serves as a vehicle for obtaining external funding and provides a process for water resources planning, with an emphasis on achieving multiple objectives. The IRWM Program also serves as an informal vehicle for communication with the San Diego Water Board through its Regulatory Workgroup (which met from 2012-2013 and identified ways to collaborate between the IRWM Program and San Diego Water Board on issues in common) and with frequent participation of San Diego Water Board speakers in the IRWM Program's Regional Advisory Committee meetings. The IRWM Program provides a forum for consideration of cross-jurisdictional perspectives and development of projects that can be important to integrated watershed management and can help to overcome some of the implementation challenges created by jurisdictional limitations and regulatory constraints. The larger perspective provided by the IRWM Program can also help to improve project timing – knowing that a certain project will be implemented or is being considered by one agency or coalition can help to inform development of other projects. Additionally, the San Diego IRWM eligibility requirements for projects to be included in the regional plan ask for formally addressing integration in one or more of the following elements:

1. *Partnership*: Establishing partnerships between different organizations to increase cost-effectiveness through sharing of data, resources, and infrastructure.
2. *Resource Management*: Employing multiple resource management strategies within a single project to effectively address a variety of issues.
3. *Beneficial Uses*: Developing solutions that address multiple beneficial uses to expand benefits.
4. *Geography*: Implementing watershed- or regional-scale projects to benefit a greater amount of people and potentially save costs through economies of scale.
5. *Hydrology*: Addressing multiple watershed functions within the hydrologic cycle to holistically address issues and resolve conflicts.
6. *Sustainability*: Implement projects that meet the needs of the present without compromising the ability of future generations to meet their own needs and broadly support social, environmental, and economic benefits.

[1] The San Diego Water Board has developed a Practical Vision, which is a seven-year plan to shift the regulatory culture at the San Diego Water Board, and help focus their limited resources on the highest priorities in the region, through actions and collaboration with the regulated community.

In the Hodges Catchment, the IRWM Program plays a role in identifying and leveraging watershed solutions. In general, the IRWM Program funds water resources projects that provide multiple benefits and address multiple objectives of the IRWM Plan (which are designed to address the key issues identified in the Region). Successful IRWM projects involve partnerships among multiple stakeholders, including agencies and NGOs. Current IRWM projects that fit this description include the *Hodges Reservoir Hypolimnetic Oxygenation System Project* and the *Hodges Reservoir Natural Treatment System Project* (see callout box below). Both projects have multiple project partners assisting in the implementation of the project and have secondary benefits outside of resolving water quality issues in Hodges Reservoir. These projects help to address water quality and supply directly at Hodges Reservoir, as well as at the watershed level. The projects build upon and complement one another while helping to achieve some of the goals of the San Diego Water Board's Practical Vision such as promoting healthy waters, conducting ongoing monitoring, utilizing a coordinated approach, engaging in public outreach, and working towards creating sustainable water supplies.

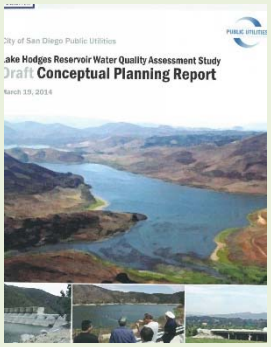
In addition to these IRWM grant-funded projects, the San Dieguito Water Quality Improvement Plan (WQIP) identifies a host of strategies and commitments on behalf of municipal stormwater permittees that, while focused on stormwater discharges, will improve water quality throughout the watershed and support the San Diego Water Board's Practical Vision.

2. Leverage Existing Watershed Management and Advisory Groups

Watershed management groups, such as the San Dieguito River Valley Conservancy or the future San Pasqual Valley Groundwater Sustainability Agency currently being formed as part of the Sustainable Groundwater Management Act, could assist in overcoming some of the challenges associated with the lack of localized focus efforts for watershed management. The IRWM Program, as a non-regulatory but formal and well-funded group, can serve as a vehicle for coordination of watershed entities (water, stormwater, and land management agencies, agricultural interests, relevant industries, NGOs, and other interested parties). The IRWM Program can help improve coordination by providing a forum for water managers and stakeholders to focus on communicating planned projects and activities, and using those efforts to develop a comprehensive, scientific understanding of the watershed. Support for watershed-based solutions is evident in the priorities expressed by the IRWM Program's Regional Advisory Committee during both regional planning and funding decisions.

