SCHOOLS ARE PART OF THE CALIFORNIA DROUGHT AND WATER QUALITY SOLUTION

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ABSTRACT
Through the One Water LA program, the City of LA (City) is working with the California State Water Resources Control Board (SWRCB or State Water Board) to determine the feasibility of capturing offsite stormwater for infiltration or for capture and reuse at schools throughout the state. As a result, the City has identified many of the issues that need to be addressed by school districts, municipalities and counties to develop agreements and memorandums of understanding to implement cooperative projects and programs.

KEYWORDS: Stormwater management, offsite stormwater, water quality, water supply, flooding, drought, resiliency, schools

INTRODUCTION

Objectives of One Water LA 2040 program include the integration of water resource management by increasing coordination and cooperation between City departments, partners, regional entities, agencies, and other stakeholders. In the State of California, there are 1,025 school districts (CA Department of Education), which utilize much public land, and, thus, hold much potential for partnership opportunities. One Water LA has evaluated potential opportunities for using land owned by school districts in the State of California as well as the applicable requirements of the State Water Resources Control Board to understand the feasibility of capturing offsite stormwater on school sites. Discussed in this paper is the magnitude of potential opportunity on school property for water quality improvements and potentially augment local water supplies. There are many partnership opportunities between school districts and public agencies that have existing stormwater permit requirements. A partnership example between a small school district and the State's Department of Transportation (Caltrans) is provided.

One of the goals of the evaluation is to highlight how these partnerships can improve stormwater quality, maximize lands where stormwater can be captured, improve habitat and watershed health, and identify symbiotic relationships related to regulatory requirements and the associated costs for implementation, monitoring, and operations and maintenance (O&M). Several opportunities for, and barriers to, diverting offsite stormwater onto school properties were identified and are discussed.

This paper is divided into the following sections based on the study completed:

- Section 1- Current Conditions
- Section 2–Barriers Identified
- Section 3- Offsite Stormwater Concept
- Section 4 –School Partnership Considerations
- Section 5 – Conclusion and Recommendations

SECTION 1 – CURRENT CONDITIONS

Currently, school districts in the state of California do not have a small municipal separate storm sewer system (MS4) permit requirement. Instead, California school districts are required to comply with a construction permit which includes a Stormwater Pollution Prevention Plan (SWPPP). It is important to note that SWPPPs are only one component of a Phase 2 Small MS4 permit. This is partly due to the fact that when school district permits were up for renewal, there were both State and local budget cuts. School districts throughout the State were strapped for funds and adding additional expenses and requirements was determined to be too much of a financial burden. The Board and Executive Management of the State Water Board made the decision in the mid to late-2000's that the small MS4 requirements would not be written for school districts until a later date.

The State requires specific land owners within California to comply with the State Water Board's National Pollutant Discharge Elimination System Regulations. California delegates the management of implementation and compliance to nine regional boards throughout the state. Finding cost sharing opportunities is a function of the One Water LA effort. Through One Water LA, the City observed that there was an economically beneficial advantage if public agencies worked with school districts since there could be shared use of resources and expertise. In addition, it was recognized that some of the stormwater regulatory requirements for water quality protection were the same and overlapped, such as monitoring and reporting requirements. The timing of new school district regulations, set to begin in 2018, as well as many City and County TMDL deadlines align. The potential mutual benefit between school districts and local and regional entities exists at multiple levels and departments within numerous organizations.

The State issues a General permit and then the local regional board issues a permit that is specific for the region or area. Requirements for a General state-wide stormwater permit include:

- Retention of runoff from the 85th percentile, 24-hour rain event or the 0.75 inch, 24-hour rain event, whichever is greater;
- Improved storm water quality;
- Stream habitat improvement;
- Cooperative problem solving by diverse interests;
- Project completion within five years including the construction and start-up of treatment facilities.

