

Fremont Learning Corridor Concept Plan

Innovative teacher and student education to create the next generation of STEM ready students

Math Science Nucleus



Fremont Unified School District



City of Fremont



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CHAPTER 1. INTRODUCTION

The **Math Science Nucleus (MSN)**, **Fremont Unified School District (FUSD)**, and **City of Fremont (COF)** propose to use 3 unique features found in Fremont, California (exposures of the Hayward Fault, urban waterways, and Ice Age fossils) and incorporate them into a regional learning center for schools and the public. The **Fremont Learning Corridor (Corridor)** will also provide instruction for teachers, and administrators on how to integrate science, math, and technology into curriculum to improve performance in STEM (Science, Technology, Engineering, and Math) subjects. This concept plan presents a justification for expanding the present facilities mainly within the Corridor creating dynamic classrooms and outdoor laboratory for field trips, service learning, and workshops for FUSD and other school districts. This plan builds on a 15 year successful relationship that has increased school performance.

This Corridor (red circle on map) begins at Tule Ponds at Tyson Lagoon Wetland Center next to the Fremont BART station. It follows the Hayward Fault toward the Alameda Main Library, through Central Park and Lake Elizabeth including Stivers Lagoon. It continues toward the Gallegos Winery, whose remains are a reminder of its collapse in the 1906 Earthquake. The Corridor will connect with Sabertooth Cat Historic Park and Trail, which exposes the beginning of the Ice Age. Improvements would allow greater use of the Corridor for regional field trips, teacher workshops, community service, service learning, student internship, and community recreation. Working together we can save, preserve, and expand these unique features for future generations as a world class learning center.

This area can be easily reached by public transportation and can train generations of teachers and administrators while serving the school districts in the San Francisco Bay area.





Students helped save Duck Island by stopping erosion.

LOCAL EDUCATIONAL SUCCESS

In 1982 a group of scientists in the San Francisco Bay area started a non profit to help schools get more science in their schools. They looked at different soci-economic areas. Fremont Unified School District (FUSD) was eager to have their schools participate in this plan. From that early work, a complete science curriculum was developed which is available free online called the Integrating Science, Math, and Technology Reference Curriculum (I. Science MaTe). In the 1990's the program went national as the Math Science Nucleus (MSN) visited areas throughout the country. However, a national decline in science education with "No Child Left Behind," forced MSN to work on more local issues.

In the last two decades MSN and the City of Fremont (COF) slowly developed a way to not only train its youth in FUSD but to use students to help maintain and expand wildlife corridors. Unique in this concept is using service learning and community service (for 7th -12th graders) to restore, learn, and maintain areas. High school interns are also used to monitor scientific problems such as pollution, restoration benchmarks, and earth movement. This helps to authenticate learning in the classroom, to teach civic responsibility, strengthen our local community, while providing possible career choices. The younger students (K-6th grades) benefit through field trips that enhance their learning in the classroom. All of these programs evolved from the I.Science MaTe Reference Curriculum.

Several learning centers located in the Corridor have been successfully influencing the surrounding school districts including Tule Ponds at Tyson Lagoon Wetland Center and Stivers Lagoon Nature Center. These facilities will be used to expand use of this unique experience for teachers, administrators and students not only for FUSD but other San Francisco Bay regions. These centers will also facilitate regional training on subjects like earthquakes, environmental sciences, and paleontology.

This concept plan looks at the physical corridor and explore each of the unique features which would make this an outdoor natural museum. It will describe how the corridor is used today by schools and community throughout the region. It will document the impact that this region already has on FUSD and other school districts in the region. It will explore some ways in which it can benefit more schools in a systematic way to not only benefit all of FUSD but to extend a helping hand to all other schools in the area.

This plan will also look at how to preserve this corridor not only for generations, but will act as a regional training center for teachers, administrators, in STEM related subjects. Sustainability of the Corridor would include fee based services for both the schools and public. The Corridor will act as a training area for students to fulfill service learning and community service and engage in scientific research.

Curriculum is important to this proposal and will use the award winning Integrating Science, Math, and Technology Reference Curriculum (I. Science MaTe) developed by scientists to increase student comprehension and love of science at an early age. It has been used to guide the integration of formal with informal education in Fremont. Hands-on labs, electronic storybooks, and field trips will make a major impact on children understanding of STEM subjects. We will also use our experience in developing service learning and community service projects to help other districts and schools

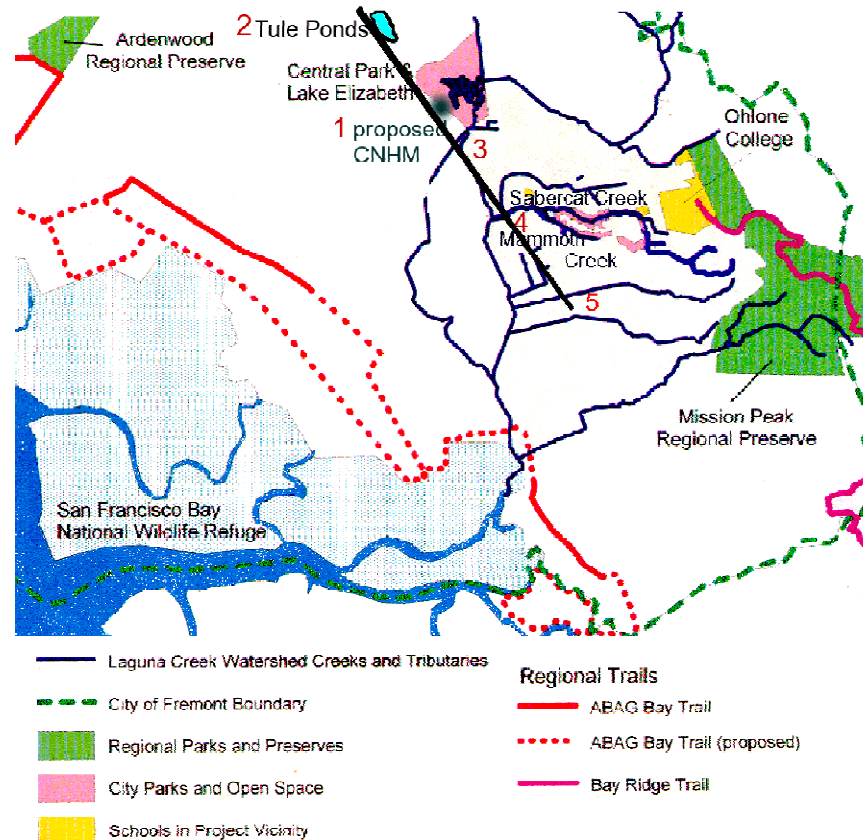
The City of Fremont will provide the building and physical amenities while the Math Science Nucleus will provide facilities, exhibits, programming, maintenance, and staffing. Fremont Unified will also provide facilities, administrative support, master teachers, access to teachers and students, and evaluation tools as we expand the program. Other agencies will also be involved to insure success of this expanded Corridor.