San Diego IRWM leverages the efforts of watershed groups and has been instrumental in early project coordination and in obtaining grant funding for a variety of projects in the watershed. A key requirement for IRWM includes partnerships and outreach that demonstrate watershed stakeholder engagement in project planning.

FIGURE 3: IRWM PROJECTS TO IMPROVE WATER QUALITY IN THE HODGES CATCHMENT



Hodges Reservoir Natural Treatment System Conceptual Design: The San Dieguito River Valley Conservancy, in partnership with the City of San Diego and Santa Fe Irrigation District, modeled the Hodges Catchment and evaluated nutrient loading from various sources. The model used existing land use and actual water quality data to identify sources of loading and opportunities for the use of natural treatment systems to reduce pollutant loading to Hodges Reservoir. This project developed initial design and work plan for a natural treatment system, which is an established, cost-effective and environmentally sound way to address pollution issues. Natural treatment systems considered by this project included restored and constructed wetlands. This project's recommendations and findings were consolidated with other projects in the area to develop a cost-effective and integrated approach to addressing nutrient issues in the reservoir. *(Total Cost: $182,540 | Grant Award: $97,000)*

Biofiltration Wetland Creation and Education Program: The San Diego Zoo Safari Park received IRWM grant funds to develop a biofiltration wetland within the San Diego Zoo Safari Park (upstream of Hodges Reservoir) to improve water quality within the Park through natural biological filtration and enhance wetlands habitat. This wetland removes high biological oxygen demand, total suspended solids, organic nitrogen, and nitrates. Completed in 2012, the project also serves as an educational tool on water conservation and the importance of conserving wetlands. *(Total Cost: $841,000 | Grant Award: $700,000)*

Hodges Reservoir Water Quality Assessment Study: This project evaluated methods available to improve water quality within Hodges Reservoir, and assessed potential vulnerabilities from quagga mussels. It developed a set of three proposed coordinated "in reservoir" projects. Proposed actions include hypolimnetic oxygenation, vigorous epilimnetic mixing, wetlands creation, and reservoir operation strategies to improve water quality and allow water from the Hodges Reservoir to meet local supply and imported storage needs. The City of San Diego used the recommended action of this study to apply for subsequent grant funding and was awarded San Diego IRWM grant funding for the *Hodges Reservoir Hypolimnetic Oxygenation System Project*. *(Total Cost: $1,173,000 | Grant Award: $630,500)*

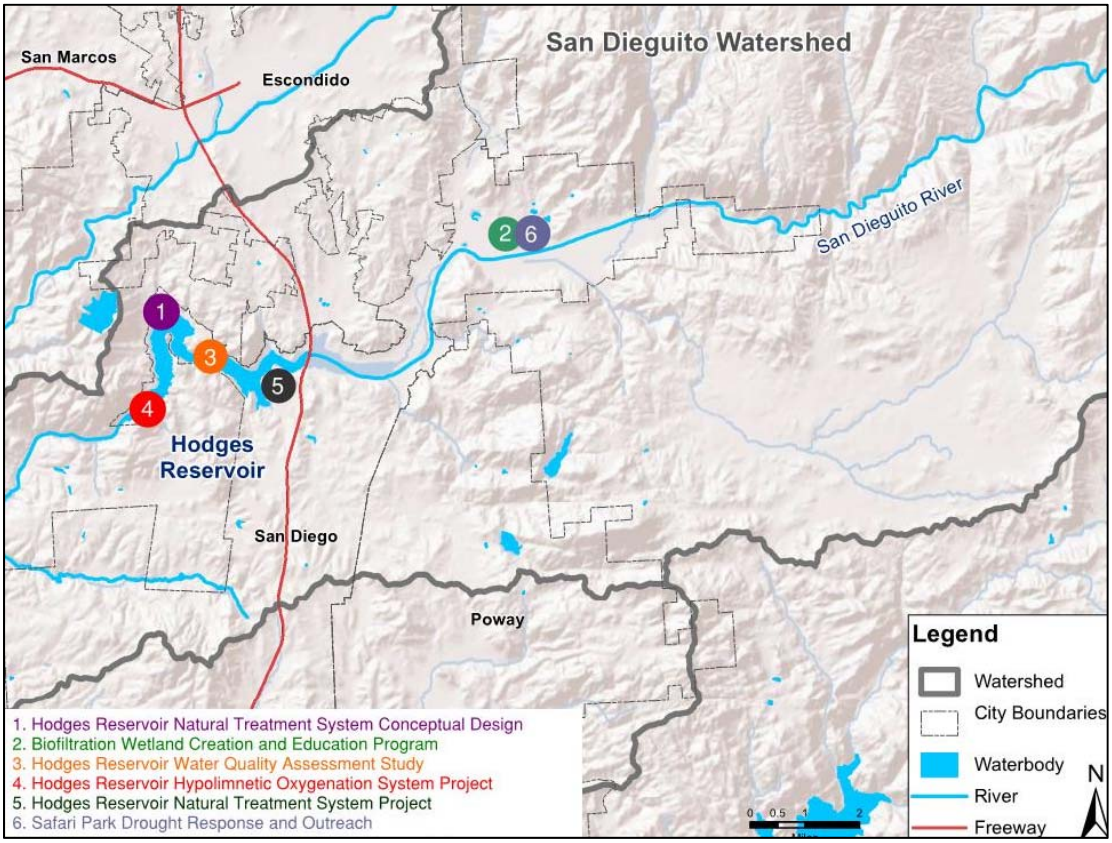
Hodges Reservoir Hypolimnetic Oxygenation System Project: This project is designed to reduce and control excessive algal productivity, reduce methyl mercury concentrations, increase oxygen concentration, and manage nutrients in Hodges Reservoir. Current water quality issues in the reservoir prohibit water from the reservoir from entering the regional system, leading to stranded water in some years and inability to capture water during wet years due to lack of available storage (which could have been achieved by moving water into the regional system). Improved water quality will be achieved through construction and operation of a Speece Cone in the reservoir to oxygenate the deep portions of the reservoir and improve water quality, increasing the ability to move water in and out of the reservoir to respond to droughts, and manage water supplies during normal or wet years. *(Total Cost: $3,468,735 | Grant Award: $2,554,500)*