City of LA Regulations

An example of a permit, is Order No. R4-2012-0175 entitled *NPDES permit No. CAS004001 waste discharge requirements for municipal separate storm sewer system (MS4) discharges within the coastal watersheds of Los Angeles County, except those discharges originating from the city of Long Beach MS4.* This permit was issued by the Los Regional Water Quality Control Board (RWQCB) and adopted by the SWRCB to the Los Angeles County Flood Control District, as well as the 84 cities within LA County. The permit addresses the following:

- Discharge Prohibitions - Non-Storm Water Discharges
- Effluent Limitations and Discharge Specifications
- Receiving Water Limitations – including groundwater
- Provisions
    - Standard Provisions
    - Monitoring and Reporting Program (MRP) Requirements
    - Watershed Management Programs
    - Storm Water Management Program Minimum Control Measures
    - Total Maximum Daily Load Provisions

Regulations Affecting School Districts

Recently, many school districts in CA have been notified that when their permit is up for renewal, the Phase 2 small MS4 permit requirements will be incorporated in to their new permit. For some school districts, new permits are expected to be issued in 2018. However, not all 1,025 school districts in the state will be renewed in the same year.

The following are the six Phase 2 Small MS4 Program elements, termed "minimum control measures":

- **Public Education and Outreach** – Distributing educational materials and performing outreach to inform citizens about the impacts polluted stormwater runoff discharges can have on water quality.

- **Public Participation/Involvement** – Providing opportunities for citizens to participate in program development and implementation, including effectively publicizing public hearings and/or encouraging citizen representatives on a stormwater management panel.

- **Illicit Discharge Detention and Elimination** – Developing and implementing a plan to detect and eliminate illicit discharges to the storm sewer system.

- **Construction Site Runoff Control** – Developing, implementing, and enforcing an erosion and sediment control program for construction activities that disturb one or more acres of land.

- **Post-Construction Runoff Control** – Developing, implementing, and enforcing a program to address discharges of post-construction stormwater runoff from new development and redevelopment areas. Applicable controls could include preventative actions such as protecting sensitive areas (e.g., wetlands) or the use of structural best management practices BMPs.

- **Pollution Prevention/Good Housekeeping** – Developing and implementing a program with the goal of preventing or reducing pollutant runoff from municipal operations. The program must include municipal staff training on pollution prevention measures and techniques (e.g., regular street sweeping, reduction in the use of pesticides or street salt, or frequent catch-basin cleaning).

Two obvious areas where shared resources and expertise could occur include the Post Construction Runoff Control section of the permit as well as the development of programs. Many existing municipalities and counties have already developed procedures and processes for monitoring and reporting as well as programs. School districts can minimize costs by working with these agencies to integrate and find common ground.

SECTION 2 – BARRIERS IDENTIFIED

One of the objectives of the evaluation was to facilitate discussions to identify and then determine how to break down barriers and facilitate discussions on making it easier to capture off site stormwater and divert it to a school site. While there are some cases where there are no barriers, there are numerous cases where for various reasons a school district has not allowed to accept the diversion of off-site stormwater. Two categories of barriers were evaluated. The first category related to legal, political, and institutional barriers. The second category related to the physical characteristics of a school site.

Legal, Political and Institutional Barriers

Discussions were held with the SWRCB as well as with the Department State Architect (DSA) and the Department of Toxic Substances and Control to determine concerns that have been expressed by school districts in taking off-site stormwater and infiltrating it or treating, storing and reusing it, on school sites. Some of the issues that have been of concern to school districts in CA include the following:

- How to engage the three major agencies mentioned previously that could be involved from the beginning of a project
- What roles and responsibilities need to be defined for these agencies? While some school districts believe it is clear, others do not: SWRCB for stormwater and water quality; DTSC for contaminated soils during construction; and the DSA for structural soundness
- Site Risks – how hazards from contaminants (e.g. oil or other contaminants that could spill on the street; fires; earthquakes
- How to delineate the costs for cost-sharing purposes since a portion of costs will come from on-site stormwater and the rest from off-site stormwater managed

- How long a stormwater structure must remain there place in case space for new facilities/classrooms is needed in the future; whether a school district can build on top of a stormwater facility
- Whether the structure can be 'removed' after 20-30 years
- How to properly define roles and responsibilities of project partners; and
- How MOU agreements will be developed to address funding including cost sharing, liability, indemnification, etc.

To determine the physical characteristic barriers, a review of how Stormwater projects were identified for the City of LA's Enhanced Watershed Management Program (EWMP) was conducted. The same approach was slightly modified for schools and is presented below.