Third grade learn about native plants by making bookmarks at Tule Ponds

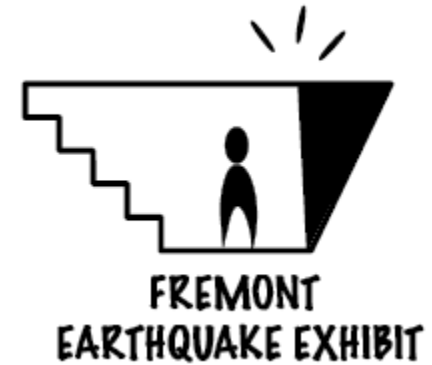
CHAPTER 2. UNIQUE COMPONENTS OF CORRIDOR

The unique features of this area include a continuous exposure of the Hayward fault, exposed waterways, and a fossil site that defines the beginning of the Ice Age in North America. This chapter will look at each of the components and outline the projects that make the partners of this proposal feel confident that it is of regional significance for educating the next generation of children, teachers, and administrators. The map shows the corridor. The black line is the trace of the Hayward Fault. There are also facilities not within the corridor that would be used for this project, such as the Native American Museum (FUSD) and the Children's Natural History Museum (MSN).



HAYWARD FAULT

The Hayward Fault is a major fault of concern in the East Bay. It has been considered the most dangerous area for a possible major seismic event by the U.S. Geological Survey. There is a one in three chances of a major earthquake of 6.8 or greater on the Hayward Fault within the next 30 years. The last major quake in this area was on October 21, 1868, with a magnitude of 7.0, which ripped almost a continuous shear of about 6 feet from Milpitas to Oakland. It may be coincidental, but it was in 1868 when the first Ice Age fossils were found in Fremont, which is located on the fault.



View of Hayward Fault Trench

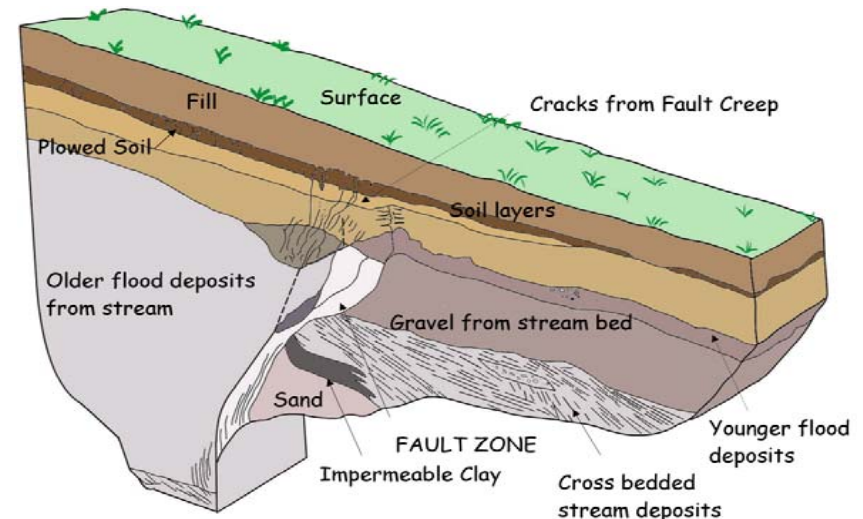
The Hayward Fault connects this Learning Corridor which extends from the Fremont BART Station to the proposed Irvington BART Station. In 2006 MSN was involved in the Fremont **Earthquake Exhibit** that attracted over 23,000 people to visit a trench of the fault. It was a joint effort with the **U.S. Geological Survey**, MSN and the City of Fremont. for the 100th anniversary of the 1906 earthquake.

The Hayward Fault is one of a handful of faults in the world that is presently creeping. Fault creep, where a fault moves steadily at the surface (instead of staying locked by friction, like most faults), has many observable effects in the East Bay – it separates curbs and paving slabs, cracks asphalt and walls, and damages buildings. The rate of movement, around 5 mm per year, is enough to visibly move objects within a year or two. In this region there is about 3 miles that is exposed so people can actually walk along the trail and see these features. There is even a Community Center that is being ripped apart!

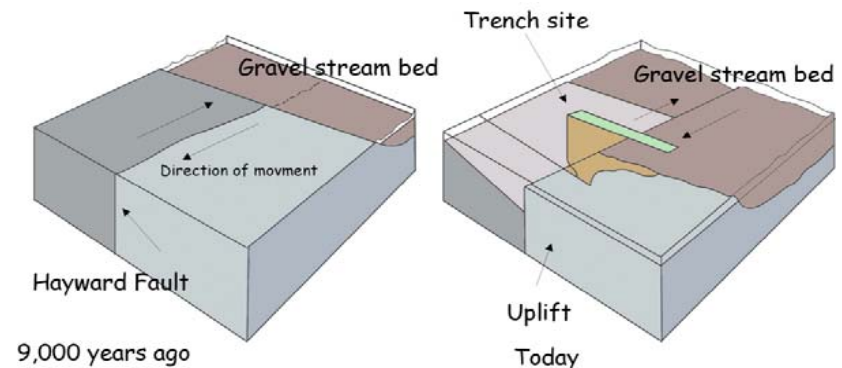
Geophysicists are interested in this unusual behavior for a couple of reasons. First, it may explain why some faults creep and others do not – why it happens on the Hayward fault in Fremont, and not on the San Andreas fault in Palo Alto. Second, and more importantly, knowing where and how fast the Hayward fault creeps allows seismologists to make estimates of where it is not creeping. These ‘locked’ areas are accumulating strain for a future earthquake. Understanding in advance where this earthquake will happen will allow citizens, the public utilities and city governments to prepare for the worst.

The Fremont Earthquake Exhibit in 2006 was so successful that there was an attempt to develop a permanent display. The typical reaction after visiting the exhibit is one of appreciation and fascination at the opportunity to see an earthquake fault and to receive up-to-date information on earthquakes. School groups appreciated learning about earthquake preparedness. People were generally ‘wowed’ by the continuous fault creep. Seeing the offset curbs next to the exhibit make the children see the earth is ‘alive’ and active. Thinking about what happens during earthquakes, and why, sparks their interest and enhances their impression of science.

This concept looks at developing a fault trail and tour in Central Park so people could actually see these features. It also looks at using student interns to work with scientists to photograph the creep over years and compare it with satellite data. The trail would be integrated with the permanent Fremont Learning Center.