Hodges Reservoir Natural Treatment System Project: In support of ongoing efforts to reduce pollutant loading to Hodges Reservoir, the *Hodges Reservoir Natural Treatment System Project* implements a natural treatment system based on the findings of the *Hodges Reservoir Natural Treatment System Conceptual Design* and the *Hodges Reservoir Water Quality Assessment Study* projects. This project will design and construct a natural treatment system that includes a constructed wetland at Green Valley Creek and Hodges Reservoir. The project will improve the quality of water entering Hodges Reservoir, and reduce downstream treatment costs and challenges. It cost-effectively consolidates two previously recommended natural treatment system projects. *(Total Cost: $3,850,880 | Grant Award: $2,886,472)*

Safari Park Drought Response and Outreach: The Zoological Society of San Diego, which operates the San Diego Zoo Safari Park (upstream of Hodges Reservoir), is working to reduce groundwater pumping and pollutant loading in the watershed. This project will convert 2.9 acres of turf to xeriscaping, upgrade Safari Park's on-site wastewater treatment plant from secondary to tertiary treatment, increase the volume of wastewater treated at the facility, and improve treatment of surface pond water that is used in exhibits and for irrigation. Tertiary treatment will reduce the bacteria, dissolved and suspended solids entering the San Pasqual Groundwater Basin and Hodges Reservoir through percolation and stormwater overflows from Safari Park. In addition, Safari Park is able to leverage its existing education programs to educate visitors on water and conservation programs, which currently reach over 48,000 students per year, in addition to Safari Park's 5 million annual visitors and 23 million online visitors. *(Total Cost: $3,867,000 | Grant Award: $2,900,000)*

IRWM Regulatory Workgroup: The IRWM Program established a Regulatory Workgroup during development of the *2013 IRWM Plan* that included participation of San Diego Water Board staff and a wide range of stakeholders. Through a series of workshops, the Workgroup served as a think tank to develop recommendations on how the IRWM Program and San Diego Water Board could collaborate to more effectively address regional water issues. As a result of this effort, a series of "Implementation Actions" was developed, including a dedicated liaison with the San Diego Water Board, and a regular presence at San Diego Water Board meetings. The San Diego Water Board and IRWM Program have improved communication and are actively exploring opportunities for collaboration and leveraging of one-another's programs.

Figure 4: IRWM Water Quality Projects in Hodges Catchment



The San Dieguito River Valley Conservancy is a non-profit organization that is implementing the San Dieguito River Park and the Coast to Crest trail, and partners with the San Dieguito River Valley Regional Open Space Joint Powers Authority (JPA) and other stakeholders to provide coordinated protection of the San Dieguito River corridor. Although implementation by a non-profit with limited funding and resources can have limited impact, funding via the IRWM Program enabled development of the *Hodges Reservoir Natural Treatment System Conceptual Design* which then informed the City of San Diego's *Hodges Reservoir Natural Treatment System Project* (construction of a natural treatment wetlands). This type of collaborative planning, scientific analysis, and solution development – the IRWM approach – will lead to greater water quality successes by working together.