Identification of a School Site

To determine an ideal school site, it is recommended that a list of potential school sites be identified by watershed and maps are created that plot the school locations. Using Geographic Information System (GIS) tools, an initial list of schools for each watershed is then generated. This initial list of schools will needs to be screened and ranked by using the following screening criteria:

- Schools that overlap with high priority sub-drainage areas
- Parcels identified during regional project screening (this could have been performed during the EWMP development)
- Schools immediately adjacent to potential regional projects, such as a municipal park
- Saturated Hydraulic Conductivity – low hydraulic conductivity sites are less favorable
- Depth to Groundwater Table – sites with shallow groundwater are less favorable
- Estimated Usable Area – the estimated usable area was quantified in acres with more area being more desirable
- Site Size – same as above
- Upstream Watershed Land Use – the types of upstream land uses were identified to determine those land uses that could potentially adversely affect runoff water quality (i.e., industrial)
- Water Quality improvements – regional and TMDL water quality constituent improvements were identified (i.e., Copper, Lead, Suspended Solids)
- Community (Disadvantaged/Severely Disadvantaged) – sites that positively influenced a disadvantage community are more favorable

Schools with low saturated hydraulic conductivity and the shallowest groundwater table depth are recommended to be removed from the list of potential sites. Based on the attributes mentioned above, potential school sites for the off-site stormwater capture pilot can be identified. The list of potential school sites should then be evaluated and compared to the School District's existing Capital Improvement Plan (CIP) list to identify an optimal school site for a stormwater

project or program that takes advantage of aligned timing for multiple improvements and construction to occur simultaneously.

SECTION 3 – OFF-SITE STORMWATER CONCEPT

The One Water LA team approached this evaluation through interviews, meetings and discussions with various public agencies, including the SWRCB. In addition, a concept was developed for off-site stormwater to be diverted from a sub-watershed to a school site.

The purpose for developing a concept was to determine how to divert off-site stormwater to a school site whiles considering and understanding existing barriers. The primary benefit was to improve the local watershed and sub-watershed water quality. Other benefits recognized included reducing local flooding, increasing local water supply, and/or off-setting potable water demand.

Figure 1 presents a conceptualized process flow diagram to divert stormwater to a school site for infiltration.

Figure 1
Concept of Diverted Stormwater System (Profile View)