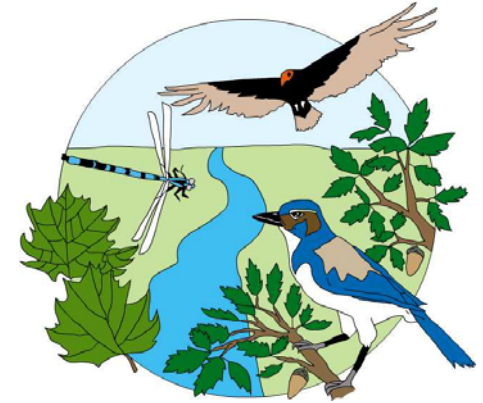
Trench profile to show where the current trench is located (identified as Fault Zone). Adapted from San Jose Mercury (1989)



9000 years ago there was large stream flowing about 150 feet from the current location. Through time movement on the fault has offset the sediments. (Adapted from San Jose Mercury (1989))

URBAN WATERWAYS

Since Fremont was agricultural until recently, many of the natural waterways are still visible. In the 1950's Alameda Flood Control modified many of the creeks to help prevent flooding. Fremont has the same water issues that faces many California regions. MSN, COF, and Alameda County have developed innovative ways with FUSD and other school districts to solve non-point pollution and education.



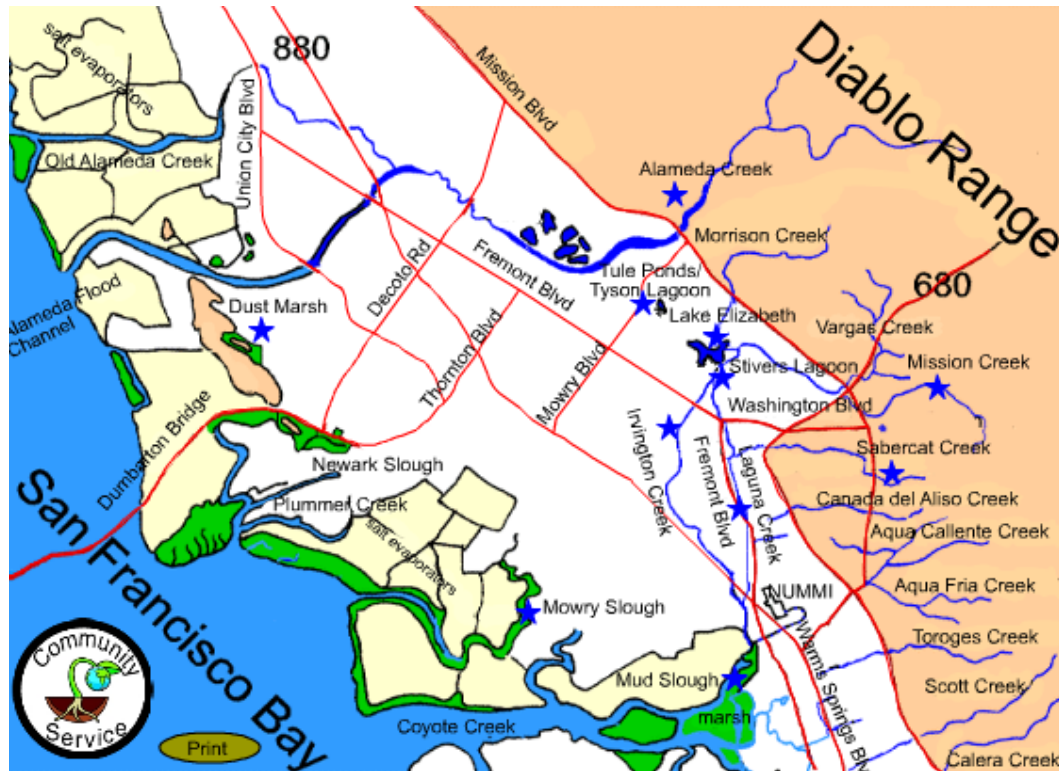
Fremont is the second largest city in size in the San Francisco Bay area. Much of the southern part of the city lies in the Laguna Creek Watershed, which is fully contained within Fremont. The much larger Alameda Creek Watershed, in the northern part of the city runs through many other cities. The City of Fremont in the early 1990's felt it could make an impact only on a watershed that they can control and monitor.



Tyson Lagoon

In 1997, the City of Fremont approved the Laguna Creek Reconnaissance Study and Water Quality Enhancement Plan study that urged the city and county to use the channels to help beautify as they made them eco-friendly. The report identified several locations where opportunities exist for implementing water quality monitoring and creek enhancement and stewardship projects. The Math Science Nucleus, a member of the task force, felt that the restoration they were outlining would be perfect for educating the children of the city about the need for restoration and keeping our water clean.

This began a series of grants and contracts that MSN received to integrate science into the schools using sound environmental principles. The map on the next page shows the different sites (blue stars) that the MSN received grants to work with students. All the material we developed is still online and many schools use the materials for projects. We have published 4 books on the different areas, including a "Restoration Manual" so students can read as background material. However, there are hundreds of miles of creeks in this area that need restoration and scientific monitoring



and we feel that high school students with scientists overseeing the project can provide a stewardship that will benefit the children, teachers, and the City of Fremont. COF, MSN, and FUSD feel they have created a true solution that not only restores watersheds but maintains them using service learning and community service.

MSN and FUSD worked on several large restoration projects near schools and integrated curriculum and outdoor experiences. Mission Creek in the 1970's was a hangout for teens. A \$2 million restoration project with the California State funds, Alameda County, City of Fremont, Union Sanitary District and MSN converted the "hiding place" into an environmentally friendly area. The highest ranking junior high (Hopkins JH) in the state uses the creek as an outside learning lab. Irvington Creek was

another example in which MSN received EPA funds to work with low achieving students. MSN with Irvington teachers designed a program that provided areas for students to work on projects.

MSN used their Integrating Science, Math, and Technology Reference Curriculum (I. Science MaTe) as their guide and developed many electronic storybooks that helped weave science with literature for elementary school teachers. For example, *Phoca, The Traveling Habor Seal* is a story about a young seal that was born in Fremont in the last active pupping area in the San Francisco Bay. Other stories such as *Murder in the Mud* (the food chain of mollusk of SF Bay), *Wetland in the City* (how Tule Ponds at Tyson Lagoon was built), and *Frog Tales* (story about the metamorphosis of frogs) all provide ways in which teachers and parents can access the material. We also identified the species of the different plants and animals of the area by noted scientists in the area.

The end products of these activities from 1997- present are restored areas that incorporated service learning and community service as a model. Many schools in the local area not only participate in helping restore and maintain but elementary schools have available field trips that are docent led. These field trips are integrated into the Science and History standards of all the school districts that use our services.

The two areas that are currently in the Corridor and would be used for extended training include Tule Ponds at Tyson Lagoon and Stivers Lagoon. Tule Ponds at Tyson Lagoon Wetland Center is fully functioning and Stivers Lagoon Nature has a temporary facility that needs to be expanded.

Tule Ponds at Tyson Lagoon

Math Science Nucleus manages **Tule Ponds at Tyson Lagoon Wetland Center** under contract from Alameda County Flood Control and Water Conservation District. This natural pond formed by the Hayward Fault is one of the oldest lakes in the San Francisco Bay area. The lake bed records a history of earthquake activity, and is one of the most seismological studied areas in the world. MSN maintains a classroom equipped with sinks, lab tables, and displays.