The municipal stormwater permittees have a working group that meets regularly to discuss watershed water quality issues and implementation and assessment of the San Dieguito WQIP. These meetings are open to the public. The WQIP was developed by the municipal stormwater agencies and vetted by a Consultation Committee with representatives from the environmental community, development community, water supply agencies and San Diego Water Board, and it is reassessed and updated as needed as part of the adaptive management process. The WQIP sets priorities for the watershed to address stormwater conveyance discharges.

3. Pursue Innovative Stakeholder-Driven Approaches to Compliance that Provide Regulatory Flexibility

San Diego IRWM provides a platform for data sharing to assist in the development of stakeholder driven approaches to regulatory compliance.

Regulatory obligations are commonly and understandably the default drivers of agency priorities, but they can detract from integrated watershed management approaches when they are not completely aligned with local priorities. Supporting a stakeholder-driven approach to compliance could open the door for innovative programmatic solutions to watershed issues. To some extent, the San Diego Water Board is exploring flexibility in defining specific pathways to compliance. For example, the *Santa Margarita Watershed Nutrient Study* (Proposition 84-Round 1 and Round 2) is working to establish watershed-specific nutrient water quality goals (WQGs) for the Santa Margarita River estuary that will lead to implementation of nutrient reduction practices and avoid or delay the need for development of a nutrient TMDL. The WQGs are being established through a watershed stakeholder group (which includes San Diego Water Board staff), using monitoring and special studies to address identified data gaps. Funded by the IRWM Program, this type of innovative stakeholder-driven approach can be more effective for achieving long term watershed health. Similar approaches could be used in the San Dieguito Watershed.

With the Practical Vision, regulations are likely to evolve in a more holistic fashion, creating more opportunities for agencies and regulators to expand the use of these alternative pathways. But any new approaches must still achieve the Basin Plan's human and environmental health objectives. Proving compliance would require clear, scientifically-sound understanding of the watershed and related issues and would use data to support regulatory changes, while simultaneously demonstrating that such changes remain protective of human and environmental health. A coordinated approach to providing such data, such as the one provided by the IRWM Program, could help to reduce the cost and burden on individual agencies, and could generate solutions to complex watershed problems. Increased coordination between stakeholders (regulated community, advocacy stakeholders, regulators, and others) could also improve the potential success of stakeholder-driven compliance programs. The collaborative projects underway to improve water quality within Hodges Reservoir (see **Figure 3**) demonstrate that the IRWM approach can make progress in accomplishing watershed goals. However, additional coordination is needed to ensure that regulatory compliance is achieved and that actions are to the benefit of all watershed stakeholders.

4. Focus on Implementation of Multi-Benefit Solutions to Achieve a Sustainable and Holistic Watershed Vision

San Diego IRWM prioritizes multi-benefit projects. The process of selecting projects highlights the importance of quantifying benefits to gather support from watershed stakeholders and ensure that projects are complementary.

The IRWM Program encourages project sponsors to explore the interconnectivity of water management projects and each one's influence on multiple resources in the watershed. Projects seeking grant funding must demonstrate that they are seeking collaboration with other agencies and entities in the watershed, and must quantify the water supply, water quality and/or natural resource benefits of their projects. This is of critical importance to holistic management given that financial assessment of multi-benefit watershed projects is insufficient to fully articulate the benefits of those projects, and potentially significant positive benefits of indirect effects and externalities can be overlooked. Quantitative and qualitative triple-bottom-line criteria should be measured, and the positive externalities of projects should be accounted for to reflect more than the financial elements of projects. IRWM grant-funded projects are asked to identify all positive externalities and quantify them to the maximum practical extent. The key aspect is to not only present the costs to implementing projects and programs, but also to quantify the benefits and the value added. Benefits include,

but are not limited to, reduced cost to treat water, habitat improvement, protection and increase of property values, improved quality of life, and improved public health.

Different entities working together on water management projects can also have a compounding effect because more cost-effective, sustainable solutions can be identified. In the Hodges Catchment, projects such as the *Biofiltration Wetland Creation and Education Program* and the *Hodges Reservoir Natural Treatment System Project* both use constructed wetlands at different locations in the watershed to provide substantial water quality benefits, along with water supply, reduced treatment costs, habitat creation, and recreational benefits. IRWM projects addressing water quality in strategic locations in the watershed will lead to more sustainable outcomes.