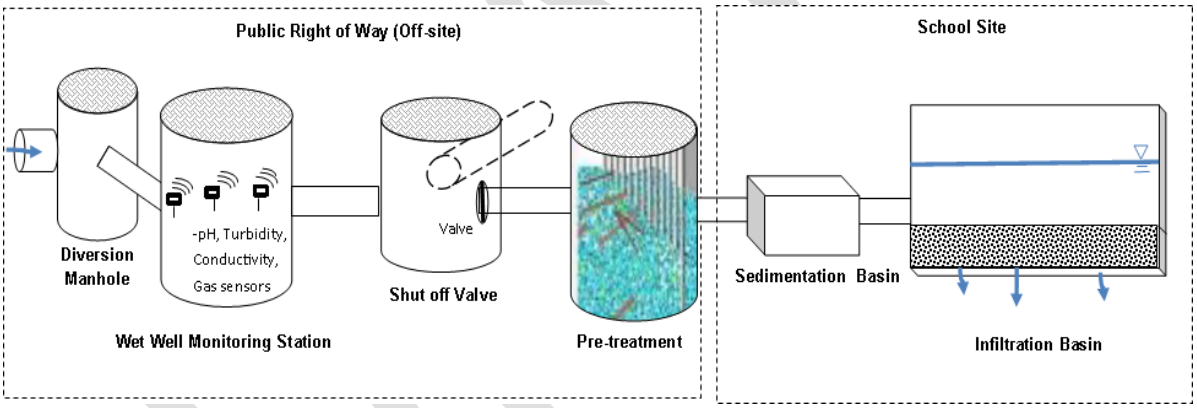
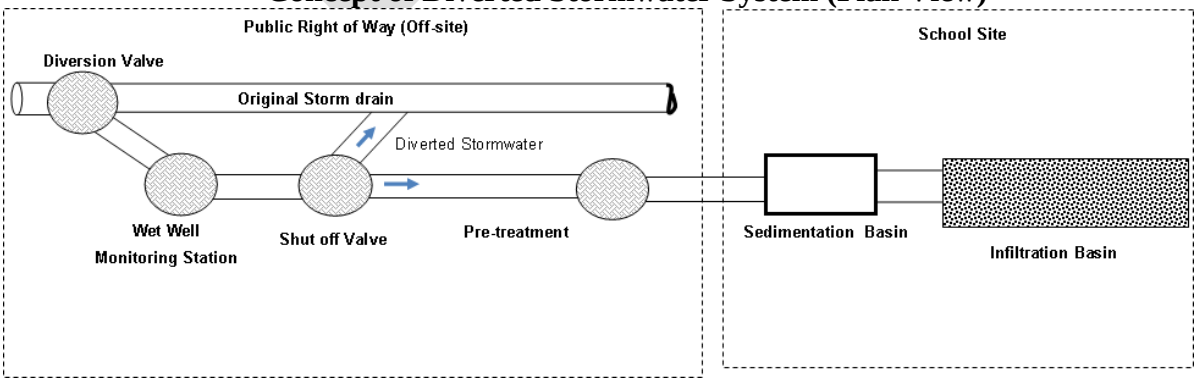
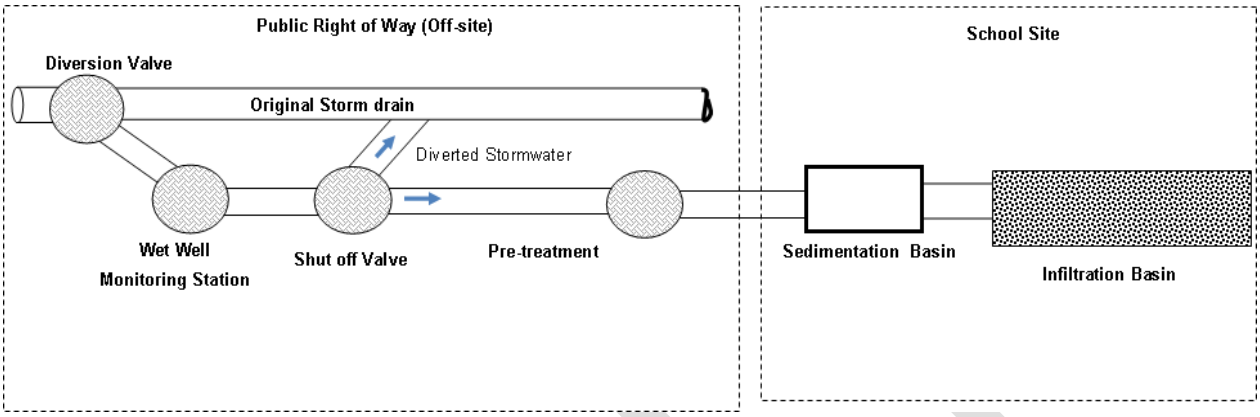


Figure 2
Concept of Diverted Stormwater System (Plan View)



Error! Reference source not found.**2** is the plan view of the same concept. Both figures highlight the potential components that can be included in such an effort. It is assumed that the stormwater is flowing down the side of the street in the curb and gutter, and additional maintenance holes are strategically placed to divert, monitor and pre-treat the stormwater.



The project concept components are as follows:

- **Diversion Valve** – the valve that is engaged to capture off-site stormwater and divert it to the school site.
- **Wet Well Monitoring Station** – real-time monitoring to trigger emergency shut off valve.
- **Shut-off Valve** – the valve will close in an event where the stormwater becomes too contaminated.
- **Pre-treatment** – to remove trash and solids.
- **Sedimentation Basin** – to detain sediment laden runoff for a sufficient length of time to allow settleable solids to settle out in the basin.
- **Infiltration Basin** – will infiltrate the captured stormwater and recharge the City's aquifers.

An effort was made to estimate the approximate costs for the stormwater concept, with all the components presented above. It should be noted that these costs are site specific and economies of scale can apply if the project is larger in capacity. Also not that not all projects may need treatment. The unit costs was developed internally by LASAN staff and by using existing similar projects as a reference, such as the EWMP plans. **Table 1** summarizes the high level cost opinion of this stormwater infiltration concept including tanks and other components.