MSN offers free field trips to 100 schools in Alameda County. Since Tule Ponds is about 100 feet from the Fremont BART Station and AC Transit, many schools use public transportation. MSN uses this 17 acre site to conduct high school internships, teacher workshops, community lectures, and larger public events. MSN provides community service and service learning opportunities for local high schools which maintain the facility. MSN also supervises Eagle Scout projects, that include trail building and educational structures. Since this is a major site of where the Ohlone Indians lived and created homes from the abundant tules, we interweave history into the structure of the field trips. More information on the entire area can be found online (<http://www.msnucleus.org/watersheds/tule/tule.html>)

Stivers Lagoon

Stivers Lagoon is a wetland area that is used by flood control as a water basin as waters rush from the nearby hills. The area has a creek area that has served as a crayfish hunting ground for years. It also was a Hobo Village from the nearby trains in most of the 20th century. MSN was also involved with the restoration project using students from Irvington High School. A self-guided tour is available online, so school groups can take advantage of this beautiful outdoor environment. The materials that were developed can be found online (<http://msnucleus.org/watersheds/stivers/stivergen.html>).

The area is 3 times larger than Tule Ponds and has great potential for service learning and community service. MSN can be used to develop a better trail system and maintain the vegetation for learning purposes. However, unlike Tule Ponds, Stivers Lagoon does not have a permanent classroom and display center.

The City of Fremont's **Clean Water Program under Environmental Services** provides free field trips to over 50 schools in Fremont. The original concept and trails were designed by MSN. They currently use a portable classroom to help deliver science and environmental programs. During the summer they use the space to teach fee based programs.

This concept plan uses the successful models developed at Tule Ponds, Stivers Lagoon, and other areas in Fremont to expand and train students, teachers, administrators, and other agencies on our unique methodology based on scientific restoration. Expansion of the classroom at Stivers Lagoon would allow more training and educational services to schools and the public. Since environmental sciences have many different STEM career paths we would continue to offer internships for both high school and candidates for teaching credentials. We would use the sites in the corridor for training, but look at other sites for actual work. We would work with the juvenile system to extend a helping hand to provide these students and their teachers to learn critical thinking skills using the outdoors.



ICE AGE FOSSILS



Original mural by Laura Cunningham can be seen in the Wes Gordon Fossil Hall

Almost 2 million years ago **Sabercat and Mammoth Creeks** were probably one large braided stream that meandered down an incised valley caused by newly forming mountains to the east. The surrounding stream was lush with native riparian plants like buckeyes, sycamores, oaks, tupelos, and bay laurel as well as aquatic plants like tules and cattails. Large mammals like **mammoths, sabertooth cats, camels, horses, giant short-faced cave bear, and mastodons** ruled the area. This fauna first appeared around 1.8 million years ago and lasted until 300,000 years ago. The animals roamed on a savannah-like landscape that extended for miles into the present San Francisco Bay and Pacific Ocean.

The **Hayward and Calaveras Fault** systems slowly created the southern **Diablo Range**, which prevented the flow of water through this area and slowly choked a once mighty river. The land corridor was reduced. The climate was changed, which altered the food chain. The local habitat could no longer support these animals. While the smaller animals thrived, many larger mammals became extinct. The remains of these creatures can still be found in the conglomerates, sandstones, and siltstones that once represented the river's sediment.

Dr. Orlando Gordon Yates, a dentist, discovered the first fossils in the Irvington District in 1868. This was the year of the 7.0 earthquake that devastated the East Bay. Dr. Yates could not determine what they were. He sent the fossils to the **Smithsonian Institute** in Washington D.C. and it was established that they were fossils of Ice Age origin in the western United States.

Dr. Stirton, who had found fossils at the Yates site in 1934, recommended that Wes Gordon, a teacher, take the boys to this quarry in Irvington. When Wes went with his students the fossils were lying within plain sight and sparked an interest for years to come. **Wes Gordon**, with his team of “**Boy Paleontologists**” would find

fossils that represented the early Ice Age in California.



Dr. Savage from UC Berkeley uncovering a 13-foot mammoth tusk.



Left to right: Wes Gordon, Les Kent, Dr. Stirton, Dr. Camp, and Phil Gordon

In 1951 **Dr. Donald Savage**, a paleontologist from the University of California, Berkeley used

fossils found at what is now the Irvington District in Fremont, to define the early Ice Age (Pleistocene). As a result of Dr. Savage's work, the **Irvingtonian North American Stage** was recognized as an internationally known slice of time, ranging from 0.3 to 1.8 million years ago. It refers to a time when mammoth fossils appear in great abundance alongside Sabertooth cats, short-faced cave bears, camelids, pronghorn antelope, and other extinct mammals. The La Brea Tar Pit in Los Angeles, a national historic site, reflects the late Pleistocene (**Rancholabrean North American Stage**), when the bison first appears

Presently the collection is in a Children's Natural History Museum at the present Math Science Nucleus main center. The museum occupies about 5000 square feet at the Math Science Nucleus and allows students to touch real fossils. The museum has several halls all with specific field trips associated with them. The CNHM currently has a Fossil Hall, Hall of Small Wonders, Mineral and Rock Hall, Hall of Stars, and Nature Hall. Materials in the museum add to the Math Science Nucleus' field trips. We conduct a model lesson using electronic slideshows and animated storybooks. The students perform 3 hands on lessons within 1.5 hours. Teachers would have all the tools to duplicate the lesson. However the museum adds that something special and is a place where they can come back to and learn more.



The Fremont Learning Center would include many of the specimens to create a living museum effect. We would engage museum graduate students and other volunteers to help create the displays that are interactive for children but yet something a school or university could duplicate. Coordination of the museum and the continued development of the **Sabertooth Cat Historic Park**, within the Corridor will also increase a regional and national awareness of the City of Fremont. .

This concept plan looks at upgrading parts of the Children's Natural History Museum to increase training capacity and restoring Sabertooth Cat and Mammoth Creeks so we can reopen the quarry. The design of the park would invite people to go back through time. We would create an outdoor classroom so students, teachers, and public can learn about how extinction of large animals occurs. We would also develop long term plans to tie this site with the proposed Irvington BART station by working with COF, BART, and Caltrans which own some of the property. This site would be used as a training site for students who may want to help with scientific studies. These sites will create exciting field trips in the San Francisco Bay area not only for students but the public.

CHAPTER 3. EXPANSION OF CORRIDOR - IMPROVING STEM EDUCATION

The Corridor defines an area that will help train teachers/administrators, and secondary age students on different aspects of STEM subjects and how to integrate them into the school curriculum. Numerous studies demonstrate that inquiry is the best methodology for studying science, including teacher understanding. Students who are actively involved in doing science and using math will enjoy these subjects and do better on standardized test because they will have conceptual understanding. Rote memorizing and teaching to the tests are not effective ways to learn science and math. Being engaged in learning science and math through hands-on experiments helps to encourage students to go into STEM fields as they enter post secondary education.

The health of a school district is vital to any community. The higher performing the schools the more the property value increases. The cycle of good schools and health of a city is intertwined, but in many cases schools and city do not work well together in STEM subjects. The City of Fremont and Fremont Unified School district with the STEM direction of the Math Science Nucleus is an exception.