5. Improve Scientific Knowledge and Data Collection and Sharing

San Diego IRWM has provided funding to support the feasibility of a regional data sharing system. San Diego IRWM has also provided a forum for multi-agency information sharing via the Program's Regional Advisory Committee meetings.

Any successfully implemented mechanism that helps to achieve integrated watershed management must be based on a scientifically sound understanding of the watershed and its processes. Improving scientific understanding of the watershed through special studies (on water quality and other issues) and coordinated data collection and sharing would help to provide the evidence necessary to support regulatory changes that remain protective of human health and the environment. Enhanced understanding would also help to provide an enhanced understanding of the role of temporal and physical features in the watershed and its processes. Improved data sharing could also help identify potential projects or project enhancements to implement in the watershed that optimize the multi-benefits that would accomplish watershed goals.

Modeling of the watershed and Hodges Reservoir completed with IRWM funding has provided the basis for proposed reservoir water quality solutions. For example, the City of San Diego's *Hodges Reservoir Water Quality Assessment Study* has focused on characterizing nutrients and associated eutrophication in the reservoir, as well as reservoir operation strategies to improve water quality and allow water from the reservoir to meet local supply and imported storage needs. As part of the San Dieguito WQIP, the municipal stormwater permittees are currently funding and conducting a bacterial source identification study for the watershed. Additionally, the municipal stormwater agencies and water supply agencies are working together on nutrient source identification.

The IRWM Program provides a platform for the implementation of projects for data management and exchange. For example, watershed stakeholders are currently coordinating on a nutrient monitoring effort to understand loading into Hodges Reservoir. The IRWM Regional Advisory Committee has also served as a critical medium for communication and information sharing between agencies about projects, programs, regulations, and the status of multiple evolving issues in the region's watersheds.

6. Continue to Explore and Pursue Grant Funding

San Diego IRWM has been the primary funding mechanism for integrated water quality and water supply projects in the watershed.

A lack of viable funding mechanisms was repeatedly identified as a substantial challenge for implementing integrated watershed management. These challenges are exacerbated when multiple entities share responsibility for a watershed, and where there are many contributors to a particular issue. Although such funding challenges affect all sectors of watershed management, stormwater projects have traditionally faced some of the most significant funding challenges because, unlike water supply and wastewater agencies, stormwater agencies are not enterprise agencies. Current funding options available to the Region include grants, San Diego Water Board funds, voter-approved initiatives (including fees, general and special taxes), funding agreements through JPAs and Memoranda of Understanding (MOUs), and recreation fees. One important source of funding that will help implement watershed management projects is Proposition 1: Water Quality, Supply, and Infrastructure Improvement Act of 2014. Proposition 1 includes funding opportunities for stormwater, water supply, water quality, ecosystem, and watershed protection projects, among others.

To-date, IRWM grants have been the primary funding mechanism for water quality improvements in the Hodges Catchment, and are anticipated to continue funding integrated watershed management projects both within the watershed and throughout the region. When acting together, IRWM-funded projects for Hodges Reservoir are anticipated to provide substantial water quality, water supply, and natural resource benefits at reasonable costs. Some IRWM projects could also be eligible for federal funding.

Further promoting an integrated approach, the San Diego Region Storm Water Resource Plan is underway and will be incorporated into the San Diego IRWM Plan. With an emphasis on integration and multi-benefit projects, this planning effort helps to better integrate stormwater into water resource planning and implementation efforts, including improved access to Proposition 1 funding opportunities. With the San Dieguito WQIP in place, municipal stormwater permittees are also committed to and funding projects and activities in the watershed that will improve water quality. The IRWM Program and individual Hodges Catchment stakeholders are all working diligently toward maximizing grant funding opportunities, whenever possible.

Promoting the Message of Integration

The San Diego RWMG is committed to promoting the message of integrated watershed management. The IRWM Program can act as a much-needed vehicle in achieving multi-benefit solutions to water quality problems across the San Diego region. Promoting collaboration among stakeholders is a crucial first step towards developing strategies aimed at ensuring long-term sustainability of water resources. Efforts by various agencies to address water quality issues in the region must complement one another in order to produce the most beneficial water quality outcomes in a manner that is also cost-effective. Incentivizing collaboration and delivery of multi-benefits through grant funding can lead to meaningful shifts in how watershed entities work together. Through this, the IRWM Program enables regional agencies to overcome some of the hurdles that currently exist in managing water resources.