Table 1
Estimated Stormwater Concept Cost for a School Site

Potential BMP	Capacity (SI)	Capacity (English)	Capital Cost[1]	Annual O&M[1]
Concrete Infiltration Tank	3875 m^3	1 MG	$5,000,000	$50,000
Sedimentation Tank[2]	3875 m^3	1 MG	$4,000,000	$80,000
Piping	1609 m	1 mi	$2,217,600	$22,176
Monitoring System[3]	1.0 unit	1 unit	$200,000	$10,000
Stormwater Treatment[4]	0.53 m^3/s	1 mgd	$6,000,000	$240,000
Stormwater Pre-treatment[5]	0.53 m^3/s	1 mgd	$3,000,000	$120,000
Manhole	4.0 unit	4.0 unit	$20,000	$400
Shut off Valve[6]	1.0 unit	1.0 unit	$50,000	$2,000
Other				
Pumps	0.06 m^3/s	2 cfs	$1,320,190	$39,606
		Total	**$21,807,790**	**$564,180**

Notes:

(1) Regional project assumes 1 MG concrete tank, 1 mile of 12-inch gravity pipe, 1 monitoring system at $100,000, and 1 MGD treatment system.

(2) Cost is dependent on the volume of the tank.

(3) Monitoring system assumes two probes, one meter, electrical system, and controls.

(4) Treatment cost assumes filtration system and UV disinfection.

(5) Pre-treatment cost assumes mechanical screening and chemical pre-treatment.

(6) Shut-off valve assumes 12-inch diameter butterfly valve with electrical system (automatic shutoff) and controls.

Abbreviation:

(1) m= meters, MG= million gallons, MGD = million gallons per day, cfs = cubic feet per second

Existing School Project Example

There is very limited information on existing schools currently capturing offsite stormwater into the school site. Many schools currently capturing stormwater only capture onsite and very rarely do they divert the stormwater into the schools location.

An example of a successful project that has used an integrated approach to capture offsite stormwater is the Madrid Middle School Park Project. The agencies involved include the school district, two non-profit organizations, and Caltrans.

Figure 1: Madrid Middle School Location (source amigosdelosrios.org)

Figure 2: Madrid Middle School Retrofit (source: amigosdelosrios.org)

The project helped retrofit a 0.25 acre site that had served as a trash dump for green and household waste for over 20 years. The site was renovated into a physical fitness area with native plant gardening and stormwater capture elements. The existing site now captures offsite stormwater runoff from a nearby highway and infiltrates it onto the school site.

This project helped provide the following benefits to the agencies involved:

- Meet the schools future Small MS4 permit requirements;
- Meet Caltrans and the City's MS4 permit requirements;
- Community Engagement and Education;
- Water Supply Benefits for the City;
- and more

Replicating this project in other Counties can help increase the amount of local water supply, improve the water quality of urban runoff, help provide multiple benefits to all the agencies involved and, most importantly, the improve community wellbeing. Increasing the amount of schools that capture offsite stormwater can also motivate other districts to capture both offsite and onsite stormwater.

SECTION 4 – SCHOOL PARTNERSHIP CONSIDERATIONS

Creating a MOU is important when beginning discussions with a school district, particularly for a practice that they may not be familiar or had experience with. In California, many school districts are familiar with some of the NPDES and MS4 requirements, but not all of the new regulations. Therefore, evaluating how local municipalities and counties can help and/or partner with school districts is beneficial. Further, when working with a school district, it is important to understand their perspective on health and safety of the students and how these standards are defined in their district.

Below are some suggested considerations for developing an MOU between the school district and the local municipality/county in order for a stormwater project to move forward. The following are various talking points and suggested topics that should be addressed:

- Defined stormwater capture capacity for both off-site and on-site stormwater and water quality improvements
- Defined site improvements – this could be playing fields, tennis courts, parking lots, etc.
- Defined payment structure for the design and construction of the project – this includes all geotechnical and structural considerations
- Operation and maintenance requirements of the facility – this could include potential labor agreements between the school district and the City
- Creation of a Standard Operating Procedure (SOP) that both parties can follow, as required
- Easement for construction, O&M access, stormwater capture, treatment, and reuse for a minimum of 20 years
- Joint relationship and/or identification of roles and responsibilities during design and construction with the DSA, the SWRCB, and the DTSC
- Review of the requirements for a Stormwater Phase II Small MS4 Permit.