This chapter outlines the educational uses of the Corridor so we have a permanent indoor and outdoor training facility for teachers, administrators, students, and the public. The setting is in Silicon Valley that is accessible through public transportation, but offers natural features that set this area apart from other locations in the San Francisco Bay Region.

This corridor expansion will allow an innovative way of using public lands to not only help our educational system but to continue the education through public access. Integration is a well talked about goal, but it is difficult to achieve. This



Monitoring at Stivers Lagoon with High School Students

can be a model for other agencies that can bridge the education and public interest while increasing the role of science and math in the schools.

Expanding the Corridor will allow FUSD and MSN to take a lead in effective STEM training for teachers in the San Francisco Bay region while helping the City of Fremont to restore and preserve a scientifically important greenbelt corridor. It will also develop a consortium of other educational institutes and agencies to participate so they can learn how a high achieving school district can reach all of its students. The area could also be used as a training for earthquake and disaster training throughout the state.

The corridor can assist the training of educators throughout their career, by allowing them to learn innovation in STEM subjects and to learn how to become involved to actually make a difference in a community. Traditional teacher training does not allow for long term creation that solves problems that they can transfer to their school. Learning about pH through mindless “gee whiz” experiments does not give teachers nor students the understanding of its use by scientists. Long term service learning not only allows a student to feel like a scientist, but it allows him/her to have a guided inquiry into a subject that is difficult to teach if not a scientist. We are not creating an artificial science museum, but an innovative way in which STEM components can be taught; similar to what we created at the Children’s Natural History Museum and Tule Ponds at Tyson Lagoon Wetland Center.

The corridor will also allow the local residents to have a way to understand their local natural history through Parks and Recreation Department of COF. Earthquake education would be much more dramatic if learned on the site of the fault.

TRAIN TEACHERS AND ADMINISTRATORS

Teachers and administrators are usually trained on sites that are removed from an actual classroom. The training centers that are used in our programs are actually classrooms. These provide a look at how to create STEM ready classrooms. Teachers and administrators rarely experience how to bring



Teachers learning how to take samples

STEM education into a formal setting. MSN has been training teachers for over 20 years on how to make science an integral part of their classroom. An important part of our training is to show teachers and administrators how to tie hands-on into a fully tested and functional K-6 curriculum, Integrating Science, Math, and Technology Reference Curriculum.

The Corridor and the expanded facilities that we will discuss in the next chapter, will allow MSN and FUSD to train many more teachers while providing more space for field trips and classes that would be conducted by both MSN and COF. It will also highlight how to develop curriculum around a local area. For example, the Native Americans in this area (Ohlone) used tules to build their houses and native plants to survive. We allow the students to understand the science of why these plants work (tule is a natural polymer with extreme strength).

LOCAL GOALS

1. Expand classrooms space to make sure all teachers go through training in the Corridor. These classrooms would be used by MSN and COF as field trip for schools and informal education.
2. Create a STEM early learner classroom that can train new teachers and also act as a fee based center for the Tiny Tot serving the City of Fremont.

REGIONAL GOALS

1. Working with other school districts to see if the materials designed for FUSD could be used for regional training
2. Consult with counties on Service Learning/Community Service to develop localized areas that might work for a city
3. Discussion and program development for Juvenile systems
4. Work with local colleges to see if integration of best practices at MSN can be incorporated into their teacher education program
5. Hands-on STEM program to familiarize teachers with careers through science orientated projects in the Corridor
6. Provide other school districts training in STEM education
7. Provide workshops for Administrators to see how local areas can facilitate learning while helping the city they reside in
8. Workshops for city managers and recreation directors who want to be involved with their local school district

NEEDED:

1. Staff
2. Upgrading of Children's Natural History Museum
3. Expansion of Teen Center in Central Park (Fremont Learning Center) for design of model classroom space, with multipurpose use.
4. Renovation of existing building for a Native American Center
5. Complete Earthquake Fault Trail.
6. Expansion of Stivers Lagoon Nature Center for use by programming and smaller workshops.
7. Development of plans of an interpretive center at Sabertooth Cat Historic Park for programming and to open quarry for public programming.

EVALUATION, ANALYSIS TO IMPROVE PROGRAMS

A successful program allows for easy evaluation to determine if a program works. Over the years we have developed ways to see if program changes increase performance of children and teachers. We strongly feel that looking at data and trying to assess a program adds to validation.

There is not one test that can evaluate a program as complicated as the one we have designed. Each of the program pieces from Math to Science have different evaluation tools. However, testing is difficult, and we have learned to use the tests that are already mandated to see how they progress. There will be a method to test administrators, who are the key to any fundamental change.

LOCAL GOALS

1. Assess teachers on how they transfer the materials they are learning to bring it to the students.
2. Assess administrators on how to transfer the materials from top administration to school site.

REGIONAL GOALS

1. Transfer of evaluation to different types of school districts.

NEEDED:

1. Regional online assessment to see if the training helped them to focus on improvements
2. Training
3. Customized materials

CURRICULUM MATERIALS

Many schools both elementary and secondary have trouble teaching hands-on STEM subjects. This concept uses materials that are more local in nature to provide workshops for teachers that they can use directly in the classroom. Currently in FUSD, the Math Science Nucleus is customizing local materials from the I. Science MaTe program so there is enough material for students to use. In these economic times Science specialists were eliminated in many of the elementary schools, so in order to get the classroom teacher into the labs FUSD administrators and MSN came up with the plan. The plan developed from the Dana Raimonidi Math Program where MSN is working in sixth grades to prepare low achieving children in pre-algebraic skills. The program has such dramatic results, on which the current program (Helping Hands Science) is based on.



We would expand educational materials to other areas outside the Corridor, but modeled after the materials that have proven to be successful. For example, Irvington High School uses the materials on our “Local Watershed” link for use in their Change Program. During this six month program, use of our website is directly linked to student use.



Curriculum materials would need to be refined for the Sabertooth Cat Historic Park which would be used to generate funds for public programming. Materials that celebrate the local history including Native American artifacts need to be stored in a training facility.

LOCAL GOALS

1. Increase the number of teachers using the materials already developed through science coaches at the district level.
2. Increase the materials to include all of the Corridor facilities and to reflect other STEM areas that may be deficient.
3. Complete the Secondary materials of the I. Science MaTe program that is currently available.