Management Issues

In addition to the above talking points and topics, the following additional issues were identified through discussions with various agencies that should be addressed as soon as is reasonable.

- Clearly define who is the lead agency or project owner (i.e. wih respect to CEQA compliance);
- Identify who is responsible for removal and/or maintenance of any installed structure(s) at the end of the term of the agreement;
- If there is subsidence, settling, rupture, damage because of intervening third party conduct, or other "worst case scenarios," who is responsible for remediation and/or repairs as well as the cost of any interruption, and in what proportion;
- If there is a "discharge" as determined by the Regional Water Quality Control Board, who would be responsible for any notices of violation issued;
- Clearly define the access/easements required;
- Clarify funding sources, their limitations, if any, and the proportion of funding for design, construction, operation and maintenance, etc. Determine whether there are any limits on conditions of funding (i.e. certain grant requirements).
- Identify how long the structure must be in place and whether a school can build facilities on top of the stormwater structure

One of the main topics for stormwater projects are the O&M activities and the roles and responsibilities. Delineating O&M responsibilities and the responsibility of costs at the conceptual project phase is important to ensure buy-in and commitment to the project. These activities are defined in greater detail below:

- Performance Monitoring – drawdown time and infiltration rate
- Cleaning Frequency – remove trash and debris accumulation
- Existing Conditions and Maintenance Documentation (field log) – Based on the facility, the frequency of inspection and O&M typically ranges from quarterly to annually, and is

largely dictated by variables that are project-specific (e.g., type of project, location of project, drainage area to project, project phase, etc.)

The annual O&M cost of a medium-scale green infrastructure project, such as an infiltration basin is estimated to be 5 percent of the capital cost (U.S. EPA, 1999; Weiss et al., 2005). O&M requirements for the proposed pilot will be determined as a joint effort between the agencies involved.

SECTION 5 – CONCLUSIONS AND RECOMMENDATIONS

Evaluating the barriers and challenges for school districts to capture offsite stormwater is useful in order to identify where clarity and additional discussions are needed. The timing of school districts receiving new MS4 permits may be the perfect opportunity to start discussing mutual benefits and cost sharing opportunities. Collaborating with municipalities and other public agencies with existing regulatory requirements can assist school districts with their new permitting requirements and offset costs. With EWMPs compliance deadlines based on the watershed and the TMDL, school districts are poised to contribute to regional water quality solutions.

On the basis of this evaluation, the recommendations are:

- Existing MS4 permit holders to reach out to school districts and consider partnership opportunities. Begin discussions with the different divisions in the school district.
- Create a list of school regulators and identify their role and responsibility. Understand their relationship with the school district
- School districts to evaluate the new 2018 Phase 2 small MS4 permit requirements and consider partnering with public agencies with existing MS4 permits
- Consider a technical site tour of an existing stormwater project similar to what could be done at a school, with ‘safety’ measures explained
- Work with the architecture, engineering, facilities and O&M managers re: technical information
- Develop a project and/or program concept. Develop a pre-design layout
- Evaluate school sites for optimal infiltration, capture and reuse and treatment
- Assess potential legal concerns
- Draft a Standardized Agreement /MOU between both parties (local municipalities and school districts) for cost sharing opportunities.

REFERENCES

Amigos de los Rios. Madrid Middle School Park. 2017. May 2017 <http://www.amigosdelosrios.org/alfred-madrid-middle-school/>.

California Department of Education. Enrollment in California Public School Districts. Excel. Sacramento: California Department of Education, Data Reporting Office, 2017.

California State Water Resource Control Board. "Stormwater Discharges from small municipal seperate storm sewer systems fact sheet." Fact Sheet. 2013.

City of Los Angeles. Enhanced Watershed Management Plans. 2015. <http://www.lastormwater.org/green-la/enhanced-watershed-management-program/>.

Environmental Protection. Small MS4Stormwater Program Overview. 2005. <https://www3.epa.gov/npdes/pubs/fact2-0.pdf>.