4. Permanent space for Native American culture that is integrated into curriculum

REGIONAL GOALS

1. Assist school districts to customize kits or materials for their needs by having a staff scientist work with the school district.
2. Create web materials that could be used for schools and keep it on the Math Science Nucleus site for other districts to use

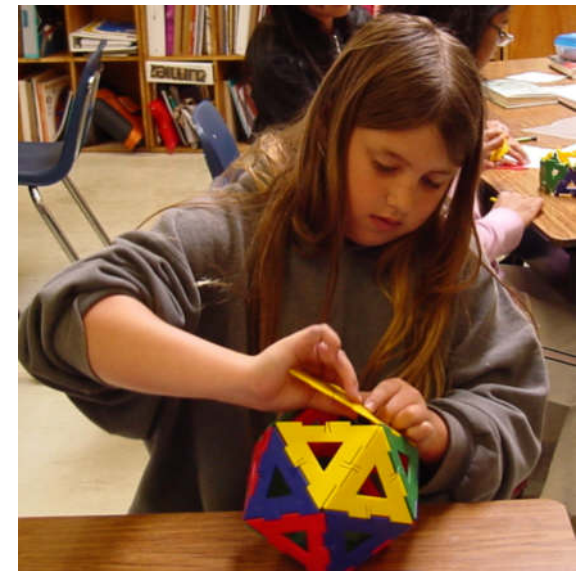
NEEDED

1. Staff
2. Materials for creation of non consumable kits for school that are participating
3. Web design consultants, including creating animated books, and including new math connections similar to the materials developed under the Dana Raimondi Math Program

INNOVATIONS THAT TURN AROUND LOW PERFORMING SCHOOLS

Low performing schools usually just need a little assistance that takes into consideration the family life of the students. In most cases low performance is directly related to economic level. FUSD although the third largest school district in the San Francisco Bay area cares for a diverse population of immigrants and economic levels. However, their Title 1 schools perform at a higher level than most school districts. Key to this difference is the resources afforded to these schools in extra personnel and strategies. FUSD and MSN have partnered with the Dana Raimondi Math Program to help low income school by modeling 5 key lessons for teachers in their classroom.

The service learning components we will be using with students will not only increases their interest in science, but will make a difference for students at risk of failing science or dropping out of school. Studies have shown a positive link of



Dana Raimondi Math Program for Title 1 schools

service learning and increased retention in schools, especially when students are asked to solve real community-based problems.

LOCAL GOALS

1. STEM coach to work with low performing schools in elementary schools (5 schools)
2. Work with high school students and develop strategies (intervention) for those students who are struggling with materials and those who are financially disadvantage
3. Increase projects that are problem based service learning.

REGIONAL GOALS

1. Developing workshops to help administrators and teachers involved in low performing schools

NEEDS

1. staff
2. materials
3. travel

EARLY LEARNING IMPROVEMENTS FOR COMMUNITY

The City of Fremont has one of the top rated programs for young children and parents, called Tiny Tots. The program looks at the needs of the community and develops programming. Their ability to teach STEM based programs is limited because of inappropriate space and not lack of materials. The Math Science Nucleus had developed pre-school materials, but never had a permanent classroom for little ones.

In this concept the MSN would develop materials specifically for this group of learners and COF would provide the staff. The classrooms in the Corridor would be ideal for teachers. The development would also include teacher workshops to help staff of early learners to understand how to incorporate STEM subjects in their programs. These workshops would be open to interested groups regionally and would use the classrooms in the Corridor.



LOCAL GOALS

1. Increase the number of STEM classes for “Tiny Tots,” a popular program administrated by COF Recreation Dept.
2. Develop materials to train staff of early learner
3. Activities in the Corridor for early learners and their parents
4. Programs that go into preschools

REGIONAL GOALS

1. Develop workshops for regional staff of early learners
2. Workshops for agencies involved in early learners

NEEDS

1. Staff for early learners to develop materials
2. Staff to model teaching for instructors of pre-school
3. Materials for classroom for early learners
3. Classroom design that provides an early for early learners

SKILLS FOR STEM CAREERS

There are not enough opportunities for high school students to work with scientists on projects in this country. STEM careers are rigorous and many students who want to be a researchers know little about how involved the career paths are. Many times students realize too late and it is difficult to go back to school as one gets older. MSN has several internships programs available for students, but they are limited because of lack of funds. However, some of the classrooms that we are proposing could facility more internships programs with staff funding. If correctly designed we feel that we could benefit local companies where they would be involved in a consortium that would help students but also help their agency. For



High school students engineering a platform with Alameda County engineers

example, at Tule Ponds at Tyson Lagoon, MSN is under contract from Alameda County to collect data. It is a cost effective way to train students and to collect data.

Since 1997, MSN and FUSD have partnered with helping develop environmental service learning opportunities for an innovative and award winning “Change” project at Irvington H.S. All freshman students work in teams to try and change an environmental problem. This program has exposed students to careers they would not normally have considered. MSN, FUSD, and Alameda County have been involved in several restoration projects that have allowed students to take ownership of their own backyard. All of these have been recorded and documented for the last 10 years on the Math Science Nucleus website (<http://msnucleus.org> click on Fremont Watersheds)

As the Sabertooth Cat Historic Park develops, there will be many opportunities to work with fossils. Presently, MSN is getting fossils from Fairmead Landfill in Madera County so Fremont students can volunteer to clean fossils.

Restoration projects also require data collection. Computer and mathematic students can be recruited to develop ways to collect data and communicate them to other regions. Projects could be done throughout the city. Administrators and teachers can learn by experiencing the techniques of data collection. MSN has found that many teachers and administrators do not really understand the importance until they experience it.

LOCAL GOALS

1. Involve all high schools in STEM career projects. Some could be modeled after the Irvington HS Change Project.
2. Create more Green Technology teaching opportunities with relevant curriculum, especially Ohlone College’s Green Technology Program
3. Develop communication with local STEM employers so they are aware of opportunities.
4. Create a classroom that includes facilities for possible internship especially during the summer similar to Tule Ponds at Tyson Lagoon.

REGIONAL GOALS

1. Workshops for administrators and high school teachers to learn techniques on how to make STEM a part of the curriculum.

NEEDS

1. Staff
2. Classrooms that have space for materials

SPECIAL NEEDS CHILDREN

Many school districts are faced with challenges fully meeting the needs of students with special needs. However, special needs children can be helped by other programs if other agencies are aware of the needed. In Fremont we have the California School for the Deaf and Blind, and they use the facilities that we have designed. MSN also has developed programs for other special needs students such as autistic students. FUSD has developed many award winning language intervention programs.

Juvenile offenders would also be a target group. MSN did a study in the early 1980's of how to get juvenile offenders to reconnect with science. It was determined that many of these students never really played with toys that allowed them experience magnetism, electricity, growing a seed, observing nature, and many other science related experiences. After MSN developed an adult play, the students were more willing to be engaged in science learning.

LOCAL GOALS

1. Science Summer Camps for students in our Title 1 schools.
2. Special Education Science classes and field trips during summer for mild to moderate autistic classes.
3. Science Summer Camps for 7th and 8th grade at risk female students
4. Science Parent Nights in each attendance area to boost interest in science and to promote the corridors with translators available at each session.
5. Work with Alameda County and their juvenile offender schools.
6. Native American classes on how Ohlone Indians used their understanding of native plants for living.
7. Native American cultural classes offered to parents

REGIONAL GOALS

1. Develop manual with low cost materials on how to duplicate in other school districts.
2. Train key people in other districts on methodology of classes and camps.

NEEDS

1. Staff
2. Appropriate facilities.

CHAPTER 4. EXPANSION OF FACILITIES

FREMONT LEARNING CENTER

There is a space available in Central Park, Fremont that would be an excellent site for the Fremont Learning Center to model lessons with teachers and students. Master teaching is one of the best ways to illustrate best practices in teaching. The dynamics of children always creates new situations and when one sees the methods it is much more effective for training.

The area would be located near the Hayward fault and centrally located for all FUSD schools and students. It will be 100 feet from the Alameda County Main Library and ½ mile from Tule Ponds at Tyson Lagoon.

Fremont Learning Center could be used for multi purposes. We would redesign and renovate the 8000 square foot area adjacent to the Teen Center. It would use material from the Children's Natural History Museum and the Math Science Nucleus and create a classroom training center for teachers and students. Not just a room, but a place where we could take STEM materials and create a larger facility to train teachers and administrators as well as to use for other events.

The Fremont Learning Center would have 3 areas. A Pre-school area would be fitted with appropriate materials and seating for little ones. It will be used not only to train teachers but as a classroom. This would be the site where COF would be able to offer Tiny Tot Science. An elementary area would be used to train elementary teachers and administrators on teaching STEM subjects through learning. It will be a real classroom that would be used for field trips



Portions of the Teen Center that could be revitalized as use for regional teacher center as well as use by COF

and incorporated STEM displays so teachers can get ideas on how to create an atmosphere of learning in their own classrooms. This area would also be used for the starting point for the Hayward Fault earthquake trail and other STEM field trips. We would be able to store materials that would be used for satellite workshops on STEM subjects

Hayward Fault Trail

Central Park in Fremont was created by the Hayward Fault and modified by the City and Country to help prevent flooding. There was always a series of sag ponds in the area, but Lake Elizabeth was created so the waters from the mountains would overflow in this area.

The combined Fremont Learning Center and Hayward Fault Trail would be an excellent site for regional disaster training, especially to understand the science behind faulting and how earth behaves during seismic events.

The trail would go through the area so people could see offsets and creep movement over the last 60 years. The trail would go through compression ridges that show the buckling of the earth.



Area of walking Tour including Tyson Lagoon on the left, present site of Earthquake Exhibit and Stivers Lagoon on the right.

We are proposing several kiosk and several small markers to inhabit the current exhibit site and walking tour. The kiosk would provide information explaining the relationship of the Hayward Fault with Lake Elizabeth, the Old City Hall site, fault creep cracks, and offsets. A trail that would help bring people through the area will also be constructed if enough funds

are secured. The kiosk and small markers would be coordinated by the Math Science Nucleus and provide information on the Hayward fault, details on a walking tour, and how to prepare for earthquakes.



The walking tour would include the major surface features that you see today throughout the city. We have developed a walking tour that goes from Tule Ponds at Tyson Lagoon Wetland Center (a 17 acre Alameda County owned facility that the Math Science Nucleus manages) to Stivers Lagoon (part of Central Park). This represents over 2 miles of features that can be divided into several components. The walk includes both traces of the Hayward Fault. Participants walk through the area and see features that are caused by fault creep and to compare them to features that

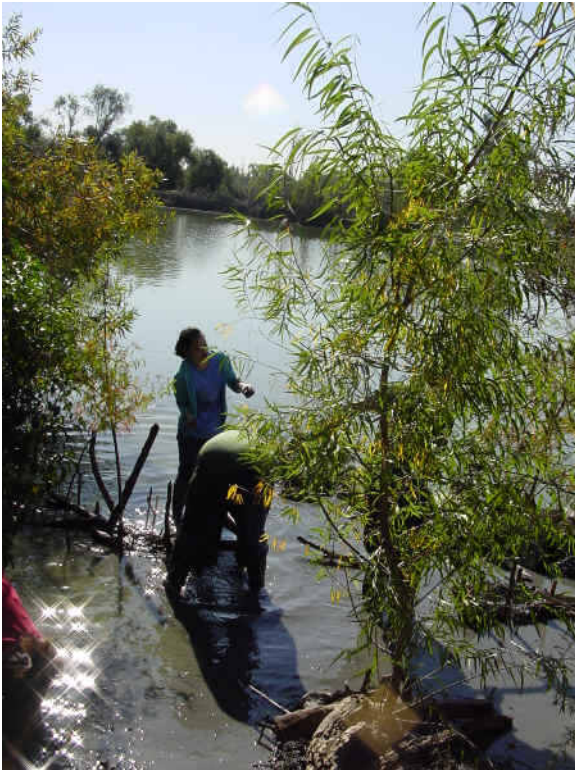
are not.



Area in front of the proposed site and trace of Hayward Fault in red. The knoll in the top of the photo shows extra parking that could be used.

STIVERS LAGOON NATURE CENTER

Stivers Lagoon is the southern part of Central Park, a 430 acre park with a 83 acre Lake Elizabeth within the heart of the City of Fremont. It is home to urban wildlife, especially to the many year round and migrating birds.



Restoration work on Duck Island

Presently there is a 900 square foot portable that is used for Clean Water Education for the COF. We are proposing to expand this center to a 2000 – 3000 square foot classroom with facilities to do monitoring and restoration. The classroom would be built to include the many displays that rangers at Central Park have collected over the years. It would also have an office for the Naturalist Ranger and assistant. There would also be an area for tools that will be used by community service and service learning projects to maintain the trails, wildlife, conduct tours, and public lectures. This facility would be multifunctional and in the summer there would be fee programs conducted by City of Fremont, Recreation Department.

Included in this area would be a boardwalk over the parking lot into the wetland to do monitoring and observation of the wild animals that live in these 60 acres. This location will also be headquarters for scientific monitoring of Lake Elizabeth and Duck Island. The nearby Water Park may also be incorporated into presentations on water sciences and physics.



SABERTOOTH CAT HISTORIC PARK

The last portion of the Fremont Learning Corridor is Sabertooth Cat Historic Park. COF recently purchased 14 acre of land that was once a quarry. This site is where the early Ice Age fossils were found. COF already owned 60 acres of open space. This 3 mile long linear park can connect the San Francisco Bay trails with a pedestrian bridge over the 680 freeway.

This area is still rich in fossils and if designed correctly would bring students, teachers and the public back through time to the beginning of the Ice Age. We are proposing to put a small portable classroom with bathrooms so we can accommodate field trips. Designing a park with the educational system in mind requires about 1-2 years of piloting. Community service and service learning opportunities will allow high school students and the community to become part of the transformation similar to what MSN and Alameda County achieved at Tule Ponds.



Michael Semyonov found a large camelid scapula in 2008.



Photo shows Sabertooth Cat Creek in the north and Mammoth Creek in the south (tree corridor).. 680 is to the west.

The development of the quarry site for educational purposes will be the main goal of this partnership. COF will be spending about 2 million dollars on the environmental improvement of Sabertooth Cat Creek.

NATIVE AMERICAN CENTER

The plan would be to take three existing classrooms at the Adult School and convert them for use for the Native American Studies Program. They are 960 square foot classrooms. They will be converted into a museum with artifacts representing the 10 tribal areas of North America. The support spaces include a large multi-purpose classroom/work area used for classes and meetings, a large storage area, a copier area and an office/counseling room.

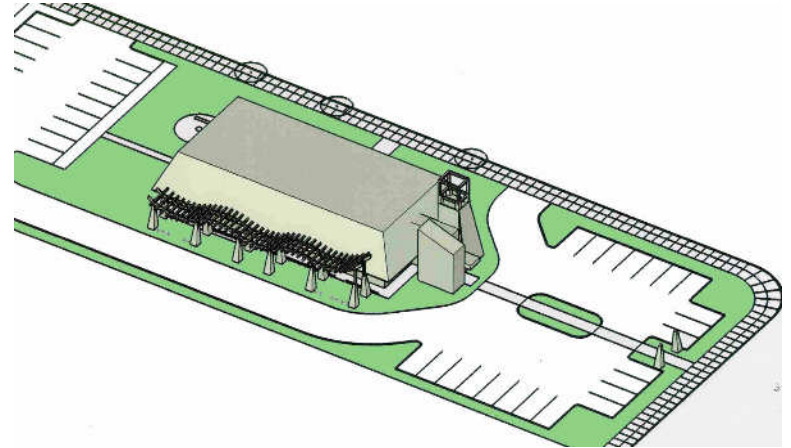
The new space will give the program a permanent home to conduct their activities. They would provide museum tours to schools throughout the area, introducing the breadth and variety of native peoples and their contribution to North American history. The program provides tutoring to Native Americans students and culture classes to educate people about Native American Heritage.



The new space will provide adequately designed space to allow the multiple functions. It will provide much easier access for museum tours for school groups and the general public. Since it is located at the Fremont Adult School, it will become an integral part of every ESL classes provided at the Adult School. All ESL classes will include the museum tour and Native American cultures as part of the requiring of completing the ESL program.

CHILDREN'S NATURAL HISTORY MUSEUM

The **Math Science Nucleus** has served the public since 1982 as a leader in **science curriculum development**. The Children's Natural History Museum started developing in 2004 with the addition of materials from the San Lorenzo School District and the Wesley Gordon Family Trust. Today we have about 5000 square feet devoted to the display with another 2000 square feet of classroom space. We use the specimens in the museum as part of our field trips. Unlike most museums we do not allow the students to roam freely. They are directed by an instructor to do hands-on activity during the course of their stay. We do one class at a time, and they



choose standards based lessons that go along with the state science framework. We actually use the materials developed for the I. Science MaTe program and incorporate the electronic storybooks and slideshows. Teachers can then review with the students at their school or do the experiments in their classroom. In effect, we are modeling how to teach the lesson plans. Students also can access the storybooks at home, extending the learning.

We need to upgrade some of the areas in our classroom and museum to facilitate more children. We currently need an outdoor area so students can explore as they have lunch on 1 acre of land. The above design was from COF Redevelopment, which helped us to see how we could better use our space.

CHAPTER 5. PARTNERS

Math Science Nucleus – non profit since 1982; scientists, engineers, mathematics helping schools get STEM education into formal education; manages Tule Ponds at Tyson Lagoon Wetland Center and Children's Natural History Museum; owns Integrating Science, Math, and Technology K-8 reference curriculum

- Tule Ponds at Tyson Lagoon Wetland Center - standard based field trips, community service for schools and groups; service learning for schools; science internships, teacher training
- Children's Natural History Museum - standard based field trips, teacher training
- Dana Ramonidi Math Program - increasing low income schools access to pre-algebra concepts, tutoring
- Integrating Science, Math, and Technology Reference Curriculum – research generated science curriculum that spirals form K-8 grades
- Museum Shop has been in operation for 20 years and an online store has been available for 10 years.

Fremont Unified School District - 33,000 students; 30 elementary, 5 junior high, 5 high school, 1 continuing education; adult school, and a ROP center FUSD has 3,000 employees making it the second largest employee in the city. All FUSD employees work hard everyday to ensure that every student in the District has access to an excellent education.

FUSD is located in the City of Fremont, a thriving international community. Residents come from countries across the globe to call Fremont home. We take pride in our diversity, in our community, and in our schools. The students in Fremont speak 26 different languages. FUSD is a high performing school district in California, with many award winning schools.

City of Fremont - Located on the southeast side of the San Francisco Bay, Fremont is a city of over 213,000 people with an area of 92-square miles, making it the fourth most populous city in the Bay Area and California's fifth largest city. Fremont is located within Alameda County.

Fremont is one of the most ethnically and culturally diverse cities in the Bay Area. Residents are attracted to Fremont for its nationally-recognized high-ranking public schools, its numerous well-kept parks, and a variety of recreational amenities, including beautiful Lake Elizabeth, Central Park, and Mission San José (California's 14th mission).

STAFFING

Math Science Nucleus

1. Coordinator – oversees the entire program (\$175,000)
2. Development – looks for funds and strategies that will maintain programs developed and a comprehensive business plan (\$125,000)
3. Administrative Assistant – help coordinator and development (\$80,000)
4. Scientist coaches (4) customize curriculum for lower grades and upper grades to provide modeling, mentoring, and coaching; they would be research scientist, also coordinate and develop service learning and community service opportunities; first year work with FUSD, subsequent years work in different school districts (\$110,000.00 x 4 = \$440,000)
5. Student Interns \$50,000.00

Total 820,000.00

Fremont Unified School District

1. Teacher Science Coaches 3 at elementary including one devoted to Title 1 schools; 1 at Junior High, 1 at High School (5 total 5 x \$110,000 = \$550,000.00)
2. Math Coach at secondary level (\$110,000)
3. Grants Administrator (\$150,00)
4. Administrative Assistant (\$80,000)

Total 890,000

City of Fremont

1. Naturalist Ranger (two on assignment to develop fee programs open to the public) \$90,000 x 2= 180,000

2. Facilities coordinator (1) scheduling (\$60,000)
3. Coordinator of facilities (looking for long term business plan and establish endowments) \$150,000
4. Administrative intern (\$60,000)

Total \$450,000

\$216,000.00 x 5 = 10,800,000.00

FACILITIES

Workshop/classroom facility (Teen Center extension) \$3,000,000.00

Sabertooth Cat Historic Park, reopening the dig site, classroom, feasibility study, opening dig site, staging area for maintenance \$2,000,000.00

Nature Center at Stivers Lagoon Classroom expansion \$1,500,000.00

Earthquake Trail \$500,000.00

Native American Center \$500,000.00

Children's Natural History Museum \$300,000.00

Tools for expanded service learning (including sheds, vehicle) \$150,000.00

TEACHER/ADMINISTRATOR WORKSHOPS

Release time, workshop materials for teachers, stipends for Sat workshops: \$250,000 - \$1,000,000.00